EIGHTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM

1892.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

TORONTO:
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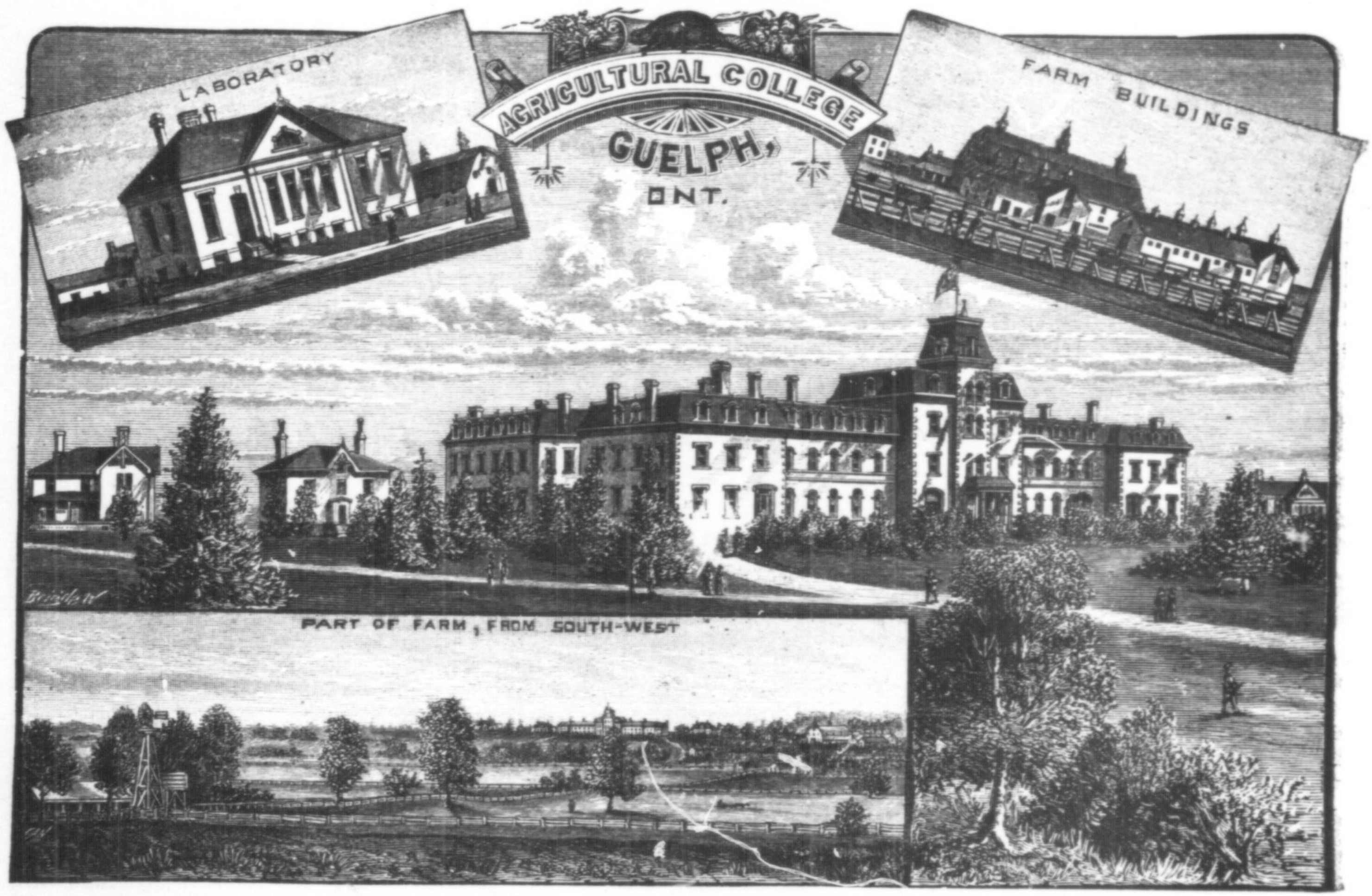
FARM BUILDINGS
AGRICULTURAL COLLEGE
LABORATORY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EIGHTEENTH ANNUAL REPORT

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GUELPH, January 2nd, 1893.

To the Honorable JOHN DRYDEN,
Minister of Agriculture:

DEAR SIR,—I have the honor to transmit herewith the Eighteenth Annual Report of the Ontario Agricultural College and Experimental Farm.

In this Report we have reviewed briefly the work of the year 1892 under the following heads:

PART I.—REPORT OF THE PRESIDENT.

PART II.—REPORT OF THE PROFESSOR OF GEOLOGY AND NATURAL HISTORY.

PART III.—REPORT OF THE PROFESSOR OF CHEMISTRY.

PART IV.—REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.

PART V.—REPORT OF THE FOREMAN OF THE HORTICULTURAL DEPARTMENT.

PART VI.—REPORT OF THE PHYSICIAN.

PART VII.—REPORT OF THE PROFESSOR OF AGRICULTURE AND FARM SUPERINTENDENT.

PART VIII.—REPORT OF THE PROFESSOR OF DAIRYING.

I have the honor to be, Sir,
Your obedient servant,

JAMES MILLS,
President.

MINISTER OF AGRICULTURE

Hon. John Dryden, Toronto.

Ontario Agricultural College and Experimental Farm, Guelph, under control of the Minister of Agriculture.

OFFICERS 1893.

James Mills, M.A.	President.
Thomas Shaw	Professor of Agriculture and Farm Superintendent.
A. E. Shuttleworth, B.A. Sc.	Professor of Chemistry.
J. Hoyes Panton, M.A., F.G.S.	Professor of Natural History and Geology.
J. Hugo Reed, V.S.	Professor of Veterinary Science.
H. H. Dean, B.S.A.	Professor of Dairy Husbandry.
John McCrae	Assistant Resident and Mathematical Master.
Captain Walter Clarke	Instructor in Drill and Gymnastics.
C. A. Zavitz, B.S.A.	Experimentalist.
H. B. Sharman, B.S.A.	Assistant Chemist.
A. McCallum	Bursar.

ADVISORY BOARD.

C. C. James, M.A.	Deputy Minister of Agriculture, Toronto.
John I. Hobson	Mosborough, County of Wellington.
John McMillan, M.P.	Constance, County of Huron.
Edward Jeffs	Bond Head, County of Simcoe.
J. S. Smith	Maple Lodge, County of Middlesex.
G. B. Boyce	Norham, County of Northumberland.
D. A. Dowling	Appleton, County of Carleton.
Wm. Donaldson	Woodstock, County of Oxford.

Chairman of Board	John I. Hobson.
Secretary of Board	C. C. James, M.A.

PART I.

REPORT OF THE PRESIDENT.

The year 1892 has been in every sense a very pleasant and prosperous one in the history of the Ontario Agricultural College and Experimental Farm. The ordinary routine of College work has not varied much from that of former years; but we have made gratifying progress along several lines.

Chemical Laboratory.

By the construction of a tank for a regular supply of water and the addition of a considerable amount of new apparatus, the equipment of our chemical laboratory has been much improved. We are now in a position to give a good course of general instruction in chemistry to our first year students, a fair amount of practice in analytic work to our second year men, and, I think I may say, a very broad and thorough training in both theoretical and practical chemistry to candidates for the degree of B.S.A. We still need to fit up a part of the excellent basement under the laboratory proper for practice in elmentary work by the first year men.

Greenhouses and Botanical Laboratory.

Our new greenhouses and botanical laboratory have been finished within the year. The former are now fairly well supplied with economic and ornamental plants for the instruction of our students and the entertainment of visitors; and the latter is furnished and fully equipped for potting, grafting, microscopy, lecture-room work, and original investigation in the Departments of Botany and Horticulture.

We shall soon have a better representation of economic plants in the greenhouses, and an additional house to be divided into sections and set apart specially for practical work and original investigation by our senior students.

Experimental Dairy.

In the Dairy we have made more changes and greater advancement during the year than in any other department. We have made large additions to our dairy building and have furnished it anew with all the appliances necessary for the setting of milk, the handling of cream, and the making of butter and cheese on the most approved methods. We have also made large additions to our dairy stables, so that we now have ordinary stalls for thirty milch cows, with all the box-stalls and pens that we are likely to need for calves and other animals which it may be advisable to keep in this department. We have likewise erected a very nice dairy piggery, a large circular silo, and a building for a tread-power to run a cream separator in connection with the stables.

A fuller account of these additions and alterations will be found in Professor Dean's report in Part VIII. of this volume.

Dairy School.

Our aim in erecting these new buildings and in making the additions and alterations just referred to, was to provide thorough instruction in dairying for our regular students and for others who might wish to come here for a course of lectures, with practical instruction in butter and cheese-making. With this object in view we decided to start a special Dairy School on the 1st February, 1893; and on the 15th of last November, we issued the following circular for the information of butter-makers, cheese-makers, and others interested in dairying:

Course in Dairying.

The great importance of the dairy industry and its rapid growth in this Province have induced the Hon. John Dryden, Minister of Agriculture for Ontario, to give this branch of farming special attention within the last two years. Almost immediately after taking office as Minister of the Crown, Mr. Dryden announced his intention of sending a travelling dairy through the country, to give the farmers and their families practical instruction in the art of butter-making. Three of these dairies have been at work during the past summer, and by the end of the year 1893, they will have covered the whole Province. The next step in advance, to which the Minister gave his approval, was the enlargement of our dairy building, with a view to provide thorough instruction in dairying for our regular students, and for others who might wish to avail themselves of a special course of lectures with practical work in butter and cheese-making.

As an outcome of the Minister's action in these matters, we have decided to commence a short course of instruction in dairying at the close of the Farmers' Institute work in January next. In this course we intend to give such theoretical and practical instruction in butter-making and cheese-making as seems to be specially needed by butter-makers, cheese-makers, and farmers' sons and daughters throughout the Province.

We think the time has come when such a school for special instruction in dairying should be started in this Province—a school in which, at comparatively small cost and without spending too much time, factory men, creamery men, and others can receive valuable lectures and learn from practical object lessons the latest and most approved methods in the two great branches of dairying.

Competition at home and abroad is becoming so keen that those who will not take the trouble to learn the latest and best methods in their respective branches of farming, must soon give up the business and turn their attentoin to something else. The system of payments by results, or according to the quality of the milk supplied, is being introduced by cheese factories, and for this reason it is important that cheese-makers should, as soon as possible, become familiar with the Babcock tester and learn how to distribute fairly the products of their factories on this new plan. Patrons also in many localities are now thinking of altering their factories, so as to make cheese in summer and butter in winter. Consequently the men in charge of these factories should at once learn how to run centrifugal cream separators, handle cream, and make butter according to the most approved methods. For these and other reasons, we have concluded to open a special dairy school in connection with this institution on the 1st of February next; and, by delivering lectures on the principles of dairying, by illustrating the best methods of manufacturing butter and cheese on the factory and private dairy plans, by explaining the various methods of testing the quality of milk, by exhibiting samples of the principal breeds of dairy cows, by showing how such cows are fed and managed, by bringing factorymen and others who may wish to learn something about butter and cheese-making, into contact with men and methods that may be new and helpful—by these means we hope to impart useful information and infuse new life into the dairy industry throughout this Province.

Buildings and Equipment.

Our dairy building is divided into two sections—one for butter and the other for cheese. On the ground floor of the end devoted to butter-making there is an office occupied by the Professor of Dairying, and containing a number of books of reference for the use of both students and officers of the dairy department. There is also a large class-room with elevated seats looking into the butter-room, in which there are two hand cream separators, a power separator, a butter extractor, a Boyd starter, milk and cream vats, churns, butter-workers, printers, and other things required for instruction in butter-making. Close by, on the same floor, there is a milk testing room, equipped with Babcock testers, a Beimling tester, a set of lactometers, and other simpler testers sometimes used to determine the quality of milk. Also, under this end of the building, there is a dairy cellar, which contains a refrigerator, a store-room, a wash-room, and all the boxes, creamers, and vats necessary to illustrate the different methods of setting milk.

The end of the building set apart for experimental cheese-making contains two rooms—a large cheese-room and a moderate-sized curing-room. At one end of the cheese-room there are elevated seats looking towards the other end, in which the work is to be done; and in this latter portion there are vats, presses, curd mills, and other things required in cheese-making.

Near by the dairy building there are a dairy piggery, a circular silo, a commodious cow stable, and a small building containing a tread-power, on which a bull is to be used for cutting feed, pulping roots, and running a cream separator.

Instructors.

The following instructors will take charge of the work under the general oversight and control of H. H. Dean, B.S.A., our Professor of Dairying:

1. *In Butter-making*—

F. C. Rogers—To give instruction in the setting of milk, the handling of cream, and the churning, salting, working, printing and packing of butter.

F. B. Linfeld, B.S.A.—To take charge of the separators, extractor and other machines.

2. *In Cheese-making*—

Adam Bell, Instructor in Dairy School of Western Dairymen's Association at Tavistock—to give instruction in making and curing cheese.

T. B. Miller, Inspector and Travelling Instructor under Western Dairymen's Association—to assist Mr. Bell in the cheese department.

3. *Milk Testing*—

W. J. Palmer, B.S.A.—To give instruction in testing milk with the Babcock tester, the Beimling tester, the lactometer, lactoscope, etc.

Course of Study.

The school will open on the 1st February and close on the 31st March, 1893; and a course of fifty lectures will be given as follows:

Professor of Dairying.—Twenty-eight lectures on breeds of dairy cattle; selection, breeding, feeding, and care of dairy cows, with illustrations by reference to our dairy herd of Ayrshires, Holsteins, Jerseys, Guernseys, Red Polls, and a number of Grades; composition of milk; ferments in milk; butter and cheese; the marketing of dairy products, etc., etc.

Professor of Agriculture.—Four lectures on general agriculture.

Professor of Veterinary Science.—Four lectures on veterinary science, including common diseases of the cow.

Professor of Biology.—Four lectures—two on geology and two on botany.

Professor of Chemistry.—Four lectures on the nomenclature and general principles of chemistry.

Mathematical Master.—Six lectures on mathematics and book-keeping, explaining fully the decimal system.

Practical Work.

Students will be sent in rotation to (1) butter-making, (2) cheese-making, and (3) milk-testing. Work will commence immediately after the morning lecture, and continue until each student has finished the work assigned for the day.

In the butter department full and detailed instruction will be given in the operation of cream separators, butter extractor, and other machines, and in the handling of cream, the making, printing, and packing of butter, etc. In the cheese-room, lectures with practical object lessons, will be given daily on the best methods of making cheese on the factory plan, the use of rennet tests, the proper care and curing of cheese, etc. Likewise, in the milk-testing room, full information, with practice in the testing of milk, will be given daily throughout the course.

Further, some time will be devoted to the judging of butter and cheese. Samples will be obtained from day to day. The students will be required to judge them by points, and their judgment will be compared with that of experts.

Ladies Invited.

Ladies are invited to take this course. They may either take the full work, or confine their attention to milk-testing and butter-making ; and, this being the first time that we have opened the College to ladies, it is hoped that some will avail themselves of the opportunity now offered.

Terms of Admission, Cost, etc.

No Entrance Examination will be required for this Course.

Tuition.—Free to residents of the Province of Ontario ; to non-residents, $5 for the course.

Incidentals.—A payment of $5 in advance for incidental expenses, will be required of all students in this course. Also, a deposit of $2 to cover possible breakage. This sum of $2, or a portion of it, if not required for breakage, will be refunded when the student leaves.

Board and lodging can be obtained in Guelph (a mile and a half from the College) at $3 to $3.50 a week, and at $3 a week for a limited number close to the College grounds.

Working Clothes.—Every student must provide two special suits of clothes to be worn in the Dairy—white and blue gingham dress, with white cap and white apron, for ladies , and white linen or cotton suit, with white cap and white apron, for young men.

Applications for admission should be addressed to the President of the College. For the first year we can accommodate only 50 ; and we shall take them in the order of application, with this proviso, that a preference will be given to candidates from Ontario.

Candidates whose applications are accepted will be expected here on the first day of the course ; and all students will be required to attend the lectures and practical work regularly and punctually while they remain at the school.

Travelling Dairies.

Again, by order of the Minister of Agriculture, we sent out three Travelling Dairies early in the month of May—one west, and two through the eastern part of the Province. W. J. Palmer, B.S.A., took charge of one ; F. B. Linfield, B.S.A., of another ; and P. H. McIntosh, of a third.

Mr. Palmer, assisted by J. A. McTavish, an experienced butter-maker, held his first meeting near Gananoque on the 2nd of May, and continued his work through the summer and fall, till the 15th December. During this period of 7½ months, he held meetings at 151 places throughout the following counties: Leeds, Grenville, Dundas, Stormont, Glengarry, Carleton, Lanark, Renfrew, Frontenac, Lennox, Addington, Hastings, Prince Edward and Northumberland—14 in all.

Mr. Linfield began at the same time in the county of Wentworth, with Mr. Hume as his butter-maker, and remained at his post till the 17th of December—for a period of 7½ months, during which time he held 156 meetings in 14 counties, as follows: Wentworth, Lincoln, Welland, Monck, Haldimand, Brant, Norfolk, Elgin, Kent, Middlesex, Oxford, Perth, Waterloo and Wellington.

Mr. McIntosh, who was not directly under my control, and from whom I have not yet received any report, was sent to hold meetings in the French portions of the counties of Russell, Prescott, Stormont and Carleton.

The work of these dairies has been of great practical benefit to many farmers in the counties visited, and has done much to awaken an intense interest in dairying throughout all parts of the Province. For a full account of the work done by two of them, see reports of Messrs. Palmer and Linfield in Part VIII. of this volume.

Experiments with Live Stock, Grain, Roots, Etc.

Marked progress has been made in this department. Our experimentalist, Mr. C. A. Zavitz, under the supervision of Professor Shaw, has been reaching out and pressing forward in various lines of experimental work, especially in testing different varieties of grain, not only at our College station, but at various other points throughout the Province. Nearly 150 acres of our farm is now devoted to experimental work—55 acres in small plots, 30 acres in plots of one acre each, and 66 acres in still larger plots.

On the plots at the College Mr. Zavitz has tested 67 varieties of barley, 116 of oats, 61 of peas, 63 of spring wheat, 62 of winter wheat, 76 of fodder corn, 114 of potatoes, 62 of turnips, 38 of mangolds, 10 of sugar beets, 23 of carrots, 18 of clovers, 40 of grasses, 11 of millets, 3 of rape, and 3 of sunflower. He has also tried different dates of seeding on 48 plots, mixtures of grain on 25 plots, application of fertilisers on 60 plots, methods of preparing potatoes for planting on 20 plots, various ways of planting and cultivating fodder corn, roots and potatoes on 233 plots, and a number of other experiments with grain, rape, roots and grasses on 80 plots.

To this may be added some live stock experiments, conducted by Mr. A. Cuppage under the joint supervision of Professor Shaw and Mr. Zavitz, as follows:

With Cattle............	6 experiments............	20 animals.
" Sheep............	3 "	666 "
" Pigs	1 "	12 "

In addition to the experiments at the College, the following valuable work has been done under the control and supervision of our experimental department:

Co-operative Experiments conducted by members of the Ontario Agricultural and Experimental Union and other interested farmers throughout Ontario:

Number of experiment.	Names of experiments.	Number of plots required for each test.		Plots used for these tests during 1892. By Ontario Experiment Station.	By farmers over Ontario.
1	Testing nitrate of soda, superphosphates, muriate of potash, mixture, and no manure with oats	4	Fertilizers..	14	165
2	Comparing the advantage of nitrate of soda over no fertilizer with rape............................	2			
3	Ascertaining the relative value of three varieties of millet	3	Fodder crops	26	470
4	Growing lucerne as a crop for fodder	1			
5	Testing six promising varieties of fodder corn..	6			
6	Testing five promising varieties of turnips	5	Root crops..	20	705
7	Testing five promising varieties of mangels	5			
8	Testing five promising varieties of carrots	5			
9	Testing six promising varieties of spring wheat......	6	Grain crops.	55	4,348
10	Testing six promising varieties of barley	6			
11	Testing six promising varieties of oats	6			
12	Testing five promising varieties of winter wheat......	5			
				115	5,688

See report of Professor Shaw and Mr. Zavitz in Part VII. of this volume, and the report of the Experimental Union attached to this volume.

Live Stock.

We have not made any large addition to our live stock during the year. We purchased three Guernsey and a few grade cows in the early part of the summer; and the Minister of Agriculture imported a few cattle and sheep, which we needed for the purpose of instruction. The imported animals are as follows:

Cattle.

Shorthorn bull "Manfred" (3415)—calved 2nd May, 1890, and bred by James Black, Old Meldrum, Scotland.

Sussex bull—under two years of age.
Guernsey bull—a little over one year old.
2 Guernsey cows—for the Dairy Department.
2 Ayrshire cows " " "

Sheep.

Rams, shearling—Shropshire, Oxford, Suffolk, Leicester, Lincoln and Cotswold.
Ram lamb—one Dorset Horn.
Ewes, shearling—4 Cotswold and 4 Lincoln.

Cows in Dairy Department.

I may add that we now have five distinct breeds of cows in our Dairy Department, viz., Jersey, Guernsey, Red Polled, Ayrshire and Holstein.

FARM PROPER.

The work on the farm proper has gone on pretty much as usual; and the crops, excepting potatoes, have been fairly good. Professor Shaw has made some further efforts towards the eradication of a few remaining weeds, and has devoted a considerable amount of time to the work of grading the large lane which runs through the farm from from north-east to south-west.

VISITORS.

Never before were there so many visitors at the College as in 1892. We had excursions nearly every day in the month of June, ranging from 300 to 2,500 each, and aggregating not less than 18,000 people—chiefly farmers and their families. We waited on these excusionists to the best of our ability; and, generally speaking, they seemed to be well pleased with what they saw and heard.

STUDENTS IN ATTENDANCE.

About ten years ago we imposed a heavy tuition fee upon non-residents, and immediately thereafter the number in attendance was considerably reduced. Of late years there has been a gradual increase in our numbers, and at length we are compelled to refuse applicants for want of accommodation—nine or ten for the regular course, and between sixty and seventy for the Special Dairy Course to commence on the 1st February.

The number in attendance in 1892 was 159, the great majority of whom are Ontario farmers' sons. Forty-three counties and districts have been represented, and the largest representation has been from the Counties of Huron, Simcoe, Wellington, Brant, Lincoln, Oxford, Middlesex and York.

COUNTY STUDENTS.

Of those in attendance during the year, forty-two were nominated by county councils, and, as a consequence, were exempted from the payment of tuition fees. The counties represented were the following:

Brant, Bruce, Durham, Dufferin, Elgin, Frontenac, Glengarry, Grey, Grenville, Halton, Hastings, Haldimand, Huron, Kent, Lambton, Lanark, Leeds, Lincoln, Middlesex, Muskoka, Northumberland, Ontario, Oxford, Peel, Perth, Peterborough, Prince Edward, Parry Sound District, Renfrew, Russell, Simcoe, Stormont, Waterloo, Wellington, Wentworth, York.

Analysis of College Roll.

Counties, etc.	No. of students.	Counties, etc.	No. of students.
Addington	1	Northumberland	1
Brant	6	North-West Territories	3
British Columbia	1	Nova Scotia	2
Bruce	3	Ontario	4
Carleton	1	Oxford	5
Dufferin	1	Parry Sound District	2
Dundas	2	Poland	1
Durham	3	Peel	3
Elgin	1	Perth	2
England	12	Peterborough	2
Frontenac	2	Prince Edward Island	3
Germany	1	Prince Edward County	3
Glengarry	3	Quebec	1
Grey	3	Rainy River District	1
Haldimand	3	Renfrew	4
Hamilton	2	Russell	1
Halton	2	Scotland	1
Hastings	2	Simcoe	10
Huron	10	Spain	1
India	1	Stormont	1
Kent	1	Toronto	7
Lambton	2	Waterloo	4
Lanark	2	Welland	1
Lincoln	5	Wellington	7
Leeds	2	Wentworth	3
Lennox	1	Wisconsin, U.S.A	1
Middlesex	5	York	5
Muskoka	1		
Norfolk	1		159

For full list of students see Appendix I. at the end of this Report.

Religious Denominations.

Methodists	54	Friends	2
Presbyterians	49	Disciples	2
Episcopalians	35	Evangelical Reformed	1
Baptists	7	Evangelical Association	1
Roman Catholics	5		
Congregationalists	3	Total	159

Age of Students.

5	16	years	2	23	years
18	17	"	6	24	"
22	18	"	6	25	"
23	19	"	1	26	"
20	20	"	2	27	"
33	21	"	3	28	"
17	22	"	1	32	"

Average age .... 20 years.

Class-Room Work.

Our class-room work has gone on as usual during the past year. All the candidates for degrees were successful in passing the examinations held by the Senate of the University of Toronto; and a fair proportion of the first and second year students gained a respectable standing in our College examinations, but the number of failures is still much larger than it should be. (See class-lists in Appendix IV. at the end of this report.)

Examiners.

The third year examinations were conducted by the University of Toronto, and those of the first and second years by the Professors of the College and four other gentlemen, to whom we are much indebted:

T. C. L. Armstrong, M.A.	English Literature.
J. M. McEvoy, B.A	Political Economy.
C. A. Zavitz, B.S.A.	Agriculture and Live Stock.
H. B. Sharman, B.S.A.	Live Stock.

Bachelors of the Science of Agriculture.

Seven candidates for the degree of B.S.A. were examined in the month of May. These candidates were all successful, and received their degrees at the regular commencement exercises of the University of Toronto in June. The list is as follows:

Carlyle, W. L.	Chesterville, Dundas, Ont.
Gibson, D. Z.	Willow Grove, Haldimand, Ont.
Harrison, F. C.	Ronda, Spain.
Hutchinson, J. W.	Randolph, Wisconsin, U.S.A.
Marsh, G. F.	Thornbury, Grey, Ont.
Morgan, R. N.	Kerwood, Middlesex, Ont.
Newcomen, W. F.	Epping, Essex, England.

Recipients of Associate Diplomas.

Twenty-six young men, having completed our regular course of two years, received diplomas admitting them to the Status of Associates of the College. The diplomas were presented by the Hon. John Dryden, Minister of Agriculture, at our closing exercises, on the 30th of June, and the names of the recipients are as follows:

Aylesworth, D.	Bath, Lennox, Ont.
Beckett, H. L.	Hamilton, Wentworth, Ont.
Bell, L. G.	Q'Appelle Station, Assa.
Brown, B. C.	Barriefield, Frontenac, Ont.
Burns, J. A. S. (Valedictorian)	Halifax, Nova Scotia.
Carlaw, Walter	Warkworth, Northumberland, Ont.
Carpenter, F. C. S.	Rat Portage, Rainy River District, Ont.
Crealy, J. E.	Strathroy, Middlesex, Ont.
Day, G. E.	Guelph, Wellington, Ont.
Dyer, W. D.	Columbus, Ontario, Ont.
Eaton, L. W.	Dartmouth, Nova Scotia.
Gies, N.	St. Jacobs, Waterloo, Ont.
Graham, W. R.	Belleville, Hastings, Ont.
Harcourt, R.	St. Anns, Lincoln, Ont.
Harvey, W. H.	Exeter, Huron, Ont.
Honsberger, J. D.	Jordan, Lincoln, Ont.
Hurley, H. B.	Belleville, Hastings, Ont.
Roper-Curzen, S.	Norbiton, Surrey, England.
Ruthven, W. A.	West Essa, Simcoe, Ont.
Shaw, R. S.	Ontario Agricultural College.
Silverthorn, C.	Summerville, Peel, Ont.
Soule, A. M.	Niagara Falls South, Welland, Ont.
Story, H.	Picton, Prince Edward, Ont.
Tolton, J. E.	Walkerton, Bruce, Ont.
Wiancko, A. T.	Sparrow Lake, Muskoka, Ont.
Yuill, A. R.	Carleton Place, Lanark, Ont.

First class Men.

The work in the College is divided into five departments, and all candidates who get an aggregate of 75 per cent. of the marks allotted to the subjects in any department, are ranked as first-class men in that department. We would like to have a larger number of such men, but we are determined that none shall be so ranked unless they really deserve it. The following list contains the names of those who gained a first-class rank in the different departments at the examinations in 1892, arranged alphabetically:

First Year.

1. *Atkinson, J.*, Seaforth, Huron, Ont.—in four departments: Agriculture, Natural Science, Veterinary Science and Mathematics.

2. *Ferguson, J. J.*, Smith's Falls, Leeds, Ont.—in five departments: Agriculture, Natural Science, Veterinary Science, English Literature and Mathematics

3. *McCallum, W.*, Guelph, Ont.—in three departments: Agriculture, Natural Science and English Literature.

4. *Spencer, J. B.*, Brooklin, Ontario County, Ont.—in one department: Agriculture.

5. *Walker, F.*, Norwich, Oxford, Ont.—in two departments: Agriculture and Mathematics.

Second Year.

1. *Beckett, H. L.*, Hamilton, Wentworth, Ont.—in two departments: Veterinary Science and Mathematics.

2. *Day, G. E.*, Guelph, Ont.—in four departments: Natural Science, Veterinary Science, English Literature and Mathematics.

3. *Dyer, W. D.*, Columbus, Ontario County, Ont.—in three departments: Agriculture, Natural Science and Mathematics.

4. *Harcourt, R.*, St. Anns, Lincoln, Ont.—in one department: Agriculture.

5. *Shaw, R. S.*, Guelph, Ont.—in five departments: Agriculture, Natural Science, Veterinary Science, English Literature and Mathematics.

6. *Soule, A. M.*, Niagara Falls South, Welland, Ont.—in three departments: Agriculture, Veterinary Science and English Literature.

Medalists.

Medals were given to the three students who ranked highest in general proficiency in the theory and practice of the second year. The competition was keen, as usual, with the following results:

Gold Medalists.—G. E. Day, Guelph, and R. S. Shaw, Guelph.

Stanley Silver Medalist.—H. L. Beckett, Hamilton, Wentworth, Ont.

Second Silver Medal.—A. M. Soule, Niagara Falls South, Welland, Ont.

First Year Prizemen.

Agriculture, Live Stock and Dairying.—1st, J. J. Ferguson, Smith's Falls, Leeds, Ont.

" " " 2nd, James Atkinson, Seaforth, Huron, Ont.

Natural Science.—1st, J. J. Ferguson; 2nd, James Atkinson.

Veterinary Science.—1st, J. J. Ferguson; 2nd, James Atkinson.

English Literature.—1st, J. J. Ferguson; 2nd, W. McCallum, Ontario Agricultural College.

Mathematics and Book-keeping.—1st, J. J. Ferguson; 2nd, James Atkinson.

General Proficiency.—1st, J. J. Ferguson; 2nd, J. Atkinson; 3rd, W. McCallum.

Second Year Prizemen.

Agriculture, Live Stock and Dairying.—1st, R. S. Shaw; 2nd, A. M. Soule.

Natural Science.—1st, G. E. Day; 2nd, W. D. Dyer.

Veterinary Science.—1st, G. E. Day; 2nd, H. L. Beckett.

English Literature and Political Economy.—1st, G. E. Day; 2nd, A. M. Soule.

Mathematics and Book-keeping.—1st, G. E. Day; 2nd, H. L. Beckett.

General Proficiency.—1st, G. F. Day ; 2nd, R. S. Shaw ; 3rd, H. L. Beckett.

Special Prizes for Essay on Fat Stock Show.—1st, A. M. Soule ; 2nd, R. Harcourt ; 3rd, L. G. Bell.

The English Bible.—(Prize given by a friend.)—1st, Leonard G. Bell.

Closing Exercises.

Our closing exercises for the year took place on the 30th June. The weather was fine and the attendance very large. There were between 800 and 900 people present from Guelph and the surrounding district. His Honor, Lieutenant Governor G. A. Kirkpatrick, favored us with his presence, and delivered a short but interesting address to the students and visitors, some of whom had come a long distance to hear him. Hon. John Dryden, Minister of Agriculture, James Innes, M.P., D. Guthrie, Q.C., M.P.P., Lieutenant-Colonel Macdonald, Sheriff McKim, a number of clergymen, and other leading men from the County of Wellington, were present and assisted in the presentation of medals, prizes and honor certificates.

Valedictory Address.

The second year man chosen to deliver the valedictory address for the year was J. A. S. Burns, of Halifax, Nova Scotia.

Changes in the Staff.

Two changes in our staff have taken place within the year. E. L. Hunt, B.A., who rendered us faithful service as Assistant President and Mathematical Master for nearly ten years, resigned his position on the 1st November last for the purpose of completing a course of study in Knox College, which he began some time since with a view to enter the ministry of the church to which he belongs. Mr. Hunt is a very active, earnest worker, and we wish him abundant success in the important calling which will hereafter engage his attention.

Mr. John McCrae, a fourth year undergraduate in the University of Toronto, was appointed to take Mr. Hunt's place. Mr. McCrae is an active young man of good parts, and I have no doubt he will prove a good disciplinarian and a successful teacher.

The other change referred to was in the Veterinary Department. F. C. Grenside, V.S., who has been our Professor of Veterinary Science for the last ten years, resigned his rofessorship a short time ago to take effect at the close of 1892. I need scarcely say that Dr. Grenside's services in the College and at Farmers' Institute meetings throughout the Province have been entirely satisfactory to all concerned. He has resigned, that he ma evote the whole of his time, without interruption, to the practice of his profession in Guelph.

J. Hugo Reed, V.S., of Guelph, a gold medallist at graduation and for some years a successful veterinarian in this neighborhood, has been appointed to succeed Dr. Grenside. Dr. Reed is at present travelling as the head of a Farmers' Institute deputation in the eastern part of the Province.

Farmers' Institutes.

Under the control of the Minister of Agriculture and in consultation with N. Awrey, M.P.P., representative of the Central Farmers' Institute, I have once more had the honor to arrange for the winter meetings of the Farmers' Institutes throughout the Province ; and I am pleased to be able to report that this branch of our work is still increasing in magnitude and importance.

In making out the provincial programme, I have endeavored to arrange so as to have each deputation composed of a representative of the College, and two other good men qualified to discuss some of the many questions which are of interest and practical importance of the farming community

The following is the list of meetings to be held in January, 1893. This list embraces 119 meetings and covers nearly the whole Province, excepting East Simcoe, and the Districts of Muskoka, Parry Sound, and Algoma, which are to be arranged for at later date:

INSTITUTE MEETINGS IN JANUARY, 1893.

Division 1.

Professor Thomas Shaw, H. L. Hutt, B.S.A. and John Jackson.

Durham	S. Grey	Jan. 3rd, 10.30 a.m.
Kenilworth	E. Wellington	" 4th, 10.30 a.m.
Damascus	E. Wellington	" 5th, 10.30 a.m.
Harriston	W. Wellington	" 6th, 1.30 p.m.
Paisley	C. Bruce	" 7th, 1.30 p.m.
Port Elgin	N. Bruce	" 9th, 10.30 a.m.
Tara	N. Bruce	" 10th, 10.30 a.m.
Teeswater	S. Bruce	" 11th, 1.30 p.m.
Brussels	E. Huron	" 12th & 13th, 1.30 p.m. on 12th.
Holyrood	S. Bruce	" 14th, 10.30 a.m.
Kincardine	C. Bruce	" 16th, 10.30 a.m.
Dungannon	W. Huron	" 17th & 18th, 1.30 p.m. on 17th.
Hensall	S. Huron	" 19th, 10.30 a.m.
Zurich	S. Huron	" 20th, 10.30 a.m.
Park Hill	N. Middlesex	" 21st, 10.30 a.m.

Division 2.

Professor A. E. Shuttleworth, D. McCrae and W. L. Carlyle, B.S.A.

Drayton	W. Wellington	Jan. 3rd, 10.30 a.m.
Berlin	N. Waterloo	" 4th & 5th, 1.30 p.m. on 4th.
New Hamburg	S. Waterloo	" 6th & 7th, 1.30 p.m. on 6th.
Listowell	N. Perth	" 9th, 10.30 a.m.
Milverton	N. Perth	" 10th, 10.30 a.m.
Mitchel	S. Perth	" 11th & 12th, 1.30 p.m. on 11th.
Ilderton	E. Middlesex	" 13th & 14th, 1.30 p.m. on 13th.
Coldstream	N. Middlesex	" 16th, 10.30 a.m.
Wyoming	E. Lambton	" 17th & 18th, 10.30 a.m. on 17th.
Sombra	W. Lambton	" 19th, 10.30 a.m.
Brigden	W. Lambton	" 20th, 10.30 a.m.

Division 3.

Hon. Charles Drury, Thomas Mason and J. H. Broderick.

Appin	W. Middlesex	Jan. 3rd, 10.30 a.m.
Bothwell	E. Kent	" 4th, 10.30 a.m.
Thamesville	E. Kent	" 5th, 10.30 a.m.
Chatham Centre	W. Kent	" 6th, 10.30 a.m.
Maidstone	N. Essex	" 7th, 10.30 a.m.
Woodslee	N. Essex	" 9th, 10.30 a.m.
Kingsville	S. Essex	" 10th & 11th, 1.30 p.m. on 10th.
Tilbury Centre	W. Kent	" 12th, 10.30 a.m.
Bismarck Station	W. Elgin	" 13th, 10.30 a.m.
Shedden	W. Elgin	" 14th, 10.30 a.m.
Aylmer	E. Elgin	" 16th & 17th, 1.30 p.m. on 16th.
Delhi	N. Norfolk	" 18th, 10.30 a.m.
Port Rowan	S. Norfolk	" 19th, 1.30 p.m.
Vittoria	S. Norfolk	" 20th, 10.30 a.m.

Division 4.

W. J. Palmer, B.S.A., Wm. S. Fraser and A. McD. Allan.

Hamilton	S. Wentworth	Jan. 3rd, 10.30 a.m.
Hall's Corners (Binbrook P.O.)	S. Wentworth	" 4th, 10.30 a.m.
Campden	Lincoln	" 5th & 6th, 1.30 p.m. on 5th.
Niagara Falls South	Welland	" 7th, 10 30 a.m.
Welland	Welland	" 9th, 10.30 a.m.
Pelham Town Hall	Monck	" 10th, 10.30 a.m.
Cayuga	Haldimand	" 11th & 12th, 1.30 p.m. on 11th.
Canborough	Monck	" 13th, 10.30 a.m.
Waterford	N. Norfolk	" 14th, 10.30 a.m.
Norwich	S. Oxford	" 16th & 17th, 1.30 p.m, on 16th.
Mount Pleasant	S. Brant	" 18th & 19th, 1.30 p.m. on 18th.
St. George	N. Brant	" 20th & 21st, 1.30 p.m. on 20th.

Division 5

John I. Hobson, Samuel Hunter and G. C. Caston.

Embro	N. Oxford	Jan. 3rd, 10.30 a.m.
Drumbo	N. Oxford	" 4th, 10.30 a.m.
Freelton	N. Wentworth	" 5th, 10.30 a.m.
Nassagaweya	Halton	" 6th, 1.30 p.m.
Weston	W. York	" 7th, 10.30 a.m.
Woodbridge	W. York	" 9th, 10.30 a.m.
Owen Sound	N. Grey	" 10th & 11th, 1.30 p.m. on 10th.
Maxwell	C. Grey	" 12th, 10.30 a.m.
Markdale	C. Grey	" 13th, 10.30 a.m.
Shelburne	Dufferin	" 14th, 10.30 a.m.
Orangeville	Dufferin	" 16th, 10.30 a.m.
Erin	C. Wellington	" 17th, 10.30 a.m.
Fergus	C. Wellington	" 18th, 10.30 a.m.
Guelph	S. Wellington	" 19th, 10.30 a.m.
Brampton	Peel	" 20th & 21st, 1.30 p.m. on 20th.

Division 6.

John McMillan, M.P., F. B. Linfield, B.S.A. and D. W. Beadle.

Burlington	Halton	Jan. 3rd, 10.30 a.m.
Bond Head	S. Simcoe	" 4th & 5th, 1.30 p.m. on 4th.
Collingwood	W. Simcoe	" 6th & 7th, 1.30 p.m. on 6th.
Elmvale and Wyevale	C. Simcoe	" 9th, 1.30 p.m. at Elmvale.
Minesing	C. Simcoe	" 10th, 10.30 a.m.
Newmarket	N. York	" 11th & 12th, 1.30 p.m. on 11th.
Agincourt	E. York	" 13th & 14th, 1.30 p.m. on 13th.
Uxbridge	N. Ontario	" 16th, 10.40 a.m.
Cannington	N. Ontario	" 17th, 10.30 a.m.
Woodville	W. Victoria	" 18th, 10.30 a.m.
Beaverton	N. Ontario	" 19th, 10.30 a.m.
Oshawa	S. Ontario	" 20th, 10.30 a.m.
Pickering	S. Ontario	" 21st 10.30 a.m.

Division 7.

H. B. Sharman, B.S.A., D. E. Smith, B.A. and R. F. Holtermann.

Lindsay	W. Victoria	Jan. 3rd, 10.30 a.m.
Bobcaygeon	E. Victoria	" 4th & 5th, 1.30 p.m. on 4th.
Lakefield	W. Peterborough	" 6th, 10.30 a.m.
Peterborough	W. Peterborough	" 7th, 10.30 a.m.
Warkworth	E. Northumberland	" 9th & 10th, 1.30 p.m. on 9th.
Grafton	W. Northumberland	" 11th, 10.30 a.m.
Picton	Prince Edward	" 12th, 10.30 a.m.
Wellington	Prince Edward	" 13th, 10.30 a.m.
Napanee	Lennox	" 14th, 10.30 a.m.
Bath	Lennox	" 16th, 10.30 a.m.
Cannifton	E. Hastings	" 17th, 10.30 a.m.
Baltimore	W. Northumberland	" 18th, 10.30 a.m.
Orono	W. Durham	" 19th, 10.30 a.m.
Bullock's Corners	N. Wentworth	" 20th, 10.30 a.m.

Division 8.

Professor J. Hugo Reed, V.S., T. G. Raynor, B.S.A. and A. H. Pettit.

Blackstock	W. Durham	Jan. 3rd, 10.30 a.m.
Tweed	E. Hastings	" 4th & 5th, 1.30 p.m. on 4th.
Sharbot Lake	Frontenac	" 6th & 7th, 1.30 p.m. on 6th.
Perth	S. Lanark	" 9th, 10.30 a.m.
Smith's Falls	S. Lanark	" 10th, 10.30 a.m.
Almonte	N. Lanark	" 11th, 10.30 a.m.
Pakenham	N. Lanark	" 12th, 10.30 a.m.
Renfrew	S. Renfrew	" 13th, 10.30 a.m.
Eganville	S. Renfrew	" 16th, 10.30 a.m.
Richmond	Carleton	" 17th & 18th, 1.30 p.m. on 17th.
Winchester	Dundas	" 19th, 10.30 a.m.
Avonmore	Stormont	" 20th, 10.30 a.m.

Division 9.

Professor J. Hoyes Panton, Joseph Yuill and Edward Jeffs.

Spencerville	S. Grenville	Jan. 3rd, 10.30 a.m.
Oxford Mills	N. Grenville	" 4th & 5th, 1.30 p.m. on 4th.
Metcalfe	Russell	" 6th & 7th, 1.30 p.m. on 6th.
Vankleek Hill	Prescott	" 9th & 10th, 1.30 p.m. on 9th.
North Lancaster	Glengarry	" 11th, 10.30 a.m.
Martintown	Glengarry	" 12th, 10.30 a.m.
Cornwall	Cornwall	" 13th, 10.30 a.m.
Morrisburg	Dundas	" 14th, 10.30 a.m.
New Dublin	Brockville	" 16th, 10.30 a.m.
Athens	Brockville	" 17th, 10.30 a.m.
Lansdowne	S. Leeds	" 18th, 10.30 a.m.
Delta	N. Leeds	" 19th, 10.30 a.m.
Centreville	Addington	" 20th & 21st, 1.30 p.m. on 20th.

FINANCIAL STATEMENT.

I.—College Expenditure.

(a) *College Maintenance.*

1. *Salaries and Wages*		$15,642 97
2. *Food*—		
Meat, fish and fowl		3,201 38
Bread and biscuit		618 89
Groceries, butter and fruit		4,226 92
3. *Household Expenses*—		
Laundry, soap, and cleaning		388 69
Women servants' wages—cooks, laundress, housemaids, etc.		1,716 17
4. *Business Department*—		
Advertising, printing, postage and stationery		966 65
5. *Miscellaneous*—		
Laboratory—chemicals, apparatus, etc.		445 81
Library—books, papers and periodicals		304 76
Medals		115 61
Unenumerated		749 43
		$28,327 28

(b) *Maintenance and Repairs of Government Buildings.*

Furniture and furnishings	$757 33	
Repairs and alterations	893 97	
Fuel	3,477 94	
Light	897 60	
Water	650 00	
Sewage disposal	148 04	
		$6,824 88
		$35,152 16

College Revenue.

Tuition fees	$1,818 66	
Laboratory fees for gas and chemicals	220 00	
Fees for supplemental examinations	17 00	
Balances paid for board, after deducting allowances for work on farm, etc	4,847 24	
Fines, breakages, etc.	31 99	
Sales of bones	7 80	
Sale of ice	15 50	
Refund from public works	3 00	
		6,961 19
Net cash expenditure of College		$28,190 97

The net sum voted by the Legislature for the College and the maintenance and repairs of Government buildings (see Estimates for 1892, pp. 35 and 40) was $30,195. Hence the unexpended balance for the year is $2,004.03.

II.—Farm.

(a) *Farm Proper.*

1. *Permanent Improvements*—

Underdraining, building new kitchen to carpenter's house, enlarging silo and wagon shed, grading and fencing lane, etc.		$2,729 22

2. *Farm Maintenance*—

Salaries and wages	$4,555 65	
Live stock imported from Great Britain	2,968 31	
Live stock—cows, steers, lambs, etc	2,536 81	
Maintenance of stock	4,556 25	
Seeds	185 52	
Manures	2 75	
Binding twine	55 90	
Repairs and alterations	569 87	
Furniture and furnishings	281 24	
Tools and implements	343 53	
Advertising, printing, postage and stationery	571 84	
Fuel and light	311 02	
Contingencies	396 90	
Hire of horse labor	10 00	
		$17,345 59
		$20,074 81

Farm Revenue.

Sale of cattle	$2,629 31	
" lambs	4,950 38	
" pigs	767 69	
" wheat	196 64	
" oats	130 25	
" rye	20 75	
" barley	21 50	
" peas	1 50	
" hides and pelts	18 65	
" wool	183 89	
" milk and cream	108 71	
" potatoes	1 20	
" old iron	19 65	
Service of animals	157 00	
Keep of animals	37 00	
Notes paid for stock sold by public auction, 1891	906 74	
Refund of registration fees	5 00	
Sale of sundries	8 00	
		$10,163 86
Net cash expenditure of farm proper		$9,910 95

(b) *Experiments.*

Salaries and wages—

Assistant Superintendent of Experiments	$1,199 98
Special assistant	118 73
Experimental feeder	395 86
Labor	2,083 15
	$3,797 73

Seeds	362 00
Manures and special fertilizers	95 60
Team of horses and stock for feeding	281 50
Furniture, furnishings and repairs	362 98
Printing, postage and stationery	171 37
Implements	246 51
Feed and fodder	7 85
Exhibitions	252 53
Contingencies	8 75
	$5,586 82

III.—Experimental Dairy.

Salaries and wages—	
Assistant for experimental work	$530 79
Laborers for milking and feeding stock, etc.	407 38
Temporary assistance	126 80
	$1,064 97
Cattle imported from Great Britain	478 00
Purchase of cows and pigs	377 55
Feed for cows and pigs	676 63
Furniture, furnishings and repairs	511 00
Laboratory expenses, gas, chemicals, etc.	18 27
Advertising, printing, postage and stationery	146 61
Fuel	110 06
Dairy appliances for fitting up new butter and cheese rooms—extractor, accumulator, separator, curd-mills, milk vats, etc	991 30
Expenses *re* travelling dairy	6,301 26
Contingencies	96 88
	$10,772 53

Dairy Revenue.

Cash sales of cattle	$90 00	
" pigs	216 03	
" butter	495 96	
" milk	79 54	
" butter tubs	22 50	
" creamery plant	200 00	$1,104 03
Net expenditure of Experimental and Travelling Dairies		$9,668 50

IV.—Garden, Lawn, etc.

Salaries and wages—	
Foreman	$700 00
Gardener	480 00
Assistant Gardener	317 44
"	300 00
Teamster	324 96
Laborers	1,338 14
	$3,460 54

Manure		90 60
Trees, seeds, bulbs, and plants		207 68
Furniture, furnishings and repairs—		
Tools, implements, flower-pots, etc		380 46
Fuel and light		541 40
Contingencies		34 02
		$4,714 70

Less Garden Revenue.

Sale of vegetables	$47 50	
" old greenhouse frame	30 00	
Refund from Public Works	3 60	
		$81 10
Net expenditure of the Horticultural Department		$4,633 60

V.—Mechanical Department.

Salary of foreman	$700 00
Extra carpenter for erection of buildings	430 00
Lumber, nails, oil, paint, etc	35 66
Tools, etc	79 40
Fuel and light	25 80
Expenditure of Mechanical Department	$1,270 86

Total Net Expenditure for Maintenance in all Departments in 1891.

College	$28,190 97
Farm proper	9,910 95
Farm experiments	5,586 82
Experimental and travelling dairies	9,668 50
Garden, lawn, etc	4,633 60
Mechanical Department	1,270 86
	$59,261 70

VI.—College in Account with Farm and Garden.

(a) *With Farm.*

To 252 bags potatoes, 50c.		$126 00
" 66 " " 70c.		46 20
" 4,705 gallons milk, 12½c.		588 13
" feed for College horse (without attendance)		75 00
" " Bursar's " " "		75 00
" putting in ice for College		26 25
" cartage for College, offset by kitchen refuse used by farm		
" hauling sludge from sewage tanks, offset by manurial value of sludge		
		$936 58

(b) *With Garden.*

To fruit and vegetables supplied from time to time		$739 02
		$1,675 60
By amount paid by College for student labor on farm and garden (mostly on farm)	$3,150 47	
" half of farm superintendent's salary	1,000 00	
		4,150 47
By balance to credit of College		$2,474 87

VII.—Farm in Account with Experimental Dairy.

To putting in ice for dairy	$18 00
" hauling stone	12 00
" sowing and cultivating corn	6 00
" mowing field No. 10	3 00
" 100 tons ensilage, $1.25	125 00
" 1,300 bushels turnips, 7c.	91 00
" service of animals	41 00
" 1 mower knife broken	4 50
	$300 50

Buildings still needed.

We have, as already stated, made several important additions to our buildings during the past year, and our equipment is now quite creditable; but we require four or five more to enable us to do fully and satisfactorily the work we have on hand. Those most needed are as follows:

(1) A double house for the assistant and the cattleman in the dairy department.

(2) An experimental building.

(3) A poultry building.

(4) Houses for the Professors of Chemistry, Natural History, and Dairying.

Hoping that you may find it possible to erect some of these before the end of the year 1893.

I have the honor to be, sir,

Your obedient servant,

JAMES MILLS,
President.

PART II.

REPORT OF THE

PROFESSOR OF NATURAL HISTORY AND GEOLOGY

To the President of the Ontario Agricultural College:

In presenting to you a report referring to the Department of Natural History, I do so this year with great pleasure. Never in the history of the College has the equipment of this department presented such a favorable appearance as now. During the past year the botanical laboratory has been completed and we have at last after years of patience, reached the dawn of brighter days. The class-room, seated for 94 students, is perfect in its acoustic properties. The wall in front forms a most admirable screen for projecting views upon by means of the stereopticon which we now use with the limelight. By a simple arrangement it is readily adapted for the display of diagrams. At a time when so much stress is laid upon technical education too much cannot be done to illustrate every lecture with diagrams either upon canvas or by means of views projected upon a screen. For some time I have been working in this direction and have succeeded in getting many slides prepared to illustrate the teachings of science as it bears upon agriculture. We are now able to procure excellent views of beneficial and injurious insects; injurious parasitic plants such as blights, mildews, rusts, etc., and many subjects in both zoology and geology. The arrangements for the study of microscopy in the adjoining room are exceedingly well adapted to practical work. We can now give each student a table and outfit. Everything in connection with this subject of study is so planned that the tendency to confusion is reduced to a minimum.

The private room is also very suitable for work and study. The small room on the north side will be very convenient for keeping plants for further study, and also for carrying on experiments from time to time. Seldom are four rooms so well arranged for experiment, teaching, work and study as those connected with the botanical department. Our three cabinets containing collections of injurious and beneficial insects, minerals and plants, are most valuable in the study of economic entomology, geology and botany. I am certainly much indebted to you for securing the apparatus recommended in my last report, and hope to make good use of it by fostering in the minds of students a love for the study of subjects connected with agricultural science. We have made so many strides during the past few years that great changes have been made in the curriculum of studies, and consequently a marked increase in the work and responsibility of each department has resulted.

In former years there was no annual report to write, no bulletins to prepare, no farmers' institutes to attend, no third year to teach and scarcely any inquiries to answer. To-day these five additional duties demand our attention. As for my department, you are aware that much of the teaching is of such a nature that diagrams and apparatus are constantly in use and require time to arrange, etc. This will increase because there is a greater demand for technical education, and besides it makes the work far more attractive and impressive to the student when we appeal to his eyes as well as ears. This of course means much of the lecturer's time spent in preparation. Further, the establishment of experimental stations in the United States has produced a flood of literature bearing upon problems in agricultural science. Consequently the professor of a department requires to spend much time in examining the results of the investigations bearing upon subjects of which he is the teacher. With such a demand upon my time, I believe we have reached a point in progress where the establishment of a fellowship in connection with the Department of Natural History might be reasonably advocated. This fellowship could be awarded to one of our best students in the third year who desired to continue at the College for a longer period with a view to perfecting himself still more in subjects of study and at the same time act as assistant to the professor of the department.

My duties hitherto have been as follows:

1. To deliver a course of lectures on Hygiene, Zoology, Structural Botany and Geology to the students of the first year.

2. A course on Theoretical Horticulture, Economic Entomology and Economic Botany to the second year.

3. A course on Physiological Botany, Economic and Systematic Botany, and Biology to the third year. Also, to superintend practical work in Microscopy two afternoons of each week until May.

4. As librarian, to superintend the library and reading-room.

5. As curator of the museum, to oversee it.

6. To arrange for the taking of meteorological observations, and to report annually upon them.

The taking and recording of observations relating to the weather belongs properly to the Experimental Department, and to such should be transferred; especially now as I reside in the city, and not at the College, as formerly when it was placed in my charge.

In the museum so many specimens have been added of late years that there is a great deal of labelling, etc., which cannot be done without assistance. The library, too, has become a great source of work, and much could be done there in indexing, etc., which, at present, cannot be undertaken. Our students are showing much more interest in reading now than in former years; many more books are sought after, and a greater desire is manifested for consulting works in the library. At present it is open for giving out books a short time in the morning, but this is not sufficient. Until I removed to the present botanical laboratory my office was in the library, consequently any one of the staff coming to the library could gain access; but now, in my absence, such cannot be. The result is, that much inconvenience arises to members of the staff who desire to consult books from time to time. In fact we should have a librarian there all the time, and use the adjoining room as a reading room; but, probably, we are not in a position yet to ask so much. Should we get an assistant appointed to the Department of Natural History, much improvement would be effected in the museum and the use of the library.

Having placed this suggestion before you, I feel assured you will give it that consideration its importance and practicability demand.

1. Museum.

The following persons have donated specimens to the museum this year:

G. C. Peacock, Mt. Salem: 8 species of weed seeds. E. Newton, Esq., Guelph: fossils from the Utica slate formation, Collingwood. W. N. Howell, Grey: a peculiar plant growth. F. DeHart, Whitby: a bottle of pickles put up in '79, also a flint arrowhead. Beverley Ruffin, Danville, Va.: specimens of tobacco. David Carstairs, Bowmantan: larvæ of ground beetles.

A number of weed seeds have been gathered, and arranged at the side of plants in our collection of weeds upon the walls. Our museum is yearly becoming more useful as an adjunct to the class-room. The specimens desired are those of a practical nature, rather than suited for the ordinary observer, who looks only for strange things. At present I am negotiating for some botanical specimens which will prove of great practical value to the student in Economic Botany.

2. Library.

Several useful volumes have been added during the year, and our list is gradually embracing a valuable collection of books for students in agricultural science. Far more books are being read now than in former years, and students are learning more than ever the sources from which knowledge may be obtained regarding the latest discoveries in agricultural science.

The chief complaint is that our course is not long enough to give an opportunity to make more use of the library. One hundred and thirty volumes have been added during the year; these may be grouped as follows:

Reports, chiefly agricultural	63
Natural History	4
Veterinary	1
Agriculture	6
Chemistry	1
Literature	20
Botany	3
History	3
General Science	2
Parliamentary Reports	10
Travels	5
Biography	7
Entomology	2
Horticulture	1
Miscellaneous	2
	130

3. Reading Room.

This is one of the most commodious and pleasant rooms in the College, and is becoming yearly more used for the purpose it was intended. It is well furnished for reading and study; excellent tables and chairs, and convenient reading desks, upon which are found the best agricultural journals published, a list of which is given below.

The following is a list of papers, journals and magazines which come to the College, and are for the use of the students in attendance:

(a) *Sent free by the Publishers.*

Name.	Where published.
1. Journal of Commerce	Montreal.
2. Canadian Baptist	Toronto.
3. Christian Guardian	"
4. Canada Presbyterian	"
5. Monthly Weather Review	"
6. Presbyterian Review	"
7. Sheep Breeder and Wool Grower	Chicago.
8. Manitoba Weekly Free Press	Winnipeg.
9. Canadian Horticulturist	Grimsby.
10. Canadian Entomologist	London, Ont.

Name.	Where published.
11. Bee Journal	Beeton.
12. North York Reformer	Newmarket.
13. Acton Free Press	Acton.
14. Ontario Evangelist	Erin, Ont.
15. Evangelical Churchman	Toronto.
16. Farmers' Review	Chicago.
17. Canadian Independent	Toronto.
18. Rural Home Journal	Kentucky.
19. Canadian Churchman	Toronto.
20. " Independent	"
21. " Evangelist	"

(b) *Furnished by the College.*

1. Daily Globe	Toronto.
2. " Mail	"
3. " Empire	"
4. " Mercury	Guelph.
5. " Herald	"
6. Rural Canadian	Toronto.
7. Grip	"
8. Poultry Review	"
9. Farmers' Advocate	London, Ont.
10. Canadian Stock Raisers' Journal	Toronto.
11. Nor'-West Farmer	Winnipeg.
12. Breeders' Gazette	Chicago.
13. North British Agriculturist	Edinburgh, Scotland.
14. American Garden	Greenfield, Mass.
15. Cultivator and Country Gentleman	Albany, N.Y.
16. Scientific American	New York.
17. Live Stock Journal	England.
18. American Dairyman	New York.
19 Botanical Gazette	Crawfordsville, Ind.
20. Agricultural Science	Geneva, N.Y.
21. Literary Digest	Boston.
22. Entomological News	Philadelphia.
23. Canadian Agricultural and Home Magazine	Peterborough.
24. Hoard's Dairyman	Ft. Atkinson, Wis.
25. Maritime Agriculturist	New Brunswick.

The following bulletins have been issued from this Department during 1892 :

FUNGICIDES AND INSECTICIDES.

Of the numerous experiments that are being carried on at Experiment Stations in Canada and the United States none have afforded more definite results than those conducted for the purpose of ascertaining what compounds may be used successfully against such parasitic plants as blights, mildews, rusts and smuts, and against the insects injurious to vegetation.

Although results of these investigations are printed in agricultural and horticultural journals from time to time yet many Canadian farmers are not fully informed in regard to them. During a late trip in connection with Farmers' Institutes I was surprised that so few had as yet learned anything from this field of investigation.

With a view to reach at least the members of Institutes in Ontario I have put into this bulletin some practical knowledge upon the results of researches in reference to the use of fungicides and insecticides, and hope it will prove handy for reference when information regarding these is required.

Fungicides.

Fungicides may be defined as chemical compounds or mixtures used for the purpose of destroying such injurious forms of plant life as live upon other plants by absorbing their juices to such an extent as to affect their vitality. Examples are seen in the *rusts, smuts, mildews and blights.*

It is but a comparatively short time since the life history of these obscure forms of plant life has been made out; but during late years wonderful strides have been made in this department of biology, and we are now in possession of knowledge that enables us to hold in check their destructive effects by the application of so-called fungicides; among which some of the most important are:

Bordeaux Mixture. (1) This consists of copper sulphate, lime and water in the following proportions: 6 lbs. of copper sulphate, 4 lbs. lime, 22 gals. water. This may be prepared by dissolving the copper compound in 16 gals. water; slake the lime in 6 gals. water, and when the latter is cooled pour it slowly into the copper solution and mix thoroughly. Some use less water for dissolving the first. This solution sprayed has been successful against downy mildew of the grape and potato blight.

(2) A modified form 4 lbs. copper sulphate, 4 lbs. lime and 50 gals. water has been beneficial upon raspberries affected with anthracnose.

(3) 6 lbs. copper sulphate, 4 lbs. lime, 50 gals. water.

Eau Celeste. This consists of copper sulphate, ammonia (commercial) and water, 2 lb. copper sulphate, 2 pints ammonia and 50 gals. water. Dissolve the copper sulphate in about 2 gals. hot water, as soon as cool add the 2 pints ammonia and dilute to 50 gals.

A modified form has given better results, viz: 2 lbs. copper sulphate dissolved in 2 gals. water, 2½ lbs. sodium carbonate (washing soda) dissolved in another vessel. Mix these, and when chemical action has ceased add 1½ pints of ammonia and dilute to 22 gals. Some dilute even to 30 with good results.

This has been found good against downy mildew of grapes, black rot of grape, anthracnose, blight of potato, rot of the tomato, gooseberry mildew, and scab of apple when sprayed upon the affected plants.

Eau Grison (Grison liquid). This consists of sulphur, lime and water. Boil 3 lbs sulphur and 3 lbs. lime in 6 gals. water until reduced to 2 gals. When settled pour off the clear liquid; this may be bottled and when used dilute with 100 parts water. This is used to destroy downy mildew and powdery mildew of the grape and the mildew of the gooseberry.

Copper Sulphate. 1 lb. in 24 gals. water used to destroy smut on seed grain. Soak the seed in this for from 12 to 16 hours; then dip it into lime water for five minutes. The last step is not absolutely necessary, but is an improvement. 1 lb. in 25 gals. water is sprayed in early spring on vines to kill the spores of fungi.

Ammoniacal solution of copper carbonate. Copper carbonate, ammonia and water. Dissolve 4 oz. copper carbonate in 2 quarts ammonia, and when about to use dilute to 30 gals. Used to destroy grape mildew and apple scab. In the latter disease it has been very successful.

Potassium Sulphide. 1 oz. potassium sulphide to 2 gals. water destroys gooseberry mildew and strawberry blight—so called "Sunburn."

Sodium Hyposulphite. 1 lb. to 10 gals. water used against apple scab, but not so successful as Eau Celeste and the ammoniacal solution of copper carbonate.

Galloway's Mixture No 5. This is a mixture of equal parts, ammoniated copper sulphate and ammonium carbonate used at the rate of 8-12 ozs. to 25 gals. of water reported good against the apple "spot."

Treatment of some Common Forms of Fungi.

"Spot" on the Apple—No. 1. 1st, spray before blossoms open with Bordeaux mixture, No. 2. 2nd, 3rd, 4th, same mixture with 4 oz. Paris green to the barrel. This will act as an insecticide. The second application is made when the fruit is well formed; the others at intervals of two weeks.

2. Ammoniacal solution of copper carbonate. 1st, before blossoming. 2nd, apples about size of peas; 3rd, two weeks later.

Brown rot on cherry, plum and peach. Same as for apple "spot."

Pear leaf blight. Apply ammoniacal copper carbonate. 1st, as soon as leaves begin to open, 2nd, 3rd and 4th at intervals of two weeks.

Strawberry blight. Ammoniacal copper carbonate or Bordeaux mixture every two weeks during July and August.

Black rot on grapes. Ammoniacal solution copper carbonate, 5-7 times; commence early in May every two weeks.

Downy mildew on grapes. Spray with Eau Celeste. 1st, before blossom (10 days.) 2nd, when berries are well set. 3rd, three weeks later.

INSECTICIDES.

Compounds or mixtures used to destroy insects injurious to vegetation.

Paris green (arsenite of copper containing 50 to 60 per cent. of arsenic). Applied dry or in solution. In the dry form best mixed with 50 to 100 parts plaster, wood-ashes, flour or air-slacked lime and dusted upon the affected plants. The wet form is usually used in the proportion of 1 lb. Paris green to 200 gals. of water, but if the foliage is tender 250 to 300 gals. water (applies to application upon the plum). As this green powder does not dissolve it requires to be kept thoroughly mixed. It is an excellent insecticide against potato bug, plum curculio, canker worm, tent-caterpillar, grape-vine beetle and codling moth. It can be used successfully in nearly all cases of leaf-eating insects.

London purple. An arsenite of lime obtained as a by-product in manufacturing dyes; is largely used instead of Paris green; but being more soluble in water it is likely to injure the foliage, and besides its composition varies considerably so that when used it is not likely give as uniform results as Paris green.

In spraying for codling moth it is usual to spray after the blossoms fall, when the apples are about the size of peas and before they have turned downwards on the stem, and a second time about ten days after. For plum curculio, as soon as the fruit is formed followed by two or three applications with an interval of ten days between. In this case the solution is weaker than that used upon the apple, 1 lb. in 250 to 300 gals. of water.

Kerosene emulsion. A mixture of coal oil and water. There are three mixtures of this kind that are used to a considerable extent:

(*a*) Riley-Hubbard emulsion. ½ lb. hard soap in 1 gal. rain water, boil till dissolved, then add 2 gals coal oil and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. In using dilute with 9 parts water (soft).

(*b*) Cook's emulsion (soft soap). 1 quart soft soap, 2 quarts boiling water. While hot add 1 pint of coal oil. Mix thoroughly. In using dilute with equal amount of water. May use hard or soft water.

(*c*) Cook's emulsion (hard soap). ¼ lb. hard soap, 2 quarts water and 1 pint coal oil, and thoroughly mix while hot. In using dilute with twice the amount of water (hard or soft).

These emulsions are very excellent against plant lice, scale insects, chinch bug, cabbage-worm and even rose-beetle.

Hellebore. Obtained from the powdered roots of a plant (Veratrum album). May be applied dry or as a liquid. 1 oz. to 3 gals. water. Excellent against currant worm and cherry slug.

Pyrethrum. Made from the powdered flowers of the genus pyrethrum, a plant of the sunflower family. It should be fresh, and hence should be kept in closed vessels. Used in dry form, 1 part pyrethrum, 5 to 8 parts flour; or liquid 1 oz. in 3 gals. water. A good remedy for cabbage-worm.

A combined insecticide and fungicide. 4 oz. Paris green with Bordeaux mixture No. 2, good against potato beetle and blight, codling, moth and "spot" of apple.

Carbolic Acid Emulsion. 1 part carbolic acid to 5 or 7 parts of a solution consisting of 1 quart soft soap or 1 lb. hard in 2 gals. water. This applied to affected trees destroys bark-lice and the borers. It should be well rubbed upon the parts attacked.

Carbolized Plaster. A mixture of carbolic acid and land plaster, 1 pint of the former and 50 lb. of the latter. A remedy against flea beetles.

Tobacco. The refuse from cigar manufactories answers the purpose. A strong solution added to one gallon water destroys plant lice and flea beetles. About 1 lb. of tobacco to 2 gallons.

Alkaline Wash. (1) A strong solution of washing soda mixed with soft soap until about as thick as paint. Applied to the trunk of trees destroys the borers, and gives a healthy vigorous tone to the tree. (2) 1 qt. soft soap or $\frac{1}{4}$ lb. hard soap in two quarts of water; add 1 part of carbolic acid to 7 of this.*

Application of Fungicides and Insecticides.

The foregoing compounds and mixtures are usually applied by means of spraying machines, many of which are now advertised and information concerning them may be readily obtained from seedsmen or others concerned in their sale. As such are readily accessible to farmers and gardeners it is unnecessary to give the names of manufacturers.

The following list of prices will give the readers an idea of the approximate cost incurred by the use of certain compounds in making up mixtures. Price per lb.:

Ammonia, 25c.; copper carbonate, 60c.; Paris green, 30c.; London purple, 15c.; pyrethrum, 40c.; copper sulphate, 12c.; hellebore, 25c.; sodium carbonate, 5c.

Precautions in Spraying, etc.

1. Keep poisonous substances labelled and out of the way of children.
2. Do not continue to spray so far into the season as to affect the fruit.
3. In making emulsions remember the inflammable nature of coal oil.
4. Never spray trees in bloom.
5. Try mixtures on a small scale if you have any doubts regarding their effect upon the foliage.
6. Be careful and thorough in your work.

Much has been said of late regarding the danger incurred by eating fruit from trees and vines which had been sprayed with Paris green, but careful chemical analysis shows there is no ground for such an alarm. In the case of some suspected apples it was found that eight tons would require to be eaten before a dose of poison would be taken.

* A good remedy against *Bark-lice* is to rub affected trees with alkaline solution No. 2 in early spring, and spray in June with kerosene emulsion.

Bees in Relation to Fruit.

An Act passed by the Ontario Legislature last session, referring to the prevention of spraying fruit trees while in bloom, has led to considerable discussion among fruit-growers and bee-keepers. The former feel that they should be permitted to spray whenever they desire, claiming that bees are not killed from visiting sprayed trees in search of nectar, and that this cry of alarm raised by bee-keepers is unfounded. Further, many are under the impression that bees injure ripe fruit, and that it is questionable whether bees are as useful in the fertilization of flowers as is claimed for them by their admirers.

The bee-keepers, on the other hand, maintain that bees are important in the fertilization of flowers, and thus become necessary to fruit production; that they do not injure fruit, and that they are killed where trees are sprayed while in bloom. They go so far as to say that honey is affected where bees have been poisoned by Paris green.

In this somewhat confused state of affairs a bulletin bearing upon bees in relation to fruit should be of interest and practical benefit when the following Act (*passed April, 1892*) is about to be enforced:

1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use or cause to be used any mixture containing Paris green or any other poisonous substance injurious to bees.

2. Any person contravening the provisions of this Act shall, on summary conviction thereof before a justice of the peace, be subject to a penalty of not less than $1 or more than $5, with or without costs of prosecution, and in case of a fine or a fine and costs being awarded, and of the same not being upon conviction forthwith paid, the justice may commit the offender to the common gaol, there to be imprisoned for any term not exceeding thirty days unless the fine and costs are sooner paid.

3. This Act shall not come into force until the first day of January, 1893.

Bees in Relation to Fertilization.

During the process of fertilization the contents of the pollen grains become mingled with those of the ovules, after which the latter develop into seeds. This takes place somewhat as follows: The dust-like substance (pollen) on the ends of the stamens falls upon the top of the pistil. The outer coat of the pollen grain bursts, and the inner pushes out in the form of a tube, which forces its way from the top of the pistil down through it until it reaches the ovary (the lower and enlarged part of the pistil) where the ovules are located. In the meantime a minute structure (germinal vesicle) has formed in the ovule. This point is reached by the pollen tube, an interchange of elements takes place, the ovule is fertilized, and at once changes begin which end in the complete development of a seed.

The question naturally arises: How do the pollen grains get to the pistil? This effected, fertilization will in all likelihood take place.

Observation shows that this may be done in several ways.

1. *By the wind.* Where this is the usual way we find the plants are rich in pollen, have no nectar, grow crowded together, in some cases bloom before the leaves appear, and are seldom attractive in appearance. The grasses, willows, and some maples afford examples of plants largely dependent upon the wind for the transport of the pollen to the pistil.

2. *By artificial means.* Man can effect the same result by simply taking the pollen and placing it upon the pistil. This has enabled him to cross-breed and hybridize to such an extent that he has developed innumerable varieties of plants of great economic value, as is exemplified in our beautiful flowers and luscious fruits.

3. *By birds*, which to some extent aid in carrying pollen from plant to plant, especially such as the humming birds.

4. *By insects.* This, probably, is by far the most common method in nature, and may be viewed as the chief use of insects.

Plants fertilized by insects present an attractive appearance, are rich in perfume, and above all supply nectar to the insects which frequent them. It can be readily seen how insects moving about in a flower will become loaded with the dust-like pollen, and in passing to other flowers aid much in transferring the pollen from one plant to another, and thus bring about a cross-fertilisation, or in other words, cross-breeding, which seems as essential to the production of vigorous and fertile plants as it does in animal life.

Among insects which aid largely in this interesting process no class is more useful than bees. Where imperfect fertilization has taken place fruit is incompletely developed in size and form, so that the quantity and quality are affected. Careful investigation has shown that the fruitfulness of many plants is largely influenced by bees and such insects as search for the nectar and pollen of flowers.

Although many flowers have both stamens and pistils in the same flower, still scientific observation has shown that even in these cross-fertilziation is favored by the structure of the flower. From observations made it is claimed that orchards with bee-hives in them have been more fruitful than those without hives. In some cases bees have been given access to greenhouses so that the flowers might be fertilized, and thus develop more and better fruit under such conditions. Flowers have been covered so as to prevent insects reaching them, but light and air admitted. Side by side were others to which bees had access. An examination of the seed showed those of the former to be weak in vitality, those of the latter strong. In many instances it has been observed where fruit trees were covered with bloom and poor results followed, that the weather at the time of bloom was cloudy, wet, and cold, and thus unfavorable to bees working among the flowers.

Scientific investigation indicates more and more as the question of fertilization is considered, that bees are important factors in the production of fruit and thus become co-workers with fruit-growers.

Bees in Relation to the Destruction of Fruit. Along this line of investigation exhaustive experiments have been carried on under the direction of the Department of Agriculture, U.S. Neither care nor expense was withheld by the apiculturist to whom the work was intrusted. Hives were kept within a building from which the bees could not escape. In this grapes, peaches, pears and plums, varying from green to dead ripe, were placed. The bees were deprived of food and left with the food exposed, so that they might feed upon it when hunger affected them. Many came to the fruit from time to time but never broke the skin, but where they found it broken they at once fed upon the exuding juice. They showed no tendency to use their jaws in cutting open a place. The test was continued for thirty days and other bees tried with similar results. In all cases food was taken only from fruit which had been previously broken. Consequently it appears that bees will not injure perfect fruit, a conclusion arrived at by many observers before these thorough experiments were undertaken. This is what might be expected when the construction of the bee's mouth is considered. It is quite different in the case of wasps, which are supplied with jaws suitable to break into the skin, and in all likelihood they are the cause of the injured fruit upon which some observers have seen bees feeding. Much evidence has been collected upon the amount of injury done by bees to fruit, and it all seems to be in favor of exonerating the bee from the charge of injuring sound fruit.

Paris Green in Relation to Bees. In several places where spraying is carried on extensively it has been observed that since the introduction of that practice many bees have perished during the time trees are in bloom, and some observers have noticed that the brood also perished.

Before the days of spraying such mortality was unknown. Now, although there has been no analysis of the bodies of the dead bees for the purpose of ascertaining the presence of arsenic, still the death of the bees is so intimately associated with spraying that there seems but little reason to believe otherwise than that the bees have been poisoned with Paris green used in spraying fruit trees. However this will likely soon be settled by an analysis of the bodies of bees supposed to have been poisoned, and I have no doub arsenic will be detected. I suggest the propriety of bee-keepers forwarding some speci mens of poisoned bees to the chemist of the Agricultural College.

Prof. Cook, of Michigan, has proved by experiment that a solution of Paris green in the proportion of 1 pound to 200 gallons (a common mixture used in spraying trees) proved fatal to bees in twenty-four hours.

Regarding the effect upon honey there is considerable diversity of opinion. The writer is not aware of any experiments having as yet been undertaken to show that even the honey is effected, though there is in the minds of some very practical men, (such as the inspector, Mr. McEvoy, who is thoroughly convinced), a great fear that honey produced at the time of spraying is a dangerous article of food. The writer would suggest that some such suspicious honey be sent to the chemist already referred to so that there may be no longer any doubt regarding the subject.

Experiment in the laboratory and observation by practical men indicate that spraying trees in bloom with Paris green is followed by most disastrous results to bees in the neighborhood, and no doubt some degree of injury to the trees as far as fruit is concerned.

THE TIME TO SPRAY. To spray when trees are in bloom is a great mistake, because it is a waste of material, time and fruit. The plum curculio and codling moth are the chief enemies we seek to destroy with Paris green. The adult of the former lays its eggs in the plum just beneath the skin and is not likely to be present to any great extent till the fruit is *set*, consequently applying the poison while the trees are in bloom is commencing the attack too soon. If thought necessary to attack insects before the time of bloom, spraying may be done, and afterwards, but certainly *never while the trees are in flower*.

In the case of the codling moth which deposits its eggs in the blossom end of the young apple, a mistake is also made by spraying before the fruit is set, which does not take place till the bloom is off.

The portion of the pistil upon which the pollen falls is exceedingly tender and sensitive, so much so, that the application of such substances as Paris green injure it to so great an extent that the process of fertilization is affected and the development of fruit checked. With these facts before us as revealed by scientific investigation, it does seem strange that anyone would attempt to spray at a time not in accord with the teachings of science, and that anyone would feel it a hardship to conform to the requirements of a law calculated to protect the interests of two so important classes as the producers of fruit and honey. Spraying is only in its infancy, but as time rolls on and this practice becomes more general, the practicability of the law referred to will become more evident and the efforts of those seeking to enforce it thoroughly appreciated.

METEOROLOGY.

Observations are regularly taken at the hours of 8 a.m. and 8 p.m. daily, and recorded in a book printed for the purpose. The instruments in use are as follows:

Barometer—Showing the atmospheric pressure at the time of observation.

Maximum thermometer—Indicating the highest temperature between times of observation.

Minimum thermometer—Indicating the lowest temperature between times of observation.

Pluviameter—Used in measuring the rainfall.

Thermometer—For observing ordinary temperature.

Besides taking observations from these instruments, the cloudiness of the sky is observed, and general remarks on the weather for the day are recorded in the daily register. At the close of each month a summary of the month's observations is made out. From these summaries the statement of the year's meteorology is made.

In conclusion, allow me to thank you, and through you the Minister of Agriculture, who has so kindly furnished us with the means by which we have been able to do so much towards increasing our facilities to make the department of Natural History instructive, attractive and practical.

Yours respectfully,

J. HOYES PANTON,
Professor of Natural History.

O. A. C. GUELPH,
DECEMBER 31st, 1892.

PART III.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

To the President of the Ontario Agricultural College:

SIR,—The past year has been one of unusual interest and activity in this department. A determined effort is being made to meet the two main purposes of the chemical department. As this is a teaching institution, we make it our first object to provide efficient instruction for our students, and, whenever we can, improve upon past methods. Chemical investigation, in conjunction with the field, dairy and live stock experiments of this station, presents a claim for our attention second only to that of instruction.

My report, therefore, is under two headings: (1) Teaching; (2) Analysis.

TEACHING.

At the beginning of this term, the assistant chemist, Mr. H. B. Sharman, B.S.A., was relieved almost entirely from teaching and other class duties that he might give most of his time uninterruptedly to chemical analysis. The increased grant of money voted for the chemical department has enabled us to add largely to the stock of chemicals and apparatus required for class purposes. With this additional equipment, we have been able to make the course of instruction more practical and, we think, more thorough than it has been hitherto. Our department is still without a room where first year students, when sufficiently advanced, can work at their own laboratory desks or tables. Such a room is very much needed. The basement properly fitted up would answer very well; but that portion of building is still occupied with experimental grains. Our third year class is twice as large as it has been during any year of its existence, and this increase has necessitated the expenditure of a larger proportion of our grant for third year supplies than was anticipated. To accommodate this large class, nearly all the available space in the analytical room is occupied. While maintaining the usual broad course of instruction, we intend that the third year men shall give a little more time to the analysis of feeding stuffs, soils, etc, than was given by former classes.

ANALYSIS.

During the past year, a great variety of substances, such as soils, marls, prepared fertilizers, rocks, drinking water, etc., has been sent to this laboratory for chemical analysis. Unless in a few instances in which the analysis is of general importance, we refer those sending these miscellaneous substances to private laboratories. We do so for the reason that the analytical work of this station is far greater than can be accomplished with our present assistance, and we do not think it right to exclude analyses of Provincial interest to do private work of this kind.

Manure Analyses.

At the close of the experiment (April 12th), "Feeding Shorn and Unshorn Lambs in Winter," the manure was carefully sampled under my personal supervision and analysed. The manure also from "Fattening Lambs for the British Market," was likewise sampled and analysed. The results are reported in connection with the experiments by Prof. Shaw and Mr. C. A. Zavitz in Bulletins LXXVIII and LXXXIII. At the present time we are analysing manure made by a cattle beast during the successive periods of its growth. The results are given in Part VII of this report.

Milk and Butter Analyses.

In continuation of the investigation begun in 1891 as to the effect of food on milk and butter, we have made a great number of milk and butter analyses. This year the experiment proper covered a period of ten weeks. The cows were six in number, divided into two groups of three each called lot I and lot II. During one-half of the experimental period, lot I received a poor ration and lot II a rich ration. The order of feeding was reversed through the second half of the period, lot I receiving the rich ration and lot II the poor ration. On forty days *i.e.* four days of each week, the per cent. of water, fat and solids not fat in every cow's milk was determined. The water, fat, casein, ash, iodine number and melting point in fifteen samples of butter were determined. From lot I eight samples were taken, four while receiving the poor ration and four while receiving the rich ration. Seven samples were taken from lot II, four while being fed on the rich ration and three while being fed on the poor ration. The tabulated results of these analyses have been reported in connection with the experiments by Prof. Dean in Bulletin LXXX, "Effect of Food on Milk and Butter."

Water Tank.

The water tank in the upper part of the laboratory, asked for in last year's report, has given entire satisfaction, affording a constant supply of water and a regular pressure.

Cleaning and Painting.

The general appearance of our building has been very much improved by the thorough cleaning and repainting which it received early in the year.

Yours respectfully,

A. E. SHUTTLEWORTH,
Professor of Chemistry.

PART IV.

REPORT OF

PROFESSOR OF VETERINARY SCIENCE.

To the President of the Ontario Agricultural College:

SIR,—I beg to submit my annual report for the year 1892. During my eleven years' connection with the College, and professional attendance upon the stock of the farm, I have never been called upon for so little veterinary attendance. I attribute this comparative immunity from ill-health as due to the remarkable keenness of observation, vigilant care, and intelligent management of Mr. Joseph Barnett, who has the cattle, sheep, and swine under his immediate care. There has been only one fatal case of marked importance, which was the death of the Dorset bull, that was imported in the autumn of 1891. This case, from a professional standpoint, is interesting, chiefly on account of its rarity of occurrence. During this animal's stay of ninety days in quarantine, there was no unfavorable report with regard to his health, but on his arrival at the College it was noticed that his bowels were not sufficiently active, and that his appetite was not good. At first he responded to some extent to treatment, but soon began to grow gradually worse. The most marked symptoms were almost complete loss of appetite, inactivity of the bowels, and a tendency to bloating occasionally. The hand on being passed into the bowel encountered masses of solid material, the nature of which was not determined until after death. For four or five weeks the symptoms were combatted with medical agents, and every effort made to support the failing strength of the patient, but all was of no avail, so the animal was destroyed, and a *post mortem* made, which revealed the deposit of immense quantities of fat in the abdomen.

The presence of the great amount of fat was by no means astonishing, as the animal was in the most possible obese condition, but the peculiarity of the fatty deposits was that they were perfectly solid, having assumed a state adipose tissue occasionally does, on fat individuals, of marked induration. The large amount of fat present in the abdomen, together with its hardness, caused a mechanical impediment to the action of the bowels and stomach ; hence the symptoms of indigestion. Having reached this stage of accumulation and hardness, it was impossible for absorption of the fat to take place, so that death was only a question of time after the action of the bowels and stomach were suspended. The canal of the bowels, instead of being an inch or more in some places in diameter, was almost completely occluded by the pressure of the fat surrounding its coats, so that their ceasing to act was not to be wondered at. The occurrence of a case of this sort, although rare, is one of the possible results that a feeder for the show ring may experience.

TUBERCULOSIS.

Fortunately during the last year we have encountered no trouble from tuberculosis amongst the College herd, but it is a disease that is liable to make its appearance, under varying circumstances, at any time, particularly in pure bred herds of certain breeds, so that the stock owners of this Province should receive all the aid available from the Department of Agriculture in order to control this trouble as much as possible. Hence my reason for drawing attention to the most advanced efforts that have been made to get this disease under restraint. It is well known that the symptoms of tuberculosis vary exceedingly with the location of the lesions, and that sometimes the disease may be quite severe, but so located that diagnosis by the ordinary methods is impossible. The tubercles may be situated in the liver, udder, intestines, or lungs, and not be discovered by a most careful physical examination. Then, auscultation of the lungs of cattle cannot be depended on to the extent to which we rely upon the results obtained by this method of examination in man, the horse or the dog. Sounds are heard, even in healthy lungs, which will deceive the most experienced ear, and slight lesions of the mucous membrane of the bronchial tubes may produce sounds simulating those heard in pulmonary tuberculosis.

So when a disease appears in a herd and the evidently affected are removed, we have no certainty that there are not more subjects of tuberculosis remaining to scatter the germs broadcast and perpetuate the disease. In fact, this is the usual history of cases in which eradication is attempted. We have lacked a reasonably sure means of diagnosis, and this short-coming has served to make it impossible to carry out most of the measures advocated to suppress the disease.

In December, 1890, Koch announced his discovery of a substance which had a specific action on tubercular processes, which, when properly administered, caused a hyperæmia around the tubercle and an elevation of the body temperature. This action was not observed when the substance was injected into healthy men or animals, or into subjects of disease other than tuberculosis. This substance is known as Koch's lymph or tuberculin, and it was hoped for a time that it would cure consumption. But this hope has been abandoned.

In January, 1891, Prof. Gutmann, of the Veterinary Institute of Dorpat, Russia, employed tuberculin in cattle and found that the results were quite similar to those obtained on man. That is, there was a temperature reaction on tuberculous cattle, and none in other cattle. The substance has since been used in the diagnosis of tuberculosis of cattle in every civilized land, and the reports are almost uniformily favorable. The Tuberculosis Commission of the University of Pennsylvania, of which Prof. Zuill was chairman, introduced its use for diagnostic purposes in this country, and the report of this commission was cautious, because the number of their experiments was limited, but it was decidedly favorable. The Imperial Health Officer in Berlin has recently published an extensive report on the use of tuberculin in the diagnosis of tuberculosis of cattle, which says that it has been found reliable in all sorts of cases. Even when the lesion is hidden and the animal appears healthy, tuberculin reveals the presence of the disease. The Berlin *Veterinary Weekly*, of which Prof. Dieckerhoff is the senior editor, contained an editorial in a recent number in which this statement occurred: "The proof which has been presented to our readers is more than sufficient. The results are absolute and gratifying, and show that tuberculin is a reliable agent for determining the presence of tuberculosis in cattle. When animals do not react after the injection of tuberculin it can be said with almost absolute certainty that they are free from tuberculosis; since not a single case has been unquestionably established in which animals containing tubercles have not reacted."

The method of using tuberculin is as follows: A ten per cent. solution is made in a one per cent. solution of carbolic acid, and of this dilution 2.5 to 5.0 cc. are injected beneath the disinfected skin in the region of the shoulder. The temperature is taken for fifteen hours at intervals of three hours, and if an elevation beyond the normal variation occurs, it is a reaction, and the animal probably has tuberculosis. The amount of reaction varies from two to six degrees, and lasts from twelve to twenty-four hours, or sometimes longer.

Respectfully submitted,

F. C. GRENSIDE, V. S.

PART V.

REPORT OF

THE FOREMAN OF THE HORTICULTURAL DEPARTMENT.

To the President of the Ontario Agricultural College:

Sir,—In submitting to you a statement of the garden and orchard produce supplied to the College during the year, I have much pleasure in saying that owing to the unusually favorable season for vegetable growth, garden crops of all kinds were abundant in quantity and good in quality, as they have been with us for the last six or eight years. Our kitchen garden from successive enriching, principally with barnyard manure, is now in such a fertile condition that failure in any culinary crops is a rare exception. Hence it is needless to particularize any special crop when nearly all were equally good and in excess of an average yield. The season was also favorable for all kinds of planting and transplanting trees, shrubs, etc. The young orchard planted two years ago in field No. 12, is now fairly well established. The apple and pear trees stood the last winter well, have made a fair growth this season, and look quite promising. The small fruits in the same field, including grape vines, raspberries, currants, gooseberries, and strawberries, have all done extra well. The raspberries were a full crop, producing all that were required during the fruiting season, as well as a sufficient supply for canning and preserving. The currants and gooseberries, being but young bushes, have not borne much, but are improving from year to year. They are strong healthy plants, of good varieties, and, from their promising appearance, we think that they are likely to meet in full for years to come all demands for home consumption. The young grape vines have barely reached the bearing stage, so only a small quantity of fruits may be expected the next few years.

The Vinery. It may not be out of place here to review briefly some of the work undertaken and accomplished by this department during the last ten or twelve years. The old grape vines planted eleven years ago under the direction of the Fruit-Growers' Association and selected by them as an experimental test of vine-growing in this section of the Province, have never proved satisfactory; and this fall they have been rooted out as cumberers of the ground, to give place to other, and I trust more successful experimental work. Our lack of success is due, I believe, to the two following reasons: First, the vines were planted in field No. 16, where the soil is a clay loam, the subsoil clay with boulders, and very spongy—the field being undrained. In consequence of this cold bottom, they were late in making their growth and could neither ripen their fruit nor mature the wood. Second, many of them were such varieties as are not likely to succeed in this locality, even under more favorable circumstances. The 760 vines then planted, covering about two and a half acres, were composed of 98 varieties, the great majority of which, we believe, will never be productive in this part of the country. The Concord is, perhaps, the best known as well as the most prolific grape grown in this country; and our experience tells us that any later variety cannot be successfully grown for profit in this section.

From this standpoint the vines for our new vineyard have been selected. They are 140 in number, and comprise the following varieties, which we would place in order of merit as follows, viz.: Worden, Moore's Early, Salem, Delaware, Montgomery (red), Lindley, Brighton, Agawam, Wyoming (red), Roger's No. 28, Roger's No. 41, Early Victor, Lady, Moyer and Concord. This order may not coincide with the experience of every grower. Of course new and untried varieties, as well as very favorable aspects, may break any such arrangements; but from our rather extensive list, we have selected the above as likely to prove fairly successfully in this neighborhood.

Tree Clumps. The forest tree clumps continue healthy and have made a good average annual growth. The walnuts planted in fields Nos. 16 and 17 eleven years ago have become quite thick, the branches so interlacing that they now require to be thinned out at least one-half, in order to give the remaining trees a chance for further development. The same may be said of field No. 2 where two clumps were planted, one of European larch in 1881, and the other the following year composed of a variety of trees raised from seed, some in the garden and some in the experiment grounds; and although they were quite small when planted, they have grown luxuriantly since, and now make a dense mass, so close that further cultivation is impracticable until they are thinned out, which should be done this winter.

In 1887 another plantation was set out in field No. 3, about three acres in extent, the object being to cover a large unsightly and comparatively useless gravel knoll and old pit which lay in full view from the College buildings. This plantation is composed of larch, Norway spruce, Austrian pine, walnut, butternut, birch, English ash, American ash, Norway and hard maple, elm, sycamore and linden planted in lines eight feet apart. All these trees have made good growth; they now nearly cover the ground and present a fresh and pleasant variety of foliage as seen from the College buildings. In field No. 4, a portion of which is situated on the rising ground nearly south of the College, about four acres in extent, which up to five years ago lay in a very rough state, denuded of all the principal wood, the ground was unbroken and used as a cattle and sheep run apparently for years. In 1887 the clearing was finished and the ground plowed up. Two farm crops were taken, the field partly levelled, and put in good condition for planting, which was done in the spring of 1890, principally with trees as already named, to which was added some young mountain ash, hickory, catalpa, and sweet chestnut, all of which are now fairly well established, and for years to come, from a landscape standpoint, will add materially to the appearance of the ground. The effect might be yet further improved by cutting down a number of old basswood and scrub elms, etc., which stand in the lower portion of the field obstructing the view from the College.

The said clumps have all been planted with trees raised either from seed or grown from seedling plants in our small nursery established in field No. 13 eleven years ago. Its area is but little over half an acre, divided into five plots by ornamental hedges; but, although the space is small, it has done good service during its existence, and now contains from two to three thousand young trees, consisting of Norway and white spruce, Colorado blue spruce, a few larch, elm, white ash, catalpa, and from twelve to fifteen hundred Austrian pine, the latter about three feet high, well rooted and in first-class order for transplanting into permanent position. And I may here, at least, name an idea that has frequently occurred to me where they might be utilized; nearly one-half of field No. 17 has been kept in bush—but underbrushed and left open for cattle, sheep and hogs: consequently many of the larger trees are decaying and likely to continue doing so while under existing conditions. The south and western sides are much exposed, and heavy storms from those directions have already made a partial clearance. Now, if it is the intention of the powers that be to retain this as permanent bush, I would suggest fencing to exclude stock, and plant the said Austrian pine around the exposed sides and irregularly, in as far as the open space extends, which would do much to cover the broken and unsightly appearance it now presents and ultimately become a wind-break for the protection of the whole.

Lawn and Arboretum. Up to 1880 the College lawn existed only in name. The field in front of the buildings had been seeded down for several years; but it was with agricultural grasses, put in with a farm crop, the ground having been left so rough that the lands throughout were distinctly defined by the plow furrows; and part of an old orchard and the walls of an old building that had been burned down, stood near the centre. A few clumps of Norway and native spruce had been planted, and a wind-break of native spruce along the western boundary, inside of which was a cultivated border containing a number of fine healthy specimen trees of Austrian pine and Norway spruce, interspersed with a number of deciduous shrubs. The whole ground, embracing about 15 acres, was considered rather extensive for a lawn, and the idea was conceived of planting an Arboretum, to consist of as many trees and shrubs, both deciduous and evergreen, ornamental or otherwise, as were likely to prove hardy enough for the climate. This matter was laid before the Commisssioner, and the further laying out and grading of the grounds urged upon his attention; but it was not until the spring of 1882 that a plan was procured and approved by the Government. A large collection of nearly 400 trees and shrubs was then selected and carefully planted in the nursery until the ground was prepared for them; work was commenced in the fall, by breaking up a portion of the ground, changing the principal entrance, and making new drives, made necessary by the erection of new buildings; grading and levelling was carried on as long as the frost would permit, as well as preparing for transplanting in the frozen state over one hundred of the evergreens above mentioned, which was done by digging a trench 15 or 18 inches wide around each tree, cutting all the large roots and partly undermining the ball. The trenches were then filled up with straw for the winter, to prevent the frost from getting underneath, but allowing the ball to get frozen through. Early the following spring those trees, varying in height from six to sixteen feet and in weight from one to two tons, according to size of tree, were successfully moved on a stoneboat by a team of horses to the desired positions without a single failure, the holes having been prepared for them in the fall. Much was, perhaps, due to the favorable season for such work; but we have yet some pleasure in pointing to the success of the experiment which our Canadian winters favor. The remaining portion of the grounds was broken up early in the season, the cultivation, grading and levelling were carried on throughout the summer, and a design for flower beds laid out and sodded, the whole involving much labor and an expenditure to the full amount of the appropriation, leaving the ground in good order for seeding down and planting, which was done the following spring. The Arboretum was arranged according the family or natural order of each, embracing 32 families, 100 genera and 350 distinct species and varieties, a complete list of which was given in the Report of 1882. Some of the trees and shrubs, notwithstanding what winter protection we could give them, have proved too tender for this locality and have left a few vacancies in the various groups; but, on the whole, the appearance of the grounds has improved from year to year; and this season, on account of the copious and timely showers, the grass has kept green throughout the summer; and the flower beds and borders, furnished as they were with over fifteen thousand flowering and decorative plants, never looked better, showing a continuous growth and bloom from the 1st of June to the end of October.

Greenhouses. The old greenhouses and workshops did good services in their day; but for years they have stood in the way of required improvements in that part of the grounds, which could not well be changed until the old structure is removed, a change much needed and long looked for; but now that they are superseded by buildings more worthy of their surroundings, I trust that provision will be made the coming season for the breaking up and grading of this portion of the grounds, which will complete the original plan and give a finished appearance to the whole. The new conservatory, store and greenhouse are now quite full. Looking forward to the increased space, we propagated and grew on from early in the season a greater number of such plants as we had, principally of a soft-wooded class, composed largely of chrysanthemums, begonias and geraniums, which have come in useful, and have made a good display of flowers during the fall and winter.

A consignment of large and valuable plants from the Central Prison has added much not only to the effective furnishing of the various houses in the meantime, but has given us a variety of such specimens as would take us years to grow. We are also indebted to several Toronto gardeners for donations of a varied and valuable assortment of plants. Although many of them are but small, they increase our variety, and, added to what we have, make a very creditable collection.

The following form shows the value of what was supplied to the College each month during the year at current rates, $739.02 ; also a small surplus sold for cash, $46.50.

Garden produce.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for the year.
	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
Apples	....	....	....	....	....	....	....	5 70	10 12	20 90	30 00	26 00	92 72
Asparagus	....	....	....	....	14 32	21 20	....	....	....	....	....	....	35 52
Beans	....	....	....	....	....	....	2 40	80	30	....	....	....	3 50
Beets	....	35	70	....	25	....	90	30	....	75	52	52	4 29
Cabbage	2 60	4 30	5 80	6 30	5 40	....	2 25	1 75	80	3 80	8 00	2 75	43 75
Carrots	....	....	....	....	....	....	30	60	15	1 40	90	1 00	4 35
Caul flower	....	....	....	....	....	....	4 00	7 35	50	5 95	....	....	17 80
Celery	2 40	3 60	1 60	....	....	....	....	1 75	5 40	23 25	14 50	18 00	70 50
Cherries	....	....	....	....	....	....	2 31	....	....	....	....	....	2 31
Citrons	....	....	....	....	....	....	....	....	....	9 00	....	....	9 00
Corn	....	....	....	....	....	....	....	6 00	3 78	....	....	....	9 78
Cucumbers	....	....	....	....	....	....	....	9 51	....	....	....	....	9 51
Currants	....	....	....	....	....	....	13 96	....	....	....	....	....	13 96
Gooseberries	....	....	....	....	....	1 92	35 52	....	....	....	....	....	37 44
Grapes	....	....	....	....	....	....	....	....	5 01	37 44	....	....	42 45
Herbs	....	1 00	40	20	10	15	25	55	35	90	....	15	4 05
Lettuce	....	....	....	50	18 75	5 80	1 80	....	....	....	....	....	26 85
Onions	2 25	3 75	1 25	3 90	20	20	40	....	1 35	2 80	4 00	2 50	22 60
Parsnips	1 00	2 00	4 72	1 90	1 70	....	....	....	20	2 40	2 00	1 60	17 52
Peas	....	....	....	....	....	5 00	6 50	3 00	....	32 40	....	....	46 90
Potatoes	....	....	....	....	....	....	13 50	19 50	6 80	....	11 40	18 90	70 10
Raspberries	....	....	....	....	2 00	....	12 11	14 56	....	....	....	....	28 67
Radish	....	....	....	70	8 70	3 50	....	....	....	....	....	....	12 90
Rhubarb	....	....	....	....	....	9 30	2 20	4 50	....	....	....	....	16 00
Spinach	....	....	....	....	....	5 40	2 80	....	35	....	....	....	8 55
Squash	....	....	....	....	....	....	....	80	....	8 00	50	....	9 30
Strawberries	....	....	....	....	....	3 78	15 89	....	....	....	....	....	19 67
Tomatoes	....	....	....	....	....	....	1 80	9 00	25 80	8 50	....	....	45 10
Turnips	60	2 20	1 50	1 00	1 10	30	....	....	....	30	1 60	1 30	9 90
Sundries	1 00	25	30	30	15	38	30	15	30	15	30	45	4 03
Totals	9 85	17 45	16 27	14 80	52 67	56 93	119 19	85 82	61 21	157 94	73 72	73 17	739 02

Your obedient servant,

JAMES FORSYTH.

PART VI.

REPORT OF THE PHYSICIAN.

To the Honorable John Dryden, Minister of Agriculture:

SIR,—I have the honor of presenting to you my annual report:

During the first half of the year we had several severe cases of "la grippe;" and during the same period many of the students and some of the servants suffered from an inflammatory condition of the throat.

We had five mild cases of diphtheria; but nothing of a serious nature occurred.

One young man had a very narrow escape from being fatally injured. He fell off a mow in the barn and landed on the end of a fork handle, causing such injury as to confine him to bed and to his room for weeks; but in time he made a good recovery.

The improvements you have made this year in reference to ventilation and sewerage have made the sanitary condition of the College entirely satisfactory.

I have the honor to be, Sir,

Your obedient servant,

E. W. McGUIRE, M.D.,

College Physician

Ontario Agricultural College, December 31, 1892.

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To the Pres

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B.S.A., assis
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PART VII.

REPORT OF

THE PROFESSOR OF AGRICULTURE

AND FARM SUPERINTENDENT.

ONTARIO AGRICULTURAL COLLEGE, EXPERIMENT STATION,
GUELPH, December 31st, 1892.

To the President:

SIR,—I have the honor of herewith submitting my report for the respective departments of this institution under my own immediate supervision. These include in addition to my own report proper, a joint report of the experimental work by Mr. C. A. Zavitz, B.S.A., assistant in the experimental department, and myself; the report of Mr. J. E. Storey, the farm foreman, and also that of Mr. James McIntosh, foreman in the mechanical department.

The work in both the farm and experimental departments has this year again been very successful. The crops grown as a rule were excellent, although the yields were by no means phenomenal as during the year 1891. The wet weather in the month of June which was probably without a parallel during recent years, not only injured some crops (as potatoes) but it very greatly hindered the progress of the work, and added to its expense. The field work in the experimental department was still further extended as will be more fully brought out when treating more particularly of that work. Nearly all the field work done now is more or less of an experimental character. It is, therefore, scarcely possible to clearly determine what belongs to the farm or to the experimental department.

The following is a summary of the principal items relating to the farm:

I. IMPROVEMENTS MADE DURING THE YEAR:

1. The improvements of roads. 2. The erection of fences. 3. Paving the barnyard. 4. Maintaining cleanliness in the fields. 5. Underdraining.

II. SPECIAL CROPS GROWN UPON THE FARM:

1. Rye and rape. 2. Lucerne. 3. Catch crops.

III. MISCELLANEOUS ITEMS:

1. The exhibits made. 2. The sale of live stock. 3. The sale of seed grain and potatoes. 4. Visitors during the year. 5. Work done for other departments. 6. Lambs purchased for feeding.

I. IMPROVEMENTS MADE DURING THE YEAR.

1. The Improvement of Roads.

Some attention was given to the roads constructed during previous years. As soon as the road-bed had settled firmly after the frost had left the ground, the roads were gone over with an iron hand rake and the stones drawn towards the centre of the road where they were left in a line. This work was done by one or two persons on opposite sides of the road, according as the road-bed was wide or narrow. Those engaged in the work face in the same direction. A cart drawn by a single horse was then driven directly over the line of stones lying in the road, and the stones thrown into the cart from behind by one person with a scoop shovel. Five students would in this way remove the loose stones from a mile of road in half a day. The stones were, of course, carted away to a proper receptacle for them. The roads in consequence were beautifully smooth during the whole season, and we fail to see why this plan could not be adopted on all gravel roads at that season of the year. The driving would thereby be very much improved during the whole of the season following.

The grading of the lane was continued on both sides of the Brock road. The road-bed was made 28 feet wide from the outside of the bordering ditches. The ditches are shallow and so shaped that there will be no difficulty in using the field mower on the whole road except the gravelled portion. The gravelled portion is 12 feet wide.

The field mower was used in cutting the grass on the Brock road late in the month of June, and also on the town-line road referred to in the report for 1889, p. 103. There were 3½ tons of hay taken from the sides of the Brock road during the early days of July. This road is one-half mile long. From the town line road an equally good cutting would have been obtained but for the cropping of sheep running at large. If the borders of public roads generally were so shaped that they could be thus kept clean, the labor and cost of keeping them in this condition would be reduced to a minimum.

2. The Erection of Fences.

The old fences were removed from both sides of the private road which runs far back into both divisions of the farm, and were replaced with new ones. This fence is the same in construction as that put up along the Brock road the previous year, and which is described in the report for 1891, pp. 48 and 141. There were erected in all about 500 rods of the same. The work of grading the road, levelling the borders, and building the new fence was nearly all done by the students and the regular help of the farm. As stated in the report of the previous year, we sedulously avoid using special grants to perform labor that can be done by our own help. Because of this line of procedure, improvements are not made nearly so quickly in some instances as if made through special grants.

3. Paving the Barnyard.

Late in autumn a portion of the barnyard was paved with field stones. The plan at first decided upon called for a pavement 16 feet wide from the stone wall in front of the sheep house, and 12 feet wide in front of the barn and horse stables, respectively, and asked that the inside corners should be rounded so that a loaded team could drive around the yard without leaving the pavement. We ventured, however, to extend the pavement to the width of 25 feet in front of the stone wall referred to above, that there would be ample room for all the stock to stand upon it on the sunny side of the yard and without going into the manure in the centre, and this change met with the approval of the Minister. I would here venture to recommend that next season the paving be extended to 25 feet in front of the horse stables, and also sufficiently far in front of the bull house to allow wagons to be brought into the yard without going off the pavement.

The stones used in paving are kept in place by dressed curb stones sunk into the earth. A sloping pavement descends from the curb stones to the portion of the yard which receives the manure, and which is several inches lower than the top of the curb stones. This sloping pavement thus secures the double object of keeping the curb stones in place, and of allowing loaded wagons to drive up on the pavement on any part thereof. The whole pavement has sufficient slope to run the water which falls upon it into the central portion of the yard.

The laying of the pavement was done by hired labor, but the material was all laid down by the labor of the farm with student help. Some idea of the enormous amount of material wanted will be given when it is mentioned that the yard is 160 feet long and 105 feet broad. The work was deferred until the autumn plowing was nearly completed, that the labor of the farm would not be unduly interfered with. This was followed, however, by the disadvantage arising from unfavorable weather, while the work was being done, which added to its expense.

In sections where cobble stones and sand are plentiful, this plan of paving, at least a portion of the yard, is well worthy the attention of the farmer. It would of course be more prudent in many instances to do but a portion of the work each year as opportunity may offer.

4. Maintaining Cleanliness in the Fields.

In the report of 1891, p. 52, the following statement is made: "We expect to keep this farm clean henceforth, at an outlay of not more than $75 per annum over and above the ordinary methods of good cultivation. This estimate includes private roads, fence borders, unbroken pastures and bye places." A first year student, Mr. A. Walker, was engaged to give attention to this work, and an accurate account was kept daily of all time spent in this way. When Mr. Walker was not so employed he gave attention to other work on the farm If anyone else assisted Mr. Walker at any time, the labor so employed was carefully accounted for. The time thus spent in spudding and hand-pulling amounted to 512 hours. At 12½c. an hour this amounts to $64, or $11 less than the sum mentioned a year ago as the probable amount required.

The hoed crops were not cared for quite so perfectly as during the years immediately preceding. This was owing to the extraordinary rainfall through June and on into July, which deferred the season of attending to this until other crops were ready for harvesting, but on the whole they were so cared for that, all things considered, the returns were very satisfactory.

And here I desire to repeat and to emphasize what was said in the report of 1891, p. 52, viz., that when once a farm had been made fairly clean "The hand-spudding essential in keeping it clean of weeds, should not be more than $25 per year for 100 acres." The more I investigate the weed question, the more I am convinced that it is possible to entirely free our farms from the more noxious forms of weed life and to keep them so.

And I again appeal to the farmers of this country to put forth every reasonable effort to free their farms of every form of weed filth so far as this can be done. I make this appeal under the firm conviction that it will be found much more profitable to till a clean farm than one that is not clean. The methods of dealing with the more offensive and troublesome weeds of this Province are given later in the report.

5. Underdraining.

In field 17 we have been troubled more or less every season with the water gathering in the low parts, greatly to the detriment of the vegetation growing upon these. This year the field was thoroughly underdrained by laying 5-inch tiles in the main depressions and 2½-inch tiles as laterals leading into these. The former were sunk to the depth of 3 feet, and the latter to the depth of 2 feet 9 inches. The junctions were made in the usual way, viz., by chipping a hole in the side of the tile in the main, and adjusting the first tile of the lateral to this. We were unable to get junction tiles from any of the firms which make tiles in this vicinity. Six hundred and forty rods in all were laid in this field. The cost of digging the drains by contract was 25 cents per rod, without board, and this included placing the tiles in position. The filling was done by farm labor. In constructing these drains, old drains were found in the same field, some made with tiles and some with stones, but they were evidently not working. The field was plowed immediately after the tiles had been laid, in the month of June, and sowed with rape. The grapery which occupied one portion of this field was taken away late in the season and the fence removed which surrounded it. The entire field, comprising 20 acres, will now be devoted to experimental work, and this addition to the acreage of that department should greatly increase its effectiveness.

Late in the season another main drain was carried up from this field into the experimental field, No. 18, above it, and some short laterals were put in, in one part, where sometimes there had been a superabundance of moisture. The entire length of these drains was 64 rods.

In field No. 16 also, drains were laid in low places at both ends of the same, and here again traces were found of drains that had ceased to fulfil the ends for which they had been constructed. These drains were in all 184 rods in length.

II. SPECIAL CROPS GROWN UPON THE FARM.

1. Rye and Rape.

The forty acres of rye sown upon the farm in the autumn of 1891 grew magnificently, but, as stated in the report of the farm foreman, we failed in the attempt to cure the portion cut for fodder, owing to the successive and prolonged rains in June After 30 acres had been put in shock we judged it better to defer cutting the balance of the 40 acres, and as the showers continued to fall it was allowed to ripen. The whole of the ground on which the rye had been cut early, was at once plowed, drilled, and sowed with rape, along with the whole of field No. 17, referred to as having been drained. But to our great chagrin we found that the major portion of the rape seed sown was a variety which was not possessed of much feeding value. It bore but few leaves, with a large amount of fibrous stalk, and came out into blossom in less than two months from the time of sowing it, whereas the true Dwarf Essex does not come into blossom the same season that it is sown.

We are not yet quite certain as to the true name of this variety of rape, as we have not been able to glean information of a satisfactory character in reference thereto on either side of the Atlantic. The idea has gained currency that it is the German Bird or summer rape. But this view is not correct, as we grew the Bird rape true to name, and it has but little resemblance to the aforementioned variety. The Bird rape is much less vigorous, branches more widely, and comes sooner to maturity. The kind which we purchased for the Dwarf Essex is probably a hybrid variety which is grown for the oil got from the seeds. We obtained a small quantity of what proved to be the same variety from an American seedsman and which was labelled the "Broad Leaf Dwarf Essex." This seed was sown in one of the experimental plots, but we have good reasons for suspecting the integrity of the name.

At all events the same species of rape was sown extensively in this country, and in considerable test quantities in the United States. The seedsmen in Ontario assure us that they ordered the Dwarf Essex as usual when laying in their stock of seeds, hence the mistake was made by seedsmen on the other side of the Atlantic. To prevent the repetition of the occurrence, for it is a serious one, we would venture the suggestion that seedsmen lay in their stocks early, and prove trueness to name by actual trial.

The mistake thus made was peculiarly unfortunate for our work here. It prevented us from realizing properly on the lambs purchased for feeding, and it marred extensive experiments planned with much care in reference to various modes of growing rape, to the extent of rendering them valueless. A large number of letters were received in the autumn enquiring whether there would be any real danger that some of the seeds would mature and thus grow in the crop the following year. In many instances the crop was turned under when in full bloom lest such a result should follow. We found that these precautionary measures were not necessary, for when the lambs were turned in upon the rape the blossoms and seed pods were the parts that were first eaten. It may also be mentioned here that now that we do not require to grow rape to anything like the same extent for cleaning the land, we will grow it henceforth more as a catch crop after some other crop has been removed, as meadow or grain.

2. Lucerne.

We find that lucerne is a valuable plant to grow on this farm. We have grown it in various ways, but more especially by sowing it along with the grass seeds in meadows. When thus grown it is usually ready for cutting somewhat in advance of the other grasses. This is so far objectionable, as, unless it is cut quite promptly at a certain stage of growth, it becomes quite woody, and hence it is much less relished by the stock. In such instances the leaves also fall off readily when it is being cured, which still further impairs its value. But it furnishes a fine lot of pasture after the removal of the hay, and this result is relatively more marked in dry seasons, owing to the deep feeding habits of this plant.

To ascertain more accurately its value as a fodder plant on soils such as we have here, we determined to sow a field of it alone. The poorest field on the farm was chosen, viz., No. 21. It has received very little manure for many years past. It contains 12 acres, but the test will be confined to 8 acres, as the remainder is as yet imperfectly drained, and must remain so until some change is made in relation to the lands bordering upon it, which are not the property of the Government. The eight acres are somewhat rolling. The soil is what may be termed a clay loam, with an inclination to gravel, more especially in the higher portions. The subsoil is gravelly, but is not real gravel.

The lucerne was sown on this field in the early spring at the rate of 15 pounds of the seed to the acre. It was sown with the ordinary seed drill and along with one bushel per acre of the Oderbrucker barley. Fortunately for the results from the barley crop in the present condition of the field as to fertility, the season proved wet. The barley gave a return of 22 bushels to the acre. The straw of the barley had so much lucerne mixed with it that it will make valuable feed, but it was a little difficult to cure. The lucerne at once sprang up again, after the barley was harvested and in the month of October presented a lovely appearance. The whole field was covered with one mass of foliage fully one foot in height, beautifully even and without any weeds. Had the season been dry the results would not have been nearly so successful. With the very excellent stand which the lucerne made last autumn we do not apprehend any danger from the coming winter, hence it is likely to pass the critical time without injury. If we can get lucerne safely past the first winter it will retain its foothold for many years in suitable soils.

It is our purpose to mow this crop as frequently as necessary, and to cure it for hay, to ascertain what the average yield will be for a term of years, and to test its feeding value more accurately than has hitherto been done in this country. We should also learn a valuable lesson as to the effects which the crop will have in bringing fertility to this impoverished field.

We have also sown lucerne along with the common red clover and tall oat grass in field No. 1, as stated in the report of the farm foreman. The idea is to get mixed forage plants that may be cut twice a year for at least two years in succession. The outlook is very promising in the meantime.

I would not have the reader conclude that lucerne would be a valuable crop for every farmer to sow; far from it. On some kinds of soil it will grow indifferently, and where the subsoils are cold and wet it should not be sown at all. We have yet to demonstrate, even on this farm, evidently well adapted to its growth, that it will prove more remunerative in the end than the common red clover.

3. Catch Crops.

They were not grown to any great extent the past year for reasons previously stated when speaking of maintaining cleanliness in the fields. Rape was sown in field No. 6 after the removal of the wheat and rye, and furnished a considerable amount of pasture.

III. MISCELLANEOUS ITEMS.

1. The Exhibits Made.

The usual exhibit of grains was made at some of the leading exhibitions, as the Toronto Industrial, and the Western Exhibition held at London. A smaller exhibit was also made at Kingston. There were no less than 452 varieties of cereal grains and corn exhibited. The 314 varieties of wheat, oats and barley were also exhibited in the straw. All these were grown upon the farm in 1892. More details of the exhibit and also a sketch of the same as shown at the Western Exhibition, London, are given later in the report of the experimental department. An exhibit is being sent by this department to the World's Fair, Chicago, which will contain all the varieties included in the above summary. These have not only been all grown upon the farm, but they have been selected with much care, and it is hoped that the exhibit will not bring any dishonor on the department making it, or on the Province.

2. The Sale of Live Stock.

The annual sale of surplus live stock was this year held in the Victoria rink on December 15th, the second day of the fat stock show. The following animals were sold, viz: 5 Shorthorns, 3 Herefords, 1 Galloway, 1 Sussex, 1 Devon, 1 Red Poll, 4 Ayrshires, and 2 Holsteins; and of pigs, 3 Berkshires, 20 improved Yorkshires, and 13 Tamworths. The proceeds of the sale of the animals sold from the farm department was $1,456.50.

3. The Sale of Seed Grain and Potatoes.

The varieties of grain imported from various countries that have been found well adapted to the conditions of growth in this country are now furnishing considerable quantities of seed for distribution among the farmers. When we find that any of these new introductions do very well the first year, we sow them again in larger quantities, and if the results are again favorable, we sow them a third time in still larger areas. By the end of the third year we have considerable quantities of the seed for distribution and for sale. The mode of distribution is described in the report of the work of the Experimental Union toward the close of this volume. The grains and other products sold for seed are put upon the market at moderate prices, that they may be made easily accessible to the farmer. During the year considerable quantities of fall wheat, barley, oats, and peas were thus sold, and also several varieties of potatoes. But in some instances we find much difficulty in keeping varieties separate and pure, owing to the power that some kinds of oats possess of living over winter in the soil, and also to other reasons. Intimation of the kinds held for sale is given every year in one or other of the bulletins issued from time to time.

4. Visitors During the Year.

The number of visitors at the farm during the past year was greater than ever before. The estimate upon the number who came in 1891 was put at 15,000 in the report for that year, hence if that estimate is approximately correct, the number who came this year would be still greater. Sometimes there were from 2,000 to 3,000 persons on the farm in a single day in June, the month of farmers' excursions. While those in charge of the farm department are greatly pleased to have their work inspected, they would call attention to the difficulty of having everything without flaw or defect during a busy month, when much of the time is of necessity occupied with visitors. We think, however, that it is a matter for thankfulness that visitors come in such crowds at that season, when the field work can be inspected to good advantage. It may be mentioned here that late in the month of July the field crops can be examined with most advantage. It speaks of an interest on the part of the farming community that is radiant with hope for the future, and we can only add in this connection, come and welcome, for if our work will not stand rigid inspection it deserves to be publicly condemned, along with those who conduct it. It is a matter of regret to know that more attention cannot be given by the officers of the farm and experimental departments, when visitors come in large numbers, that such visits may be made more profitable to them and to us. But a still greater difficulty is found in the lack of guidance given to ordinary visitors who come from day to day. We frequently are unable to spend that time with them of which they are deserving, and which it would seem to be in the interests of the institution to give them. I therefore repeat the suggestion made in the report for 1891, page 57, "That the services of some one be secured whose special duty would be to see that visitors were properly entertained." There would be no difficulty in finding ample useful employment for such an individual when not engaged in directing visitors.

5. Work Done for the Other Departments.

There is usually a large amount of work done by the farm for the other departments, as the College, the dairy, and the experimental, which tends in no small degree to increase the expenditure of the farm. In view of this, I would recommend that a system of book-keeping be adopted in future which would duly credit each department for work done for the others, or for supplies furnished them.

6. Lambs Purchased for Feeding.

Lambs were purchased this year again for feeding by Mr. J. E. Story, the farm foreman. Three hundred and sixty-nine head in all were bought. The first lot were purchased in Durham county, and were shipped from Burketon on the C. P. R. to Guelph. They arrived on September 14th. The second lot were shipped from Kincardine, County of Bruce, and arrived September 29th. The outlay was as follows:

	Lot 1.	Lot 2.	
Cash for lambs	$657 80	$753 30	
Expenses purchasing	26 80	10 10	
Freight	33 80	8 00	
Total	$718 40	$771.40	—$1,489 80

The average cost per head of the lambs in lot 1, when laid down in Guelph, was $3.93, and those in lot 2, $4.14. The average cost per head of the whole lot of 369 lambs was $4.04. Of these 100 head were shorn in October for experimental purposes and they are still on hand.

The sum received for the lambs sold, including the wool from those under experiment, was $1,291.00. They went to the Buffalo market. Had the 100 lambs now under experiment been sold at the same time, and at the same rate, we would have realized for the lot $1,816.00, or an advance on the total cost price of $326.20.

Respectfully submitted,

THOMAS SHAW,

Professor of Agriculture and Farm Superintendent.

EXPERIMENTAL DEPARTMENT.

The work in this department has been still further extended, notwithstanding the marked advances of the previous year.

The following is a concise summary of the principal experiments conducted:

Field Experiments.

1 Barley	90 plots.	10 Sugar beets	10 plots.
2 Peas	85 "	11 Fodder corn	230 "
3 Spring wheat	97 "	12 Mixed grains for fodder	25 "
4 Winter "	90 "	13 Rape	70 "
5 Oats	154 "	14 Millet	20 "
6 Potatoes	178 "	15 Clover	39 "
7 Turnips	117 "	16 Grasses	80 "
8 Mangels	59 "	17 Miscellaneous	18 "
9 Carrots	46 "	18 Co-operative tests for 1892	115
		Total	1,523

These include variety tests, 942 plots; methods of cultivation, 233; application of fertilizers, 60; sowing grain at different dates, 48; selection of seed grain, 10; cutting grain at different stages of maturity, 24; growing grain for fodder in different combinations, 25; growing rape on different kinds of soil, 8; methods of preparing potatoes for planting, 20; methods of improving old grass land 38; and co-operative tests, 115 plots. The plots vary in size from 1 to 320 square rods, and cover an area of about 100 acres.

Live Stock Experiments.

1 Cattle, six experiments	23 animals
2 Lambs, three "	666 "
3 Swine, one "	12 "
Total	701

These experiments relate to the feeding and handling of the animals, to the manurial product, and to the effects of close confinement.

Co-operative Experiments.

A system of co-operative experiments is carried on over the Province through the Experimental Union, an association composed of officers, students, and ex-students of the College. A cordial invitation is extended to all progressive farmers to co-operate in this work. Seed and fertilizers, with the necessary instructions, are furnished by the station. The number and nature of the experiments which have been conducted during the present season is as follows:

1 Fertilizers	165 plots
2 Fodder crops	470 "
3 Roots	705 "
4 Spring grains	2,748 "
5 Winter grains	1,600 "
Total	5,688 "

These include 12 distinct experiments, each of which is also carefully conducted at this station.

Although the yields of grain were not equal to those of the previous year, they were encouraging. The results of the experimental work were, on the whole, satisfactory, except with the rape plots, where the seed purchased was not true to name. Apart from this there were but few failures from any source whatever.

The live stock experiments were also satisfactory. It may be mentioned here that but little was done by way of experimenting with swine, notwithstanding the importance of the industry to this Province. In explanation we may mention that with the stock on hand there was no room for conducting these. We are pleased to be able to note that the piggery for which estimates were made two years ago is now under way, so that next year we hope to enter more fully on this important line of experiment.

The great increase in the number of the co-operative experiments is very gratifying, as it speaks of the increasing interest taken by the farmers in securing new varieties of grain. We look upon this work as greatly important. We can learn from it in a short time the suitability of any variety of grain, root or fodder crop for different sections of the country which may have given encouraging results at the station. It also paves the way for the extensive introduction of promising varieties, and it enables the farmer to test the value of commercial fertilizers with but little outlay, and to judge thereby of the wants of his soil.

As it is of great importance in connection with experimental field work to note the temperature of the weather and the amount of rainfall, we append the following in regard to these taken from observations made upon the premises the past six years:

Month.	1887.	1888.	1889.	1890.	1891.	1892.
	inches.	inches.	inches.	inches.	inches.	inches.
May	1.58	1.08	3.59	2.18	.68	3.67
June	2.36	2.92	4.25	5.31	1.15	4.50
July	.61	2.21	2.67	1.44	3.54	3.15
August	2.71	2.16	1.92	1.74	3.96	3.15
September	1.52	1.55	1.04	.72	2.62	2.44
Total	8.78	9.92	13.47	11.39	11.95	16.91

The average temperatures for each month of the same period were as follows:

Month.	1887.	1888	1889.	1890.	1891.	1892.
May	60.49	50.98	52.3	50.7	50.4	53.0
June	65.02	64.36	59.8	65.4	66.4	58.8
July	72.87	67.22	67.8	68.2	62.7	67.8
August	65.58	66.56	64.4	62.8	63.7	65.5
September	55.83	54.96	58.3	55.4	61.2	57.6
Average	63.96	60.82	60.5	60.5	60.9	60.5

For the information contained in the portion of the above tables which relates to 1892, we are indebted to the Meteorological Department, in charge of Prof. Panton.

I. FIELD PLOT EXPERIMENTS.

Cereals.

(*a*) Cereals on small plots.

1. Barley, comparative test of 67 varieties.
2. Barley, different dates of seeding.
3. Peas, comparative test of 61 varieties.
4. Peas, different dates of seeding.
5. Spring Wheat, comparative test of 63 varieties.
6. Spring wheat, different dates of seeding.
7. Winter wheat, comparative test of 62 varieties.
8. Winter wheat, application of fertilizers.
9. Oats, comparative test of 116 varieties.
10. Oats, different dates of seeding.
11. Barley and peas, selection of seed.
12. Barley, peas, spring wheat and oats, harvesting at different stages of maturity.

(*b*) Cereals on large plots.

13. Barley.
14. Spring wheat.
15. Winter wheat.
16. Oats.

Potatoes and roots.

17. Potatoes, comparative test of 118 varieties.
18. Potatoes, different depths of planting the seed of tuber.
19. Potatoes, preparation of seed tubers.
20. Potatoes, different dates of seeding.
21. Potatoes, application of fertilizers,
22. Swede turnips, comparative test of 44 varieties.
23. Swede turnips, thinning plants in the drill.
24. Swede turnips, different distances between the drills.
25. Fall turnips, comparative test of 18 varieties.
26. Fall turnips, thinning plants in the drill.
27. Mangels, comparative test of 35 varieties.
28. Mangels, thinning plants in the drill.
29. Mangels, different distances between the drills.
30. Carrots, comparative test of 23 varieties.
31. Carrots, thinning plants in the drill.
32. Carrots, different distances between the drills.
33. Sugar beets, comparative test of 10 varieties.

Silage and Forage Crops.

34. Fodder corn, comparative test of 73 varieties.
35. Fodder corn, different distances between drills, and between plants in drill.
36. Mixed grain, grown for fodder purposes.
37. Peas and oats, sown in different quantities for fodder purposes.
38. Rape, its growth and uses.
39. Millet, comparative test of 11 varieties.
40. Clover, comparative test of 18 varieties.
41. Grasses, comparative test of 40 varieties.
42. Sunflower, comparative test of three varieties.
43. Miscellaneous crops.

II. LIVE STOCK EXPERIMENTS.

44. Feeding steers of different breeds from birth until two years old.
45. Fattening steers on ensilage and meal; ensilage, hay and meal; and roots, hay and meal.
46. Feeding rape to cows for milk production.
47. Feeding calves on skimmed milk, skimmed milk with linseed meal; and new milk.
48. Determining the amount of manure made by a cattle beast, during successive periods of its growth.
49. Determining the relative value of different varieties of clover hay and three varieties of sunflower, for milk production.
50. Determining the effect of constant confinement upon the breeding properties of a cattle beast.
51. Fattening lambs on rape, and finishing them on a winter ration for the Canadian and American markets.
52. Feeding lambs for the British market.
53. Fattening lambs on mixed grain, hay and roots; oats, hay and roots; and mixed grain, hay and ensilage.
54. Feeding shorn and unshorn lambs in winter.
55. Feeding swine upon rape and meal in the pen; rape and meal in the field; and rape alone in the field.

III. CO-OPERATIVE EXPERIMENTS.

56. Testing nitrate of soda, superphosphate, muriate of potash, mixture, and no fertilizer with oats.
57. Comparing the advantage of nitrate of soda over no fertilizer with rape.
58. Ascertaining the relative value of three varieties of millet.
59. Growing lucerne as a crop of fodder.
60. Testing six promising varieties of fodder corn.
61. Testing five promising varieties of turnips.
62. Testing five promising varieties of mangels.
63. Testing five promising varieties of carrots.
64. Testing six promising varieties of spring wheat.
65. Testing six promising varieties of barley.
66. Testing six promising varieties of oats.
67. Testing five promising varieties of winter wheat.

IV. WEEDS AND MODES OF DESTROYING THEM.

General principles to be observed in destroying Weeds.
Specific modes of destroying our most troublesome Weeds.

V. GRAIN EXHIBITS.

Exhibit for Ontario during 1892.
Exhibit for the World's Columbian Exposition.

VI. EXPERIMENTAL BUILDING.

I. FIELD PLOT EXPERIMENTS.

The field plot experiments during 1892 belong to eight different fields. These plots varied in size from one square rod to two acres. Nearly everything grown upon the farm was of the character of an experiment, but plots over two acres in size are not included when enumerating the area covered by experimental work.

CEREALS.

Of these 379 varieties were grown in 1892, and they represent the first, second, third or fourth year's crop from Ontario and foreign grains. The foreign grains have nearly all been imported within the past four years. They were obtained from the following countries: England, Scotland, France, Germany, Switzerland, Sweden, Russia, Italy, Hungary, Greece, Sicily, Africa, Japan, New Zealand, Australia and the United States. When grains are first introduced we grow them on small plots. Those which promise well we sow upon larger plots the second year. If they still maintain their reputation they are sown on yet larger areas the third year, so that a supply of the seed may be available for distribution. All the grains grown in the plots are also grown in single rows and usually in another field. Each row is two rods long and 200 grains are sown in a row. The objects of sowing them thus are: (1) To give information as to germination; (2) To give opportunity for convenient comparison as to strength of stem, rust, height of grain, etc., and (3) To furnish supplies for exhibition purposes without interference with the crop grown upon the measured plot.

(*a*) *Cereals on Small Plots.*

Heretofore nearly all of these grains were grown upon low lying fields where they were much subject to injury from rust. We also consider that where experiments have been grown upon the same plot for three years, an unevenness in the quality of the soil arises from the variations in the crops grown each year, and therefore it becomes necessary to change the plots. We selected for this purpose an elevated field with soil less variable than is usually found upon this farm, and which had been evenly cropped during previous years. It grew a crop of oats in 1889. In the spring of 1890 farm-yard manure was applied at the rate of 15 loads per acre, and a crop of rape was grown upon it the same autumn, which was pastured off by lambs. No manure of any kind has since been applied. It may be well to mention here that all the yields per acre which are given and which are comprised under this heading are estimates based upon the yields of the small plots.

1. Barley. Comparative Test of 67 Varieties.

In 1892, 67 varieties of barley were grown. The plots were in size one one-hundredth of an acre each. The grain was all sown April 19th. The seed was sown broadcast at the rate of two bushels per acre. The ground was then harrowed and rolled. Table I gives the characteristics relating to the 67 varieties grown during 1892. Tables II, III, IV and V give the yields of the varieties grown for four years, three years, two years and one year respectively. Table VI gives the yields per acre of the six varieties of hulless barley grown for two years past. The varieties are arranged in each table according to the average yields of grain per acre for the period indicated.

It will be noticed (Table I.) that the period of maturing extended from July 21st, until August 10th, a period of 21 days. If the Hulless varieties are not included it extended from July 28th to August 10th. It is worthy of note that the eight varieties which came first to maturity, not including the Hulless, gave an average yield of 47 bushels per acre in 1892, and they were all six-rowed. The eight varieties which came last to maturity gave an average yield of 45 bushels per acre, and they were all two-rowed. Hence it is fair to conclude that the two-rowed varieties as a rule mature later than the six-rowed.

It will also be noticed that the greatest length of plant with any variety is 49 inches, and the shortest length of the same is 31 inches, a difference of 18 inches. The Pfanen from Sweden is possessed of the longest straw, and it also stands up more than ordinarily well.

TABLE I. Characteristics of sixty-seven varieties of Barley grown in 1892.

Varieties.	Country obtained from.	Number of years grown at O. A. C.	Date of maturity.	Length of plant.	Amount of straw lodged.	Nature of head.
				inches.		
1 Mandscheuri	Russia	4	July 30	40	Medium	6-rowed.
2 French Chevalier	France	4	Aug. 3	41	Large	2 "
3 Empress	England	4	" 7	41	Medium	2 "
4 Scotch Improved	Ontario	4	July 29	41	Large	6 "
5 Selected Chevalier	England	4	Aug. 3	42	"	2 "
6 Thanet	"	4	" 3	40	"	2 "
7 Improved Cheyne	"	4	" 3	41	"	2 "
8 Oderbrucker	Germany	4	July 29	43	Medium	6 "
9 Kalina	Sweden	4	Aug. 3	38	"	2 "
10 Hallett's Pedigree	Germany	4	" 7	39	None	2 "
11 Imperial	France	4	" 6	40	"	2 "
12 Peerless White	England	4	" 5	42	Medium	2 "
13 Phœnix	Germany	4	" 2	41	"	2 "
14 Improved Golden Melon	England	4	" 10	40	Small	2 "
15 Improved Beardless	"	4	" 5	46	"	2 "
16 German Golden Drop	Germany	4	" 3	39	Medium	2 "
17 Common six-rowed	Ontario	4	July 29	41	"	6 "
18 Two-rowed Italian	France	4	Aug. 3	41	Small	2 "
19 Early Black	"	4	" 1	33	None	6 "
20 English Golden Drop	England	4	" 6	40	Large	2 "
21 Kinnakulla	Sweden	4	" 3	46	Small	2 "
22 English Malting	Ontario	4	" 7	39	Medium	2 "
23 Improved Imperial	Germany	4	" 3	42	Large	6 "
24 Cheyne	"	4	" 7	41	Small	2 "
25 Probsteier	"	4	" 3	41	Medium	2 "
26 Scotch Chevalier	Scotland	4	" 7	41½	Large	2 "
27 Invel	Germany	4	" 7	47	"	2 "
28 Two-rowed Spreading	France	4	" 3	37	None	2 "
29 Golden Melon	Germany	4	" 7	41	Large	2 "
30 Pfanen	Sweden	4	" 3	49	Small	2 "
31 Carter's Prize Prolific	England	4	" 6	40	Large	2 "
32 Italian Rice	Germany	4	" 2	31	None	2 "
33 Beardless	Ontario	4	" 8	43	Medium	2 "
34 Annats	Scotland	4	" 8	39	Large	2 "
35 Scholey's Chevalier	Germany	4	" 5	41	"	2 "
36 Emperor	"	4	" 7	39	Large	2 "
37 Dutch	"	4	" 8	41	Medium	2 "
38 French Chevalier	France	3	" 5	38	"	2 "
39 Australian	Germany	3	" 5	43	"	2 "
40 Italian	Italy	3	" 2	37	Large	2 "
41 Chevalier	New Zealand	3	" 7	45	"	2 "
42 Early Minting	England	3	" 7	40	Medium	2 "
43 Cape	New Zealand	3	" 1	......	"	6 "
44 Mensury	Ontario	3	" 1	40	"	6 "
45 Diamond	Germany	3	" 5	38	Small	2 "
46 Very Early Lapland	Russia	3	July 28	39	Medium	6 "
47 California Brewing	United States	2	" 30	40	Large	6 "
48 Duckbill	Ontario	2	Aug. 4	46	None	2 "
49 Salzer's Californian Prolific	United States	2	" 5	47½	"	2 "
50 Mansury	"	2	" 1	37	Small	6 "
51 Carter's Goldthorpe	England	2	" 8	45	Medium	2 "
52 Six-rowed Baxter's Improved	Ontario	2	July 29	37	"	6 "
53 California Chevalier	United States	2	Aug. 5	36	"	2 "
54 Highland Chief	"	2	" 9	38	Small	2 "
55 Imperial six-rowed	Ontario	2	July 29	39	Large	6 "
56 Carter's Prize Prolific	England	2	Aug. 8	37	Small	2 "
57 Martin West	United States	2	" 2	37	"	2 "
58 Gold Foil Hansfords	"	1	" 3	41	Large	2 "
59 Two rowed Canadian	Ontario	1	" 3	45	Small	2 "
60 Winter Barley	Germany	1	......	......	Large	6 "
61 Selected Canadian Thorpe	Ontario	1	Aug. 5	46	Small	2 "
62 Hungarian	Hungary	3	" 2	33	Medium	6 "
63 Guymalaya	Sweden	3	" 2	38	"	6 "
64 Black Hulless	Ontario	3	July 30	30	Large	6 "
65 Large Skinned	France	3	Aug. 2	33	"	2 "
66 Three-rowed	Germany	3	July 25	35	"	6 "
67 Skinless	Australia	3	" 21	28	None	6 "

The eight varieties possessed of the longest straw, gave an average yield of 52.3 bushels per acre, and those possessed of the shortest straw, 49.2 bushels per acre. This would in some sense point to the conclusion that there is an intimate relation between length of plant and good yields. The eight varieties with greatest length of plant were two-rowed, hence it would seem fair to conclude that the two-rowed varieties reach a greater average height than the six-rowed.

TABLE II. Yields of thirty-seven varieties of Barley for four years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bushel, 48 lb).	
	1892.	Average 3 years. 1890-91-92.	1892.	Average 4 years. 1889-90-1-2.	1892.	Average 4 years. 1889-90-1-2.
	lb	lb.	tons.	tons.	bushels.	bushels.
1 Mandscheuri	50.5	50.8	1.6	1.8	53.3	57.6
2 French Chevalier	51.3	52.0	2.0	1.8	51.7	54.0
3 Empress	51.6	52.0	2.0	2.0	49.0	52.8
4 Scotch Improved	53.5	52.3	1.2	1.3	47.6	51.3
5 Selected Chevalier	52.0	51.8	2.5	2.0	55.4	50.8
6 Thanet	52.3	52.0	2.3	1.9	53.7	50.5
7 Improved Cheyne	52.1	52.4	2.1	2.0	50.3	50.3
8 Oderbrucker	54.1	53.9	1.3	1.5	42.1	49.9
9 Kalina	53.4	52.6	1.8	1.8	49.4	49.9
10 Hallett's Pedigree	51.4	52.8	1.6	1.7	39.8	49.7
11 Imperial	52.0	52.3	1.9	2.0	44.0	48.5
12 Peerless White	53.0	53.2	2.1	1.8	52.3	48.2
13 Phœnix	53.8	53.0	2.1	1.8	54.4	48.0
14 Improved Golden Melon	52.3	52.3	1.5	1.7	38.0	47.8
15 Improved Beardless	52.3	51.6	2.4	2.0	55.2	47.8
16 German Golden Drop	52.3	53.2	2.1	2.0	47.2	47.1
17 Common six-rowed	53.3	53.1	1.2	1.3	42.8	46.7
18 Two-rowed Italian	52.6	52.5	1.9	1.9	48.0	45.4
19 Early Black	49.8	50.1	1.4	1.5	46.2	45.1
20 English Golden Drop	51.9	51.8	2.3	1.9	51.0	44.8
21 Kinnakulla	51.3	50.6	2.3	1.8	58.6	44.6
22 English Malting	52.1	52.5	2.3	1.9	51.5	44.2
23 Improved Imperial	47.0	46.4	2.2	2.0	36.6	44.0
24 Cheyne	51.1	51.9	1.7	1.7	34.9	42.6
25 Probsteier	53.1	52.7	2.0	1.7	50.2	42.3
26 Scotch Chevalier	52.0	52.9	2.2	1.6	49.6	42.1
27 Invel	50.8	51.1	2.7	1.8	54.2	42.0
28 Two-rowed Spreading	49.4	49.8	1.6	1.5	43.6	41.8
29 Golden Melon	51.4	52.1	2.1	1.6	48.4	41.1
30 Pfanen	50.5	51.2	2.5	1.7	57.3	41.0
31 Carter's Prize Prolific	52.5	52.7	2.3	2.1	40.8	40.5
32 Italian Rice	51.1	50.5	2.1	1.6	54.1	40.3
33 Beardless	51.9	51.4	2.0	1.8	46.0	40.2
34 Annats	49.6	51.0	2.8	1.8	44.5	39.5
35 Scholey's Chevalier	48.5	50.7	2.6	1.8	45.2	38.2
36 Emperor	49.0	51.1	2.3	1.9	40.5	37.0
37 Dutch	49.8	47.5	2.4	1.7	47.4	34.8
Average	51.53	51.67	2.04	1.78	47.97	45.47

It will be observed that the Mandscheuri variety, imported from Russia, has given the highest yield among 37 varieties grown for four years. It has given an average yield of 57.6 bushels per acre during that time, and in 1892 a yield of 53.3 bushels per acre. The Kinnakulla stands first among these varieties in point of yield in 1892. It was imported from Sweden. It is a two-rowed variety, is quite tall and unusually stiff in the straw, and is withal a handsome variety which has been constantly improving since it was first imported. The Duckbill variety, grown for two years at this station, bears a close resemblance to the Kinnakulla, but while the yield of the latter was 58.6 bushels per acre, that of the former was but 47.8 bushels.

The average yield per acre of the two-rowed varieties for four years, was 44.8 bushels, and of the six-rowed 49.1 bushels. The average weight per bushel was 51.8 lb. with the former, and 51.1 lb. with the latter.

The Oderbrucker, a six-rowed variety, imported from Germany, gave the heaviest average weight per measured bushel. It weighed 53.9 lb., has eighth place in point of yield, is possessed of good length of straw, and is early maturing, but has only medium strength of straw.

TABLE III. Yields of nine varieties of Barley for three years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bushel, 48 lb).	
	1892.	Average 3 years. 1890-91-92.	1892.	Average 3 years. 1890-91-92.	1892.	Average 3 years. 1890-91-92.
	lb.	lb.	tons.	tons.	bushels.	bushels.
38 French Chevalier......	49.5	52.4	2.5	2.1	52.3	**55.6**
39 Australian	51.5	51.5	2.2	1.9	52.4	**53.1**
40 Italian	52.6	52.3	2.1	2.0	56.2	**51.7**
41 Chevalier	50.6	52.5	2.7	2.1	48.2	**51.7**
42 Early Minting	51.3	51.8	2.2	2.0	41.9	**51.5**
43 Cape	43.8	46.6	1.6	1.4	50.0	**49.8**
44 Mensury	51.1	51.4	1.3	1.3	44.3	**49.0**
45 Diamond	51.0	52.0	2.2	1.7	48.6	**44.4**
46 Very Early Lapland.........	47.0	47.3	1.1	1.2	43.7	**41.0**
Average	49.82	50.87	1.99	1.74	48.62	**49.76**

Two lots of French Chevalier barley were imported from France, one of which has been grown for four years, and stands second in the list among 37 varieties in point of yield. The other has been grown for three years, and stands first in the list of nine varieties grown. These were probably from the same variety originally, grown in different provinces of France, and the similarity in the results tends to confirm the view that this is a productive variety. It is two-rowed, and is possessed of good average properties. The yield for the past three years was 55.6 bushels per acre.

TABLE IV. Yields of eleven varieties of Barley for two years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bush. 48 lb.)	
	1892.	Average 2 years 1891-2.	1892.	Average 2 years 1891-2.	1892.	Average 2 years 1891-2.
	lb.	lb.	tons.	tons.	bush.	bush.
47 California Brewing	44.3	44.5	1.7	1.7	61.5	**64.2**
48 Duckbill	52.1	52.2	1.8	2.0	47.8	**61.5**
49 Salzer's Californian Prolific ..	52.0	52.9	2.0	1.8	47.9	**60.2**
50 Mansury	48.5	49.3	1.6	1.6	48.1	**60.0**
51 Carter's Goldthorpe..........	51.1	51.2	2.3	2.1	54.7	**59.5**
52 Six-rowed Baxter's Improved.	53.8	53.0	1.3	1.5	43.5	**58.2**
53 California Chevalier	52.1	51.6	2.2	2.2	56.0	**57.8**
54 Highland Chief........... ..	51.3	51.6	1.4	2.0	32.5	**56.7**
55 Imperial six-rowed	53.4	52.6	1.1	1.4	41.0	**55.8**
56 Carter's Prize Prolific	52.0	52.0	1.7	1.9	46.2	**53.4**
57 Martin West	54.8	54.8	1.8	1.7	44.6	**53.2**
Average...	51.40	51.43	1.72	1.81	47.62	**58.23**

The California Brewing which stands at the head of the list in table IV has given the highest yield among sixty-seven varieties grown in 1892. The yield was 61.5 bushels per acre, but the weight, which was only 44.3 lb. per measured bushel, will preclude it from taking a place along with malting varieties. It is a six-rowed barley, and it is weak in the straw. The Carter's Prize Prolific, which has thirty-first place among thirty-seven varieties grown for four years, has tenth place among the eleven varieties grown for two years. The seed of this variety from which the lot included in the table was grown, was imported from England in 1891.

TABLE V. Yields of four varieties of Barley for 1892.

Varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre, (bush. 48 lb.)
	lb.	tons.	bush.
58 Gold Foil Hansfords	50.9	2.7	**50.0**
59 Two-rowed Canadian	53.4	2.1	**46.4**
60 Winter Barley	48.8	2.1	**44.8**
61 Selected Canadian Thorpe.........	51.0	2.0	**43.8**

The two-rowed Canadian and the Selected Canadian Thorpe, which were obtained from Ontario seedsmen, bear a close resemblance to one another. They are both two-rowed varieties, and are strong in the straw. One variety in this table, which came to us from Germany labelled "Winter barley," and which has been grown at the station for three years, seems to be improving in hardihood, and may yet be found worthy the attention of the farmer.

TABLE VI. Yields of six varieties of Hulless Barley for three years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bush. 60 lb.).	
	1892.	Average 3 years '90-91-92.	1892.	Average 3 years '90-91-92.	1892.	Average 3 years '90-91-92.
	lb.	lb.	tons.	tons.	bush.	bush.
62 Hungarian	......	....	1.7	1.7	44.6	**46.9**
63 Guymalaya	59.4	58.9	2.0	2.0	46.2	**42.4**
64 Black Hulless	62.9	64.6	1.8	1.6	48.7	**42.2**
65 Large Skinned	60.8	60.4	1.5	1.4	27.5	**28.9**
66 Three-rowed	58.0	60.0	1.4	1.2	34.0	**27.4**
67 Skinless	61.0	61.0	1.2	1.1	36.4	**26.9**
Average....	60.42	60.98	1.6	1.5	39.57	**35.78**

Several of these varieties are possessed of considerable promise. It will be observed they weigh so heavily that 60 lb. is the standard per measured bushel. They are all light colored, except the Black Hulless variety, which is possessed of some notoriety in several parts of Ontario. It is very weak in the straw. The Hungarian and Guymalaya, which stand first and second in the list respectively, possess straw which is considerably stronger. These two varieties are deserving of considerable attention if grown for feeding purposes.

2. Barley. Different Dates of Seeding.

The following table is a part of an experiment conducted simultaneously with peas, spring wheat and oats, to ascertain the results from sowing them at different dates. The barley was sown in duplicate plots in 1891 and 1892 respectively, and each of the two plots contained a different variety. The plots were one one-hundred-and-sixtieth of an acre in size, and two bushels of seed were used per acre, sown broadcast.

Table VII. Comparative yields of Barley from different dates of seeding.

Dates of seeding.	Weight per measured bushel.			Straw per acre.			Yield of grain per acre.		
	1891.	1892.	Average	1891.	1892.	Average	1891.	1892.	Average
	lb.	lb.	lb.	tons.	tons.	tons.	bush.	bush.	bush.
April 22nd	50.3	47.0	48.7	1.17	.9	1.04	29.5	22.7	26.1
May 1st....	48.6	45.3	47.0	1.39	1.0	1.20	37.8	18.0	27.9
May 9th	47.1	44.9	46.0	1.33	1.0	1.17	37.8	16.5	27.2
May 18th	45.5	39.9	42.7	.91	1.0	.96	24.8	11.7	18.3
May 26th	44.2	39.6	41.9	.90	1.3	1.10	17.7	5.9	11.8
June 6th	42.4	Failure.	....	.96	Failure.	....	17.4	Failure.	....

It will be observed that the best yields were obtained from the second and third seedings in 1891 and from the first seeding in 1892. The crop from the last seeding in 1892 was of no value. The weight in each instance decreases with every seeding during both years. The soil in which tests that relate to different dates of seeding were made was not of a very suitable character, hence the low yields in each instance.

3. Peas. Comparative Test of Sixty-One Varieties.

The plots, upon which the sixty-one varieties were grown in 1892, were one one-hundredth of an acre in size. The seed of each variety was sown broadcast April 23rd. They were sown in quantities, varying from two to four bushels per acre, according to the character of the peas. After they were sown the ground was harrowed and rolled. Table VIII gives the characteristics and yields of the fifty-seven varieties which germinated successfully.

Of the 61 varieties grown in 1892, the Princess Royal gave the largest yield, viz: 46.2 bushels per acre, and the Early Racehorse the heaviest weight per measured bushel, viz: 62.8 lb. Owing to imperfect germination of the seed in 1891, the results for that year were considered too incomplete to be of any especial value. In 1890, 20 varieties were grown. The six varieties which gave the highest average yield for two years, viz, 1890 and 1892, are as follows:

Name of variety.	Weight per measured bushel. lbs.	Yield per acre. bush.
Prussian Blue	62.7	43.4
Black Eyed Marrowfat	61.2	39.9
Princess Royal..........	60.7	39.2
White Eyed Marrowfat	62.1	38.7
Multipliers	61.8	37.9
Early Racehorse	63.5	35.9

The Mummy pea, popular in many parts of Ontario, gave an average of 33.7 bushels per acre for the two years mentioned, and an average weight of 63.8 lb. per measured bushel.

TABLE VIII. Characteristics and yields of fifty-seven varieties of Peas.

	Varieties.	Country obtained from.	Date of maturity.	Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
				lb.	tons.	bush.
1	Princess Royal	England	Aug. 15	57.75	1.54	46.20
2	Early Britain	“	“ 15	59.50	1.72	44.38
3	Blue	New Zealand	“ 15	60.75	1.38	43.07
4	Prussian Blue	Ontario	“ 11	61.75	1.90	41.77
5	White Wonder	New Zealand	“ 12	61.50	1.28	40.63
6	Black Eyed Marrowfat	Ontario	“ 17	60.25	1.60	39.07
7	Field	New Zealand	“ 12	61.75	1.35	39.17
8	Brown	“	“ 13	57.00	2.24	38.80
9	Mummy	Ontario	“ 14	61.75	2.01	38.75
10	Tall White Marrowfat	“	“ 13	60.50	1.94	37.72
11	Canada Cluster	“	“ 13	60.75	2.13	35.83
12	Early Racehorse	England	“ 12	62.75	1.43	35.57
13	Cleveland's Advance	Ontario	“ 13	59.75	1.59	35.22
14	Early June	“	“ 13	62.13	1.40	35.10
15	Multiplier	“	“ 21	61.00	1.69	34.50
16	Royal Dwarf Marrowfat	“	“ 15	59.25	1.60	34.22
17	No. 10 Rennie	“	“ 12	61.25	1.54	34.12
18	McLean's Advance	“	“ 9	54.25	.93	34.02
19	White Eyed Marrowfat	“	“ 15	61.00	1.44	33.55
20	Crown	“	“ 12	60.25	1.55	33.33
21	Scotchman	United States	“ 19	61.75	2.08	33.07
22	Golden Vine	Ontario	“ 14	61.00	1.65	32.68
23	Centennial	“	“ 14	60.13	1.47	31.82
24	Canada Field	United States	“ 14	60.50	1.60	31.67
25	Sword	“	“ 12	60.75	1.42	29.38
26	Prince Albert	Ontario	“ 18	61.13	1.94	29.22
27	Sexton's Alpha	United States	“ 9	54.50	1.44	28.70
28	Telephone	Ontario	“ 9	53.50	1.37	28.60
29	Perfection White	England	“ 11	59.75	1.22	28.55
30	Champion of England	Ontario	“ 13	54.75	1.57	28.48
31	Early Maple	England	“ 19	60.00	1.85	28.33
32	Prince of Wales	Ontario	“ 9	52.13	1.15	27.08
33	Philadelphia Extra Early	United States	July 30	59.00	.70	25.15
34	Oakshot Field Pea	England	Aug. 19	52.50	1.39	24.58
35	Veitche's Perfection	“	“ 17	52.50	1.59	23.55
36	Striped Wisconsin Blue	Ontario	“ 17	61.75	1.77	22.82
37	Telegraph	“	“ 2	58.13	1.08	22.68
38	Cleveland's Rural New Yorker	“	July 23	62.50	.69	21.88
39	McLean's Little Gem	“	“ 29	54.13	.68	20.78
40	Stratagem	“	Aug. 11	53.00	1.30	20.73
41	Glory	England	“ 12	61.50	1.73	20.52
42	Cleveland's Alaska	Ontario	July 25	59.50	.61	19.85
43	Pride of the North	“	Aug. 9	58.13	1.02	19.48
44	Sugar	“	“ 11	58.25	.59	18.80
45	Hero of Reading	England	“ 2	59.00	1.23	18.33
46	Selected Maple	“	“ 3	60.25	.65	18.28
47	Tom Thumb	Ontario	July 22	61.50	.55	16.77
48	Prince Albert	“	Aug. 12	60.50	1.38	16.67
49	Sweet Jessie	England	July 30	61.50	.84	16.30
50	Potter	Ontario	Aug. 6	60.25	.92	15.93
51	British Queen	“	“ 11	52.50	1.40	15.83
52	Grass	“	....	60.75	....	14.98
53	Yorkshire Hero	“	Aug. 6	52.50	1.07	12.82
54	Anticipation	“	“ 10	53.75	.58	12.40
55	Earliest-of-all Blue	England	“ 2	61.25	.41	11.47
56	Blue Peter	Ontario	July 24	57.00	.51	9.85
57	American Wonder	“	“ 23	52.50	.39	7.08

Four varieties of those sown in 1892 were complete failures, owing to a lack of germination. Several of the smallest-yielding sorts are table varieties, which ripen early and have a short habit of growth of straw.

4. Peas. Different Dates of Seeding.

The following table is a part of an experiment conducted simultaneously with barley, spring wheat and oats, to ascertain the results from sowing them at different dates. The peas which have been grown but for one year were sown in duplicate plots, and each of the two contained a different variety. The plots were one one-hundred-and-sixtieth of an acre in size, and two and a half bushels of seed were used per acre, sown broadcast.

Table ix. Comparative yield of Peas from different dates of seeding.

Date of seeding.	Weight per measured bushel.	Straw per acre.	Yield of grain per acre.
	lb.	tons.	bush.
April 22nd	57.9	1.3	19.5
May 1st	59.2	1.4	21.1
May 9th	60.7	1.2	21.8
May 18th	61.0	1.4	18.5
May 26th	61.2	1.1	9.7
June 6th	61.5	1.3	5.2

It will be noticed that the highest yields were obtained from the peas sown on May 9th, at the third seeding. This would seem to imply that it is not so important that peas should be sown early as in the case of some other varieties of grain. But from only one year's experience it would not be safe to draw conclusions of a positive character. It is not a little remarkable, however, to note the gradual increase in the weight of the peas per bushel with each successive seeding, which is just the opposite of what we find to be the case with the other varieties of grain.

5. Spring Wheat. Comparative Test of 63 Varieties.

In 1892, 63 varieties of spring wheat were grown. The plots were one one-hundreth of an acre in size. The grain was sown April 23rd. It was sown broadcast by hand and at the rate of two bushels per acre. The ground was then harrowed and rolled. Table x gives the characteristics of the 63 varieties.

Tables xi, xii, xiii, and xiv give the respective yields of the varieties grown for four, three and two years, and also for one year. The names of the varieties are arranged according to the average yield during each of the respective periods.

It will be noticed (Table x) that the period of maturing extended from August 9th to August 19th. It is worthy of note that the 12 varieties which came first to maturity gave an average yield of 14.2 bush. per acre in 1892, while the 7 varieties which came last to maturity gave an average yield of 19.4 bush. per acre. All of the later-maturing varieties were imported, while in the list of early-maturing varieties 5 Canadian sorts are included. When the four earliest-maturing Canadian varieties are compared with the four latest-maturing kinds, the average yield per acre is in favor of the latter to the extent of 4.3 bushels. It would seem, therefore, judging from the experience of the past season, that early ripening in varieties of spring wheat is not to be specially sought for. This view is confirmed in our experience of growing spring wheat in 1891 and also in 1890. In the former year, while the 6 earliest-yielding sorts gave an average of 29 bushels, the latest-yielding varieties gave an average of 24 bushels, and in 1890, while 7 of the earliest-ripening sorts gave an average of 14.2 bushels, 8 of the latest-maturing kinds gave an average of 16.7 bushels.

TABLE X. Characteristics of sixty-three varieties of Spring Wheat.

Varieties.	Country obtained from.	Number of years grown at Ont. Agri'l College.	Date of maturity.	Length of plant.	Amount of straw lodged.	Amount of rust.	Nature of head.	Color of grain.
			Aug.	in.				
1 Herison Bearded	France	4	11	43	Medium	Slight	Bearded	Red.
2 Pringle's Champion	Germany	4	11	47	"	"	"	"
3 Saxonka	Russia	4	12	44	"	"	"	"
4 Holben's Improved	Germany	4	16	47	Small	"	Bald	"
5 Bart Trimenia	Greece	4	13	42	"	Trace	Bearded	"
6 Summer	Germany	4	11	40	"	Medium	"	"
7 Ordinary Bearded March	France	4	13	42	"	"	"	"
8 Konisberg	Russia	4	13	44	"	Trace	"	"
9 Odessa Ghirka	"	4	14	45	Medium	Medium	Bald	"
10 Nenhert	Germany	4	16	50	Small	Slight	"	"
11 King Bartigen	"	4	13	44	Medium	Large	Bearded	"
12 Dantzic	Russia	4	12	42	"	Medium	"	"
13 Bearded Red	France	4	10	45	Small	"	"	"
14 April Bearded Red	England	4	11	45	Medium	"	"	"
15 Red Bearded March	France	4	10	48	"	"	"	"
16 Ordinary March	"	4	10	43	"	"	"	"
17 March Debrie	"	4	14	42	Small	"	Bald	White.
18 Chidham White	Germany	4	17	43	Medium	Large	"	"
19 French Summer	France	4	11	44	"	Medium	"	Red.
20 Large Flag	"	4	10	40	None	"	"	White.
21 Lonzella White	"	4	16	40	Medium	Large	"	Red.
22 Hickling's March White	"	4	13	50	Small	Medium	"	"
23 Red Fern	Ontario	3	11	49	Medium	Slight	Bearded	"
24 White Russian	"	3	13	45	Large	"	Bald	White.
25 White Fyfe	"	3	12	45	None	Trace	"	"
26 Red Fyfe	"	3	12	47	Medium	"	"	Red.
27 Wild Goose	"	3	11	52	"	Slight	Bearded	"
28 Mountain	Hungary	3	17	46	Small	"	Bald	"
29 Triumph	Ontario	3	10	40	Large	Medium	"	"
30 Colorado	"	3	10	43	Small	"	Bearded	"
31 Sorentino	Italy	3	15	44	"	Large	"	"
32 Medeah	Africa	3	12	51	Medium	Trace	"	"
33 Kubanka	Russia	3	11	42¼	"	Slight	"	"
34 Grecian	"	3	15	47	"	Medium	"	"
35 Algiers	Africa	3	11	45	Small	"	"	"
36 Ladoga	Ontario	3	10	42	Medium	"	"	"
37 Atalank	Greece	3	12	47	"	"	"	"
38 Paros	"	3	12	40	Large	Slight	"	White.
39 Neapel	Italy	3	10	50	None	Medium	"	Red.
40 Voto	Greece	3	14	44	Medium	"	"	White.
41 Square Head	Sicily	3	10	48	Small	"	Bald	Red.
42 March White	California	3	9	36	Large	"	"	White.
43 African	Africa	3	13	42	Small	Large	"	"
44 McCarlin	Ontario	2	14	52	Medium	Slight	Bearded	"
45 Rio Grande	"	2	12	48	"	"	"	"
46 Manitoulin	"	2	12	45	None	Trace	Bald	Red.
47 Okanagan Valley Velvet Chaff	U. S.	2	14	45	Medium	"	"	"
48 Saskatchewan Red Fyfe	Ontario	2	14	42½	Small	"	"	"
49 Salzer's Assiniboia Fyfe	U. S.	2	13	42	"	"	"	White.
50 Washington	"	2	13	52	None	Slight	Bearded	"
51 Pringle's Defiance	Germany	2	13	40	"	Trace	Bald	"
52 Anglo Canadian	England	2	10	46	Small	Medium	Bearded	"
53 Bearded Manitoba	Ontario	2	10	32	Large	Large	"	Red.
54 Lost Nation	"	1	11	41	"	Trace	Bald	"
55 Wellman Fyfe	U. S.	1	13	46	Medium	"	"	"
56 Velvet Chaff Blue Stem	"	1	14	46	Small	None	"	"
57 Manitoba Red	Ontario	1	11	45	Medium	Trace	"	"
58 Hayne's Blue Stem	U. S.	1	14	47	Small	"	"	"
59 New York Spring Wheat	"	1	14	43	Medium	Slight	Bearded	"
60 The Mars	Ontario	1	11	48	None	Trace	Bald	"
61 Dakota Marvel	U. S.	1	14	46	Medium	"	"	"
62 Magyar	Ontario	1	13	47	Small	Medium	"	"
63 Campbell's White Chaff	"	1	10	40	Medium	Slight	"	White.

It will also be observed that the 7 varieties possessed of greatest length of plant, viz. : 50 inches and over, gave an average yield of 19.9 bushels per acre in 1892, and the 9 varieties possessed of the shortest length of plant, viz., 40 inches and less, gave an average yield of 12.9 bushels per acre. This would justify the conclusion that in growing spring wheat there is an intimate relation between the length of the plant and large yields.

Of the 63 varieties in the above table 31 were bald and 32 bearded. The bald sorts weighed 56.93 lb. per measured bushel and yielded 18.64 bushels per acre; the bearded varieties weighed 57.83 lb. per measured bushel and yielded 19.54 bushels per acre.

The Lost Nation, an old variety well known in Ontario, gave the highest yield the past season, viz., 30.8 bush. per acre. The McCarlin variety, well known in Eastern Ontario, came second with a yield of 29.7 bush., and the Saxonka imported by the station four years ago from Russia came third giving a yield of 29.6 bushels.

TABLE XI. Yields of twenty-two varieties of Spring Wheat for four years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre (bush. 60 lb.)	
	1892.	Average 3 years 1890-91-92.	1892.	Average 3 years 1890-91-92.	1892.	Average 4 years. 1889-90-91-92.
	lb.	lb.	tons.	tons.	bush.	bush.
1 Herison Bearded	61.3	63.5	2.0	1.7	24.0	**26.0**
2 Pringle's Champion	60.5	69.8	2.1	1.8	23.7	**23.6**
3 Saxonka	60.5	60.2	2.4	1.5	29.6	**22.6**
4 Holben's Improved	58.0	59.0	2.0	1.7	22.6	**22.0**
5 Bart Trimenia	62.3	62.8	1.7	1.5	28.2	**21.8**
6 Summer	54.0	57.6	1.4	1.6	15.1	**20.7**
7 Ordinary Bearded March	55.5	58.1	2.0	1.7	22.1	**20.6**
8 Konisburg	61.8	62.1	1.5	1.5	19.8	**20.4**
9 Odessa Ghirka	57.0	59.9	2.1	1.6	17.2	**20.[illegible]**
10 Nenhert	56.0	55.0	2.0	1.6	28.4	**18.6**
11 King Bartigen	55.5	57.7	2.5	1.6	22.4	**18.4**
12 Dantzic	58.5	59.7	1.8	1.4	19.7	**17.6**
13 Bearded Red	56.0	58.3	1.4	1.3	17.1	**17.0**
14 April Bearded Red	58.3	56.4	2.1	1.7	20.6	**16.7**
15 Red Bearded March	55.3	57.3	1.4	1.1	18.1	**16.7**
16 Ordinary March	55.0	55.9	1.7	1.3	16.8	**16.6**
17 March Debrie	54.5	55.9	1.7	1.8	17.2	**15.9**
18 Chidham White	53.3	55.2	2.0	1.5	16.2	**15.9**
19 French Summer	55.3	56.2	1.7	1.4	13.6	**15.6**
20 Large Flag	53.5	55.3	1.1	.9	11.0	**12.2**
21 Lonzella White	50.0	51.9	1.7	1.5	9.3	**11.0**
22 Hickling's March White	50.0	51.1	1.7	1.5	9.2	**10.8**
Average	56.5	57.7	1.8	1.5	19.2	**18.2**

The Herison Bearded still heads the list among 22 varieties grown for 4 years. It stands fairly stiff in the straw and during all that time has been almost entirely free from rust. Both the heads and the grain are somewhat uneven in size. Pringle's Champion produces a fairly strong straw, has a well-shaped head, is not much liable to rust, and produces a fine sample of grain. The 22 varieties grown for four years gave an average yield of 19.2 bushels per acre in 1892. Of these the 5 which gave the highest yields for 4 years made an average of 23 bushels per acre and the 5 which gave the lowest yields 13.1 bushels.

TABLE XII. Yields of twenty-one varieties of Spring Wheat for three years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bush. 60 lb.)	
	1892.	Average 3 years '90-91-92.	1892.	Average 3 years '90-91-92.	1892.	Average 3 years '90-91-92.
	lb	lb	tons.	tons.	bush.	bush.
23 Red Fern	62.0	61.7	2.2	2.0	27.8	**31.4**
24 White Russian	59.5	59.2	2.1	1.8	27.1	**28.7**
25 White Fyfe	61.0	60.5	1.5	1.4	21.5	**26.3**
26 Red Fyfe	60.0	60.2	1.7	1.7	25.1	**25.4**
27 White Goose	59.6	61.0	1.8	1.8	28.0	**25.0**
28 Mountain	58.6	58.6	1.9	1.4	25.1	**22.3**
29 Triumph	57.5	59.6	1.5	1.3	15.7	**22.2**
30 Colorado	58.5	60.5	1.4	1.3	19.3	**22.2**
31 Sorentino	58.5	59.7	1.5	1.3	19.2	**20.8**
32 Mediah	61.3	61.4	1.7	1.2	23.0	**20.4**
33 Kubanka	60.0	....	1.7	...	19.9	**20.4**
34 Grecian	57.8	57.4	1.6	1.5	15.0	**20.1**
35 Algiers	56.5	58.2	1.6	1.4	18.4	**19.7**
36 Ladoga	54.0	57.2	1.5	1.4	15.3	**19.3**
37 Atalank	56.0	57.4	1.5	1.3	15.8	**18.9**
38 Paros	55.3	56.5	1.6	1.4	14.5	**18.1**
39 Neapel	51.5	54.3	1.6	1.5	13.8	**17.4**
40 Vota	54.5	56.5	1.1	1.3	10.1	**17.2**
41 Square Head	51.5	53.6	1.2	1.2	7.9	**16.2**
42 March White	48.3	55.8	1.3	1.0	9.7	**15.6**
43 African	....	....	.9	.9	4.0	**13.5**
Average	57.09	58.38	1.57	1.41	17.91	**20.05**

The Red Fern variety stands at the head of the list of the 21 kinds grown for three years. It also heads the list in weight per measured bushel in 1892 and during the two previous years. This variety is well known in many parts of Ontario, and seems to retain its good reputation even when compared with newer introductions. The Colorado, about which much has been said during recent years, has eighth place in the list. It is early, stands well and has medium power to withstand rust. The millers differ much in their views regarding its value for their uses.

TABLE XIII. Yields of ten varieties of Spring Wheat for two years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre, (bush. 60 lb.)	
	1892.	Average 2 years 1891-92.	1892.	Average 2 years 1891-92.	1892.	Average 2 years 1891-92.
	lb	lb	tons.	tons.	bush.	bush.
44 McCarlin	60.8	59.9	1.9	1.8	22.4	**29.7**
45 Rio Grande	60.1	60.6	1.8	1.8	20.5	**28.4**
46 Manitoulin	60.8	60.6	1.3	1.2	24.1	**26.8**
47 Okanagan Valley Velvet Chaff	59.5	58.5	1.7	1.7	26.4	**25.7**
48 Saskatchewan Red Fyfe	60.8	60.8	1.5	1.4	18.7	**24.8**
49 Salzer's Assiniboia Fyfe	59.5	59.1	1.1	1.3	15.8	**24.0**
50 Washington	60.1	59.6	1.3	1.3	14.4	**22.6**
51 Pringle's Defiance	58.8	59.4	1.2	1.3	13.2	**22.4**
52 Anglo-Canadian	53.0	55.6	1.3	1.6	11.1	**21.4**
53 Bearded Manitoba	.	58.3	.7	.9	16.2	**16.6**
Average	59.27	59.24	1.38	1.43	18.28	**24.24**

The McCarlin and the Rio Grande varieties in the above table, which stand first and second respectively, bear a close resemblance to each other in leading characteristics. Both are strong growers, have tall straw, large heads, large grain, are fairly free from rust and are bearded.

TABLE XIV. Yields of ten varieties of Spring Wheat for one year only.

Varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre.
	lb	tons.	bush.
54 Lost Nation	60.5	2.4	**30.8**
55 Wellman Fyfe	59.8	2.0	**26.9**
56 Velvet Chaff Blue Stem	58.8	1.6	**25.8**
57 Manitoba Red	60.0	1.9	**24.6**
58 Hayne's Blue Stem	59.5	1.7	**24.2**
59 New York Spring Wheat	58.8	1.7	**23.4**
60 The Mars	59.5	1.5	**22.7**
61 Dakota Marvel	57.0	1.6	**17.2**
62 Magyar	56.0	1.6	**13.4**
63 Campbell's White Chaff	53.5	1.1	**13.2**
Average	58.34	1.71	**22.22**

The Lost Nation, which stands at the head of the varieties grown for one year, though an old kind and tried several years ago at the station, was again re-introduced in the spring of 1892. Hayne's Blue Stem which has a velvet chaff was grown from a lot presented to the station by Prof. L. Foster, Director of the Agricultural Experimental Station, at Brookings, South Dakota. It is a variety of considerable promise. It stands well, is strong in the straw and is almost entirely free from rust. Campbell's White Chaff, which was much sought after, especially for trial plots early in the season, has not this year come up to the expectations formed of it. It was not grown at this station previously.

6. Spring Wheat. Different Dates of Seeding.

The following table is a part of an experiment conducted simultaneously with barley, peas and oats to ascertain the results from sowing them at different dates. The spring wheat was sown in duplicate plots in 1891 and 1892 respectively, and each of the two plots contained a different variety. The plots were one one-hundred-and-sixtieth of an acre in size, and two bushels of seed were used per acre sown broadcast.

TABLE XV. Comparative yields of Spring Wheat from different dates of seeding.

Date of seeding.	Weight per measured bushel.			Straw per acre.			Yield of grain per acre.		
	1891.	1892.	Average.	1891.	1892.	Average.	1891.	1892.	Average.
	lb	lb	lb	tons.	tons.	tons.	bush.	bush.	bush.
April 22nd	60.5	60.9	60.7	1.45	.9	1.18	22.9	5.9	14.4
May 1st	59.0	58.5	58.8	1.37	.8	1.09	19.1	5.2	12.2
May 9th	56.7	....	....	1.04	1.0	1.02	13.2	4.0	8.6
May 18th	54.2	27.0	40.6	.89	1.0	.95	8.0	2.7	5.4
May 26th	53.0	Failure.	....	.79	Failure.	....	3.9	Failure.	....
June 6th	51.5	Failure.	....	.76	Failure.	....	3.2	Failure.	....

It will be observed that the best yields were obtained from the first seeding in each year. The heaviest weight per measured bushel was likewise obtained from the first seeding both seasons. There was a gradual decrease in every instance both in point of yield and weight of grain with every successive seeding. The crop from the last two dates of seeding in 1892 was a total failure. It would therefore seem greatly important to sow spring wheat at the earliest opportunity after the ground is ready for sowing.

7. Winter Wheat. Comparative Test of 62 Varieties.

In growing winter wheat, and indeed any other form of cereal crop, it is highly important that the farmers give much attention to the selection of the more useful varieties. In some seasons this is not so important, as almost any variety will give a fair return, but in others when the conditions of growth and ripening are not so favorable the difference in the yields in some instances amounts to nearly 50 per cent. with the varieties grown under the same conditions. As it is impossible to forecast the nature of the season, it is always better to be forearmed by sowing varieties possessed of sufficient vigor and hardihood to enable them to bear up well under adverse conditions.

The qualities to be sought in winter wheat include the following:

1. Ability to give good yields. Occasionally we meet with varieties having nearly all the requisites given below, and yet the yield from them is only ordinary.

2. The quality of the grain, including weight per bushel and value for milling purposes. A variety possessing good milling properties is certainly to be much preferred to one equal in other respects but lacking in these.

3. Strength of straw. This is very important in some seasons, more especially on soils where the grain is liable to lodge, as it bears so directly on the yields and on the labor of harvesting.

4. Non-liability to rust. Although rust is largely dependent on season, soil and location, some varieties have the power of resisting it in a marked degree.

5. Earliness in maturing. This is also intimately associated with yield, as in some seasons an advantage of from three to five days in early ripening will make a great difference in the returns.

6. The presence or absence of beards. Beards are so far objectionable unless there is decided superiority in other directions, as they are less pleasant to handle, they lessen the value of the chaff for feeding purposes and are associated more or less with lack of refinement in quality.

Owing to the low prices ruling for winter wheat there will be an inclination to sow a less acreage this season. This tendency can easily be carried too far. We do well to remember that we have an excellent wheat-producing country and that we want large quantities of straw for bedding which cannot be secured so effectually in any other way. There is always less hazard in growing a variety of crops, and it also furnishes a more equable division of the work of the farm. And there is at the same time a possibility of some advance in prices. It is at least questionable as to whether this Province should at any time grow less wheat than will suffice for home consumption.

Location and Soil. All the varieties of winter wheat, both native and foreign, were grown in plots side by side in the same range. These plots contain each exactly the one one-hundreth part of an acre. The yield per acre is estimated from the actual yield of the plots. The aspect of the land is south-westerly, with so little slope, however, that it is almost imperceptible. The soil may be designated a mild clay loam.

Preparation of the Soil. The soil was prepared on the bare fallow system to secure uniformity of condition in a field devoted to the growth of experimental grains. This was the only bare fallow that we had on the farm. The cultivation given was much the same as is usually put upon bare fallows. Barnyard manure was applied at the rate of 15 tons per acre in the spring of 1890, and a crop of rape was grown and pastured off upon the land the same year. No manure has been put upon it since.

SELECTION OF VARIETIES. In selecting varieties to sow, those kinds should be preferred which have given the most satisfaction during a term of years rather than for one year. We sometimes find varieties give excellent yields one year which do very poorly the next. We are now able to give facts relating to the behavior of a considerable number of varieties for three years as shown in Table XVII, and these should certainly prove valuable to the farmers of this province engaged in growing winter wheat.

THE VARIETIES GROWN. There were in all 115 plots of winter wheat grown at this station during the present year, including 68 varieties. Of these, 35 varieties were grown in duplicate plots; and in another field 8 varieties were grown in plots varying from half an acre to two acres. The larger plots were duplicates of some of the smaller ones, and the particulars relating to them will be given later in the report. Of the 68 varieties grown, 44 were Canadian and American and 24 were foreign. The foreign varieties which were imported originally from Germany, England, France, and Russia in 1889, are all from last year's seed.

Table XVI. Characteristics of 44 varieties of Winter Wheats.

Varieties.	Nature of head.	Color of		Date of maturity.	Comparative am't of rust. (0 none; 100 much.)	Per cent. of straw lodged at harvest.
		Chaff.	Grain.			
1 Surprise	Bald	White	White	July 27	30	10
2 Early Red Clawson	"	Red	Red	" 26	50	50
3 Rodgers	"	White	"	" 27	25	70
4 Red Velvet Chaff	"	"	"	" 27	25	70
5 Golden Drop	"	Red	"	" 26	50	70
6 Bonnell or Landreth	"	White	White	" 25	20	70
7 Golden Cross or Volunteer	Bearded	Red	Red	" 26	60	20
8 Manchester	Bald	White	"	" 27	45	30
9 Standard	"	Red	White	" 25	45	40
10 Hybrid Mediterranean	Bearded	"	Red	" 26	40	70
11 Martin Amber	Bald	White	White	" 27	45	85
12 Seneca or Clawson	"	Red	White	" 25	30	50
13 Lancaster	Bearded	"	Red	" 26	45	95
14 Red Lyon	"	"	"	" 26	25	97
15 New Monarch	Bald	White	"	" 26	50	30
16 American Bronze	"	"	"	" 28	60	5
17 Egyptian	Bearded	"	"	" 26	40	60
18 Garfield or Natural Cross	Bald	"	White	" 26	25	90
19 Jones' Winter Fyfe	"	"	Red	" 26	45	50
20 Bulgarian	Bearded	"	White	" 26	35	30
21 Winter Pearl	Bald	"	"	" 28	40	60
22 Canadian Velvet Chaff	"	"	"	" 26	25	60
23 Democrat	Bearded	"	"	" 26	25	40
24 Dawson's Golden Chaff	Bald	Red	"	" 26	80	0
25 Mediterranean	Bearded	White	Red	" 26	65	90
26 Fulcaster	"	"	"	" 24	45	60
27 Red Wonder	"	"	"	" 27	55	95
28 Deitz Longberry	"	"	"	" 26	55	80
29 Reliable	"	"	"	" 27	25	10
30 Fultz	Bald	"	"	" 24	40	10
31 Russian Amber	Bearded	"	"	" 26	30	40
32 Coryell	Bald	Red	"	" 24	60	80
33 Rutherford	Bearded	"	"	" 26	35	90
34 Rumsey	"	White	White	" 29	25	40
35 Genesee	"	"	"	" 26	40	50
36 Valley	"	"	Red	" 26	30	10
37 Walker's Reliable	"	"	"	" 27	30	50
38 Hybrid Delhi	Bald	"	White	" 27	20	78
39 Monette	"	"	Red	" 28	35	50
40 Red Russian	"	Red	"	" 27	30	20
41 Longberry Red	Bearded	"	"	" 27	50	80
42 Velvet Chaff	"	"	"	" 24	40	10
43 Manilla	Bald	White	White	" 26	40	50
44 Scott	"	"	Red	" 27	30	10

The extent to which the plots were affected by rust and by weak straw may be noticed at a glance by referring to the two right hand columns respectively of the table, but it should be remembered that these relate only to the present year.

Manner and Time of Seeding. The seed was sown by hand as we have no machines suitable for sowing in drills in plots of the size mentioned. The plots were all sown September 2nd, with the exception of Nos. 27, 29, 36, and 40 mentioned above, which were sown September 9th, and Nos. 34, 37 and 39, which were sown September 15th. The same amount of seed was sown upon each plot, and at the rate of $1\frac{2}{3}$ bushels per acre by weight.

The Conditions of Season and Weather. These were on the whole not so favorable as during the previous wheat year. The weather in the autumn was such that all the Canadian and American varieties made a good growth, and they also passed the winter safely. But the months of May and June were abnormally wet, which along with the heavy winds that prevailed caused more or less of lodging in nearly all the varieties. Some of them also rusted considerably. In fact none of them could be said to be entirely free from leaf rust. During the ripening period the temperature was unduly high, but notwithstanding the yields were in many instances fair.

Table XVII. Yields of 15 varieties for three years.

Varieties.	Straw per acre (tons).		Weight per measured bushel (lb).		Grain per acre (bush. 60 lb.).	
	1892.	Average 1890-1-2.	1892.	Average 1890-1-2.	1892.	Average 1890-1-2.
Surprise	3.43	2.71	59.8	60.6	45.7	**46.37**
Early Red Clawson	3.22	2.57	59.3	59.9	46.7	**45.70**
Rodgers	3.23	2.53	60.0	61.1	40.5	**43.23**
Red Velvet Chaff	3.07	2.49	57.5	60.8	35.8	**42.83**
Golden Drop	3.46	2.53	62.0	62 1	51.2	**42.66**
Bonnell or Landreth	3.27	2.76	58.4	60.7	34.3	**41.96**
Golden Cross or Volunteer	2.83	2.50	61.5	61.3	43.8	**41.93**
Manchester	3.41	2.47	60.4	62.0	45.4	**41.17**
Standard	3.44	2.73	57.8	60.2	31.8	**40.60**
Hybrid Mediterranean	3.53	2.72	61.0	61.8	45.5	**40.53**
Martin Amber	3.18	2.65	60.2	61.2	37.3	**40.07**
Seneca or Clawson	3.45	2.76	58.8	60.2	34.0	**39.43**
Lancaster	3.61	2.86	61.5	62.6	41.3	**39.13**
Red Lyon	3.96	2.81	61.1	61.7	41.2	**38.30**
New Monarch	3.27	2.49	61.5	60.6	41.1	**33.97**

As the facts given in Table XVII relate not only to results of this year's crop, but also to the average obtained for the past three years, they may be regarded as of special importance. The average yield of grain per acre of these 15 varieties was 30.9 bush. in 1890; 51.6 bush. in 1891, and 41 bush. in 1892. For the three years the average was 41.19 bush. The average weight per bush. in 1890 was 60 lb.; in 1891, 63.3 lb.; in 1892, 60 lb. For the three years the average was 61.1 lb. The Surprise heads the list in point of yield, averaging 46.37 bush. per acre for the three years. It is possessed of many good qualities, as ability to yield well, good strength of straw, freedom from rust and good milling properties The Early Red Clawson follows closely with an average yield of 45.70 bush. Its earliness of ripening is a strong point in its favor. The Rodgers, which comes third on the list, doe[illegible] [illegible]ot stand high as to milling properties. The Manchester, which yields well in some localities, has not done so well with us, as it is somewhat prone to rust. The Red Lyon, which several years ago was sold in some localities for $15 per bush., is very weak in the straw. It weighs well, and this is the best feature about it.

TABLE XVIII. Yields of 8 varieties for two years.

Varieties.	Straw per acre (tons).		Weight per measured bushel (lb).		Grain per acre (bushel 60 lb).	
	1892.	Average 1891-2.	1892.	Average 1891-2.	1892.	Average 1891-2.
American Bronze	3.38	2.77	59.3	61.1	39.8	**52.5**
Egyptian	3.32	2.63	61.5	62.7	47.5	**50.4**
Garfield or Natural Cross	2.87	2.69	59.3	60.6	32.5	**48.4**
Jones' Winter Fyfe	2.54	2.15	59.2	61.7	37.8	**47.1**
Bulgarian	3.08	2.34	61.6	63.0	47.7	**47.0**
Winter Pearl	2.84	2.67	60.5	60.7	36.1	**45.8**
Canadian Velvet Chaff	2.98	2.40	55.4	58.8	30.7	**45.3**
Democrat	3.18	2.43	62.0	63.2	47.2	**44.4**

These varieties have been grown here for but two years, and like those of the previous table, under the same conditions. The average yield obtained from them in 1891 was 55.3 bush. per acre; in 1892, 39.9 bush.; for the two years, 47.6 bush. The average weight per bush. in 1891 was 63.2 lb.; in 1892, 59.9 lb.; for the two years, 61.5 lb. The American Bronze, which stands first in point of yield for the two years, did not give nearly so good a return comparatively this year as last. Although it stood up well, it was considerably affected with rust. The Egyptian, though an old variety, has done well, and it will also be observed that it weighs well. The Garfield, coming third in point of yield, betrayed considerable weakness of straw, while the plots on either side of it stood up well. Jones' Winter Fyfe, although possessed of first-class milling properties, is only medium as to yield and weight of grain. The Bulgarian, which bears considerable resemblance to the Democrat, yields fairly and weighs well. It seems to be a rugged wheat, and is possessed of good milling properties. The Canadian Velvet Chaff has done rather poorly with us this year. The yield of grain was comparatively low, and it was notably deficient in weight.

TABLE XIX. Yields of 21 varieties for one year.

Varieties.	Straw per acre.	Weight per measured bushel.	Grain per acre.
	tons.	lb.	bush. (60 lb.).
Dawson's Golden Chaff	3.46	59.5	**51.2**
Mediterranean	3.42	61.8	**50.9**
Fulcaster	3.23	64.5	**50.5**
Red Wonder	4.18	62.8	**48.8**
Deitz Longberry	3.34	61.9	**48.7**
Reliable	3.14	62.2	**47.9**
Fultz	3.12	62.5	**47.5**
Russian Amber	3.26	61.5	**46.7**
Coryell	2.86	61.5	**46.2**
Rutherford	3.61	59.8	**46.2**
Rumsey	3.35	61.5	**45.1**
Genesee	3.43	61.0	**43.8**
Valley	2.59	61.5	**43.7**
Walker's Reliable	2.66	60.4	**42.9**
Hybrid Delhi	2.86	59.5	**42.8**
Monette	3.34	59.0	**42.1**
Red Russian	3.16	61.4	**41.4**
Longberry Red	3.34	61.0	**41.2**
Velvet Chaff	2.98	63.0	**40.5**
Manilla	3.59	58.7	**38.6**
Scott	2.70	61.0	**32.5**

The 21 varieties in Table IV were grown here this year for the first time in these comparative tests, and considerably more than one half the number were imported from the United States. The average yield per acre is 44.74 bush., and the average weight per measured bush. 61.3 lb. The yield of straw is abnormally large, being 3.2 tons per acre, which is probably 50 per cent. more than in ordinary seasons. Weighing the straw at a later date would doubtless cause some reduction. The Dawson's Golden Chaff, originated in 1881 by Robert Dawson, of Paris, Ont., comes first in point of yield. This wheat stood up better than any other variety, but it was affected considerably by rust, which no doubt affected the quality of the grain.

The old Mediterranean, imported from the United States, comes second in point of yield, showing that it still retains its old time vitality. The Fulcaster, also from the United States, gave the remarkable weight of 64.5 lb. to the bush. The Red Wonder came out well, but is very weak in the straw. It would probably do well on sharp, sandy land. The Scott, so popular at one time, seemed to be lacking in vitality, and stands at the foot of the list in point of yield.

TABLE XX. Comparative summary of results.

——	Number of varieties.	Average yield of straw per acre (tons).	Average weight per measured bushel (lb).	Average yield of grain per acre (bush. 60 lb).
Bald	24	3.29	59.61	40.15
Bearded	20	3.17	61.64	45.53
White Chaff	30	3.17	60.55	42.30
Red Chaff	14	3.35	60.65	43.51
White Wheat	15	3.23	59.60	39.92
Red Wheat	29	3.23	61.08	43.97

It will be observed here that generally speaking the bearded red chaff red wheats gave more straw and more grain per acre, and also gave grain weighing more per bush. than the bald white chaff white wheats. There is very little difference in the relative quantities of straw produced. In weight of grain the average difference in favor of the bearded varieties as compared with the bald is 2.03 lb. per bush. In 1891 the difference (1.37 lb.) is also in favor of the bearded sorts. The red wheats outweigh the white varieties by 1.48 lb. per bush. In 1891 the difference in the same direction was 1.96 lb. In 1892 the bearded varieties gave an average yield of 5 bush. per acre more than the bald, while in 1891 the bald varieties yielded 9.9 bush. per acre more on an average than the bearded. The present season the red wheats yielded 4 bush. per acre more than the white, while last season the white wheats yielded over 5 bush. more than the red. In Bulletin LXVII., issued on winter wheats in 1891, it is stated "that when wheat is grown under favorable conditions the bald varieties yield considerably more than the bearded." To this we may add that from the results obtained this year it would seem to be true that in seasons when the conditions are not really favorable the bearded varieties will yield more than the bald.

As we had a limited quantity of seed for distribution, in a bulletin issued Aug. 22nd, 1892, we appended the following in reference to it: "We will supply any of the following varieties, viz., American Bronze, Jones' Winter Fyfe, Early Red Clawson, and Bulgarian, in lots of one and two bushels. As the quantity of each variety is limited we can only agree to furnish seed while the supply lasts and in the order in which we receive the applications. The prices charged will be moderate. For further information apply to the Professor of Agriculture, Guelph, Ont.

"Some of the varieties will be distributed in smaller lots through the medium of the Ontario Agricultural and Experimental Union. This Union, which meets annually at the Agricultural College, is composed of the officers, ex-students, and students of the

College, and all farmers throughout the Province are invited to co-operate in the work that is being carried on by the Association. This work consists of the testing of seeds and fertilizers under conditions as nearly similar as may be found practicable. The seeds are furnished by the Union free to farmers, and full instructions regarding the mode of conducting the tests are also furnished at the same time. The only return asked of the farmer is a report of the results to be sent after harvest by a time fixed upon as mentioned in the instruction sheet. These reports are made upon blank forms furnished to each experimenter along with the instructions. At the present time there are no less than 5,088 plots under experiment in this Province conducted by ex-students and other farmers, the results of which are published annually, and cannot fail to be of much service to the agriculturist.

In the subjoined table will be found the different sets of varieties of wheats which will be sent by mail in half-pound lots of each variety to farmers applying for them and in the order of the application so long as the supply lasts.

Three sets of Fall Wheat for Co-operative Tests.

(1.)	(2.)	(3.)
Dawson's Golden Chaff.	Dawson's Golden Chaff.	Dawson's Golden Chaff.
American Bronze.	American Bronze.	American Bronze.
Early Red Clawson.	Fulcaster.	Jones' Winter Fyfe.
Bulgarian.	Red Wonder.	Fultz.
Mediterranean.	Surprise.	Golden Drop.

Each farmer wishing one of these sets will please address the Secretary, C. A. Zavitz, Experiment Station, Guelph, *mentioning which set he desires*, when the grain, with instructions for testing and blank forms on which to report, will be forwarded free of cost to his address."

Conclusions.

The results of the experiments may be thus summarized :

1. That the average yields per acre of the 44 Canadian and American varieties grown in 1892 were: straw 3.2 tons, grain 42.6 bush. per acre and weight per bush. 60.5 lb.

2. That as the averages obtained from the 15 varieties grown at this station for three years were 30.9 bush. in 1890; 51.6 bush. in 1891, and 41.6 bush. in 1892, while the average weight per bush. in these respective years was 60, 63.3 and 60 lb., we are justified in concluding that the wheat producing capabilities of Ontario are still of a high order.

3. The four best yielding varieties in 1892, all of which gave more than 50 bush. per acre, are Dawson's Golden Chaff, Golden Drop, Mediterranean and Fulcaster, named in the order of the yields which they made.

4. The four varieties giving the heaviest weights per bush. in 1892 were the Fulcaster, 64.5 lb.; Velvet Chaff (bearded), 63 lb.; Red Wonder, 62.8 lb., and Fultz, 62.5 lb.

5. The four best yielding white wheats in 1892, were Dawson's Golden Chaff, Bulgarian, Democrat and Surprise, and the four best yielding varieties of red wheat were the Golden Drop, Mediterranean, Fulcaster and Red Wonder, in the order named in both instances.

6. That the bald Velvet Chaff varieties gave an average of 7.8 bush. less per acre than the mean average of the 44 varieties grown in 1892 and weighed 3.1 lb. less per bush.

7. That in our experience of the past three years the average yields per acre of the red and white wheats have not been far different, being about one bushel per acre in favor of the white wheats.

8. That in our experience of the past three years we have found that the red wheats average from 1 to 2 lb. more per bush. than the white wheats.

Winter Wheats. Comparative Test of Foreign Varieties.

These foreign varieties have been grown upon the experimental plots for three years. When we reported upon them in 1891, we hesitated to recommend them to Canadian growers, because of their lack of hardiness. With a number of them there has been some improvement, but we do not feel justified even now in recommending them for general cultivation. The size of the plots was one one-hundreth of an acre. The seed was sown by hand, broadcast, on September 2nd, 1891, and at the rate of $1\frac{2}{3}$ bushels per acre. The general cultivation was the same as that given to the Canadian and American varieties.

Table XXI. Yields of eighteen varieties of foreign winter wheats.

Varieties.	Country obtained from.	Number of years grown at O. A. C.	Weight per measured bushel.		Straw per acre.		Grain per acre (bush. 60 lb.)	
			1892.	Average 3 years '90-91-92	1892.	Average 3 years '90-91-92	1892.	Average 3 years '90-91-92.
			lb.	lb.	tons.	tons.	bush.	bush.
1 Square Head	Germany ..	3	52.75	56.92	....	....	48.20	**39.47**
2 Dividend	" ..	3	51.50	55.09	3.66	2.93	27.92	**32.71**
3 Lamed Hybrid	France	3	55.00	57.75	3.03	2.01	36.57	**30.60**
4 Russian Odessa	Russia	3	54.25	59.20	2.64	2.01	22.92	**30.11**
5 Spalding Red.	England ...	3	54.50	57.59	3.02	2.03	30.93	**30.03**
6 Golden Drop Red.	" ...	3	51.50	57.00	2.98	1.82	27.40	**30.00**
7 Imperial Velvet Chaff..	" ...	2	51.50	55.50	2.98	....	....	**29.64**
8 White Patenelle........	France	3	53.00	56.59	3.56	2.09	34.68	**28.37**
9 Square Head Red.......	England ...	3	59.00	59.75	2.64	1.83	28.75	**27.36**
10 Herefordshire White....	" ...	3	50.25	56.17	2.17	1.80	19.48	**26.84**
11 Regent	Germany ..	2	52.00	56.30	1.88	....	14.33	**25.29**
12 Browick Red	England ...	3	53.00	56.83	3.06	1.94	26.35	**24.20**
13 Miracle	Germany ..	2	55.00	58.30	2.77	....	27.72	**24.17**
14 Lammas Red	England ...	3	53.00	57.33	3.20	1.97	23.33	**23.74**
15 Saumur	France	3	52.75	56.75	2.92	1.78	26.88	**22.85**
16 Kessingland Red	England ...	3	49.50	54.10	3.15	....	22.50	**22.01**
17 Galezien Summer.......	Germany ..	3	53.00	59.50	1.82	1.50	14.48	**20.8**
18 Red Inversible	France.	3	54.00	58.00	3.01	1.70	25.63	**19.80**

Several of these varieties are possessed of characteristics which are very valuable in a crop of winter wheat, such as freedom from rust and strength of straw. But their lack of ability to endure our winters, and lateness of ripening, seem to give them a lower place than that occupied by nearly all our Ontario varieties. When they become better acclimatized, some of the varieties may find a place in general cultivation. The Galezien Summer stands high in the estimation of millers for giving strength to the flour, and the Miracle for giving colour to the same. They were both imported from Germany, but whereas the Galezien Summer stood first in point of yield of all the foreign varieties grown in 1890, and the Miracle was among the lowest yielding varieties, the former is rapidly deteriorating while the latter is improving considerably.

8. Winter Wheat, application of Fertilizers.

This experiment relates to the application of different commercial fertilizers, alone and in various combinations, upon plots of the Canadian Velvet Chaff winter wheat. These plots were one-twentieth of an acre in size. The fertilizers were applied broadcast, April 15th, 1891. When these were used separately the following amounts were applied per acre, viz. : nitrate of soda and muriate of potash, 160 lb. each, and superphosphate 320 lb. When two of these fertilizers were used in combination, one-half the quantity of each was applied that is mentioned above. When three of them were used in combination, one third of the quantity of each as mentioned above was used. Salt was applied at the rate of 400 lb. per acre.

The object of this experiment was to ascertain the effect of these fertilizers upon the yield of wheat in a soil which may be termed a gravelly loam. It will also serve in some measure as a guide to the farmer in the quantities of these fertilizers to apply when testing the wants of his soil with reference to the application of fertilizers.

TABLE XXII. Winter wheat, application of fertilizers.

Fertilizers.	Yields of grain per acre (bush. 60 lb.)
	bush.
Nitrate of Soda and Muriate of Potash	27.66
Nitrate of Soda	26.33
Superphosphate and Muriate of Potash	25.33
Salt	24.33
Superphosphate and Nitrate of Soda	24.00
Nitrate of Soda, Muriate of Potash and Superphosphate	23.66
Muriate of Potash	22.66
No fertilizer	22.66
Superphosphate	21.66

It will be observed that while the combination of nitrate of soda and muriate of potash give the best results, when the fertilizers are used singly, the largest yield was obtained from nitrate of soda, while the superphosphate seemed of no value whatever to the wheat crop. The teaching of this experiment would serve to show that the soil of this field was more in need of nitrogen than of potash, and of potash than of phosphoric acid. Some profit was probably derived from some of those applications, especially the first, but the exact profit is not easily ascertained, owing to the unexhausted increment left in the soil which varies with the season and the crop. It will be remembered that these results are in no sense to be taken as guides where the soil conditions differ, and even where they may be somewhat similar, as they are the result of but one season's test.

9. OATS. COMPARATIVE TEST OF 116 VARIETIES.

In 1892, 116 varieties of oats were grown. The plots were each one-hundredth of an acre in size. The grain was all sown April 18th. The seed was sown broadcast at the rate of 2¼ bush. per acre. The ground was then harrowed and rolled. Table XXIII gives the characteristic, relating to the 116 varieties grown during 1892, and tables XXIV, XXV, and XXVI give the yields of the varieties grown for four years, two years and one year respectively. The varieties are arranged in each table according to the average yields of grain per acre for the period indicated.

The time of maturing (Table XXIII.) extended from August 3rd to August 15th, a period of only twelve days. They ripened too quickly, owing to weather unduly hot at the time, hence the yields were much less than they would otherwise have been. The 11 varieties which came first to maturity gave an average yield of 55.3 bushels per acre, and the 13 sorts which came last to maturity gave an average yield of 48.9 bushels per acre. This would seem to indicate that we may expect the largest average yields from the early maturing sorts. The early ripening varieties were somewhat more free from rust than the later ones, and the former were all white in color, while some of the latter were black and some yellow. The varieties giving the greatest length of plant measured 63 inches, and that variety which gave the shortest length of the same measured 42 inches. The 9 varieties which were over 60 inches in height, gave an average yield of 54.7 bushels per acre, and the 10 kinds which were under 40 inches in height gave an average yield of 57.5 bush. per acre.

TABLE XXIII. Characteristics of 116 varieties of Oats.

Varieties.	Country obtained from.	Number of years grown at O. A. C.	Date of maturity.	Length of plant.	Amount of rust.	Amount of straw lodged.	Nature of head.	Color of grain.
			Aug.	In.				
1 Joanette Black	France	4	7	43	None	Medium.	Spreading	Black.
2 Chenailles Black	"	4	6	43	"	"	"	"
3 Black Etampes	"	4	7	42	"	"	"	"
4 Siberian	Russia	4	6	56	Slight	Slight	"	White.
5 Houdan Black	France	4	6	47	None	None	"	Black.
6 Dancbrog	Germany	4	6	60	Very slight.	"	"	White.
7 Oderbrucker	"	4	7	54	Slight	Medium.	"	"
8 Improved Besthorn	"	4	8	59	Very slight.	Small	"	Yellow.
9 Probsteier	"	4	8	60	Medium	Medium.	"	White.
10 Pringle's Progress	Ontario	4	4	51	Slight	"	"	"
11 Poland White	France	4	4	62	"	None	"	"
12 Waterloo	Germany	4	8	56	Medium	Large	"	"
13 White Canadian	"	4	10	59	None	None	"	"
14 Georgian	"	4	7	52	Slight	Slight	"	"
15 Bavarian	Ontario	4	12	60	"	Medium.	"	"
16 Egyptian	"	4	8	58	"	Slight	Mane	"
17 Siberian	France	4	4	57	"	"	Spreading	"
18 Yellow Gigantic	"	4	13	60	Very slight.	None	Mane	Yellow.
19 Acclimatized Black Tartarian	Ontario	4	8	60	Slight	Small	"	Black.
20 Black Poland	Scotland	4	8	56	Large	Large	"	"
21 Yellow August	Germany	4	14	57	Very slight.	Slight	Spreading	Yellow.
22 Black Hungarian	France	4	12	61	Slight	None	Mane	Black.
23 Black Champion	Ontario	4	11	62	"	Small	"	"
24 Nubian Black	Germany	4	12	58	Very slight.	None	"	"
25 Improved Waterloo White	England	4	9	59	Slight	Small	Spreading	White.
26 Flying Scotchman	"	4	4	61	"	Large	"	"
27 White Tartarian	Russia	4	13	52	Medium	"	"	"
28 Black Tartarian	Scotland	4	12	61	S ight	None	Mane	Black.
29 California White	Germany	4	13	61	"	Slight	"	White.
30 Victoria White	Scotland	4	4	63	"	"	Spreading	"
31 Rosedale	Ontario	4	8	54	Medium	Medium.	Mane	"
32 White Abundance	France	4	13	56	Large	Large	Spreading	"
33 Cluster or Triumph	Ontario	4	3	59	Slight	Small	"	"
34 Potato	New Zealand.	4	12	58	Very slight.	Slight	"	"
35 August White	Germany	4	10	57	Slight	"	"	"
36 Georgian White	France	4	13	51	Medium	Large	"	White.
37 Black Red Crown	"	4	14	45	"	Medium.	"	Black.
38 Early Blossom	England	4	3	54	Slight	Slight	"	White.
39 Hopetown	Ontario	4	10	49	Very slight.	"	"	"
40 Podolischer	Russia	4	8	55	Slight	Large	"	"
41 Victoria Prize White	England	4	3	55	"	Medium.	"	"
42 American Welcome	Germany	4	3	57	"	"	"	"
43 White Tartarian	Scotland	4	13	58	Very slight.	Slight	Mane	"
44 Black Tartarian	Ontario	4	11	50	Slight	Small	"	Black.
45 Pedigreed Black Tartarian	"	4	12	50	Large	Medium.	"	"
46 Dutch Bren	England	4	3	53	Slight	Large	Spreading	White.
47 Carter's Prize Cluster	Ontario	4	4	54	"	Medium.	"	"
48 White	Australia	4	3	56	"	"	"	"
49 Colommiers	France	4	13	51	"	None	"	Black.
50 Welcome	Ontario	4	3	56	"	Small	"	White.
51 White Hungarian	France	4	14	57	"	None	"	"
52 White Poland	Russia	4	7	55	"	Small	"	"
53 Brie Black	France	4	15	51	"	None	"	Black.
54 Rennie's Prize Cluster	Ontario	4	3	53	"	Medium.	"	White.
55 Providence	Sweden	4	9	52	"	None	"	"
56 Racehorse	Ontario	4	3	54	"	Large	"	"
57 Round or Branching Black	France	4	13	46	"	None	"	Black.

TABLE XXIII.—*Continued.*

Varieties.	Country obtained from.	Number of years grown at O. A. C.	Date of maturity.	Length of plant.	Amount of rust.	Amount of straw lodged.	Nature of head.	Color of grain.
			Aug.	In.				
58 Flanders White	France	4	10	53	Slight	None	Spreading	White.
59 Dun	New Zealand	4	12	56	Very slight	"	"	Dun.
60 Thurigen	Germany	4	15	49	Slight	"	"	Yellow.
61 Prolific Black	California	4	11	50	Medium	"	Mane	Black.
62 Bertram's Prolific	Scotland	4	11	53	"	"	Spreading	White.
63 Longfellow	Germany	4	10	62	Slight	"	"	"
64 Hamilton	Scotland	4	10	50	"	"	"	"
65 Yellow Flanders	France	4	11	52	"	"	"	Yellow.
66 Port Adelaide	Australia	4	4	54	"	Large	"	White.
67 Early Racehorse	England	4	3	55	"	Medium	"	"
68 Longfellow	Scotland	4	11	58	"	None	"	"
69 Potato	"	4	4	54	"	Large	"	"
70 Scotch Potato	Russia	4	10	46	"	None	"	"
71 Dun	Scotland	4	10	48	"	"	"	"
72 Angus	"	4	8	57	Very slight	Small	"	"
73 Triumph	Australia	4	10	57	Slight	None	"	"
74 Birlie	Scotland	4	9	50	"	Large	"	"
75 Australian White	Australia	4	10	54	"	None	"	"
76 Improved Scotch	Ontario	4	9	55	"	"	"	"
77 Hopetown	Germany	4	10	61	"	"	"	"
78 Hungarian Black	Hungary	4	12	53	Medium	"	Mane	Black.
79 Hopetown	Scotland	4	11	54	Slight	"	Spreading	White.
80 Red Spot	France	4	8	51	"	Large	"	Dun.
81 Selected Winter	England	4	12	54	"	None	"	"
82 Golden Giant	Ontario	2	14	49	"	"	Mane	White.
83 Magnet	"	2	11	49	"	"	Spreading	"
84 Vick's American Banner	United States	2	8	54	Large	"	"	"
85 Holstein Prolific	Ontario	2	7	51	Medium	"	"	"
86 White Mane	"	2	10	49	Slight	Medium	"	"
87 White Schonen	"	2	8	53	"	None	"	"
88 Danish	New Zealand	2	8	51	Medium	"	"	"
89 Wide-Awake	Ontario	2	7	53	Slight	"	"	"
90 Giant Swedish	"	2	13	55	Medium	"	Mane	Yellow.
91 Early Calder	"	2	8	49	Slight	Medium	Spreading	White.
92 Giant Yellow	United States	2	3	50	"	Small	"	Yellow.
93 Early Gothland	Ontario	2	7	61	"	"	Mane	White.
94 White Swiss	United States	2	9	54	"	"	"	"
95 Black Mane	Ontario	2	12	53	"	None	"	Black.
96 White Belgian	"	2	6	59	"	Medium	Spreading	White.
97 Black Glen Rothern	"	2	15	48	Very slight	None	"	Black.
98 Early Archangel	"	2	4	53	Slight	Medium	"	White.
99 Clydesdale	"	2	4	55	"	"	"	"
100 Steele's New White Cave	"	2	7	55	"	None	Mane	"
101 Japan	United States	2	4	59	"	Medium	Spreading	"
102 New Rosedale White	Ontario	2	10	55	Medium	None	Mane	"
103 Carter's Early Black	England	2	....	49	Slight	"	"	Black.
104 Canadian Triumph	Ontario	2	4	54	"	Small	Spreading	White.
105 Dakota	United States	2	4	58	"	"	"	"
106 Victoria Prize White	England	2	4	53	"	Medium	"	"
107 Rennie's Prize White	Ontario	2	3	59	"	"	"	"
108 Carter's Prize Cluster	England	2	4	57	"	"	"	"
109 American Beauty	Ontario	1	12	59	None	None	Mane	"
110 Joanette	"	1	13	48	Slight	Medium	Spreading	Black.
111 Abyssinian	"	1	14	59	Medium	None	Mane	White.
112 Baltic White	United States	1	12	57	Slight	"	Spreading	"
113 Thousand Fold	"	1	7	59	"	Trace	Mane	"
114 Wilson's White Prolific	"	1	....	....	....	....	....	"
115 New Wonderful	Ontario	1	10	48	Slight	Medium	....	"
116 Badger Queen	United States	1	7	52	....	Large	....	"

TABLE XXIV. Yield of 81 varieties of Oats for four years.

Varieties.	Weight per measured bushel. 1992.	Weight per measured bushel. Average 3 years 1890-91-92.	Straw per acre. 1892.	Straw per acre. Average 4 years, 1889-90-91-92.	Grain per acre (bushel 34 lb.) 1892.	Grain per acre (bushel 34 lb.) Average 4 years, 1889-90-91-92.
	lb.	lb.	tons.	tons.	bush.	bush.
1 Joanette Black	36.0	35.8	2.8	2.7	76.5	83.0
2 Chenailles Black	35.6	35.8	2.7	2.8	73.4	79.1
3 Black Etampes	36.1	36.4	2.7	2.6	76.1	79.0
4 Siberian (Russian)	34.6	36.7	2.6	2.5	75.6	77.2
5 Houdan Black	38.9	36.4	2.2	2.1	72.1	77.1
6 Danebrog	32.9	33.7	2.3	2.4	69.9	75.4
7 Oderbrucker	27.3	30.2	2.8	2.5	82.4	75.1
8 Improved Besthorn	29.5	33.5	2.4	2.0	74.9	74.7
9 Probsteier	28.6	33.0	3.3	2.5	79.8	74.5
10 Pringle's Progress	30.0	30.1	2.1	2.3	74.7	74.2
11 Poland White	36.3	38.8	2.4	2.3	68.8	74.1
12 Waterloo	26.5	31.7	3.1	2.5	77.9	74.0
13 White Canadian	34.9	34.3	2.6	2.7	60.0	72.8
14 Georgian	31.0	33.4	2.5	2.6	65.3	71.4
15 Bavarian	24.9	31.4	2.9	2.6	71.4	70.8
16 Egyptian	33.6	36.5	2.2	2.7	58.2	70.3
17 Siberian (French)	40.5	38.3	2.1	2.1	56.2	70.0
18 Yellow Gigantic	28.0	29.4	2.5	2.6	71.8	68.8
19 Acclimatized Black Tartarian	26.5	29.9	2.7	2.5	66.7	68.6
20 Black Poland	22.5	30.8	3.8	2.9	50.8	67.0
21 Yellow August	30.8	31.3	2.5	3.0	70.5	65.5
22 Black Hungarian	25.8	30.8	2.6	2.8	54.1	65.1
23 Black Champion	28.1	30.5	2.6	2.4	61.4	65.1
24 Nubian Black	29.9	32.0	2.3	2.6	55.9	64.8
25 Improved Waterloo White	31.9	32.7	2.1	2.0	68.6	64.3
26 Flying Scotchman	33.3	37.9	2.4	2.3	52.6	64.3
27 White Tartarian	28.6	29.6	2.6	3.3	61.0	64.2
28 Black Tartarian	28.8	33.3	2.4	2.7	52.1	64.1
29 California White	34.8	34.3	2.7	2.7	67.4	64.0
30 Victoria White	37.5	40.7	2.3	2.4	57.2	64.0
31 Rosedale	29.8	35.6	3.0	2.9	67.5	63.5
32 White Abundance	25.4	32.6	2.8	2.5	35.5	62.6
33 Cluster or Triumph	37.5	39.4	2.3	2.2	58.9	61.7
34 Potato	31.3	37.0	2.6	2.4	46.3	60.8
35 August White	36.9	39.5	2.7	2.9	57.7	60.7
36 Georgian White	26.8	32.2	2.9	2.8	28.5	60.7
37 Black Red Crown	33.0	32.8	2.1	2.3	58.1	60.6
38 Early Blossom	41.4	40.0	2.1	2.2	58.0	60.6
39 Hopetown	33.4	34.4	1.9	2.3	56.4	60.0
40 Podolischer	40.5	40.4	2.1	2.5	57.5	59.9
41 Victoria Prize White	35.4	39.2	2.4	2.0	54.9	59.8
42 American Welcome	40.3	40.9	2.1	2.3	57.2	59.6
43 White Tartarian	27.0	32.8	3.1	3.2	24.4	59.1
44 Black Tartarian	30.9	32.6	1.8	2.0	52.8	59.1
45 Pedigreed Black Tartarian	30.5	35.3	2.0	2.2	51.3	59.0
46 Dutch Bren	36.5	38.8	2.6	2.2	60.9	58.7
47 Carter's Prize Cluster	38.8	40.7	2.0	2.1	51.3	58.1
48 White	37.6	40.2	2.2	2.1	52.2	57.8
49 Colommiers	31.4	32.3	2.3	3.0	51.1	57.7
50 Welcome	37.3	38.8	2.0	2.1	52.2	57.3
51 White Hungarian	32.9	34.0	2.2	2.6	49.3	56.7
52 White Poland	30.6	34.1	2.5	2.6	52.4	56.0
53 Brie Black	30.3	31.8	2.6	3.0	49.8	56.1
54 Rennie's Prize Cluster	35.0	39.0	2.5	2.3	51.3	55.2
55 Providence	30.0	34.1	2.4	2.7	38.5	53.9
56 Racehorse	34.4	38.0	3.0	2.2	57.9	53.7
57 Round or Branching Black	29.9	31.4	2.1	2.5	44.0	53.7
58 Flanders White	30.5	27.3	1.9	2.1	53.1	53.6
59 Dun	31.0	32.4	2.5	2.5	39.6	53.6
60 Thurigen	27.3	30.3	2.1	2.8	47.1	53.5
61 Prolific Black	29.0	30.9	2.4	2.3	57.7	53.4

TABLE XXIV. Yields of 81 varieties of Oats for four years —*Continued.*

Varieties.	Weight per measured bushel. 1892.	Weight per measured bushel. Average 3 years 1890-91-92.	Straw per acre. 1892.	Straw per acre. Average 4 years 1889-90-91-92.	Grain per acre (bushel 34 lb.) 1892.	Grain per acre (bushel 34 lb.) Average 4 years, 1889-90-91-92.
	lb.	lb.	tons.	tons.	bush.	bush.
62 Bertram Prolific	29.3	33.8	2.4	2.9	35.9	**52.5**
63 Longfellow	32.9	35.4	1.8	2.6	42.1	**52.0**
64 Hamilton	30.0	34.6	2.1	2.8	36.6	**51.5**
65 Yellow Flanders	27.4	31.1	2.0	2.6	47.1	**51.4**
66 Port Adelaide	36.6	39.5	2.4	2.2	54.2	**51.0**
67 Early Racehorse	37.3	40.2	2.2	1.9	47.2	**50.7**
68 Longfellow	31.0	33.3	2.5	2.8	43.0	**50.2**
69 Potato	30.3	33.3	2.4	2.6	46.7	**50.0**
70 Scotch Potato	31.0	33.8	1.8	2.5	35.1	**49.9**
71 Dun	29.0	32.5	1.9	3.2	36.0	**49.4**
72 Angus	33.3	35.1	2.6	2.5	50.2	**49.2**
73 Triumph	33.6	32.0	2.1	2.3	53.5	**48.4**
74 Birlie	31.8	36.0	2.3	2.6	35.2	**47.9**
75 Australian White	36.5	38.3	2.3	2.2	47.1	**46.8**
76 Improved Scotch	32.8	33.5	2.3	2.6	42.1	**46.5**
77 Hopetown	31.0	31.4	2.3	2.8	37.2	**44.1**
78 Hungarian Black	25.5	29.5	2.3	2.0	42.7	**43.4**
79 Hopetown	25.0	31.8	2.4	3.0	26.5	**41.2**
80 Red Spot	21.5	27.4	2.1	2.5	20.5	**38.0**
81 Selected Winter	29.0	32.7	2.3	2.3	39.4	**36.8**
Average	31.87	34.36	2.41	2.50	53.93	**60.13**

Of the 81 varieties grown for four years the 9 leading kinds are all foreign. Only 15 of these varieties were from a Canadian source, and they include nearly all the old kinds. The Joanette Black, Chenailles Black, Black Etampes and Houdan Black, are very much the same in all essential characteristics, so much so, that the three first mentioned appear to be one and the same variety, though probably grown for some time in different localities in France previous to their importation. The straw is fairly strong but under medium in height. These varieties are, therefore, more suitable for sowing on good, rich land. They stand up fairly well, are not coarse, and are almost entirely free from rust tendencies. They are also inclined to shell easily when ripe. The hull is unusually thin and is easily removed in threshing. The 10 varieties which gave the highest yields for four years, made an average of 76.9 bush. per acre in 1892, and the 10 kinds which gave the lowest yields made an average of 44.2 bush. per acre. The 14 best yielding varieties for the four years have all a spreading head. The American Welcome, imported from Germany, gave the highest weight per measured bushel for the four years, viz., 40.9 lb. The heaviest weighing variety in 1892 was the early Blossom, imported from England. It weighed 41.4 lb. per bush. The lightest weighing variety was the Red Spot, imported from France, which in 1892 weighed but 21.5 lb. per bush.

TABLE XXV. Yields of 27 varieties of Oats for two years.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre (bush. 34 lb.).	
	1892.	Average 2 years '91-92.	1892.	Average 2 years '91-92.	1892.	Average 2 years '91-92.
	lb.	lb.	tons.	tons.	bush.	bush.
1 Golden Giant	26.5	28.6	2.1	2.3	62.2	**89.0**
2 Magnet	29.1	32.6	1.9	2.1	52.8	**86.4**
3 Vick's American Banner	28.9	32.9	2.2	2.1	66.7	**86.3**
4 Holstein Prolific	31.6	34.1	2.0	2.0	62.9	**86.0**
5 White Mane	30.5	32.9	2.2	2.3	59.4	**84.3**
6 White Schonen	31.5	33.0	2.1	2.1	60.9	**83.7**
7 Danish	30.0	33.0	2.1	2.1	61.8	**81.8**
8 Wide-Awake	34.5	35.1	2.1	2.0	64.5	**81.7**
9 Giant Swedish	28.5	29.9	2.2	2.1	63.3	**81.5**
10 Early Calder	32.1	33.4	2.2	2.1	64.2	**77.5**
11 Giant Yellow	34.1	34.6	1.7	2.0	50.9	**77.1**
12 Early Gothland	35.8	37.3	2.2	2.0	55.2	**74.1**
13 White Swiss	34.5	36.3	2.1	2.1	54.3	**72.6**
14 Black Mane	26.1	30.4	2.3	2.2	51.7	**72.0**
15 White Belgian	34.8	36.9	2.2	2.2	57.7	**70.0**
16 Black Glen Rothern	29.6	33.1	2.4	2.5	48.4	**69.9**
17 Early Archangel	36.3	38.2	2.0	2.2	47.2	**69.4**
18 Clydesdale	38.6	38.1	2.2	2.3	54.9	**68.4**
19 Steele's New White Cave	36.6	38.1	2.1	1.9	62.7	**68.3**
20 Japan	36.6	39.3	2.1	1.9	50.4	**66.9**
21 New Rosedale White	34.0	36.9	2.0	2.1	44.2	**66.8**
22 Carter's Early Black	29.6	30.2	2.0	....	53.9	**65.3**
23 Canadian Triumph	38.9	40.6	1.9	1.7	44.5	**63.8**
24 Dakota	39.0	40.4	2.1	2.9	54.7	**63.3**
25 Victoria Prize White	40.5	40.5	2.1	2.0	51.1	**60.7**
26 Rennie's Prize White	38.6	40.2	1.9	1.8	49.7	**58.6**
27 Carter's Royal Cluster	36.5	37.3	2.1	2.1	51.6	**57.9**
Average	33.46	35.33	2.04	2.12	55.63	**73.44**

The Golden Giant at the head of the list, stands up well, is quite free from rust and possesses straw of average height. Although a good yielder the grain is light. The Magnet which was first in 1892, holds second place among the varieties grown for two years. Vick's American Banner, so well known in many parts of the Province, stands third in point of yield; for the two years it gave an average return of 86.3 bush. per acre.

TABLE XXVI. Yields of 8 varieties of Oats for one year.

Varieties.	Weight per measured bushel.	Straw per acre.	Grain per acre (bush. 34 lb.).
	lb.	tons.	bush.
1 American Beauty	34.8	2.8	**76.7**
2 Joanette	34.9	2.6	**74.8**
3 Abyssinian	36.5	2.9	**74.5**
4 Baltic White	30.9	2.5	**70.7**
5 Thousand Fold	33.3	2.6	**65.4**
6 Wilson's White Prolific	27.1	2.7	**59.3**
7 New Wonderful	34.4	2.4	**53.9**
8 Badger Queen	31.9	2.9	**52.5**
Average	32.98	2.68	**65.98**

All the varieties in the above list were grown here for the first time in 1892, except the Joanette, the seed of which was obtained from grain newly imported by a Toronto seedsman. This variety stands second in point of yield. It gave a return of 74.8 bush. per acre, which is but 1.7 bush. less than was obtained from the crop of 1892, grown for the fourth time from seed originally imported from France. The American Beauty, obtained in Ontario in the spring of 1892, gave 1.9 bush. more per acre than the Joanette.

10. Oats. Different Dates of Seeding.

The following table is a part of an experiment conducted simultaneously with barley, peas and oats, to ascertain the results from sowing them at different dates. The oats were sown in duplicate plots in 1891 and 1892 respectively, and each of the two plots contained a different variety. The plots were one one-hundred-and-sixtieth of an acre in size, and 2¼ bushels of seed were used per acre, sown broadcast.

Table XXVII. **Comparative yields of Oats from different dates of seeding.**

Dates of Seeding.	Weight per measured bushel.			Straw per acre.			Yield of grain per acre.		
	1891.	1892.	Average	1891.	1892.	Average	1891.	1892.	Average
	lb.	lb.	lb.	tons.	tons.	tons.	bush.	bush.	bush.
April 22nd	35.7	30.3	33.0	1.54	1.5	1.52	58.2	47.2	52.7
May 1st...............	36.2	27.5	31.9	1.47	1.6	1.54	68.0	45.7	56.9
May 9th...............	34.1	24.3	29.2	1.66	1 0	1.33	64.9	42.4	53.7
May 18th	32.4	22.5	27.5	1.53	2.3	1.92	49.7	33.9	41.8
May 26th	28.5	20.3	24.4	1.78	1.8	1.79	33.3	17.2	25.3
June 6th	24.9	7.8	16.4	2.00	2.0	2.00	23.4	11.3	17.4

It will be observed that the highest yields were obtained from the second and third seedings, respectively, in 1891, and from the first seeding in 1892, while the best average yields were obtained from the second seeding. The best weight of grain was obtained from the second seeding in 1891 and from the first seeding in 1892. But the best average weights were obtained from the oats of the first seeding, and the average weights continually decreased with each successive seeding.

11. Barley and Peas. Selection of Seed.

These experiments relate to growing barley from large selected grain, small grain, and broken grain, and also peas from large selected grain, and broken grain. The object was to ascertain the extent of the advantage of using choice seed as compared with inferior seed. The plots were but one rod square. The undertaking of these experiments was something of an afterthought. They were undertaken partly for the purpose of filling up a few small unused plots. Because of this they were sown late. Spring wheat and oats were also sown in suitable plots, but the weather in harvest so interfered with these last mentioned experiments, that we have not reported on them. We are convinced, notwithstanding, that we have entered upon a very important line of experiment, and hope to be able to give it much attention in future. It would not only be interesting but also profitable to know how many years the different species of grain can be grown upon the same soil without sensible deterioration; whether for a time at least improvement could not be effected by means of the selection of seed alone, and to what extent deterioration would be accelerated by sowing inferior seed. A series of experiments relating to these questions should be of much service.

TABLE XXVIII. Hulless Barley from different qualities of seed.

Kind of seed sown.	Yield of grain per acre.
Large grains	26.98 bushels.
Small grains	18.12 "
Broken grains	13.64 "

The lateness of the seed time prevented large yields from being secured in any case, but the difference in yield between the grain grown from the large seed and the small was no less than 8.86 bush. per acre in favor of the former. When we compare the returns from the broken seed, with that from the large seed, we find it was 13.34 bush. per acre in favor of the latter. It would, therefore, seem to be very important to sow large plump seed which has the broken grains taken out of it, so far as practicable.

TABLE XXIX. Peas from different qualities of seed.

Kind of seed.	Straw per acre.	Grain per acre.
Whole peas	1.54 tons.	25.92 bushels.
Cracked peas	.86 "	12.17 "

The remark made under Table XXVIII, in reference to the care that should be exercised in removing broken grain from barley that is to be used for seed, is even more applicable with peas. They are more liable to be broken with the machine than barley, and usually it is not found easy to separate them from the whole peas, but it should be done if possible, as in this experiment the difference in the returns from the whole seed, as compared with that from broken seed, was no less than 13.75 bush. in favor of the former.

12. Barley, Peas, Spring Wheat and Oats Harvested at Different Stages of Maturity.

In this experiment 24 plots of barley, peas, spring wheat, and oats were sown, and cut at different stages of ripeness. Of these 12 were spring wheat, and there were 4 plots each of the other varieties of grain. As some features of the experiment are not yet completed, (as the analyzing of the grain and its behavior when used as seed), we do not think it prudent to say very much in regard to the experiment at this stage. It may be mentioned here, however, that the yields and the weights of the grain were not much influenced by being cut at different stages of ripeness.

(b) *Cereals in Large Plots.*

These were grown with the object of obtaining seed of promising varieties in quantities sufficient for a more general distribution through the country. They more generally consist of varieties that have been previously tested for three years. They cover an area of from 1-5 of an acre to 2 acres, according to the quantity of seed on hand. The whole area of spring grains covered by these plots was 30 acres. They were grown in fields numbers 6 and 12 respectively. In addition to the above, 66 acres were sown with grains in plots varying from 2 to 5 acres each. These larger plots were sown with various kinds of spring grains, which had given the most satisfactory results during the various previous tests that had been made with them at this station. In one 20 acre field, which had produced oats the previous season, the seed barley obtained from the large plots was so marred by the presence of oats, which grew from seed that had remained in the land over winter, that it could not be used for the purpose intended. The said field had, notwithstanding, been gang-plowed, and again plowed late in the autumn, and cultivated in the spring before sowing the barley.

13. Barley on Large Plots.

The larger plots of barley covered in all about 21 acres. Of these 20 acres, comprising 6 varieties, were grown in field No. 1, in which some of the oats from the preceding crop, remained in the ground over winter. Hence the barley which grew on these plots could not be used for seed as mentioned above when speaking of grains grown on large plots. In field No. 12 the varieties were grown which are given in Table xxx below. These plots were preceded by a turnip crop.

Table xxx. Yields of varieties of Barley on one-fifth acre plots.

Varieties.	Yield per acre.
Kinnakulla	**40.58** bushels (48 lb.)
Carter's Goldthorpe	**36.87** " "
Pfanen	**36.76** " "
Highland Chief	**35.33** " "
Hungarian (Hulless)	**35.15** " (60 lb.)

It will be observed that the Hungarian gave the largest yield, viz., 43.92 bus. per acre if we take 48 lb. as the standard bush. This variety also made a good showing in the list of grains grown for three years. The Kinnakulla stands second among 67 varieties grown in 1892.

14. Spring Wheat on large Plots.

The large plots of spring wheat covered an area of $5\frac{1}{2}$ acres. There were 7 varieties in all; of these 4 were acre plots, and 3 were half-acre plots. They were in field No. 12 and were preceded by a crop of roots.

Table xxxi. Yields of varieties of Spring Wheat on one acie and half-acie plots.

Varieties.	Yield per acre. (bush. 60 lb.)
Blue Stem	**25.70**
Holben's Improved	**20.93**
McCarlin	**18.53**
Red Fern	**17.72**
Pringle's Champion	**17.17**
Herison Bearded	**15.00**
Campbell's White Chaff	**14.93**

It will be observed that the Hayne's Blue Stem gave 1.5 bushels per acre more on the large plot than on the small plot. This is a promising variety, but has been tested only one year as yet at this station. The straw is quite strong and stands up well. The Holben's Improved gave 1.7 bushels less on the large plot as against the small.

15. Winter Wheat on Large Plots.

The large plots of winter wheat covered in all ten acres. They varied in size from one-half acre to two acre plots. There were 8 varieties in all. They were grown in field No. 6, which was at once plowed after the removal of the preceding hay crop. This field had grown hay for three years in succession. No manure was applied.

Table XXXII. **Yields of varieties of Winter Wheat on large plots.**

Varieties.	Yield per acre. (bush. 60 lb.)
Early Red Clawson	26.81
Jones' Winter Fyfe	26.14
Red Velvet Chaff	24.75
Bulgarian	21.81
American Bronze	21.52
Canadian Velvet Chaff	16.75
Galezien	15.95
Spalding Red	11.72

The early Red Clawson which stands first in the list in point of yield stands second among the varieties grown for three years. This variety seems to be adapted to a wider range of soils than some other sorts. The yields from Jones' Winter Fyfe are relatively larger in this test than in that of the smaller plots. Canadian Velvet Chaff holds relatively the same place. The two kinds which stand lowest in the lists are foreign varieties.

16. Oats on Large Plots.

The oats in large plots covered an area of 28⅗ acres. These varied in size from one-fifth of an acre to 5 acres. There were 14 varieties in all. Four varieties, viz, White Abundance, Probsteier, Golden Giant and Poland White, were grown in field No. 7. There were five acres of each variety. As these are not yet threshed we cannot report upon the yields. While each variety promises a good yield the Golden Giant was particularly attractive while growing, owing to the cleanness and strength of the straw. In plots of one acre each, 7 varieties were grown in field No. 12: these are White Abundance, Black Etampes, Siberian, White Tartarian, Flying Scotchman, Improved Waterloo and Bonanza. We cannot give yields of these as they are not threshed. The Flying Scotchman, an early ripening variety, and the White Bonanza, were very badly lodged. The other varieties promise a good return. In plots of one-fifth to two-fifths of an acre 7 varieties were grown in field No. 12. The previous crop was roots. The results of these are given in Table XXXIII below.

TABLE XXXIII. Yields of seven varieties of Oats in large plots.

Varieties.	Yield per acre. (bush.)
Siberian	60.40
Magnet	57.96
Improved Besthorn	57.16
Waterloo	54.61
Golden Giant	52.63
Danebrog	48.52
Black Poland	36.34

The Siberian which heads the list, also stands at the head of the list among the white varieties grown for four years. The Magnet, second in this test, also stands second among 27 varieties grown for two years.

POTATOES AND ROOTS.

Of potatoes 118 varieties were grown in 1892, and of roots 130 varieties. The size of the plots for potatoes was one-hundredth of an acre, and also for the different varieties of roots, but some plots relating to the cultivating of roots varied from the size just mentioned as will be more fully described hereafter. The potatoes were grown upon an old sod, plowed up after the hay crop had been removed from it in 1891. No manure had been applied for several years preceding. The aspect of the land was gently undulating, and the situation was rather fortunate in view of the wet weather which followed the crop. The soil may be designated a light colored loam. No fertilizers were applied in any form. The varieties of roots were grown upon soil where an old sod had been plowed under, after the removal of the hay crop in 1890. Potatoes followed in 1891. Fresh farm-yard manure was spread upon the ground in the winter of 1891-2, at the rate of about 15 tons per acre. The plots relating to modes of cultivation were on land which had grown cereals for three or four years in succession, followed by a crop of roots in 1891. The land was manured in the winter of 1889-90, with farm yard manure spread upon it, also at the rate of about 15 tons per acre. It may be designated a clay loam possessed of a fair amount of vegetable matter. The seed was from potatoes originally secured for the station from different parts of Ontario, Prince Edward Island, Nova Scotia, and the United States, and additional varieties were added in 1892, by securing seed in different parts of Ontario and the United States. The seeds of the different kinds of roots were obtained from England, the United States and Canada.

17. POTATOES. COMPARATIVE TEST OF 114 VARIETIES.

In 1892, 114 varieties of potatoes were grown. Two drills of each variety were planted, and the drills were all about 28 inches apart. The size of each plot was one one-hundredth of an acre. Twelve pounds of each variety of seed were used. The tubers were so cut that all the sets when planted were one foot apart in distance.

The sets when cut were somewhat uniform in size, but there was of course a difference in the number of eyes possessed by each. Flat cultivation was practically adopted. The potatoes were planted on May 14th. Table XXXIV gives the yield of 25 varieties grown for three years, Table XXXV of 16 varieties grown for two years, and Table XXXVI of 74 varieties grown for one year.

TABLE XXXIV. Yields of 25 varieties of Potatoes grown for three years.

Varieties.	Percentage of crop marketable.	Weight of 30 best developed potatoes.	Yield per acre, 1892.	Average yield per acre, 3 years 1890-91-92.
		lb.	bush.	bush.
1 Empire State	96.5	9.8	120.0	**168.6**
2 Summit	90.9	10.5	187.1	**160.6**
3 Thorburn	93.7	11.0	185.4	**148.0**
4 London	78.3	7.3	165.4	**138.0**
5 Clark's No. 1	88.5	7.8	127.1	**134.3**
6 Early Mane	77.1	6.3	112.9	**131.6**
7 Sweet St. Vernal	86.5	7.5	136.3	**123.9**
8 Rural New Yorker No. 2.	88.6	7.3	113.8	**122.9**
9 Late Rose	85.8	7.3	129.2	**120.6**
10 Minister	94.3	8.5	130.8	**114.3**
11 Early Puritan	88.8	9.5	175.0	**113.8**
12 Pootaluck	89.1	7.0	80.0	**113.5**
13 Daisy	85.7	6.5	90.0	**108.5**
14 Rural Blush	94.3	8.8	95.0	**108.2**
15 Beauty of Hebron	87.2	6.5	74.6	**99.0**
16 Early Sunrise	80.9	7.3	104.6	**98.3**
17 Green Mountain	90.2	8.3	127.1	**96.9**
18 White Elephant	93.1	9.0	120.0	**93.4**
19 Rose's New Invincible	94.2	9.5	121.3	**90.7**
20 Dakota Red	92.1	8.5	100.4	**87.0**
21 Halton's Seedling	69.1	6.0	75.4	**86.4**
22 Early Ohio	82.2	7.0	107.5	**82.7**
23 Crown Jewel	88.6	9.8	135.0	**79.5**
24 Rosy Morn	85.7	7.8	87.5	**76.3**
25 Stray Beauty	83.0	5.3	80.8	**65.6**

The Empire State which stood at the head of the list in 1890 and 1891 does not occupy so high a place relatively in 1892, although it heads the list when the average for three years is considered. The Summit, a very excellent potato, maintains its claim to second place. The Thorburn, sixth in the list for 1890 and 1891 has third place in that for three years. These three varieties are also very good for table use.

TABLE XXXV. Yields of 16 varieties of Potatoes grown for two years.

Varieties.	Percentage of crop marketable.	Weight of 30 best developed potatoes.	Yield per acre, 1892.	Average yield per acre, 2 years 1891-92.
		lb.	bush.	bush.
26 Tonhocks	81.5	8.3	216.67	**154.99**
27 Convoy	89.1	8.3	153.33	**151.77**
28 Early Oxford	83.2	6.5	186.25	**138.33**
29 Badger State	92.5	11.0	110.83	**136.27**
30 Advance	83.9	8.5	147.08	**131.04**
31 Thunderbolt	84.0	9.0	185.00	**129.70**
32 Putnam	89.9	8.0	156.67	**128.19**
33 Kosh-Konong	91.2	10.0	142.50	**127.90**
34 Early Rochester	90.6	9.5	167.92	**126.81**
35 Early Rose	85.5	8.5	160.83	**126.27**
36 Woodbury White	86.8	8.0	176.67	**120.59**
37 Silver King	85.8	7.8	161.25	**119.68**
38 Hoffman	77.7	6.5	166.25	**113.68**
39 Early Dominion	80.0	7.0	127.08	**100.04**
40 Ohio Junior	84.4	7.0	130.42	**100.01**
41 Queen of the Valley	89.8	8.8	110.00	**88.80**

Tonhocks, the seed of which was obtained in the United States in 1891, heads the list. It is a good potato for the table, and this is also true of the Convoy which stands second in the list. Both varieties are at least medium in size.

TABLE XXXVI. Yields of 73 varieties of Potatoes grown one year.

Varieties.	Country obtained from.	Percentage of crop marketable.	Weight of 30 best developed potatoes.	Yield per acre, 1892.
			lb.	bush.
42 Munro Co. Prize	United States	84.3	10.0	180.33
43 Mammoth Pearl	"	93.2	9.5	171.25
44 Island McDonald	P. E. Island	96.3	12.8	166.67
45 Burbank's Seedling	United States	85.8	7.0	164.17
46 King of Rose	"	80.2	7.8	161.67
47 Negro	"	68.2	5.5	158.75
48 Prince Albert	Nova Scotia	85.8	8.5	155.42
49 Molly Star	United States	74.7	6.5	154.58
50 Red Australian	Ontario	90.8	8.5	154.17
51 Halo of Dakota	United States	77.7	6.3	153.33
52 Early Everett	....	84.8	7.8	153.33
53 Early Germ	United States	90.6	9.3	150.00
54 Polaris	Ontario	76.8	7.0	147.56
55 The Dandy	United States	82.7	7.5	146.67
56 Hotel Favorite	"	82.6	8.0	146.25
57 Chautauqua	"	93.7	8.5	145.42
58 Eureka	"	83.6	7.3	145.00
59 Thorburn's Extra Early	Ontario	78.2	6.0	145.00
60 Watson's Seedling	United States	74.7	6.5	145.00
61 St. Patrick	Nova Scotia	89.7	9.0	141 67
62 Delaware	United States	89.0	7.5	139.58
63 Everett's Seedling	....	80.4	6.3	138 33
64 The Polaris	United States	83.1	9.3	135.83
65 P. E. I. Early Rose	"	90.8	7.8	135.42
66 Chicago Market	"	80.9	7.8	135.00
67 The Rosedale	Ontario	81.7	6.3	134.18
68 Red Australian	"	91.8	9.0	132.50
69 Sunlit Star	"	70.9	5.8	131.67
70 Paris Rose	United States	67.8	5.8	130.83
71 Mount Carbon	"	89.7	7.8	129.17
72 Landreth's Farmers' Alliance	"	88.9	8.8	127.92
73 The Ideal	....	75.7	6.5	126.67
74 Alexander's Prolific	United States	90.4	6.3	121.60
75 Landreth's State of Maine	"	88.3	7.5	120.83
76 Morning Star	"	78.5	6.8	118.38
77 Harbinger	"	52.5	5.0	118.33
78 Rose Seedling	"	92.2	9.5	117.92
79 Barpee's Extra Early	Ontario	74.4	6.3	117.08
80 Snow Queen	United States	79.4	7.0	115.00
81 Chas. Downing	"	65.2	4.8	115 00
82 Snowflake	"	58.7	4.3	115.00
83 Bella A. C	....	93.1	7.0	114.18
84 Vick's Champion	United States	89.8	8.0	114.17
85 Extra Early Vermont	"	70.2	5.3	111.67
86 Dempsey's Seedling	....	82.3	7.0	110.42
87 Garnets	Nova Scotia	71.6	7.8	108.75

TABLE XXXVI.—*Concluded.*

Varieties.	Country obtained from.	Percentage of crop marketable.	Weight of 30 best developed potatoes.	Yield per acre, 1892.
			lb.	bush.
88 Early May Flower	United States	66.9	5.0	**105.83**
89 Dakota	....	94.8	10.0	**103.33**
90 State of Maine	United States	92.2	7.0	**100.83**
91 Early Market	"	85.3	6.8	**96.67**
92 New Queen	Nova Scotia	90.4	10.5	**95.83**
93 N.B.&G. Co's. Grand Mogul	United States	89.0	5.8	**90.83**
94 White Star	Ontario	79.6	8.3	**90.00**
95 Royal Adelaide	Nova Scotia	80.1	5.3	**90.00**
96 Landreth's Garfield	United States	69.9	5.5	**90.00**
97 Pearce's Prize Winner	Ontario	89.3	8.0	**89.08**
98 Early Essex	United States	69.0	6.3	**88.75**
99 Lady Finger	Ontario	39.3	4.0	**87.08**
100 Hopeful	United States	77 6	6.0	**83.75**
101 McIntyre	Nova Scotia	85.5	8.3	**83.33**
102 Ohio Junior	United States	74.5	5.3	**78.33**
103 Boley's Northern Spy	"	79.5	6.5	**75.42**
104 Mammoth Pearl	"	83.8	6.8	**75.00**
105 Wilson's First Choice	"	59.9	4.8	**73.75**
106 White Lily	"	72.5	5.3	**69.58**
107 Vick's Perfection	"	85.0	6.8	**63.75**
108 Edwards	Ontario	78.3	6.0	**59.58**
109 Woodbury White	United States	79.5	6.3	**35.83**
110 May's Imperial	"	66.7	4.5	**25.00**
111 Vaughan	"	86.7	5.3	**18.75**
112 I. X. L	Ontario	81.4	5.0	**17.92**
113 Belle	Nova Scotia	96.4	5.5	**11.67**
114 May's Peerless	United States	60.0	3.3	**10.42**

The Munro Co. Prize potato, which heads the list of 73 varieties grown in 1892, came from the United States. Though a considerable portion of the potatoes from this variety were quite large, they were more uneven in size than those from some other varieties. The Mammoth Pearl, which stands second, came from the same country. They are a more even sample than the former. But this variety did not produce so many large potatoes. The Island McDonald, the seed of which was obtained from Prince Edward Island, although it gives a yield of 14 bush. per acre less than the Munro Co. Prize, produced larger potatoes, larger indeed than those produced by any other variety. They were also more even in sample than the Munro Co. Prize.

18. Potatoes. Different Depths of Planting Seed Tubers.

This experiment was a duplicate of that carried on in 1891, and described in the Report for that year, p. 87. It relates to planting to the depth of 1, 3, 5 and 7 inches, respectively. The test was carried on in duplicate both years. Each plot was one one-hundredth of an acre in size. The drills as in the case of the potatoes of different varieties, were 27.7 inches apart and the sets were placed one foot apart in the drill. The cultivation was practically flat. One set of plots was planted May 14th and the other May 28th.

TABLE XXXVII. Comparative yield of Potatoes from different depths of planting.

Depth of planting.	Average yield per acre of two plots, 1891.	Average yield per acre of two plots, 1892.	Average, 1891-2.
	bush.	bush.	bush.
1 inch	160.7	147.1	153.9
3 "	188.4	152.1	170.3
5 "	224.2	152.8	189.0
7 "	256.1	158.5	207.3

In this exceedingly interesting line of experiment, it will be observed that the yield increased in every instance, with the increase in the depth of planting, and the ratio of increase was somewhat marked. But the difference in favor of deeper planting was considerably more last year than this, owing very probably to the drier season of 1891. It should also be mentioned that although the deeper planting gave the best yields, it also necessitated the bestowment of more labor in planting and digging.

19. POTATOES. PREPARATION OF SEED TUBERS.

An experiment was carried on in duplicate in 1892 to ascertain the result from the preparation of seed tubers in different ways and from different modes of planting the same. In each experiment ten plots were used. The soil, including the preparation, was the same as in the varieties previously described. The drills were also the same distance apart, viz., 27.7 inches, and the planting was likewise done on May 14th. The varieties used were the Prince Albert and Royal Adelaide. The experiment as will be observed from Table XXXVIII below, relates to the use of sets of different sizes, uncut and cut, to sets cut with a different number of eyes, and to the planting of sets of the whole potatoes at different distances apart.

TABLE XXXVIII. Yields of Potatoes from seed tubers prepared differently.

——	Amount of seed used per acre.	Yield per acre.	Yield per acre, less seed.	Percentage of whole crop marketable.
	bush.	bush.	bush.	bush.
Large, whole, 1 foot apart	134	239	105	75.1
" " 2 feet "	68	160	92	81.9
" " 3 " "	46	127	81	86.0
Medium " 1 foot "	54	189	135	83.1
" " 2 feet "	27	110	83	87.7
Small " 1 foot "	22	93	71	83.7
Medium, cut in two, 1 foot apart	25	105	80	82.5
" two eyes in piece, 1 foot apart (without seed ends)	14	77	63	87.3
" one eye " " "	7	39	32	81.0
" seed ends, 1 foot apart "	4	32	28	73.8

It will be observed in the above experiments that when the seed has been deducted, the best yield was obtained from the medium whole potatoes, planted one foot apart, and the next best from large whole potatoes planted a similar distance. These remarks will apply to both experiments. All things considered the best results were obtained from the medium whole potatoes planted one foot apart. The smallest potatoes were obtained from the seed ends and from the large potatoes respectively, which had been planted one foot apart and this is true of both experiments. The best quality of product was obtained from planting medium whole potatoes two feet apart, and the second best from medium potatoes cut with two eyes in each seed tuber and planted one foot apart. But it should be remembered that these are results of tests conducted for but one year. Further experiments in the same line may give different results.

20. Potatoes. Different Dates of Seeding.

In this experiment potatoes were planted at two different dates, viz.: May 14th and May 28th. The soil was the same as that given to the different varieties; the distance between the drills was also the same, viz.: about 28 inches. The seed tuber was cut so that each section possessed two eyes, and flat cultivation was adopted. The Empire State potato was used.

Table xxxix. Yields of Potatoes from planting seed tubers at different dates.

Date of seeding.	Yield per acre.
May 14th	161.8 bushels.
May 28th	143.8 "

It is not safe to draw conclusions from this experiment until it is repeated and on a more extensive scale.

21. Potatoes. Application of Fertilizers.

In this experiment thirteen different fertilizers were used as enumerated in table xl below. The ground on which these crops were grown was the same in character as that already described in Section 17. Each plot comprised one two-hundredth of an acre and the experiment was carried on in duplicate. The drills were 27.7 inches apart. In planting sets were used which contained two eyes each, and they were placed one foot apart in the drill. The seed was covered at the depth of about three inches. The planting was done May 20th, and the fertilizers were sown in the drills after the seed had been dropped, but before it was covered. The sodium nitrate and muriate of potash were used at the rate of 160 lb. per acre, wood ashes unleached 800 lb. per acre, and all the other different fertilizers at the rate of 325 lb. per acre.

Table xl. Yields of Potatoes grown by aid of fertilizers.

Fertilizers.	Yield of potatoes per acre.
Royal Canadian	208.7 bush. per acre.
Potato manure	178.3 "
Superphosphate (animal)	159.6 "
Pure bone meal	154.6 "
Bone and Potash	154.2 "
Superphosphate (mineral)	147.1 "
Reliance	135.0 "
Nitrate of Soda	127.5 "
Capelton	124.6 "
Sure growth	123.8 "
Wood ashes	122.1 "
Muriate of Potash	116.3 "
Victor	111.3 "
No fertilizer	105.0 "

It will be noticed that the unfertilized plot gave the lowest yield. All the fertilizers used increased the yield, but in very different degrees. In some instances this increase was very marked. But we refrain from drawing conclusions until these experiments have been repeated.

22. Swede Turnips. Comparative Test of 44 Varieties.

In 1892, 44 varieties of Swede turnips were grown. The plots were in size one-hundredth of an acre. The drills were 27.7 inches apart, and the seed was sown June 15th. The ground was plowed in the autumn of 1891, and top-dressed in the winter of 1891-92 with fresh farmyard manure, at the rate of 15 tons to the acre. It was again plowed in the spring, that the fresh manure might be buried, and was harrowed more or less. Table XLI gives the yield of 36 varieties for 2 years, and table XLII of 8 varieties for one year.

Table XLI. Yield of 36 varieties of Swede Turnips for two years.

Varieties.	Soundness of roots when harvested.	Length of neck.	Yield of tops per acre, 1892.	Average weight per root.		Yield of roots per acre.	
				1892.	Average two years.	1892.	Average two years.
			tons.	lb.	lb.	tons.	tons.
1 White Swede	Good	Short	5.98	2.51	2.53	25.13	**22.53**
2 Hazard's Improved	Medium	Medium	5.00	2.48	2.70	19.50	**21.31**
3 Sutton's Champion	Good	Long	4.58	2.14	2.55	19.03	**21.29**
4 Our Selected Purple Top	"	Medium	3.90	2.08	2.49	19.45	**21.20**
5 Green Top	"	"	6.18	2.27	2.44	21.35	**21.05**
6 Hartley's Bronze Top	Poor	"	4.00	1.82	2.37	17.96	**20.95**
7 Bangholm	Good	"	5.00	2.00	2.40	20.00	**20.73**
8 Westbury's Improved	"	Long	6.05	2.10	2.31	20.80	**20.26**
9 Marshall's Purple Top	Poor	"	4.05	1.73	2.32	16.70	**20.24**
10 P. W. & Co's. Imperial Prize, P. T.	Medium	"	6.88	2.05	2.45	19.90	**19.78**
11 Carter's Imperial Hardy	Good	Short	4.10	1.83	2 31	18.18	**19.64**
12 Carter's Prize Winner	"	Medium	3.60	1.75	2.21	17.45	**19.48**
13 Lang's Improved	"	Short	3.88	1.74	2.17	17.78	**19.38**
14 Skirving's Swede	"	Long	3.78	1.62	2.19	16.00	**19.37**
15 King of Swedes	"	"	4.83	1.82	2.35	16.00	**19.18**
16 East Lothian	"	Medium	3.75	1.62	2.19	16.15	**18.84**
17 Sharp's Improved	"	"	3.10	1.55	2.11	15.30	**18.73**
18 Sutton's Champion	"	Long	5.58	1.84	2.27	18.95	**18.66**
19 Highland Prize, P. T.	"	"	5.43	2.10	2.31	17.25	**18.63**
20 Knowfield	"	Short	3.80	1.73	2.29	15.60	**18.56**
21 Hall's Westbury	Medium	Long	4.45	2.00	2.14	18.95	**18.17**
22 Royal Norfolk P. Top	Good	Short	3.00	1.67	2.19	13.93	**18.02**
23 Maston's Purple Top	"	Long	5.75	1.76	2.11	17.03	**17.94**
24 Fetticairn Green Top	Medium	"	5.15	1.84	2.18	17.10	**17.36**
25 Carter's Elephant	Poor	"	4.88	1.95	2.25	15.95	**17.36**
26 Drummond's Imperial	Good	"	5.20	1.92	2 22	16.50	**17.10**
27 Hazard's Improved	"	Medium	4.05	1.96	2.20	14.68	**16 24**
28 White Rock	Medium	"	2.90	1.45	1.78	14.35	**15.76**
29 Marquis of Lorne, P. T.	Good	Long	4.65	1.91	2.02	16.20	**15.68**
30 Aroostock's Improved	"	Medium	3.65	1.54	1.86	12 33	**15.14**
31 White Sweet Russian	Poor	"	3.80	1.42	1.89	13.53	**15.08**
32 Carter's Elephant	"	Long	4.08	1.63	1.87	14.63	**14.95**
33 Budlong's White Ruta Baga	Medium	Medium	2.65	1.57	1.77	14.40	**14.93**
34 Ashcroft's Purple Top	"	Long	3.15	1.45	1.87	12.73	**14.89**
35 Carter's Elephant	"	"	3.33	1.33	1.74	12.65	**14.06**
36 Bruce's Selected East Lothian	"	"	2.93	1.44	1.80	11.15	**13.91**

The White Swede stands at the head of the list of the varieties grown for two years, although in 1891 its place was but tenth in the list of varieties grown for that year. It is short in the neck, large in size and firm in flesh. Carter's Elephant did rather poorly this year again, notwithstanding the large yield obtained from it in 1890. We learn, however, from the co-operative experiment carried on throughout the Province that generally it gave good yields in 1892.

TABLE XLII. Yields of 8 varieties of Swede Turnips for one year.

Varieties.	Soundness of roots when harvested.	Length of neck.	Weight of tops per acre.	Average weight per root.	Yield of roots per acre.
			tons.	lbs.	tons.
37 Novelty Swede, No. 1	Medium	Medium	7.78	2.13	21.00
38 Novelty Swede, No. 2	"	Short	4.45	1.92	20.30
39 Queen of Swedes	"	"	5.80	1.90	19.50
40 Aroostock's Ruta Baga	"	Long	6.35	1.92	19.00
41 Shamrock Swede	Good	"	5.00	1.79	17.30
42 Crimson King	Medium	Medium	4.15	1.74	17.25
43 Laidlaw's Improved	"	Long	3.48	1.78	16.95
44 Rennie's Prize, P.T.	Good	Short	4.08	1.79	15.23

In 1892, 8 varieties of Swede turnips were grown for the first time at this station. The Novelty Swede No. 1, first in the list in the above table, comes third in the list of all the varieties grown in 1892. It is somewhat peculiar that a variety which grows so large an amount of top relatively as this turnip produced, should yield so well. The Novelty Swede No. 2, second in the above list, stands fifth among the varieties grown in 1892.

23. SWEDE TURNIPS. THINNING PLANTS IN THE DRILL.

The experiment, of which the above is but a part, relates to Swede turnips, fall turnips, mangels and carrots, grown at different distances in the drill, the drills being all the same distance apart, viz., 27.7 inches. The results given are the average of three experiments, except in the plot of each variety left unthinned, when but one plot was grown. Roots were grown upon the same land in 1891 except where the fall turnips were grown, in which case the turnips were preceded by corn. Barley was grown in 1890. A liberal supply of manure was applied to the land before the barley crop was grown, but none was applied since that time. The ground was plowed late in the autumn of 1891. It was ridged moderately, and the seed was sown.

TABLE XLIII. Yields of Swede Turnips thinned to different distances in the drill.

Distance between Swedes in drills.	Average weight per root.	Weight of tops per acre.	Weight of roots per acre.
	lbs.	tons.	tons.
Unthinned	0.20	3.96	7.65
8 inches	1.60	4.62	20.54
12 "	1.76	3.65	16.89
16 "	2.18	3.28	15.41
20 "	2.44	3.54	14.00

It will be observed that the largest yield was obtained from the rows with plants thinned to 8 inches in the row, and that the yield decreased in every instance with the increase in distance between the plants in thinning. Two of the roots in the drills with plants thinned to 20 inches were about equal to 3 of these from rows thinned to 8 inches. The unthinned plants were so small as to be of comparatively little use for winter feeding, and the yields were correspondingly small.

24. Swede Turnips. — Different Distances Between the Drills.

The experiment, of which the above is but a part, relates to Swede turnips, mangels and carrots, grown upon drills at different distances apart. The roots in all the drills were thinned to the same distance. The results given are in every instance the average of two experiments. Explanations regarding the previous cropping, manuring, and preparation of the soil are given in section 23.

Table xliv. Yields of Swede Turnips grown upon drills different distances apart.

Distance between drills.	Weight of tops per acre.	Average weight per root.	Weight of roots per acre.
	tons.	lb.	tons.
20 inches apart	4.17	1.43	16.56
26 "	5.08	1.80	17.31
32 "	4.10	2.22	16.88

These plots were grown in duplicate as already stated. Five of the ten rows in each plot were thinned to 16 inches between the plants, and the remaining five to 8 inches. The best average yields were obtained from 26 inches, although the variations in yield were less marked than in the size of the roots.

25. Fall Turnips. Comparative Test of 18 Varieties.

There were 18 varieties of fall turnips grown in 1892. These are also sometimes designated as white and sometimes as yellow fleshed. Two rows of each variety were grown 27.7 inches apart, and the plots were one-hundredth of an acre in size. The drills were slightly ridged and the seed was sown on June 21st. The crop of 1891 where these turnips were grown was corn, and that of the preceding year barley. The ground was plowed late in the autumn of 1891, and again in May, 1892. Fresh farm-yard manure was applied, at the rate of 15 tons per acre, in the spring of 1892, and just before the last of the two plowings mentioned above. Table xlv relates to 14 varieties grown for two years, and table xlvi to 4 varieties grown for one year.

Table xlv. Yield of 14 varieties of Fall Turnips grown for two years.

Varieties.	Color of flesh.	Shape of roots.	Soundness of roots when harvested.	Yield of tops per acre.	Average weight per root. 1892.	Average weight per root. Average for two years.	Yield of roots per acre. 1892.	Yield of roots per acre. Average for two years.
				tons.	lb.	lb.	tons.	tons.
1 Jersey Navet	White..	Long oval.	Spongy..	4.35	2.08	2.91	21.38	**24.81**
2 Greystone	"	Oval	Good	6.50	1.76	2.66	18.40	**23.24**
3 Red Globe Norfolk......	"	Round	"	4.68	1.78	2.73	17.78	**23.24**
4 Greystone Improved....	"	Broad oval.	"	8.18	1.90	3.10	16.20	**22.74**
5 Purple Top Maine......	"	Oval	"	6.58	1.93	2.71	19.33	**22.71**
6 Early American P. T...	"	Flat	Medium..	5.10	2.03	2.40	21.50	**21.80**
7 Red Top Strap Leaf	"	Very flat...	"	4.35	1.65	2.40	16.00	**20.99**
8 Early Purple Top Munnick	"	" ...	Good	.95	1.65	2.37	15.75	**20.80**
9 Pomeranian White Globe	"	Round	Medium..	8.75	1.51	2.26	16.90	**20.55**
10 Orange Jelly	Yellow.	"	Good	3.90	1.32	2.35	13.15	**18.59**
11 White Stone...........	White..	Flat	Medium..	4.03	1.91	2.32	15.10	**17.35**
12 Golden Ball	Yellow.	Oval	Good	4.20	1.50	2.12	11.85	**16.72**
13 Yellow Aberdeen G. T..	"	"	"	4.13	.99	1.69	8.43	**13.22**
14 Yellow Aberdeen P. T..	"	"	Medium..	5.13	.98	1.60	8.60	**12.93**

The Jersey Navet which heads the list for two years for productiveness, came from the United States, as did the Early Purple Top. The Jersey Navet was not so firm in flesh as the four varieties which stand next in order of yield. The Red Globe Norfolk which stands third in point of yield is first amid the varieties grown for three years.

TABLE XLVI. Yields of 4 varieties of Fall Turnips grown for one year.

Varieties.	Color of skin.	Shape of roots.	Soundness of roots when harvested.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
				tons.	lb.	tons.
15 Purple Top Mammoth or Improved Greystone	Purple	Oval	Good	4.70	1.73	**14.38**
16 Purple Top Mammoth	"	Mostly oval	Spongy	4.15	1.66	**13.70**
17 Imperial Green Globe	Green	Round	Good	2.75	1.32	**10.90**
18 Purple Top Hybrid	Purple-yellow	Long	Medium	2.65	1.00	**6.20**

The Purple Top Mammoth or Improved Greystone which heads the list, and the Purple Top Mammoth which comes second, may possibly be one and the same variety, and both may be the same as the Greystone Improved, which stands fourth in the list of those grown for two years. Sometimes change of name on the part of seedsmen and others leads to confusion in distinguishing varieties.

26. FALL TURNIPS. THINNING PLANTS IN THE DRILL.

In this experiment the turnips were thinned to five different distances and in one instance were left unthinned. Explanations regarding the previous cropping, manuring and preparation of the soil are given under section 23.

TABLE XLVII. Yields of Fall Turnips thinned to different distances in the drill.

Distance between turnips in drill.	Average weight per root.	Weight of tops per acre.	Weight of roots per acre.
Unthinned	.39	12.93	14.24
4 inches	1.02	8.05	19.61
8 "	1.59	6.66	17.57
12 "	2.15	5.44	16.03
16 "	2.71	5.09	15.06
20 "	2.97	4.53	13.19

It will be observed that the highest yields were obtained from the plants thinned to 4 inches in the row, and that the yields decrease in every instance with the increase in distance in the thinning of the plants. While the best yields were obtained from the plants thinned to 4 inches, bulbs were too small to handle conveniently for winter storage. The yields from the unthinned plants were large relatively when compared with those obtained from the unthinned Swedes contained in table XLIII. This would tend to sustain the wisdom of the practice of sowing fall turnips broadcast to furnish pasture for live stock, more especially sheep and lambs late in the season.

27. MANGELS. COMPARATIVE TEST OF 38 VARIETIES.

There were 38 varieties of mangels grown in 1892. The plots were one-hundredth of an acre in size. The drills were made 27.7 inches or three and a half links apart. The mangels were sown April 30th. Table XLVIII gives the particulars which relate to 31 varieties grown for two years and table XLIX those which relate to 7 varieties grown for one year.

TABLE XLVIII. Yields of 31 varieties of Mangels for two years.

Varieties.	Color of roots.	Shape of roots.	Yield of roots per acre, 1892.	Average weight per root.	Yield of tops per acre.	Yield of roots per acre. Two y'rs 1891-92.
			tons.	lb.	tons.	lb.
1 Carter's Champion Yellow Intermediate	Yellow	Medium long.	25.78	2.72	4.93	**29.94**
2 Improved Mammoth Prize Long Red	Dark red	Long	20.65	2.33	4.45	**28.11**
3 Evan's Improved Mammoth Sawlog	Red	"	21.35	2.44	4.28	**27.68**
4 Steele Bros'. Long Red Selected	Dark red	"	21.03	2.41	4.40	**27.18**
5 Carter's Mammoth Long Red	"	"	25.80	2.42	6.25	**26.49**
6 Elvetham Long Red	"	Medium long.	27.20	2.29	6.00	**26.27**
7 Mammoth Red Intermediate	Pale red	"	27.20	2.42	5.83	**26.22**
8 Norbitan Giant	Red	Long	19.9	2.34	4.48	**25.99**
9 New Monarch	"	Long-oval	25.85	2.33	6.65	**25.54**
10 Eiffel Tower	Pale red	Long	18.78	2.24	4.30	**25.41**
11 Colossal Long Red	Red	"	19.65	2.17	5.20	**24.66**
12 Yellow Obendorf	Yellow	Globe	20.00	1.69	3.40	**24.41**
13 Long Red Selected Stock	Dark red	Long	19.05	2.13	4.78	**24.40**
14 Giant Holstein	"	"	17.90	2.10	5.00	**23.94**
15 Chirk Castle	Pale red	Medium long.	18.95	2.02	4.00	**23.82**
16 May's Mammoth Long Red	Red	Long	23.03	2.18	6.63	**23.17**
17 Oblong Giant Yellow	Yellow	Globe	17.05	2.04	2.55	**23.02**
18 Yellow Oval-shaped Giant	"	Oval	18.40	2.02	2.50	**22.35**
19 Long Oxhorn	Deep red	Long	15.30	1.92	4.65	**21.25**
20 Carter's Warden Orange	Orange	Globe	15.15	1.80	5.85	**20.91**
21 Red Oval-shaped Giant	Red	Oval	13.35	2.02	2.85	**19.22**
22 Mammoth Golden Giant	Yellow	Globe	13.98	1.82	4.58	**18.52**
23 Golden Tankard	Dark yellow	Oval	15.10	1.63	2.90	**18.20**
24 Yellow Globe	Yellow	Globe	17.43	2.38	4.95	**17.96**
25 Oblong Giant Red	Red	Medium long.	11.43	1.94	2.78	**17.57**
26 Red Globe	Dark red	Globe	12.98	1.61	2.68	**17.44**
27 Clark's Devon Orange Globe	Orange	"	12.98	1.49	2.23	**17.26**
28 Fisher Hobb's Orange Globe	"	"	12.03	1.53	1.78	**17.05**
29 Kniver Yellow Globe	Pale yellow	"	13.75	1.52	1.88	**16.53**
30 Long Yellow	Yellow	Long	10.53	1.73	2.80	**15.99**
31 Red Tankard	Dark red	Globe	13.53	1.52	1.90	**14.81**

Carter's Champion Yellow Intermediate, first in the above list, gives a yield of 998 bushels per acre for the two years. The seed originally came from England. As the name implies it is only intermediate in length. The Improved Mammoth Prize Long Red, which stood at the head of the list in point of yield in 1891, produced an average of 937 bushels per a acre for the two years. It is a very long variety. The first in point of yield of the Globe varieties, the Yellow Obendorf comes twelfth in the list of the 31 varieties. It gave a return of 813.7 bushels per acre. The 13 long varieties gave an average yield of 24.6 tons per acre, and the ten Globe varieties a yield of 18.8 tons.

TABLE XLIX. Yields of 7 varieties of Mangels for one year.

Varieties.	Color of roots.	Shape of roots.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
			tons.	lb.	tons.
32 Sutton's Mammoth Long Red	Red	Long	5.48	2.04	**20.23**
33 Beck's Champion Giant	Yellow	Medium long.	3.13	1.81	**17.40**
34 Sutton's Golden Tankard	"	Globe	3.33	1.74	**17.23**
35 Canadian Giant	Dark red	Long	4.85	1.63	**16.10**
36 Gate Post	Pale yellow.	Medium long.	3.00	1.45	**13.53**
37 Sutton's Berkshire	Yellow	Globe	2.13	1.38	**13.08**
38 Sutton's Yellow Intermediate	Orange	"	1.35	1.03	**9.50**

The seed of Sutton's Mammoth Long Red was obtained from England. It not only stands at the head of the list but has nearly three tons per acre more roots than the variety following next to it, and also gave 75 per cent. more tops per acre than was obtained from this variety. It is worthy of note that the relation between the yields of the tops and the yields of the roots is comparatively close. None of these newer introductions have been found any improvement as yet over some of the older sorts which have been tried for years past.

28. Mangels. Thinning Plants in the Drill.

In this experiment the mangels were thinned to five different distances and were also left unthinned. Explanations regarding the previous cropping, manuring and preparation of the soil are given under section 23.

Table L. Yields of Mangels thinned to different distances in the drills.

Distance between mangels in drills.	Average weight per root.	Weight of tops per acre.	Weight of roots per acre.
	lb.	tons.	tons.
Unthinned	0.16	7.86	15.45
8 inches	1.34	5.12	19.32
12 "	1.54	3.73	15.57
16 "	1.88	3.64	14.78
20 "	2.36	3.71	15.01

The best yields in this instance were obtained from the mangels thinned to 8 inches in the row, the second best from those thinned to 12 inches and the third best from those unthinned; but the last mentioned were practically of no use for winter storage. The size of the plants increased with the increase in distance between the rows.

29. Mangels. Different Distances Between the Drills.

In this experiment the mangels were grown upon drills different distances apart. The drills were slightly ridged and then seed was sown May 27th, 1892. Explanations regarding the previous cropping, manuring and preparation are given in section 23.

Table LI. Yields of Mangels grown upon drills different distances apart.

Distance between drills.	Average weight of tops per acre.	Average weight per root.	Average weight of roots per acre.
	tons.	lb.	tons.
20 inches	3.99	1.66	**22.72**
26 "	4.82	1.83	**20.08**
32 "	4.32	1.95	**17.90**

These plots were grown in duplicate as already stated. Five of the ten rows in each plot were thinned to 8 inches in the row, and the remaining five to 4 inches. It will be observed with the mangels as with the turnips, that the most satisfactory returns were obtained from the drills which were 26 inches apart.

30. Carrots. Comparative Test of 23 Varieties.

There were 23 varieties of carrots grown during 1892. The plots were one-hundredth of an acre in size. The distance of the drills apart was 27.7 inches. The carrot seed was sown April 30th. Table LII relates to the yields of 23 varieties grown for but one year, as the carrot crop was not a success in 1891, owing to the lack of the germination of the seed, caused by dry weather at the critical time.

TABLE LII. Yields of 23 varieties of Carrots for one year.

Varieties.	Color of roots.	Length of roots.	Labor in pulling.	Average weight per carrot.	Yield of tops per acre.	Yield of roots per acre.
				oz.	tons.	tons.
1 Improved Short White	White	Medium	Easy	15.6	10.2	37.3
2 Pearce's Improved Half Long White	"	"	"	15.6	10.2	36.5
3 Large White Vosges	"	Short	"	13.8	8.5	33.9
4 White Green Top Orthe	"	Medium	"	14.3	7.8	32.6
5 Simmer's Short White Vosges	"	"	"	13.9	7.4	32.3
6 Large White Belgian	"	Long	Hard	13.9	9.5	32.2
7 Mastodon	"	Medium	Easy	13.3	8.1	31.8
8 Danver's Orange	Red	"	"	12.5	5.5	30.4
9 P. W. & Co's. Improved Giant White	White	Long	Medium	14.8	11.2	29.9
10 Giant Wiltshire	"	"	Hard	11.7	10.2	29.2
11 Sutton's Yellow Intermediate	Yellow	"	Medium	13.6	7.1	28.0
12 Guerande	Red	Short	Easy	10.1	4.7	27.0
13 Scarlet Intermediate	"	Medium	Medium	11.0	5.8	26.5
14 Half Long Stump Rooted	"	Short	Easy	9.6	4.8	25.8
15 French Intermediate	"	Medium	"	9.4	6.7	25.5
16 Mitchell's Perfected	"	"	Medium	10.5	4.4	25.2
17 Carter's Orange Giant	Yellow	Long	Hard	11.0	5.2	25.2
18 Sutton's Improved Intermediate	Red	"	Medium	8.9	4.9	22.0
19 James' Scarlet Intermediate	"	Medium	"	8.3	4.1	22.0
20 Improved Large, Long Red Altringham	"	Long	Hard	8.1	9.1	19.6
21 Long Orange	"	"	"	7.3	9.3	18.0
22 Yellow Belgian	Yellow	"	"	8.8	5.4	17.7
23 Long Red Surrey	Red	"	"	7.1	3.5	17.1

It will be observed that the yields of the carrots in the above table are unusually large. They run from 570 bushels per acre to 1,243, an average of 906 bushels per acre. The 7 best yielding varieties are all white, and the 5 best yielding sorts were all easy to pull. The 4 poorest yielding sorts were all hard to raise. The variety called the Improved Short White is a grand field carrot. It is of medium length, sound in flesh, smooth in shape and easy to harvest and handle.

31. CARROTS. THINNING PLANTS IN THE DRILL.

In this experiment the carrots were thinned to five different distances, and were also left unthinned. Explanations regarding the previous cropping, manuring and preparation of the soil are given under section 23.

TABLE LIII. Yields of Carrots thinned to different distances in the drills.

Distance between carrots in drills.	Average weight per root.	Weight of tops per acre.	Weight of roots per acre.
		tons.	tons.
Unthinned	.07	8.28	15.60
2 inches	.36	7.13	20.06
4 "	.53	5.33	15.19
6 "	.62	4.12	12.10
8 "	.67	3.61	9.94

The largest yield was obtained from the carrots thinned to two inches in the row, and the second largest from the unthinned plants. The yield from the carrots thinned to but 2 inches in the row, although only about half as large as those thinned to 8 inches, gave more than twice the yield.

32. Carrots. Different Distances Between the Drills.

In this experiment the carrots were grown upon drills different distances apart. The drills were slightly ridged and the seed was sown May 27th, 1892. Explanations regarding the previous cropping, manuring and preparation of the soil are given under section 23.

Table LIV. Yields of Carrots grown upon drills different distances apart.

Distance between drills.	Average weight of tops per acre.	Average weight per root.	Average weight of roots per acre.
	tons.	lb.	tons.
20 inches	6.56	.52	**23.43**
26 "	6.85	.55	**21.55**
32 "	6.06	.56	**17.14**

These plots were grown in duplicate as already stated. Five of the ten rows in each plot were thinned to 2 inches in the row, and the remaining five to 4 inches. It will be observed that the most satisfactory returns were obtained from the carrots grown with a distance of 20 inches between the drills.

33. Sugar Beets. Comparative Test of 10 Varieties.

In 1892, 10 varieties of sugar beets were grown. The distance between the drills was the same as that for other roots. The plots were also the same size, viz., one-hundredth of an acre each. The drills were raised slightly and the seed was sown April 30th. Table LV gives information regarding 10 varieties grown for one year. Particulars relating to the returns from an acre of the variety tested in Ontario during recent years for sugar making are given later.

Table LV. Yields of 10 varieties of Sugar Beets for one year.

Varieties.	Color of roots.	Shape of roots.	Uniformity of roots.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
				tons.	lb.	tons.
1 White Silesian	White	Long	Good	6.93	1.83	**17.70**
2 Red Top	Pinkish white.	Medium long.	"	5.05	1.77	**17.63**
3 Vilmorin's Improved White	White	Long	Medium	7.13	1.66	**16.28**
4 French White	Pinkish white.	"	"	2.83	1.63	**16.25**
5 Lane's Improved	Pink	"	Good	3.28	1.58	**16.20**
6 Champion	"	"	"	4.83	1.45	**13.93**
7 Austria Electorial Wohanka	White	Medium long.	Medium	5.95	1.29	**12.13**
8 Kleinwanz Lebei	"	"	"	4.75	1.03	**10.05**
9 Improved Imperial	"	Oval	Poor	5.20	1.07	**9.75**
10 Red Skinned	Pink	Medium long.	Medium	4.33	.89	**8.58**

The White Silesian gave a yield of 17.70 tons per acre. This variety is more commonly grown for feeding uses. Vilmorin's Improved White, which has third place this year, stood first among the varieties grown in 1891. This beet, it will be observed, is a producer of tops.

SILAGE AND FORAGE CROPS.

The experiments made under this head include those carried on with fodder corn, various mixtures of grain for fodder, rape, millet, clover and grasses.

As there is no branch of agriculture at the present time in reference to which there is so general a desire for information as that of growing corn and making silage, we have thought it best to go over the whole matter, giving more especially that which is of practical value. The information given has been drawn largely from our own experience, but this has been enlarged by that of farmers both in this country and the United States, and by details furnished by the different experiment stations, which have issued bulletins on the subject. Our aim will be to make the question so clear and concise, if possible, that any farmer, who is disposed to follow the methods laid down, will be able to grow corn and cure the same in the silo, and even build the silo itself.

In this country corn is beyond all doubt pre-eminently the crop for the silo, for the reason, first, that it can be preserved so perfectly and so certainly in the silo when the work is properly done, and secondly, it is so difficult to cure in any other way. Nearly all kinds of the other fodder crops can be cured so readily as to make it at least an open question, as to whether the practice of making them into silage should become general. Green rye and the second cutting of red clover should probably form exceptions, as the former is more palatable when made into silage, and the latter may in damp seasons be more easily cured in the silo, especially in conjunction with corn. We succeeded in making good rye silage in the summer of 1891, by cutting it at the blossoming stage, tramping it down firmly in the silo, and afterwards weighting it to some extent, but found difficulty when feeding it, owing to the rapidity with which the silage dried on the exposed surface.

34. Fodder Corn. Comparative Test of 73 Varieties.

In 1892, 73 varieties of corn were grown. The seed was obtained chiefly from the United States, and some was obtained from Ontario. All the varieties were grown in duplicate. Where the first series of plots were planted a crop of barley was grown in the ground in 1891, preceded by a crop of rape in 1890. The ground was enriched with an application of about 15 loads of fresh farm-yard manure in the spring of 1890, just before the ground was plowed for rape. This crop was grown in field No. 18, which is considerably elevated. The corn was planted on May 14th, 1892, the size of each plot was three two-hundredths of an acre, and there were three rows of each variety.

Where the second series of plots were grown the land had produced corn in 1891, planted on overturned sod, which had not been broken for five or six years previously. Fresh farm-yard manure was applied in the spring of 1892, at the rate of 15 tons per acre. These plots were located in field No. 14, which lies somewhat low. The crop was planted on May 28th, 1892. The difference in the time of planting was designed. Each plot comprised one-hundredth of an acre, and contained but one row of corn. In both experiments the soil was plowed somewhat early in the spring, and was occasionally stirred with a spring tooth cultivator until the time of planting. In both instances the corn was planted in drills and in squares, the drills being 5 links (39.6 in.) apart each way. Eight grains were planted in each hill, and after the corn was well above ground the number of plants was reduced to five in each hill. Thorough shallow cultivation was given the corn in both directions in the two experiments. Table LVI gives the average results from plots grown in duplicate in 1891, and also in 1892. Table LVII gives those from 9 varieties grown in duplicate plots in 1892.

It will be observed (Table LVI.) that the two varieties which stand at the head of the list as to weight of fodder have given an average yield of 22.2 and 20.0 tons per acre, respectively, but as they are about the latest among the varieties in maturing, and also do not produce much grain in this climate, it is at least questionable whether even in the southern part of Ontario these will prove suitable for the silo, owing to their lateness. The Thoroughbred White Flint, which we have grown for three years, and which has become comparatively well known in some sections of the province, stands seventh in point of yield. Though somewhat earlier

TABLE LVI. **Yields from 64 varieties of Fodder Corn for two years.**

Varieties.	Kind of Corn.	Condition of grain when harvested.	Average height of plants.	Yield of ears per acre when harvested.	Average weight per ear when harvested.	Average yield of crop per acre, 1892.	Average yield of crop per acre, 1891-1892.
			ft. in.	lb.	oz.	tons.	tons.
1 Mammoth White Surprise....	White Dent ...	Water	10 10½	1,894	3.8	25.2	**22.2**
2 Brazilian Flour	White Flint ...	"	9 10	484	1.4	22.6	**22.0**
3 Chester Co. Mammoth.....	Yellow Dent ...	"	10 4	2,340	3.5	21.6	**20.9**
4 Mastodon Dent	"	Late milk....	10 4	5,717	6.8	20.0	**20.0**
5 Blunt's Prolific.........	White Dent ..	Early milk...	10 10¾	2,508	3.8	20.8	**20.0**
6 Cloud's Early Yellow......	Yellow Dent...	Dough	9 9½	6,898	6.8	19.2	**20.0**
7 Thoroughbred White Flint....	White Flint ...	"	8 9½	3,494	4.8	19.8	**19.9**
8 Sheep's Tooth	White Dent ...	Early milk...	9 8	4,013	5.1	22.6	**19.7**
9 Mammoth S. Fodder	Sweet	"	8 5½	3,885	5.3	19.4	**18.8**
10 Improved Leaming	Yellow Dent ...	Dough	9 7½	6,321	5.5	21.2	**18.8**
11 Leaming Field Corn.......	"	"	9 4½	6,365	6.2	19.1	**18.5**
12 Giant Prolific S. Ensilage....	White Dent ...	Water	10 11	3,565	4.9	24.2	**18.4**
13 Horsetooth	Yellow Dent ...	Dough	10 2¼	5,915	5.5	21.5	**18.4**
14 Mammoth Cuban	"	Mature	9 3½	7,708	3.7	19.1	**18.1**
15 Golden Beauty	"	Dough	9 6½	5,571	5.3	21.0	**17.8**
16 Virginia Horsetooth.......	White Dent ...	Water	9 11¾	1,711	2.8	21.8	**17.8**
17 Mammoth Southern Sweet....	"	Early milk .	10 4½	2,962	3.9	22.6	**17.8**
18 Centennial White	"	Milk	8 11	6,117	5.9	19.1	**17.3**
19 Yellow Western.......	Yellow Dent ...	"	9 6½	5,275	[illegible]	18.6	**17.1**
20 Red Cob Ensilage	White Dent ...	Early milk ..	10 4½	2,592	3.9	20.1	**17.0**
21 Mammoth W. Cob Ensilage...	"	Water	10 7	2,721	3.7	20.3	**16.6**
22 Salzer's South Dakota......	Yellow Flint ..	Mature	7 7	6,330	5.0	16.7	**16.5**
23 Salzer's North Dakota	White Flint ...	"	7 9½	5,375	4.8	17.0	**16.3**
24 Northern White Pearl	White Dent ...	Dough	8 4	7,550	7.0	18.0	**16.0**
25 Salzer's Sup. Fed. Ensilage....	"	Early milk ..	10 2	2,677	4.1	18.7	**15.9**
26 Leaming Yellow.........	Yellow Dent ...	....	....	5,817	5.6	18.5	**15.9**
27 Improved Clarage	"	Mature	9 5	6,365	6.0	17.8	**15.6**
28 Evergreen Sweet	Sweet	Late milk....	8 2	4,309	5.1	18.9	**15.5**
29 Hickory King	White Dent....	Early milk ..	10 7¼	1,954	2.9	20.9	**15.5**
30 Hickox Sweet	Sweet	"	7 11½	4,996	5.5	19.7	**15.5**
31 Clark's Co. Champion	White Dent...	Milk	8 10	5,175	5.4	17.8	**15.3**
32 Large White Flint.........	White Flint ...	....	....	5,758	5.0	17.1	**15.2**
33 Compton's Early..........	Yellow Flint ..	Mature	7 0½	6,275	5.7	13.1	**15.2**
34 Tuscarora	White Flint ...	Dough	7 4	6,211	6.0	19.2	**15.1**
35 Egyptian Sweet	Sweet	Milk	9 2	2,888	3.9	15.0	**15.0**
36 Wisconsin Earliest W. Dent..	White Dent ...	Dough	8 1½	6,990	7.0	15.8	**14.8**
37 Queen of the Prairie.......	Yellow Dent...	"	7 5	5,792	5.2	15.3	**14.6**
38 White Flour	White Flint ..	"	8 0	3,377	3.9	15.9	**14.6**
39 Longfellow	Yellow Flint...	Mature	7 10	5,636	4.7	14.3	**14.4**
40 Wisconsin White Dent......	White Dent ...	"	8 8	7,094	6.8	17.8	**14.4**
41 Early Butler	Yellow Dent...	Dough	7 9½	7,502	6.8	13.9	**14.1**
42 Stowell's Evergreen Sweet ...	Sweet	Late milk....	7 9½	4,071	4.6	16.8	**14.0**
43 Sweet Fodder	"	Dough	7 10½	3,673	4.7	16.6	**13.9**
44 Early Adams or Burlington ...	White Dent ...	"	8 0	5,546	5.1	16.6	**13.8**
45 Angel of Midnight	White Flint ...	Mature	7 8	5,129	4.7	15.0	**13.4**
46 Old Colony	Sweet	Dough	7 4½	4,619	4.6	15.5	**13.2**
47 Marblehead Mammoth.......	"	"	6 8½	4,702	5.0	15.7	**13.2**
48 Pride of the North.........	Yellow Dent...	Mature.....	7 11	5,709	5.1	14.6	**13.0**
49 Golden Dewdrop	Yellow Flint ..	"	7 7½	5,613	5.0	13.9	**13.0**
50 Dakota Dent	Yellow Dent ..	"	7 10	5,892	5.4	13.0	**12.9**
51 Late Mammoth Sweet......	Sweet	Milk	7 2½	3,375	5.3	11.7	**12.8**
52 Golden Dent	Yellow Dent ..	Mature.....	7 7	5,175	5.0	13.5	**12.5**
53 Wauskakum	"	"	6 9	5,229	4.5	11.5	**12.4**
54 Early White Flint.......	White Flint ...	"	7 1	5,563	5.3	13.3	**12.2**
55 Queen of the North.......	Yellow Dent ..	"	7 6½	5,431	4.1	13.1	**12.2**
56 Canada Yellow	Yellow Flint ..	"	7 2½	5,069	5.0	12.7	**12.1**
57 King of the Earlies........	Yellow Dent ..	"	7 1½	5,846	5.3	13.1	**11.8**
58 Self-Husking	Red Flint......	"	6 6	5,011	4.4	12.1	**11.1**
59 Minnesota King..........	Yellow Dent ..	"	7 0½	5,565	5.1	12.1	**11.0**
60 100 day Corn	Yellow Flint ..	"	7 2	....	4.8	13.0	**10.9**
61 Rideout or Mercier..........	"	"	6 6	5,113	5.3	10.0	**10.1**
62 Crosby	Sweet	Dough ..	6 5	4,690	4.4	12.4	**10.1**
63 Smutnose	White Flint....	Mature	5 9½	5,444	5.4	9.4	**10.0**
64 Pearce's Prolific............	Yellow Flint ..	"	7 0	4,140	4.6	13.0	**9.7**

than the varieties mentioned above, it is rather late in maturing for this section. The Mammoth Cuban, which stands fourteenth in the list, came earliest to maturity among the large varieties. It matured sufficiently for the silo, and produced the highest weight of ears of all the varieties at the time of harvest. The Salzer's South Dakota, a yellow flint variety, and Salzer's North Dakota, a white flint, stand 22nd and 23rd respectively in the list. They were the largest of the Flint varieties which produced matured corn. These are promising varieties. The Canada Yellow, the variety which was almost exclusively grown in former years for the grain, stands fifty-fifth in yield for fodder uses. Compton's Early, thirty-third in the list, is an early-maturing variety. It produces a goodly quantity of well-matured grain.

In view of the experience of the past, we would recommend the following varieties as suitable for the silo, viz., the Thoroughbred White Flint, the Mammoth Cuban, Salzer's South Dakota, Salzer's North Dakota, Wisconsin Earliest White Dent, and Compton's Early. But it should be remembered that they are not equally well adapted to all parts of the province, as some of them mature much earlier than others. Yet it is at least probable that the latest ripening kinds mentioned will mature sufficiently in the more southerly latitudes of Ontario.

TABLE LVII. Yields from 9 varieties of Fodder Corn grown for one year.

Varieties.	Kind of corn.	Condition of grain when harvested.	Average height of plants.	Yield of ears per acre when harvested.	Average weight per ear when harvested.	Average yield of whole crop per acre, 1891–1892.
			ft. in.	lb.	oz.	tons.
65 Giant Beauty	Yellow Dent	Milk	10 6	9,467	8.8	26.4
66 Dr. Woodhull	"	Late milk	9 8	6,896	6.9	21.8
67 New Leaming	"	Dough	9 11	8,413	7.9	21.7
68 N. B. & G. Co's. Giant Fodder	White Dent	Water	10 1½	3,454	4.8	20.6
69 Mammoth	Sweet	Early milk	8 8½	6,384	6.2	20.5
70 Pride of Kansas	Yellow Dent	Milk	10 2	4,521	5.4	20.4
71 Silver Flint	White Flint	Mature	7 10	8,088	7.2	20.3
72 True Leaming	Yellow Dent	Dough	9 11	7,884	8.0	19.6
73 Wilson's White Prolific	White Dent	Late milk	9 3	6,521	6.5	17.9

Giant Beauty, which stands at the head of the list, has given the largest total yield per acre of the 73 varieties grown in 1892. It also has given the largest weight of ears of all the varieties at the time of harvest; and the weight of the largest ear was greater than that obtained from any other sort. In height it was surpassed by but 5 kinds. As, along with other good qualities, it is medium in maturing, it may turn out to be a valuable corn to grow in this province for ensilage. The Dr. Woodhull, which stands second in point of yield, is also a variety of considerable promise. The seed of these two sorts came from the Western States. The Silver Flint, which stands seventh in the list, matured perfectly, and besides giving a fair yield for food, produced a large quantity of well-matured ears.

THE SEED. As the power of germination in the seed of corn is easily destroyed, care should be taken to secure seed which may be implicitly relied on to start well under average conditions. The purchase of seed should receive attention sufficiently early to enable the grower to test the germinating power of the seed sometime before it is wanted for use. Of several methods that might be given the following is perhaps the most reliable and satisfactory: Plant a number of grains taken promiscuously from the lot in some soil in a box. The earth should be simply ordinary soil, as it is quite as important to note the character of the germination as to vigor as to know the seed will germinate. It should be kept moist, and at a temperature similar to that of the closing days of May. As only the most perfect ears should be chosen in selecting seed corn, and as it must be thoroughly ripened before it can be relied on to grow, it is only in limited sections of the province that it will be worth while for the farmers to try and save their own seed. There are some sections, however, where the growing of seed might assume the dimensions of an industry, in view of the large quantities that will be wanted when corn for the silo comes to be generally grown.

SOIL. Corn prefers a deep, rich, warm, dry, mellow soil, but will grow well in a variety of soils. Its favorite soils are rich loams, sandy or even gravely in texture. On humus soils it grows vigorously, but is a little later in maturing. It is not so well adapted to stiff clays, but fairly good crops may be grown even on these, providing a good, vigorous germination can be secured. As corn is a cleaning crop it may with advantage be grown on fields that have become foul with weeds. It will usually do well on clover sod, and the sod of old pastures, but in the latter instance there is some danger of disturbance to the crop from the ravages of the cut-worm which is so frequently found in such soils.

PREPARATION OF THE SOIL. The mode of preparing the land for corn will, to some extent, depend upon the place given to it in the rotation. When it is to follow a grain crop the land should be plowed as soon as possible after the grain has been removed, with a view to aid in cleaning the land. To still further effect this object, it may be well to harrow or cultivate once or twice before the final plowing late in autumn, which in nearly all soils may be or perhaps should be deep. In spring thorough and frequent surface cultivation should be given to secure good tilth, and also the retention of ground moisture, and to encourage the sprouting of weed seeds with a view to their subsequent destruction. The more the weeds can be thinned before the planting of the corn the less proportionately is the labor required to effect this afterwards When the corn is to be planted on an old sod the ground should be plowed late in autumn or early in the spring, to give opportunity to the frost and other weathering influences to improve the tilth. When it follows clover sod, the plowing may be deferred till near the time of planting the corn. The clover will then have grown considerably, and the new growth thus formed will tend to hasten the decay of organic matter in the soil for the sustenance of the crop of corn.

FERTILIZERS. Farm-yard manure is probably the best fertilizer for corn that can be used, where it can be obtained in sufficient quantities. The quantity to apply will depend on the poverty of the land, natural and acquired, the nature of the soil and the frequency of the application. Not more probably than 15 tons per acre should be applied in any case, and more especially where the land is leachy, lest some of it be lost. Frequent applications of manure in moderate quantities are decidedly preferable to heavy applications but seldom given. When available the manure may be applied in the autumn. When in the fresh state it may be applied before the final autumn plowing unless the the soil is decidedly leachy, when it should be retained upon the surface. When decomposed it should generally be spread upon the surface, but to this there may be some exceptions. When fresh manure is applied in the spring it should be plowed in early or otherwise incorporated with the soil, to give time for fermentation. Artificial fertilizers may serve a useful purpose in many localities, but before using them freely we should determine by actual test with small quantities whether our lands will be adequately benefited by them, and if so by which kinds. It is more than doubtful if a formula could be given for applying them that would be of much value, owing to great variations in our soils. Co-operative experiments carried on in New Hampshire have demonstrated that both phosphoric acid and potash are required by the average soil of that State. They have demonstrated in Massachusetts that potash is most wanted; in Ohio, that nitrogen is as much wanted as either of the other two; and in Michigan, that artificial fertilizers are so little required as yet by the soils of that State in growing corn as to make their general application of doubtful utility. As potash is largely concerned in increasing the woody portions of the stalk in corn, we are safe in saying that our Canada wood ashes would stand us in better stead when strewn upon our corn fields than when sold at a low price to be used in growing corn in the various States of New England.

Planting. The time for planting corn for the silo varies with the climate, locality, soil and sometimes with the variety of the corn. It will range betwen May 10th and June 5th. Uusually it is considered more safe not to plant corn until the soil has become warmed to the temperature of 52° to 54° Fahrenheit, as registered by a thermometer buried in the soil as deeply as the seed is to be planted. There is much difference of view as to whether it is preferable to plant in hills or drills. In our experience we have obtained the largest yields of stalk from the drills, while the hills have given somewhat more grain. All things considered we favor cultivation in drills. The distance of the drills apart may vary from 36 inches with the smaller varieties to 45 inches with the larger. The distance of the plant in the drill will also depend upon the kind of corn, and to some extent upon the character of the soil, as corn should be more thinly planted on rich than on poor soils. The amount of seed required will therefore depend very much upon the kind of corn used. The influence of planting at different distances between the rows, and at different distances of plants apart in the row, is brought out in the following experiment:

35. Fodder Corn. Different Distances Between Drills and Between Plants in the Drills.

In this experiment three varieties of corn were grown, an early, a medium, and a later variety. Each variety was grown at different distances between the drills, viz., 30, 36 and 42 inches respectively, and the corn in each set of the drills planted at the distances mentioned above was also planted at different distances apart in the drill, viz., 4, 8 and 12 inches respectively. Two grains of seed were put in where but one plant was desired, and where necessary one plant was removed from each place when about three inches high.

In this experiment all the varieties were grown on triplicate plots, and each of the test plots comprised several rows. The soil where one set of these tests was made had been in sod for three summers. It was plowed in the autumn and planted on May 31st. No manure was used in this test. The second set of these tests was grown upon land which had produced a crop of corn in 1891, preceded by a crop of barley in 1890. Fresh farm-yard manure was applied before the crop of barley was sown, at the rate of 15 tons per acre. The planting took place on May 31st. The third set was grown upon land which had produced a crop of millet in 1891, and a crop of roots in 1890. Fresh farm-yard manure was applied in the spring of 1892, at the rate of 15 tons per acre. The corn was planted on June 1st.

As in giving directions for planting corn as to distances, it had been customary, to some extent at least, to recommend the same distance somewhat arbitrarily, for all kinds of corn, without regard to variety, this experiment was undertaken to ascertain the effects of distance upon variety when growing corn for the silo, and also to glean other items of importance relating thereto. Table LVIII. gives the average results of the triplicate experiment with each variety of corn, and also the average of the results from 31 kinds of corn. This triplicate experiment includes in all 81 plots.

This experiment shows, first, that in every case the highest total yield was obtained from planting in drills 30 inches apart and thinning to 4 inches in the drill, and second, that in every instance the largest yield of green ears was obtained from planting in drills 42 inches apart and thinning to 12 inches in the drill. All things considered, it also indicates so far as we can draw conclusions, in the absence of analysis of the corn: 1. That the best results were obtained in growing the Mammoth Southern Sweet in drills 42 inches apart, and the plants 12 inches apart in the drill. 2. That with the Wisconsin Early White Dent the best results were obtained from the corn grown with 30 inches between the drill, and 12 inches between the plants in the drill. 3. That with Compton's Early the best results were obtained from the corn grown with 30 inches between the drills, and 4 inches between the plants in the drill. It will also be noticed that the thickest seeding of Compton's Early gave within .32 tons per acre of whole crop, less than the thinnest seeding of Mammoth Southern Sweet, while it gave 1.85 tons of ears per acre more than the latter.

TABLE LVIII. Yields of fodder-corn grown at different distances between the drills and between the plants in the drills.

Variety.	Distance between drills.	Distance between plants.	Average weight per ear.	Yield of ears per acre.	Yield of whole crop per acre.
			oz.	tons.	tons.
Mammoth Southern Sweet.	30 inches	4 inches.	3 64	1.34	27.00
		8 "	3.64	1.66	22.64
		12 "	4.50	1.97	21.57
	36 inches	4 "	3.44	0.87	20.76
		8 "	4.36	1.83	21.31
		12 "	5.59	2.05	19.86
	42 inches	4 "	3.91	1.35	22.68
		8 "	4.54	2.01	21.33
		12 "	5.60	2.14	20.92
Wisconsin Earliest White Dent.	30 inches	4 inches.	5.05	4.94	24.97
		8 "	7.22	4.49	19.27
		12 "	10.15	5.05	17.92
	36 inches	4 "	4.99	3.78	19.87
		8 "	8.44	4.76	18.96
		12 "	11.11	4.44	17.00
	42 inches	4 "	5.75	4.68	21.41
		8 "	8.96	4.63	18.82
		12 "	11.76	4.59	15.99
Compton's Early.	30 inches	4 inches.	4.78	3.99	20.60
		8 "	6.32	4.09	17.11
		12 "	7.88	4.07	16.52
	36 inches	4 "	4.41	3.45	17.06
		8 "	7.14	4.14	16.30
		12 "	8.59	3.74	15.55
	42 inches	4 "	4.90	3.79	16.35
		8 "	7.57	4.06	15.38
		12 "	8.69	3.92	15.31
Average of the Three Varieties.	30 inches	4 inches.	4.49	3.42	24.19
		8 "	5.73	3.41	19.67
		12 "	7.51	3.70	18.67
	36 inches	4 "	4.28	2.70	19.23
		8 "	6.65	3.58	18.86
		12 "	8 43	3.41	17.47
	42 inches	4 "	4.85	3.27	20.15
		8 "	7.02	3.57	18.51
		12 "	8.68	3.48	17.41

It may also be mentioned here, that the seed in all the experiments of 1892 was planted to the depth of $1\frac{1}{2}$ inches, but in general the depth to which the seed should be planted will vary with the soil and seasons and the time of planting. It should be shallow in moist seasons on cold soils, and in any case where it is planted early, lest more or less of the seed perish, but under the opposite conditions it may be put in as deeply as two inches on an average. In some countries corn planters made for the purpose are used, but in Canada corn is usually planted with the ordinary grain drill, using only such of the tubes as may be necessary. The ground should be rolled before the planting of the seed, and in dry weather just after as well.

CULTIVATION. The cultivation consists of harrowing, horse-hoeing, and in some instances hand-hoeing. The object of the harrowing is to encourage weeds to germinate with a view to destroying them, to destroy those which have germinated, and so to stir the surface soil that aeration will be more complete and the ground moisture intercepted and held near the surface. Sometimes the harrow is used once and sometimes twice before the seed appears, and it is usual to give two harrowings after the corn is well above the ground. The harrow should not be used after the corn is from 5 to 7 inches high. The harrows most suitable are broad, to cover a wide space of ground, light to be easily drawn, with the teeth numerous to stir the weeds well, and short to disturb the roots of the corn, but small and slanting backwards rather than forward, so that the corn will not be much disturbed. The cultivator should then stir the soil between the rows or hills not seldomer than once a week, until the corn commences to tassel. After that period further cultivation may unduly retard the ripening process. Shallow cultivation is preferable. It may be several inches deep at first, but should gradually become more shallow. The cultivator should at no time seriously interfere with the cutting or breaking of the rootlets of the corn. The cultivating may be done by using one or two horse cultivators, but in the latter stages of the work only one horse cultivators can be used. We prefer to use both kinds of cultivators. Where noxious weeds are to be exterminated some hand-hoeing may be necessary in the line of the row.

HARVESTING THE CORN. The crop is in the best condition for harvesting when the corn in the ear has reached what is known as the glazed state, but where there is a large amount to be harvested the work had better begin when the grain is in the late milk stage, lest some of it should become too ripe. Some advocate cutting corn with hooks and some with the mowing machine. A limited number have tried a reaper with elevators attached, and high enough to deliver the corn into a waggon driven alongside. This way of harvesting corn may yet become common, although it can scarcely be said to be completely satisfactory as yet. We have used a sled made by one of the graduates of the college. It consists of two flat runners 5 ft. 2 in. long and bevelled in front like the runners of a stone boat. They are made of hardwood and are $2\frac{3}{4}$ inches broad, and 5 inches high. They are kept in place by three cross pieces. Over this frame is a covering of inch boards 2 ft. 6 inches wide. The knives consist of two pieces of hardwood shaped somewhat like a V, with a piece of an old crosscut saw bolted on the outer edge of each, which is sharpened and cuts the corn when the sled is in motion. The knives are hinged on a bolt in front and the rear part may be pushed under the platform to adjust the width of the boat to any variation that may be found in the width of the rows of corn. The knives are held in position at the rear by a bolt which may be removed at will. The length of the knife is 20 inches, and the narrowest width at base $9\frac{1}{2}$ inches; the greatest width is 16 inches. Four stakes are placed in position, and a rope attached to these a short distance above the platform. The feet of the two men who stand inside are protected by this rope from any danger that might arise of being wounded in case of falling off in front of the knife. The drawing attachment is a bail of an old scraper. The two men who stand upon the platform catch the corn as it falls, and lay it down in sheaves on each side of the boat. A boy rides the horse. From 6 to 8 acres may thus be cut in a day.

Practical men are nearly all agreed that wilting is not necessary before putting the corn in the silo, and that it is a decided disadvantage in handling the corn when rain falls upon it after it is cut, owing to the unpleasantness of the work, and it is injured to some extent for cutting, and possibly also for food, by the soil and sand which adheres to it. Our experience in wilting corn has not proved entirely satisfactory.

For drawing the corn to the silo any form of low truck with a flat rack, or an ordinary rack, will answer very well. The top of the rack should not be much higher than the wheels. Sometimes two scantlings or poles with head pieces at both ends are suspended to the front and hind axles of a waggon at any desired height. Boards are then placed across these to make a platform on which the corn is loaded. With us both methods have given satisfaction.

Filling the Silo. Although corn may be preserved in the silo, without running it through a cutting box, the method of preserving it thus has not found much favor, as it is not easy to put such corn in the silo; it is difficult to pack it so as to exclude the air, and even more difficult to get it out to feed it to the stock. The cutting box should be strong, and of sufficient capacity to take the corn as fast as it can be brought from the field We have used one made, with the knives on the fly-wheel, and another with the same on the cylinder. We prefer the latter. The power used may be tread or sweep horse power or steam. Carriers are attached to the cutting box to convey the corn into the silo to any desired height or distance. The more elevated the position of the cutting box in relation to the silo, the less the power required. It is yet an unsettled question as to the lengths to which the corn should be cut. These vary in practice from ½ inch to 2 inches. The argument in favor of short lengths maintains that the corn packs more closely, handles more easily in the silo, has less tendency to make sore the mouths of the cattle in eating it, and that there is less of it rejected by them in the manger. The long cuts are advocated on the ground of economy of labor and time in handling the corn, and that the silage is relished just as well by the stock. It may be stated here that the variety of the corn and the climate in which it is grown, so far influence the succulency of the stalks as to render it unsafe to fix upon any length that would be the most suitable under all circumstances, but the ¾ inch cut which is our own practice seems to receive the majority of votes at the present time.

Labor is saved when the corn falls as nearly in the center of the silo as possible, or in the centre of each compartment. It also renders it easier to mix the heavy and light portions. This is important to preserve the equilibrium in moisture, and also in the feeding quality of the silage. The silage should be kept well spread. There is as yet much difference of opinion as to the value of tramping and the amount of this that should be given. Some favor much tramping, others almost none. Amid this conflict of opinion it will probably be found that when the corn is kept about level in the silo, that sufficient tramping around the sides and in the corners to secure even settling of the silage is all that is required. If the corn is tramped too firmly around the walls so as to lie more compactly than in the center, it will sink more in the center. Thus the silage will be drawn away from the walls, making an air space. We favor moderate tramping.

The question is now pretty well determined that filling may be rapid, and continuous or periodic as may be convenient. Equally good results have been obtained from both methods. Our experience is in favor of rapid filling, all things considered, as it is economical of labor.

Various modes have been adopted of covering the silo when filled, but there appears to be no method practised as yet which proves uniformly satisfactory. Some cover to the depth of from 6 to 18 inches with green marsh hay run through the cutting box, cut straw and chaff, which should be tramped. Others use tar paper covered with boards, or chaff or straw, sometimes weighted and sometimes not, and yet others put no covering on at all. It is premature to say which of these methods is best under all circumstances. The results from them thus far have been variable. It is at least questionable if there is economy in using any kind of covering all things considered, as the silo, when left in this condition soon coats over with a white mould several inches thick, and so forms its own covering. This is the practice of some leading authorities, who have found that the attendant waste varies from 6 to 12 inches. A favorite covering with us is old fence corner hay cut and wetted, which contains a large percentage of fine grass, and therefore lies compactly.

The Silo. In locating the silo much will depend upon the arrangement of the outbuildings already on the premises. It is usual with those that have bank barns to utilize a portion of the basement along with a corresponding portion of the mow overhead. Those with barns and stables all above ground may use any portion of the room enclosed, always keeping an eye to convenience, or the silo may be erected altogether outside of the stable, but adjacent thereto. The nearer it can be brought to the central point of feeding the better, and the lower part of the silo should always be on the same plane as the stock.

The size of the silo will depend upon the wants of the stock, actual or prospective, which are to be fed upon the silage. We have found that a cubic foot of silage weighs about 45 lb., which we have demonstrated by actual test. We also find that a mature cattle beast requires about this quantity per day when some other food adjuncts as hay and straw are used. The size of the silo to be constructed may thus be easily determined with approximate correctness from the data given. Silos are sometimes built circular in shape, and this mode of construction has some advantages. More commonly they are built rectangular, but there are some important advantages in having them square, as economy in material of building, economy of labor in filling and emptying, less of outside surface to the silage, and less hindrance to the settling of the same. It is important that the silo should be deep, as the silage settles more compactly, has less waste relatively on the top, holds more because of the greater compression, and is economical of roofing. The disadvantages arise from the greater elevation of the corn into the silo, and the increased difficulty of preventing spreading of the walls. In practice it has been found difficult to get good ensilage in shallow silos without heavy weighting after the silo has been filled.

The materials that have been used include wood, brick and stone, and the lining inside includes such substances as tar paper, coal tar, paint, petroleum, pitch, metal shingles, plaster and cement. All things considered, the wood silo with tar paper between the two linings has given the best satisfaction. It is probable that in the near future silos built of boiler iron and cylindrical in form will be used, and viewed from the standpoint of durability they should prove a success.

The foundation walls should be stone, and the wood sills which rest upon them should be firmly held in place by iron rods and bolts coming up through at least a portion of the foundation walls. The sills may be of the same size as the studding. The size of the studs and their distance apart will depend upon the dimensions of the silo, but more upon the height than upon the width. The size more commonly used is 2x10 inches, and the distance apart should vary from 12 to 16 inches, as the silo is deep or otherwise. The studs should be carefully bridged and should have double tenons at both ends. There should be a girt for receiving the studs every 8, 10 or 12 feet, according to the height of the silo. The plates may be of the same size as the girts.

The sheeting inside may consist of inch lumber jointed, and nailed horizontally on the studding. Where the sheeting covers the girt there should be an air space of one to two inches to prevent decay. This can be provided for when the studding is erected. Inside this lining sheets of tar paper are tacked up and down to assist in excluding the air. Over the paper another thickness of inch boards, tongued and grooved, is nailed horizontally, and so as to break joints. The boards should be planed on the inside to facilitate the settling of the ensilage, and tongued and grooved to exclude the air.

All things considered, lining with such materials as have already been previously mentioned do not seem to avail much in preserving the wood.

When the silo forms a part of the barn or stable there does not seem to be any necessity for sheeting on the outside of the studs.

Where a silo is large it may be necessary to put in one or more partitions, which may be temporary or permanent. If the partitions are permanent there should be a set of doors in each compartment for getting out the silage. Where the walls of the silo are high, advantage may be taken of the presence of the permanent partitions to strengthen them by running iron rods through the partition and within it, from side to side of the silo. The partitions, when permanent, may consist of two tiers of inch boards with tar paper between, or of 2 × 4 or 2 × 6 inch scantling placed flat-wise on top of one another and nailed firmly together. When the partitions are not permanent they may consist of two-inch planks kept in position at the ends with cleats.

The corners of the silo should have a board or plank 8 to 10 inches wide, with beveled edges, and the air space behind filled with some substance such as sawdust. The object is to exclude air and to secure the more perfect settling of the silage.

Several kinds of openings are in use in getting the silage out. The farm silo at this station has a succession of doors from the top to the bottom, both at the inside and outside of the studding, the former to spring inward and the latter outward. In filling the silo we fill the space between the doors with sawdust. When the silo is first opened the sawdust is removed, and the space rendered vacant forms a chute for conveying the silage from the top of the silo to the floor of the stable. A cheaper form of opening consists in having as many movable sections of the inner lining between two studs as may be required.

It is greatly important that the floor of the silo be kept dry by means of thorough drainage. Of the different kinds of floors used none have proved more satisfactory, all things considered, than clay, providing the drainage is good. Where there is apprehension of trouble from rats, a cement floor may be made by first using several inches of small stones or rough gravel, with a limited quantity of water lime over them, and above this a light coating of Portland cement.

The cost of the silo will depend upon its size, the materials used, and the cost of the labor. Sometimes it may be to the advantage of the farmer to do most of the work himself. From the data given any one who knows the cost of materials will have no difficulty in arriving at the probable cost of a silo which he may wish to erect.

Feeding Silage. The feeding of the silage may commence at once, but usually the silo is not opened for some weeks after it has been filled. It should be taken from the top of the silo, as feeding by this method is attended with the least waste.

When the silo is opened at the bottom, opportunity is given for a free admission of air, which injures the silage. Where the stable will admit of it, a truck may be used with advantage in conveying it to the stock.

Silage makes an excellent food for milch cows, beefing cattle and store cattle of all ages, when fed with other adjuncts. It has also been found highly useful as a part of the ration in feeding horses not at work; also brood mares and colts of different ages. It has furthermore given good results with breeding ewes, store sheep and lambs that are being fattened, when fed in varying quantities along with other food. Our experience in feeding it to pigs in the different stages of fattening has not been encouraging, but it has a place as a part of a maintenance ration for brood sows. It is not advisable at any time to feed it as the sole ration to any kind of stock. Nor is it prudent to feed it with meal only added for a lengthened period, as by so doing we have found that there is hazard to the life of the animals.

When fed to beef cattle fattening, and to milch cows along with a suitable ration of meal or meal and bran, a limited quantity of hay or straw, cut or uncut, should be fed along with it, and a larger quantity of the latter may be profitably fed along with it to store cattle.

In feeding it is common to put meal on the silage in the feed box. Silage is now considered the cheapest fodder ration which the Ontario farmer can produce.

36. Mixed Grains Grown for Fodder Purposes.

This experiment consisted of 11 plots, which were sown with mixtures of two, three, and four kinds of grain grown together. Each plot was one-hundreth of an acre in size. These grains were sown April 25th. They grew upon soil which had produced grain the previous year, and on which no kind of fertilizer had been used since the spring of 1890.

It will be observed (Table LIX.) that the mixture of peas and oats gave the largest yield of the various mixed fodders grown. The same mixture, with the addition of barley, gave the second best yield, and the same also with barley and spring wheat came third in point of yield. In all cases the following amounts of grain were sown per acre: barley, 66 lb.; peas, 100 lb.; spring wheat, 80 lb.; and oats, 50 lb.

Table lix. Yields of grain crops grown in mixtures for fodder purposes

Crops.	Tons of green crop per acre.
1 Peas and Oats	10.95
2 Barley, Peas and Oats	9.95
3 Barley, Peas, Spring Wheat and Oats	9.85
4 Barley, Spring Wheat and Oats	8.60
5 Barley and Peas	8.50
6 Peas, Spring Wheat and Oats	8.20
7 Peas and Spring Wheat	7.95
8 Spring Wheat and Oats	7.58
9 Barley, Peas and Spring Wheat	7.45
10 Barley and Oats	7.08
11 Spring Wheat and Barley	6.15

37. Peas and Oats Sown in Different Quantities for Fodder Purposes.

In this experiment nine plots were sown with peas and oats mixed in varying proportions. Each plot was one-hundreth of an acre in size. A grain crop was grown on the land in 1891. No fertilizer was applied since the spring of 1890. These grains were sown April 25th.

Table lx. Yields of Peas and Oats sown in different quantities for green fodder.

Quantity of Peas and Oats sown.	Yield of Green Crop per acre.
1. Oats 1½ bush. peas and 1 bush. per acre	12.10 tons.
2. " 1½ " 2 "	11.85 "
3. " 1 " 1 "	11.80 "
4. " 2 " 3 "	11.75 "
5. " 2 " 1 "	11.55 "
6. " 1¼ " 3 "	11.40 "
7. " 1 " 3 "	11.35 "
8. " 2 " 2 "	11.10 "
9. " 1 " 2 "	10.75 "

It will be observed that the best results were obtained from sowing 1½ bush. of oats per acre, and 1 bush. of peas. We require to remember, however, that another season with a different kind of weather, may give different results. But in time we hope to glean with some certainty the quantities which will give the best results in average seasons.

38. Rape. Its Culture and Uses.

In 1892, 70 plots of rape were grown. Nearly all of these were complete failures, for reasons given below.

We obtained seed of three varieties which were labelled respectively English sowing rape, Broad Leaf Dwarf Essex, and German or Summer rape. They were sown May 25th on plots one-hundredth of an acre in size. The first-named variety proved to be the true Dwarf Essex, which is the kind more commonly grown in this country. But it did not in this case give satisfactory returns, as many of the leaves turned yellow before the rape had attained the usual height. This would indicate that rape early sown is not equally successful with that put in about the end of June. The German or Summer rape began to ripen about the middle of August, and the ripening period extended over a good deal of time. The variety named Broad Leaf Dwarf Essex began to mature seeds about a month later, but it produced but few perfect seeds, notwithstanding the length of time which it continued in bloom. This was the variety so extensively sown in Canada and the United States the past season, owing to the large quantities sent out to Canadian and American seedsmen from England, and labelled "Dwarf Essex." On this farm from 35 to 40 acres were sown to our very great regret, as, in consequence, our arrangements for fattening lambs in the autumn were seriously disturbed, and all the experiments with small plots except those described above were rendered practically useless. These experiments had reference to thick and thin seeding, drills different distances apart, rape on four kinds of soil with and without salt, and plots with various applications of fertilizers. We trust that seedsmen will spare no efforts to prove seed for sale for the next crop, as another mistake similar to that of the past season would be peculiarly detrimental to the rape industry.

It is more than probable that much more attention will be given to the growth of rape in the future than in the past. Practically its growth at the present time is confined to but two or three counties in Ontario. In the other portions of the province it has not be grown at all, so far as we have been able to ascertain, unless in very small test lots since our bulletin appeared on the subject in March, 1891. A very large majority of the farmers seem entirely unacquainted with the habits of the plant, the mode of cultivating it and the uses to which it may be put It will be in order therefore to again call attention to the value of rape in our system of agriculture, and to the modes of growing it successfully and of using it when grown.

Rape is a plant which bears a close resemblance to the Swede turnip in the early stages of its growth, but it grows higher than the turnip and has a fusiform and stringy root, while that of the turnip is bulbous. On average soils when grown in drills and cultivated, it usually reaches the height of from one to two feet, but on soils very rich in vegetable matter it sometimes attains the height of three feet or more. The variety usually grown in this country is known as the Dwarf Essex. In England and in various countries of central and southern Europe, rape has been extensively grown for the oil obtained from its seeds, but since the introduction of mineral oils the growth of rape seed has been on the decline. In our country of sterner winters, the attempt has not been made to grow it for its seed, nor would it be likely to prove successful though it were tried. In countries where it is grown for the seed, it is usual to pasture it off in the autumn but not too closely, and this may be done without any injury to the crop of seed produced the following summer.

The bulletin issued on this subject in March, 1891, and embodied in the Annual Report of that year, was the first that appeared in reference to rape culture on this continent, and that which our Station issued in 1892 was the second. The first mentioned bulletin gave information gleaned during an experience of two years in growing the plant. The second supplemented the information given in the first by furnishing details of varied experiments conducted in 1891. These details had of necessity to be stated in condensed form. We shall endeavor, therefore, to supplement the information previously given by a more complete and orderly statement of what we have thus far gleaned on the subject.

Adaptability of Climate. Like the turnip, rape is adapted to temperate climates. In all probability it will be found to grow in best form in temperatures that are inclined to be cool rather than warm. It seems to grow more vigorously in our climate in the late rather than the early summer. It continues to grow until time of severe frosts when not matured at an earlier season. But this does not preclude the probability that rape will grow in good form over a large portion of this continent. It would simply imply that a later season would have to be chosen for sowing it in southerly latitudes. Rape should grow in fine form in all the southern portion of the Dominion from the Atlantic to the Pacific. It is scarcely probable that rape will live through the winter in this latitude and yet retain sufficient vigor to produce a good crop of seed, as in Great Britain. Some of the plants appear to live through any winter, but a large proportion of them are either killed outright or are much weakened by the severity of the frost. In more southerly latitudes it may turn out that seed can be grown at a profit.

Adaptability of Soils. The most suitable soils for growing rape are fairly moist free working loams, rich in organic matter. They may be of sandy or clay texture. Black loams are very suitable after the plants once get a start in them, owing to the large amount of humus which they contain. Muck swamps when drained should yield magnificient crops, and with the further advantage to the crops that come after, that the excess of organic matter in such soils will be much reduced by growing rape upon them. All prairie soils should yield good crops of rape. Soils that are suitable for the production of good crops of turnips or corn should also be suitable for growing good crops of the same. It will not grow well on stiff clays, poor sands or on any kind of soil deficient in plant food. The plants are difficult to start in stiff clays and are slow of growth, owing to the difficulty with which the roots penetrate the soil, and the preparation of such soils involves much labor. Light sands and soils deficient in plant food require stimulating, more especially with fertilizers rich in nitrogen. A moderate dressing of farmyard manure in preparing the ground and an average dressing of nitrate of soda after the plants are above ground, will prove helpful.

Place in the Rotation. When rape is grown as a pasture it should come between two crops of grain, as it is an excellent cleaning crop when grown in drills and cultivated. Fields should be selected for growing it which most require cleaning. When thus grown it should always be followed by a grain crop sown to grass, owing to the clean condition in which it leaves the land. As rape luxuriates in soils abounding in vegetable matter, it may be grown with much success on an overturned sod, inverted in the autumn or in the spring, or just after cutting the first crop of clover. We have obtained excellent results after sod overturned in August and sown to rye, cut green and followed by rape. When sown as a catch crop to furnish pasture or green manure, it may follow any cereal or hay crop. Excellent results should also be obtained by growing it after a crop of early potatoes dug and removed as soon as ripe. When grown as a catch crop it may come after any kind of crop that has been removed sufficiently early to give time for the rape to make a good growth.

Preparation of the Soil. The preparation of the soil will to some extent depend upon the rotation. When rape is the only crop grown, and the land does not particularly require cleaning, there would be no special need for any other than spring cultivation. The ground should be carefully plowed as early as possible after it becomes dry, and then worked upon the surface by an occasional harrowing until the time for sowing the rape. When the land requires cleaning it should be gang-plowed as soon as the previous crop has been removed, and then harrowed occasionally to encourage weed germination, and to destroy those seeds which have already germinated. The late plowing in the fall should be deep. In the spring a thorough cultivating early in the season, followed by an occasional harrowing, is all that is required until the land is to be drilled. When a crop of rye is grown, followed immediately by a crop of rape, the method would be somewhat as follows: Plow the ground carefully as soon as the previous crop has been removed, taking care to bury all weeds. Sow rye with the drill at the rate of not less than 2½ bush. per acre, from the 1st to the 15th of September, or even later in case of necessity. The following spring, cut the rye for winter fodder with the binder, and cure in the sheaf, or cut for silage and cure in the silo. In the first instance cut as soon as the rye is well out in head, in the second when in the first blossom. When rye is thus cured for fodder it should be run through the cutting box and fed along with other cut food. For making the rye into silage see page 54 of the Annual Report for 1891. The ground should be carefully plowed as soon as the crop is removed. In fact much of the plowing may be done while the rye is yet in shock. The skimmer should be used on the plow that all weed life may be buried. The ground should then be rolled at once to conserve the moisture, and harrowed weekly until the sowing of the rape. When the rye is to be used as pasture it may be sown as described above, but as soon as possible after the previous crop has been removed. It may then be pastured in the autumn or the following spring until the end of May, and the ground may then be plowed as already described.

When rape is grown as a catch crop the ground should be gang-plowed as soon as the previous crop has been removed, and the rape sown broadcast upon the surface after it has been properly pulverized. In very dry weather it would be more prudent to wait for rain than to sow at once. The catch crop may be pastured or plowed in as may be desired the same autumn. But rape may also be grown as a catch crop in drills. When thus grown the ground should be plowed to a fair depth after the removal of the crop. Some cultivation is required while the crop is growing, but not so much as when it has been sown earlier.

To save time, the drilling should be done with the double mould board plow, where such an implement is at hand. It is better to make the drills shallow, than deep, as low drills lose moisture less rapidly. In distance apart, they may be from 20 to 28 inches according as the soil is rich or not. In average soils from 22 to 24 inches between them is considered a suitable distance.

One real difficulty in sowing rape is to get the seed to germinate in the soil, owing to the lack of moisture at seasons when rape is usually sown. It is important, therefore to stir the soil frequently with the harrow or cultivator some time before sowing the rape where this can be done. It may also be necessary in some instances to have the drill follow close after the plow, used in drilling, and in all instances unless the ground should be unduly moist the practice is a good one.

Fertilizers for Rape. Although rape in an average season will give a fair return from ordinary land, it is usually responsive to large applications of farm-yard manure. The state in which the manure should be applied will depend on several conditions, relating to soil, season and cultivation, but the late season at which the rape is sown gives ample opportunity to apply it at almost any stage of fermentation that may be desired. Judging by the marked luxuriance produced in the growth of rape on soils enriched with farm-yard manure we would naturally conclude that a complete commercial fertilizer will prove the most satisfactory on average soils. This of course will depend largely upon the requirements of the soil and must be made by the individual by actual test. In our experience the largest increase has been obtained from the application of nitrate of soda and the next largest from the application of salt. No increase was obtained from the use of muriate of potash or of superphosphate. These fertilizers were sown at the rate of 200, 400 and 600 pounds per acre and in no instance would the increase in the crop pay for the fertilizers; but the soil was fairly rich where the tests were made. Relatively the nitrate of soda gave the best returns.

Seed and Sowing. The most suitable time perhaps for sowing rape in Ontario is from June 25th to July 5th, although a fair crop may be obtained when it is sown earlier, and a full crop may sometimes be grown when it is sown as late as the end of July. For catch crops it should be sown as soon as possible after the previous crop has been removed. Fairly good crops may be obtained by sowing it in drills as late as the latter half of August, but the crop thus obtained is less valuable as a food owing to its immaturity at the time of pasturing, and there is also more of hazard to the animals feeding upon it. One of the chief difficulties to be contended with in growing rape arises from the over-dry condition of soil at the time of sowing, especially when it follows a grain crop, the roots of which when growing have pumped much of the moisture out of the land.

The mode of sowing and the amount of seed used will depend upon the object sought.

When the ground does not require cleaning, and also on muck swamps, it may be sown broadcast at the rate of three to five pounds of seed per acre. The less the amount of plant food in the soil the larger the amount of seed that may be used. When sown as a catch crop or for green manure similar amounts will suffice, and the mode of sowing is the same. The ground should be well pulverized and rolled before sowing, and covered with a light harrow followed by the roller to conserve the moisture in the soil. When sown in drills from one to two pounds of seed may be used, according as the ground is fine and moist, or less pulverized and dry. The seed is ordinarily sown with the turnip drill which puts in two rows at a time. The Dwarf Essex variety is the kind more commonly grown, and the seed may be obtained from any of the leading seedsmen at a cost usually not exceeding ten cents per pound. The seed is hardy and will oftentimes lie without damage in the soil for a long time after it is sown, and when rains come will spring into vigorous life.

CULTIVATION. When the rough leaf has made a good start in the rape, the cultivator may be introduced. As it is important that the weeds should be destroyed by the cultivator to the greatest possible extent, it should be run as closely to the line of the rows as is consistent with the safety of the plants. The more frequent the cultivation the more rapid will be the growth of the rape. As in the case of corn the cultivation need not be so deep at the last as at an earlier stage, lest the roots be disturbed. Cultivation will of necessity cease after the tops of the rape have met or nearly so, in the line of the rows. When the soil is fairly clean no hand hoeing is required, as the rape is likely to keep in advance of the more offensive forms of weed life. But where it is foul it will be necessary to go along the line of the drill with the hand hoe once or twice to remove weeds. In our experience two such hand hoeings have cost $1.00 per acre. No attention ordinarily is paid to thinning rape, nor do we feel justified as yet in saying that thinning would repay the outlay when not more than two pounds of seed have been used per acre.

OUR EXPERIENCE WITH RAPE. In 1889 we grew 12 acres of rape at this station for pasture. In 1890, 54 acres were grown for the same purpose, and 10 acres more as a catch crop. In 1891, 40 acres were grown for pasture and 6 acres as a catch crop. That grown as a catch crop was also pastured. A large number of plots were also grown each year, in addition to the above, by way of experiment.

The following are the chief of these experiments:

1. Rape grown on four kinds of soil, with and without salt.
2. Rape grown in drills, as against flat cultivation.
3. Rape grown in drills, as against broadcast seeding.
4. Rape grown in drills, at different distances apart.
5. Using different quantities of seed per acre.
6. Thinning the plants to different distances in the drills.
7. Applying different fertilizers to ascertain their respective values.
8. Feeding lambs upon rape grown after fall wheat.
9. Testing the amount of pasturage furnished by a single crop of rape, when grown under favorable conditions.
10. Pasturing lambs upon rape alone, rape with a supplement of oats, and rape with access to a grass pasture.
11. Pasturing swine upon rape alone.
12. Feeding rape as a soiling crop.

The results of these experiments, we hope to give in summarized detail at some future time. In the meantime, we may mention that in our experience flat cultivation in drills gives somewhat larger returns than ridged cultivation; that larger crops can be obtained from rape grown in drills than broadcast; that salt and nitrate of soda are serviceable as fertilizers for rape; that oats do not seem to render much service when fed along with rape that is being pastured by lambs, and that rape and old meadow pasture are superior to rape alone as a pasture for lambs.

THE USES OF RAPE. Rape is valuable as a pasture, as a catch crop, as a soiling crop, as a green manure, and as a cleaning crop.

1. *Rape as a pasture.* Rape is an excellent pasture for sheep, and lambs, and for cattle that are being fattened. So far as we can judge from our limited experience, it will also furnish good pasture for swine. The value of rape as a pasture arises, not only from its wonderful fattening properties, but because it furnishes pasture at a season of the year when it cannot be obtained in nearly so fine form from any other source. The nutritive ratio of green rape as given by Wolf is 1:2.9, while that of red clover in full blossom is only 1:5.7. But as rape contains more water than clover, the same authority estimates clover as being worth 15 per cent. more than rape, pound for pound, for feeding purposes. On the other hand, we have found that rape will produce from two to three times more in weight from a given area than a single cutting of clover.

In 1889 we pastured 48 lambs on rape, in 1890, 537, and in 1891, 666. A number of these were carried on into the winter, after the season for pasture was over, and were finished for the markets of Canada, Great Britain or the United States. These lambs would have taken the market when brought off the rape, but they were kept on in some instances to obtain higher prices, and in others for purposes of experiment. In every instance they fed well when taken off the rape and put into winter quarters, which tends to prove that pasturing lambs on rape is an excellent preparation for winter fattening.

In our experience of three years in growing rape we find that one acre will pasture, on an average, 10 to 16 lambs from 2 to $2\frac{1}{2}$ months, when the rape has been grown after a crop of rye cut the same season for fodder.

In 1890 the average price paid for 48 lambs, when bought October 9th, was $3.85 per head, and they were sold the following March for the Halifax market at $7.71 per head. They brought $5\frac{1}{2}$ cents per pound, live weight, when sold. In 1890 the average price paid for 537 lambs, when bought in September and early October, including expenses of purchasing and carriage, on the major portion of them, for more than 300 miles, was $3.76. The average price received for 364 head shipped to Buffalo on December 19th, was $5.54. They were sold for $5\frac{1}{2}$ cents per pound. The following May 100 head were sent to England, and they sold there in the Liverpool market at $11.79 per head. A limited number of choice ones were selected and fed on through the summer. Two of these were taken to the Chicago Fat Stock Show, and won first and second prizes respectively in their classes, in continental competition.

In 1891, 666 head were purchased and brought to the farm to be fattened. Of these 362 head were purchased in Prince Edward Island, 1,150 miles from this station, 200 in Lanark and Renfrew counties, and 104 in the Toronto market. These lambs were disposed of between January 8th and May 9th, 1892. 160 head went to the Buffalo market, 209 to Halifax, 99 to England, 149 to Ontario markets, 26 to local butchers, and 23 animals were lost in transit, died or strayed. The average cost, when laid down at the farm, was $3.15 per head, and the selling price was $5.73, which was an advance in price of $2.59 per lamb. The lambs sent to England were estimated at the same price as those of equal quality sent to Halifax, as we refused an offer for them equal to the price paid for the latter.

2. *Rape as a Catch Crop.* The extent to which rape may be grown as a catch crop is only limited by the desires of the farmer, and the peculiarities of the season, as the absence or presence of moisture. When grown for this purpose, it may follow any kind of a grain crop that has been reaped early, and that is not sown to meadow. When sown in drills the ordinary plow must be used. When sown broadcast it will suffice to plow the ground with the gang-plow. In very dry seasons the crop may fail to germinate and so not come to anything, but the only virtual loss will be that of the seed, as the labor will repay itself, because of its helpfulness in destroying weeds. Especially is this true when the ground has been simply gang-plowed. Another plan is to sow some rape broadcast in the grain at some stage of its growth, and to pasture it after the rape has grown up, subsequent to the removal of the crop.

An experiment conducted at this station in 1891, in growing rape as a catch crop, is an indication of what may be accomplished in this direction. The plot covered 2.18 acres. Fifty-one varieties of winter wheat had been grown upon it. Of these 26 were Canadian varieties. They gave an average yield of 53 bush. per acre, and weighed 63.3 pounds per measured bushel. The remaining varieties, which were foreign, gave an average yield of 33.2 bush. per acre, and weighed 59.3 pounds per bushel. We mention these facts to show the extent to which the ground had been drawn upon. The ground was plowed after removing the wheat, and drills were made across the plots and the paths between the rows. The rape was sown in these on August 12th. On October 17th, 60 lambs, bought in Prince Edward Island, were put upon the rape, which sustained them for 25 days without any additional food. The aggregate increase in live weight made in that time was 390 pounds, or 179 pounds per acre. If we value this increase at 5 cents per pound we have $8.95 as the food value of one acre of the rape. This estimate takes no account of the increase in value of the original carcass, or of the manure. The land was also left in a clean and good condition for the crop coming after.

3. *Rape as a Soiling Crop.* Our experience with rape as a soiling crop is somewhat limited, but the results would almost justify the conclusion that rape may be used as a soiling crop with much advantage. Late in October and early in November we cut in all about $1\frac{1}{2}$ acres of rape which had been grown for experimental purposes, and put it in piles about half the size of ordinary haycocks. We commenced at once to feed it to various animals that were housed, but more especially to shorn lambs that were being fed for the English market. Although more than a month elapsed before the piles had all been removed, there were no indications of mould or decay in the rape, and the animals did well that were fed upon it. It may turn out that when thus put up it may be used for soiling purposes even after the snow has fallen to some depth.

We stated in a bulletin issued in March, 1891, that rape is not considered a suitable food for milch cows, as when they feed upon it the milk becomes strongly tainted. We have since ascertained that its suitability for this purpose depends upon the way in which it is fed. If the rape is eaten off as pasture the milk will certainly be tainted, but when cut and given to the cows in moderate quantity, just after they have been milked, no perceptible taint is found in the milk. At least this has been the result where the milk of cows fed in this way has been sent to cheese factories. Rape intended for this purpose may be grown broadcast or in drills, and cut with the scythe from day to day. Unless further tests with rape fed to milch cows should give results of an opposite character it is possible that it may yet come to be used in this way. It will certainly have a beneficial effect upon the milk flow, and also upon the condition of the animals, and it comes into use at a later season than any of the other soiling crops that we grow.

4. *Rape as a Green Manure.* Although our experience with growing rape as a green manure is limited, there is no doubt as to its pre-eminent adaptability for that purpose, especially when grown as a catch crop. The roots permeate the soil and furnish plant food abundantly in their decay. The vegetation which covers the ground at the season of the early fall rains hinders the leaching of nitrates out of the soil. Owing to the ability of rape to withstand frost it continues to grow when vegetation in other forms has ceased. When grown after the harvest season as a green manure, rape should be plowed in the same autumn.

5. *Rape as a Cleaning Crop.* Rape is one of the most valuable crops that can be grown as an aid in cleaning the soil when it is properly managed. There is no crop, perhaps, that will equal it in this respect now grown in this country. This is largely owing to the late season at which the rape is sown, which gives ample time for a long period of preparatory cultivation. It is further owing to the cultivation given the rape when it is grown in drills at a season of the year when many of the hurtful forms of weed life can be destroyed. As a cleaning crop we have found none that will compare with rape in all-round effectiveness. On soils suitable to its growth almost any of the more noxious forms of weed life can be eradicated in a single season with wise management, except in so far as the seeds of the same remain in the ground without germination, and a valuable crop of rape obtained at the same time. Two crops may sometimes be obtained the same season and with the same results, so far as the cleaning of the land is concerned. We have grown rape and rye in conjunction with much success and have reaped good crops of both. Other crops, as meadow and spring grains, may also be followed by rape the same season.

Precautions to be Observed in Pasturing Rape. Pasturing rape has its dangers. Sometimes scouring is induced, more especially when the lambs are first put upon it. Access to salt at all times and to an adjacent pasture have been found helpful as preventives. Tagging should also receive attention before the sheep or lambs are put upon the rape. When first turned in upon a rape field sheep and cattle will too freely partake of it unless the appetite has previously been well satisfied with other food. Bloating may in some instances be induced which, if not relieved, will soon cause death. When sheep are turned in upon it, therefore, they should be allowed continued access to it, unless in time of cold storms, and when removed in no instance should they be put back upon it when hungry. When cattle are pastured upon it they should be kept a portion of the time on a grass pasture, or, what would be preferable on the approach of cold weather, fed in the stables or sheds at night and put on the rape again each morning after having been fed. On frosty mornings when sheep eat freely of rape, especially of the leaves of plants that are immature, there is some danger that bowel disorders will be induced which may cause death. When the sheep have been removed the previous evening and get a moderate feed of oats in the morning before they return the danger is to some extent lessened. It is at least questionable if there is any profit in pasturing rape after the stalks have been made brittle with hard frost.

When the sheep or lambs have been on the rape for some time they become fat and in consequence are proportionately less active. They sometimes get on their backs in depressed places and are unable to rise, in which condition they will not live many hours. This is the case more especially where rape has been grown in ridged drills. It is a wise precaution, therefore, to visit the flocks at least twice a day, and in doing so the services of a saddle horse will be found very useful where the flock is large.

Great care should be exercised in pasturing sheep and lambs kept for breeding purposes upon rape, more especially when they are of much value, as, for instance, when they are purely bred. The loss of even a limited proportion of animals in such a case would probably overbalance the profits from the rape. In such instances it may be well to allow the animals to remain on the rape but a short time at first. The length of this period may be so increased from day to day that soon they may remain upon it all day. Caution should be exercised as to putting them upon the rape when it is wet with rain or dew, or when it is frozen, and they should never be put upon it when hungry. It may not be known to all that when sheep or lambs are affected with bloating, if they are slaughtered in the early stages of the trouble the meat is considered perfectly good. The same is true of ailments caused by eating frozen rape. By giving prompt attention in such instances nearly the full value of the lambs so affected may be realized. There is less liability to loss from these ailments when the rape is well matured, and these losses seem to vary much with the seasons.

General Observations Regarding Rape. Some authorities advocate hurdling the sheep while feeding on the rape. They argue that when it is fed off in this way the ground will be more evenly manured. While this is true the practice has some disadvantages. The sheep have less of liberty, an important element in their well being, their wool gets more soiled and they are prevented from eating any grass, which is generally believed to be helpful in regulating the health of sheep feeding upon rape. The expense of providing hurdles and the labor of placing them are also to be considered.

It is interesting to note the manner in which the sheep feed upon the rape. When it is grown in drills they walk along the line of the drills much of the time, and so do not injure the rape by tramping. When it grows very rank they do not go far into it, but eat it off nearly to the ground as they go. The waste from pasturing rape with sheep is very little indeed.

Late rape is probably not a very profitable crop. In time of cold rains and sleet the sheep are safer housed. After the rape has been frozen so as to become brittle, when it thaws out again its value as a food is probably lessened, even though the weather should turn warm again, as freezing to the extent indicated seems to leave it in a semi-wilted condition. From our experience in pasturing it at such a time we conclude that it would be more profitable to have the rape eaten off by the time the period of hard freezing arrives.

The increase in weight that may be expected from lambs when feeding on rape alone is probably not less than 10 pounds per month, although much will depend on the kind and condition of the lambs. In our experiments the lowest average gains made per month with a number of lambs were 7.80 pounds, and the highest 12.60 pounds. The former were made by a lot of lambs which were small in size and of the commonest breeding, and when they were pasturing on rape that was immature.

Although rape will not grow well on poor land, the amount of pasture that it will produce under favorable conditions is remarkable. In an experiment conducted here in 1891, the land on which the rape was grown being in good condition, we found that one acre would provide pasture for 36 to 37 lambs for two months, and that it would increase the live weight of the lambs by 762 pounds, which, at 5 cents per pound, would give the food value of the acre of rape as $38.10, without considering the increase in value of the weight of the lambs when put upon the rape, or the value of the manure. This estimate is based upon an actual test made by pasturing lambs upon a plot containing about one-sixth of an acre.

The time for disposing of the lambs that are pastured on rape is well worthy of consideration. The practice hitherto has been to market them about the time of the closing in of the winter or a little later. The aim in marketing thus early has been to avoid the necessity of providing shelter for the lambs and the labor of feeding them. This practice must now be modified, as owing to the large number of lambs put upon the market at that season, it is likely to be glutted and the prices to be low because of this. As it is not wise to sell live stock at any time in a glutted market, the lambs should sometimes be carried on into the winter months, after the holiday season. As many farmers will probably continue to push their stock upon the market before the holiday season, it is more than likely that lambs will find ready sale and bring good prices during the earlier months of the year, for some time to come. Had we sold our lambs early in December, 1891, we could only have got $4\frac{3}{8}$ cents per pound, live weight for them. On January 1st, 1892, we refused an offer of $5\frac{1}{4}$ cents per pound. The difference between the latter price and the former in the net return for the whole lot would have been $575 or nearly $1 on each lamb. The question of profit and loss, therefore, depends largely upon the time at which the sale is made.

39. Millet. Comparative Test of 11 Varieties.

In 1892, 11 varieties of millet were grown. The plots here also were one-hundredth of an acre in size. The seeding was done on June 11th. Rape had been grown on the ground in 1891. No farm-yard manure had been applied for several years previously. The soil was a mild clay loam. These same varieties were all sown upon test plots in another field on May 25th. The season was very wet at the time. The millets in consequence grew so slowly that they proved a failure, and therefore were not allowed to mature.

Table lxi. Yields from 11 varieties of Millet for one year.

Varieties.	Yield per acre, green crop.
Salzer's Dakota	7.50 tons.
German or Golden	5.93 "
Golden Wonder	5.56 "
African	4.88 "
Pearl	4.61 "
Large African	4.58 "
Siberian	3.61 "
Red French	3.88 "
White French	3.14 "
Broom Corn	2.66 "
Common	2.38 "

It should be mentioned here that a part of the plot on which the Golden Wonder variety was grown was very much impacted through treading the previous year, hence this variety was grown at a disadvantage. The Salzer's Dakota which stands at the head of the list is so far as we know an entirely new variety in this province. The seed was obtained from Lacrosse, Wisconsin. It grows to a good height, stands up well, has an abundance of leaf growth and the heads are strong and of medium length, but it is from 10 to 14 days later in maturing than the common millet. The Golden Wonder Millet is also a new and promising variety. It has long heads and medium length of plant. Three of these varieties grown as a Union co-operative experiment, under more favorable conditions, gave much larger yields relatively than were obtained from any of the plots included in the above table. Further particulars will be given as to these three varieties in the Union report which is also included in this volume.

40. Clover. Comparative Test of 18 Varieties.

In the spring of 1892, 18 varieties of clover were sown on plots which were one-hundredth of an acre in size. The seeding was done on May 9th. The ground was a nine-year old sod which was plowed in 1891 just after the hay crop had been removed. During all these years a crop of hay had been annually taken from the land. No manure had been applied during that period. The land was cultivated on the surface in the autumn, and in the winter well decomposed farmyard manure was applied at the rate of 15 tons to the acre. The plowing which followed in the spring was shallow. The clover all started well except in one or two instances. Interesting results may be expected from these during another year.

In the spring of 1891 seven varieties of clover had been sown, from all of which crops were obtained in 1892. For particulars relating to the sowing of these, see Annual Report for 1891, p. 106. The experiment with all these varieties was conducted in duplicate.

Table LXII. Yields from 7 varieties of Clover sown in 1891.

Varieties.	Yield per acre of green crop.	Yield per acre of hay crop.
Bokhara	30.65 tons.	6.88 tons.
Mammoth Red	13.33 "	2.81 "
Alsike	10.63 "	2.31 "
Welsh	10.58 "	2.25 "
Lucerne	9.23 "	2.77 "
Red	8.05 "	1.89 "
White	6.20 "	1.40 "

The figures in the above table represent the results from the first cutting only of the season. Several of the varieties were cut a second time, but owing to unfavorable weather at the time the results from the second cutting have not been obtained. The value of the experiment in consequence has been much impaired. The Bokhara which stands at the head of the list in point of yield is the same variety commonly known as "sweet clover." It has a tall and branching habit of growth, but early becomes woody. It is not much relished by live stock, but may yet be found useful to grow as a green manure, more especially on light lands deficient in nitrogen. The plot of crimson clover did not survive the winter of 1891-2. We cannot say more as yet in regard to its behavior than that it has done only moderately well.

41. Grasses. Comparative Test of 40 Varieties.

In 1892, 40 different varieties of grass were sown on May 7th. The germination of nearly all the varieties was good, but there were some partial failures. We desire to grow them for purposes of comparison as to absolute and comparative yields, hardihood and duration. We also wish to study their habits of growth more especially in regard to the time or times most suitable for cutting, their behavior in reference to seed production and suitability in every respect for the conditions of our soil and climate. For particulars relating to soil, previous cropping and preparation of soil, see remarks under section 40 which treats of clovers. The rye grasses made the most vigorous growth of all the varieties sown.

42. Sunflowers. Comparative Test of 3 Varieties.

Three varieties of sunflower were sown upon plots one-hundredth of an acre in size. The seed was planted in hills 15 inches apart both ways with one seed in each hill. The planting was done May 5th. They were hoed occasionally.

The seed of the first variety came from Muskoka. Some attention had been given there to growing the crop by the donor of the seed. In northerly latitudes where corn cannot be grown to good advantage, this crop can easily be made to mature. These varieties were cut when the seeds were in the latter stages of the dough condition, were shocked after the manner of corn, allowed to stand about four weeks and were then run through the cutting box and fed to a milch cow. The results will be reported when giving information relating to the live stock experiments.

TABLE LXIII. Yields of 3 varieties of Sunflower for one year.

Varieties.	Yield per acre.
Hollingworth	25.0 tons.
Russian	21.5 "
Mammoth Russian	20.8 "

43. MISCELLANEOUS CROPS.

Divers crops were grown on a small scale. These are not of sufficient importance to speak of them under separate headings.

FLAX. One small plot of flax was grown. The seed was sown May 25th. It produced at the rate of 10.3 bushels per acre and gave 1.1 tons of straw. The seed weighed 50.5 lb. per measured bushel, which is ½ lb. more than the standard.

BUCKWHEAT. One small plot of buckwheat was grown, the seed of which was sown May 25th. The yield of grain per acre was 3.0.9 bushels and of the straw 1.7 tons The weight per measured bushel was 45.5 lb. or 2½ lb. below the standard weight.

LATHYRUS SYLVESTRIS WAGNERI. A small plot was grown without admixture along with the plots of the clovers and grasses that comparative yields may be obtained in the future. In the spring of 1892 one pound of seed was presented to the station by Francis L. Clotton, Esq., of London, England. It made a very good, growth, but was not sufficiently large to admit of its being cut.

II. LIVE STOCK EXPERIMENTS.

These include experiments with 701 animals, conducted during the year, namely 23 cattle, 666 sheep and 12 hogs. All the food used in the different experiments was accurately weighed and accounted for except that portion of it which the animals gathered when pasturing and which it is impossible to estimate with absolute precision. Bulletins have been issued during the year giving concise statements of some of the experiments. These experiments are given more fully in this report, along with others, the results of which did not appear in bulletin form.

44. FEEDING GRADE STEERS OF DIFFERENT BREEDS.

This experiment is simply the continuation and completion of the feeding test with grade steers of different breeds, the results of which are given for one year in the Annual Report for 1891, p. 125. The animals, as stated in the said Report, were chosen from breeds whose fitness for beef production has been recognized to some extent by at least some sections of the community. The experiment commenced in the autumn of 1889, and closed when the different animals thereof were two years old, with the exception of the native or scrub. When the steers were sold the age of this animal was but twenty-three months, but in the computation it is reckoned as two years old. The reckoning for the last month is based upon the average of the results of the four months previous to the close of the experiment.

A repetition of the facts given in the description of the first year's feeding, and the results growing out of it, will be avoided as much as possible in this narrative, but it is necessary that some things should now be re-stated, to render intelligible the account of the second year's work given here.

The primary objects of the experiment were to ascertain: (1) The average cost of rearing grade steers, for purposes of beef production, from birth until the period of early maturity, when fed upon a heavy or forcing ration. (2) The comparative cost of rearing grade steers on whole and skim milk respectively, and the effects of these on development, after the termination of the milk period of feeding. (3) The comparative cost of producing beef from well-graded and native or scrub animals respectively.

The chief of the secondary objects were to ascertain: (1) The relative cost of rearing animals for beef production during different periods of growth when fed upon a heavy ration. (2) The relative daily gains; and, (3) The total relative increase in weight.

While attempting to secure these objects it was thought that something might be learned at the same time regarding the relative merits of grades of certain breeds for making beef, and the animals used in the experiment were chosen accordingly.

THE ANIMALS SELECTED. The animals secured, eight in number, were obtained from leading breeders, and wherever they could be got of a suitable character. Each individual was the offspring of a pure registered sire, except in the case of the native or scrub, and the aim was in every instance except in that of the native, to have the dam a common grade cow. The effort to secure them as near the birth period as possible was also fairly successful, except in the case of the Galloway grade, which was fifty-three days old when it reached the farm. The Shorthorn grade to which the whole milk was fed, was fourteen days old, and the others were all less than nine days old. The more important particulars regarding these animals are given in the subjoined table. The color, generally speaking, was typical of the breed of the sire.

TABLE LXIV. Particulars regarding the breeding and the leading characteristics of the different animals.

Grade.	Date when calved.	Sire.	Dam.	Characteristics of steers.
Galloway	Nov. 2nd, 1889	Rajah of Brooke (3970)	$\frac{1}{8}$ Shorthorn and $\frac{7}{8}$ Canadian.	Short legs and blocky frame.
Shorthorn	Dec. 22nd, 1889.	Methlick Hero=2723= Imp.	A Shorthorn grade	Rather leggy for Shorthorn type.
Aberdeen Poll	Jan. 1st, 1890	Runnymede 2nd, 5220.	A common 2-year-old heifer.	Not robustly developed.
Hereford	Jan. 5th, 1890	King Hal	A good common cow	Short legs and heavy body.
Devon	Jan. 8th, 1890	Duke (947)	A Shorthorn grade	Neatly and squarely built frame.
Holstein	Feb. 17th, 1890	African Prince (H.F.H.B.) 1270.	A common cow	Large sized and rather coarse in bone.
Shorthorn (fed on skim-milk).	April 1st, 1890	Macduff	A Shorthorn grade	Medium sized and neatly built frame.
Scrub or native	April 16th, 1890.	A native bull of the rangey type.	A 3-year-old native	Narrow bodied, flat ribbed and long legged.

FOOD AND FEEDING. The food and feeding until the animals were one year old are given in the Report for 1891, already referred to. During the second year the hay fed was a mixture of timothy and clover, cut. The green fodder consisted of peas and oats and corn when these were in season. The roots comprised turnips and mangels, but these were fed at different periods. The meal consisted of ground peas, ground oats and bran, given in the proportion of 2, 2 and 1. A small amount of oil-cake was given daily for the three summer months of 1891. The meal was fed dry throughout the experiment. The aim was to give the animals a liberal ration, having regard at the same time to their individual capacity to take it. Some of them would not take so much as others, and this accounts for the different amounts consumed, as given in the subjoined table. The food was given in three meals per day. They also had access to water and salt virtually at will.

They were tied in stalls and were allowed exercise daily in the barn-yard. As some fears were entertained at one time that some of them would go off their feet before the completion of the second year, they were allowed to go out to a pasture for three hours daily for ten days, commencing with June 2nd, 1892. During this period they lost in weight from 24 to 40 lb. each, notwithstanding that their usual food ration was given them.

They were sent to the Toronto and Guelph exhibitions, when they were virtually absent from the stables from Sept. 10th to Sept. 24th. The food given during this period was exactly the same in kind as that given them in our stables, except that they did not receive green fodder, and everything given them in the form of food was as usual accurately weighed. They were also at the Guelph Fat Stock Show for two days in the month of December. While the animals were on exhibition some of them made an increase and some of them decreased in weight. The exhibition of the animals told adversely upon the results of the experiment.

FOOD EATEN. Table LXV gives the consumption of food during the second year of the life of the animals.

Grade.	Food eaten during the second year.			
	Hay.	Meal.	Roots.	Green fodder.
	lb.	lb.	lb.	lb.
Galloway	2,549	3,012	6,537	1,149
Shorthorn	3,309	2,955	6,977	1,096
Aberdeen A. Poll	2,338	2,595	4,788	771
Hereford	2,656	2,737	5,849	824
Devon	3,421	2,436	5,658	1,350
Holstein	3,195	2,880	5,868	1,454
Average (grades of six breeds)	2,911	2,769	5,946	1,107
Shorthorn (fed on skim-milk)	3,429	2,712	5,932	1,182
Scrub or native	2,830	2,528	5,134	1,117

It will be observed that the Shorthorn fed on skim-milk consumed about the same amounts of food as the average grade, except in the item of hay of which he consumed more. The native or Scrub took a little less generally speaking, than the average grade. The individual preferences of the various animals for certain foods is somewhat strikingly shown in the item of roots and green fodder, where the difference in the aggregate of consumption was considerable. The total consumption of the food was large, and more especially with the more concentrated and costly rations, but this was in keeping with the objects of the experiment. It was the intention from the first to use a somewhat forcing ration.

Table LXVI gives a summary and analysis of weights.

Grade.	Individual weight when		Individual increase during second year.	Average individual daily gain.		
	One year old.	Two years old.		First year.	Second year.	Two years.
	lb.	lb.	lb.	lb.	lb.	lb.
Galloway	800	1,345	545	2.19	1.49	1.84
Shorthorn	890	1,385	495	2.44	1.36	1.90
Aberdeen A. Poll	754	1,126	372	2.07	1.02	1.55
Hereford	900	1,245	345	2.47	.95	1.71
Devon	803	1,295	492	2.20	1.35	1.78
Holstein	883	1,303	420	2.42	1.15	1.79
Average (grades of six breeds)	838	1,283	445	2.30	1.22	1.76
Shorthorn (fed on skim-milk)	848	1,285	437	2.32	1.20	1.76
Scrub or native	700	1,215	515	1.92	1.41	1.67

It will be observed that at the end of two years the weight of the Shorthorn fed on skim-milk was practically the same as that of the average grade of the six breeds to which new milk had been fed during the corresponding period. The native or Scrub weighed 68.2 lb. less. The average daily gain of the six grades during the first year was 2.3 lb. while during the second year it was but 1.2 lb. The low average of increase for the second year was doubtless caused by the heavy forcing ration purposely given, and more especially while the calves were yet young. The marked variation in the relative increase in weight made by some of the animals in the first and second years respectively will find at least a partial explanation in the remarks that are given later, when treating of the behaviour of the animals during the contest.

Estimated Value of the Food. The fodder, grain and roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. (See Bulletin LXVIII., p. 5.) The home value put upon the hay therefore when cut was $7 per ton; the green fodder $2 per ton; the oats 25 cents per bushel; the peas $48\frac{1}{2}$ cents; and the roots when sliced 6 cents per bushel. The grinding of the grain was put at 6 cents per 100 lb. The bran and oil-cake, reckoned as delivered at the average Ontario farm, were put at $13.40 and 22.66\frac{2}{3}$ per ton respectively. It will be observed that in all probability a profit has already been made upon the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values less the cost of marketing from an average Ontario farm.

This profit will be represented by the difference between the cost of growing and the market value put upon it. It is highly important that the probable profit already made upon the food grown should not be overlooked in estimating the financial results from experimental feeding. It may be that in some instances there is no profit, possibly a loss, but generally speaking there is a profit, or growing food stuffs could not be carried on but at a loss, which we know is not generally done. The amount of this profit in some instances would be a reasonable one in itself.

Table LVII. Financial results from the animals until two years old.

Grade.	Cost of					Total cost.	Value of				Total value.	Gain + or loss −.
	Animal at birth.	Food.		Attendance.			Animal.		Manure.			
		First year.	Second year.	First year.	Second year.		First year.	Increase second year.	First year.	Second year.		
	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
Galloway	2 00	27 22	41 34	5 63	6 00	82 19	44 00	29 98	6 00	12 38	92 36	+10 17
Shorthorn	2 00	47 52	43 97	5 63	6 00	105 13	48 95	34 15	6 00	12 38	101 48	− 3 65
Aberdeen A. Poll	2 00	43 02	35 01	5 63	6 00	91 66	39 59	25 16	6 00	12 38	83 13	− 8 53
Hereford	2 00	46 47	38 46	5 63	6 00	98 56	49 50	18 98	6 00	12 38	86 86	−11 70
Devon	2 00	41 62	39 00	5 63	6 00	94 25	44 17	33 53	6 00	12 38	96 08	+ 1 83
Holstein	2 00	48 53	42 16	5 63	6 00	104 32	41 94	23 21	6 00	12 38	83 53	−20 79
Average (grades of six breeds)	2 00	42 40	39 99	5 63	6 00	96 02	44 69	27 50	6 00	12 38	90 57	− 5 45
Shorthorn (fed on skim-milk).	2 00	29 59	41 40	5 63	6 00	84 62	40 28	23 97	6 00	12 38	82 63	− 1 99
Scrub or native	1 00	39 61	39 90	5 63	6 00	92 14	27 13	12 36	6 00	12 38	57 87	−34 27

No conclusions should be drawn from this table without carefully weighing all the facts relating to the experiment during the two years of its continuance.

The value put upon the animals at birth was of necessity an estimate that would be about the real value when they were dropped.

The cost of attendance was reckoned on the basis that one man would feed and care for seventy-five animals per day for the first six months under ordinary conditions when the food has all been made ready, sixty animals for the second six months, and fifty for the second year.

The animals were sold separately for the following prices per pound live weight, viz.: The Galloway grade, $5\frac{1}{2}$c.; the Shorthorn grade, 6c.; the Aberdeen Poll, $5\frac{3}{4}$c.; the Hereford grade, $5\frac{1}{2}$c.; the Devon grade, 6c.; the Holstein grade, 5c.; the Shorthorn grade fed on skim-milk, 5c., and the native or Scrub, $3\frac{1}{4}$c. They were also valued at the same time by Mr. John Phin, who did not know of the prices for which they had been sold, and yet the valuation made by Mr. Phin was almost in perfect agreement with these prices. Although we have every confidence in the ability of both Mr. J. Phin and the purchaser, Mr. L. O. Barber, to value the animals at their true worth, where so many interests are involved a larger jury of equally competent valuators would probably have given more complete satisfaction to the general public; and we are prepared to admit frankly that this is one of the weakest points in the experiment viewed in the light of its defensibility, but there were difficulties at the time in the way of carrying out our desires in this direction. We may add here that the relative valuations given are quite in accord with our own judgment.

The estimated amount of manure made per animal was 21,423 lb. This was reckoned as worth $1.50 per ton. From the sum thus obtained the deduction was made of 4,929 lb. straw used for bedding; the home value of the straw was put at $1.50 per ton. This estimate as to quantity was based upon actual results obtained from a test conducted simultaneously with another steer, and mainly with the object of ascertaining the amount of manure produced by a cattle beast during different stages of its growth. This mode of estimating the amount of the manure made was also adopted during the first year of the experiment. This steer had been fed very similarly to those in the experiment we are now considering.

Behavior of the Animals During the Contest. The Galloway grade, as was mentioned in the report for 1890, p. 196, was fifty-three days old when it reached the farm. It consumed but a small amount of milk, hence the markedly less cost for food during the milk period. He was a rugged, well-doing animal from the first, eating heartily and making a good use of his food. As he advanced in age he showed a strength of bone and a slight absence of symmetry of development not strictly compatible with the highest excellence of quality. A slight mistake occurred in Bulletin LXX in stating the estimated amount of milk consumed by the Galloway before reaching the Farm. Instead of $2,091\frac{1}{2}$ lb. as given in Bulletin LXX., it should be 1,525.9 lb., as given in the Report of 1890, p. 199. But this error does not affect the summing up of financial results, as these are all correctly given in the said bulletin.

The Shorthorn grade was a good doer from the first. He ate well, made good use of his food and retained his shapes in good form to the last.

The Aberdeen Poll grade was somewhat lacking in individual development from the first. He was always a little under size for his age, but was possessed of fair quality.

The Hereford grade, which developed creditably during the first year, failed to make so good a record during the second. He was occasionally off his feed, which is in keeping with the low increase in weight which he made. He did not, in consequence, so well retain his bloom to the close of the experiment as some of the others, and when sold showed some slight indications of roughness.

The Devon grade was a tidy, smooth, symmetrically developed steer, which on the whole fed well and retained his shapes to the last.

The Holstein grade was a rugged steer from the beginning to the end. He fed well and made relatively fairly good gains.

The Shorthorn grade fed on skim-milk, was never at any time a very smooth or shapely animal. When nineteen months old he was quite unwell for a time. During one month, at the time indicated, he lost forty-two pounds in weight. He showed some lack of thrift from that time onward until he was sold. It was ascertained at the time of slaughtering that he was affected with what may be termed a tumor in the lower part of the abdomen, and in close proximity to the paunch.

The native or Scrub had general good health. He was always hearty, and able and willing to take a fair allowance of food and made fairly good gains, more especially during the second year.

DISPOSAL OF THE STEERS. They were sold at the prices named to L. O. Barber, Guelph, who had them dressed in his own slaughter-house, where they remained open to public inspection for three days prior to their shipment to Halifax.

NOTES ON THE DRESSED CARCASSES. The following notes were taken while the dressed carcasses were still hanging in the slaughter-house:

Galloway Grade. The carcase of the Galloway grade was strong in shoulder, and it possessed an extraordinary amount of kidney-fat.

Shorthorn Grade. The Shorthorn grade killed well. The fat was well distributed over the whole outer surface of the body, and there was a moderate amount of internal fat. The development of hind quarter was excellent.

Aberdeen Poll Grade. The carcass of this steer was neat and smooth. He had a very large amount of kidney-fat, but was only moderately deep in the loin, and the amount of bone was relatively small.

Hereford Grade. This steer killed more smoothly than he appeared when living. He possessed but a moderate amount of internal fat. He had fair depth of loin and his carcass was pronounced very good for the uses of the butcher.

Devon Grade. The carcass of the Devon grade resembled that of the Shorthorn in external appearance, the fell not being quite so well covered, however, and this holds true of all the others. In depth of loin he was not quite equal to the Shorthorn.

Holstein Grade. The Holstein grade was not so well covered externally. There was an undue amount of fat over the ribs. He possessed a fair depth of loin only. The meat presented on the whole a not unattractive appearance, evidently somewhat light in the hind quarters.

Shorthorn Grade (fed on skim-milk). The carcass in a general way resembled that of the Shorthorn fed on new milk, with the difference that there was considerably less fat externally and internally.

Native or Scrub. He died as he had lived. There was a lack of thickness of carcass throughout, the deficiency in depth of rib and loin being very noticeable, and the absence of what may be termed fleshiness was conspicuous.

Six inches above the knee the shanks measured in circumference, as follows: Galloway grade, $17\frac{3}{4}$ in.; Shorthorn grade, $17\frac{1}{2}$ in.; Aberdeen Poll grade, $15\frac{3}{4}$ in.; Hereford grade, 16 in.; Devon grade, $16\frac{1}{4}$ in.; Holstein grade, 16 in.; Shorthorn grade fed on skim-milk, $15\frac{1}{4}$ in.; native or Scrub, $15\frac{1}{4}$ in.

Behavior on the Block. The carcasses of the animals were duly labelled and consigned to Mr. J. A. Leaman & Co., Halifax, by whom they were carefully weighed before being finally disposed of. The relative proportion of the dead weight to the live weight in the different animals is as follows: Galloway, 61.68 per cent.; Shorthorn, 65.42 per cent.; Aberdeen A. Poll, 63.57 per cent.; Hereford, 62.86 per cent.; Devon, 62.68 per cent.; Holstein, 62.59 per cent.; Shorthorn (fed on skim-milk), 62.12 per cent., and the Scrub or native, 57.53 per cent.

Through the kindness of Mr. Leaman we are enabled to give sketches of four of the most valuable cuts of each animal, viz., the sirloin roast, the sirloin steak, the rib roast and the plate.

A careful scrutiny of these sketches brings out many points of difference in reference to the size of the cuts from the respective animals, the amount of kidney-fat possessed by each, the depth of the loin, the relative amount of bone, the relative proportions of fat and lean respectively and the intermingling of these on the opposite.

In the comparison given below wherein the meat of the respective animals of the experiment is contrasted, that of the Shorthorn is used as the standard, for the reason that the relative number of the Shorthorn grades reared for meat-making in Ontario in the past has been much greater than of all other grades combined.

SHORTHORN GRADE.

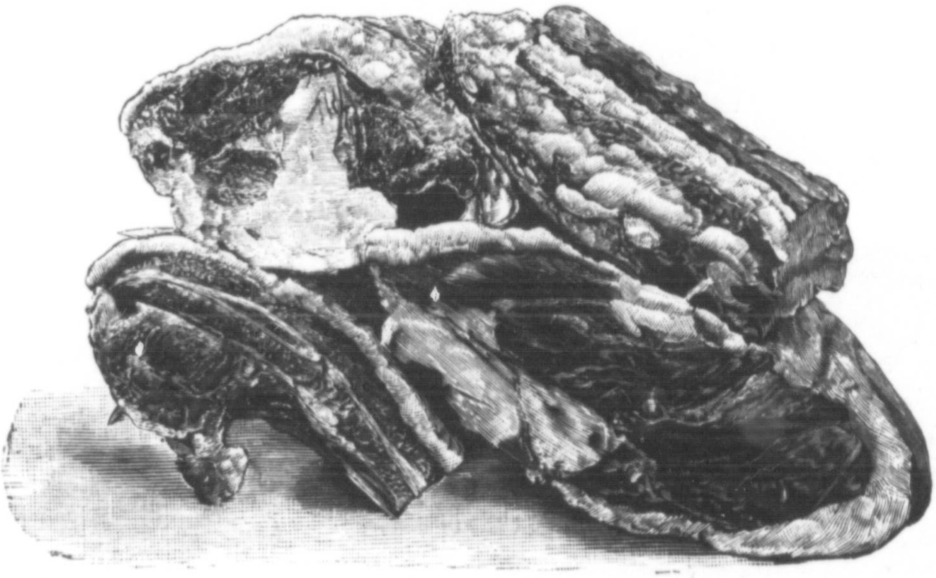
The more prominent characteristics of the cuts of the Shorthorn are shown in their size, in the depth of the flesh, in the moderate amount of the internal fat, the large amount of the external fat on the sirloin roast and the sirloin steak and in the comparative absence of marbling in the flesh, notwithstanding which the whole amount of good edible meat is certainly large.

GALLOWAY GRADE.

The more prominent characteristics of the cuts of the Galloway are the large amount of the internal fat, the small size of the plate and the beautiful flecking of the meat. Compared with the Shorthorn there is much more fat on the kidney but less on the externa portions. There is much less of size and more of leanness in the plate and a more perfect flecking of the meat especially in the rib-roast. The disposition of the fat and lean in the rib-roast of the Galloway is simply perfect.

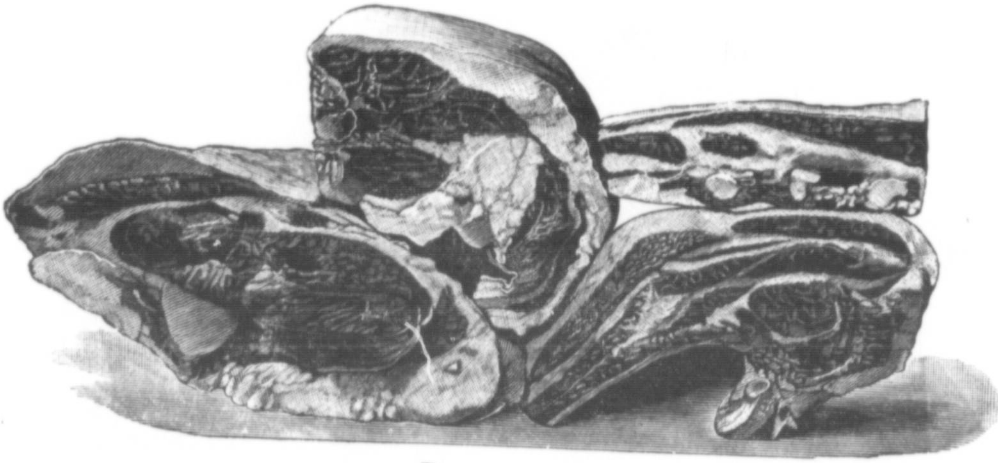
HEREFORD GRADE.

The most prominent feature of the meat of the Hereford is the large proportion of the fat to the lean, both internal and external, and the excess of the fat in the plate. Compared with the Shorthorn the Hereford has more of fat relatively, especially in the sirloin roast, and plate cuts, the plate is not so deep and the veins of fat are more pronounced in the Hereford, more especially in the rib-roast.



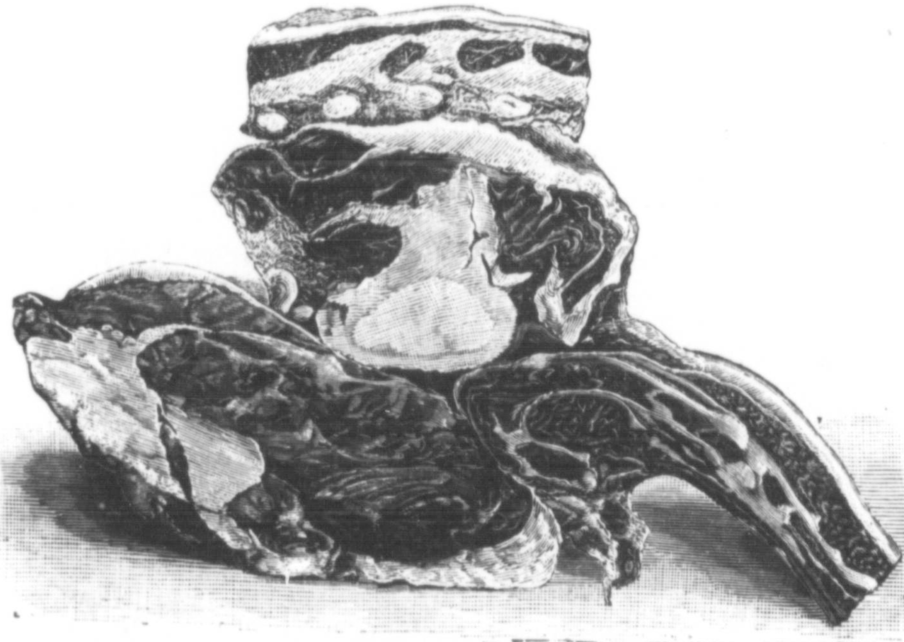
ABERDEEN POLL GRADE.

The chief of the features of the meat of the Aberdeen Poll are found in the depth and fatness of the plate and in the marbling and flecking of the meat. Compared with the Shorthorn the size of the sirloin roast is less as is also the quantity of lean meat in it, and the rib roast is not so deep, but the flecking of the meat, especially in the sirloin, as in that of the Galloway, is more perfect. A slice from either of these would doubtless be tender and juicy.



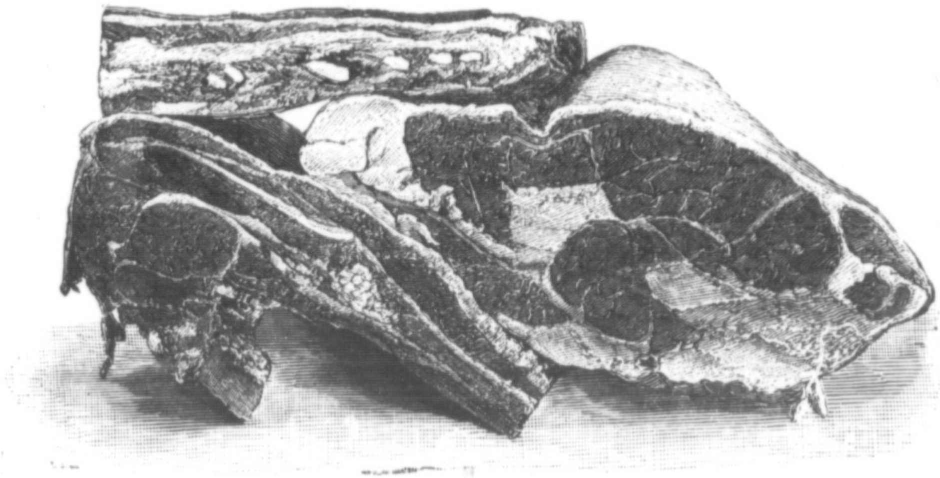
DEVON GRADE.

The principal characteristics of the meat of the Devon are found in the marbling of the same and in the large amount of the external fat on the sirloin steak and sirloin roast. Compared with the Shorthorn there is more of external fat on the larger cuts of the Devon, much less of size in the plate and more of marbling in the flesh. The rib-roast in the Devon is particularly good.



HOLSTEIN GRADE.

The more prominent features of the meat of the Holstein are found in the large amount of solid kidney-fat, the large proportion of the fat in the plate and in the nicely mixed character of the meat, more especially in the rib-roast. Compared with the Shorthorn there is less of depth of meat in all the cuts, more of solid fat in proportion to the lean, and withal more of what may be termed veining, especially in the rib-roast.



NATIVE OR SCRUB.

The chief characteristics of the meat of the native or Scrub are found in lack of depth in all the parts. It is unfortunate that the sirloin roast cut is not shown in this instance, as the amount of kidney-fat was decidedly deficient. Contrasted with the Shorthorn there is much more of thinness of meat, that is to say, lack of covering of the bony parts and lack of depth of flesh. The covering of external fat is also much less, but the blending of the fat and lean cannot be objected to.

The following are some of the more important conclusions to be drawn from the second year's feeding:

1. The great importance of quality in animals that are reared for making beef. The price received for those in the experiment varied from 6 cts. per pound live weight to 3¼ cts.

2. That in rearing beef-animals when they are fed a forcing ration during the first year, the results of the second year's feeding will not be satisfactory either as regards the general well-doing of the animals or financially.

3. That there is a marked difference in the constitutional ability of animals to bear a forcing ration, as witnessed in the behavior of the Galloway grade for instance, which made the highest daily gains during the second year of feeding.

4. That in rearing animals for beef when fed a forcing ration for two years as in this experiment the meat will be made at a loss. In this experiment the extent of the loss was $68.96 on the eight animals with the value of the manure included.

5. That the expense of rearing the native or Scrub, including outlay and income, was more than that of rearing the average grade by $28.82, and more than that of the Shorthorn fed on skim-milk by $32.28, while the total loss on the native or Scrub for the two years was $34.27.

6. That stall-fed animals though allowed daily exercise in a barn-yard will lose weight for a time when turned out on a grass pasture, and that travelling by rail though but for a short distance followed by change of surroundings for but a short time will seriously interfere with the gains of the animals.

General Observations.

Some of the objects of this experiment have been attained. Some light has been thrown upon the average cost of rearing grade steers for purposes of beef production from birth until early maturity when fed upon a heavy or forcing ration. We have found, as was anticipated, that feeding such a ration has given results that are not satisfactory. Then why, it may be asked, was the experiment undertaken? In answering this question we ask the reader to bear in mind that this is but the first of a series of experiments all bearing upon beef-making. All shades of opinion prevail in reference to the rapidity with which beef should be made. Some argue that the animals should be forced along from the first as quickly as they will take food. Some favor liberal feeding without forcing until the finishing period arrives. And yet others favor what may be termed an economical ration—feeding the animals but moderately and keeping them on what may be termed cheap rations until the finishing period. It is important, therefore, that all the light that may be available should be thrown upon these questions. This experiment has shown the easy possibility of feeding a ration too stimulating and too costly to get satisfactory results. But some allowance should be made in all feeding that is done at experiment stations for the hindrance to progress brought about through frequent disturbances necessitated by the presence of a visiting public. Because of this influence the best possible results can never be attained at these stations, so long as the animals are thus exposed to the disturbing influences mentioned.

In the next experiment the economical ration will probably be adopted, which will give excellent opportunity for comparing the merits of the two methods.

The second object of the experiment, viz., the comparative cost of rearing grade steers on whole and skim-milk respectively, and the effects of these on development after the termination of the milk period of feeding have been but imperfectly realized, owing to the temporary indisposition of the steer which had been fed upon the skim-milk ration toward the close of the test. This effectually bars the way to comparison during the second year of the experiment. Some important lessons are gleaned, however, from the first year's feeding, as pointed out in Bulletin LXX, p. 8, wherein it is shown that while the average cost of a whole milk ration with adjuncts for the first six months was $24.40 per animal, the cost of feeding the Shorthorn grade on skim-milk with similar adjuncts was but $9.06, and that although in the comparison then drawn there is a difference of $15.34 in the cost of the food, the difference in the value of the animals at the close of that period was but $5.15. It is also shown on page 9 of the same bulletin, that the animal fed on skim-milk cost $12.81 less than the average grade fed on new milk, whereas his value at that time was but $4.41 less.

Some information has been gleaned which should prove really valuable in reference to the third object of the experiment, viz., the comparative cost of producing beef from well-graded and native or Scrub animals respectively, whereas in the two years of the experiment the cost of the Scrub was $3.88 less than that of the average grade, his value at the end of that time was less by $32.70. The advantage therefore in favor of the average grade as compared with the Scrub is represented by $28.82. But it should be carefully noted that the difference, large as it is, chiefly arises from a difference in quality.

We have also gained valuable information in regard to secondary objects of the bulletin, more especially in regard to the relative cost of rearing animals for beef production during different periods of growth when fed upon a heavy ration, and also in regard to the relative daily gains. At the end of the first year the average grade of the six breeds showed a profit of 66c., while at the end of a second year he shewed a loss of $5.45. During the first year the average grade shewed a gain of 2.32 lb. per day, while during the second year it was but 1.22 lb. per day. These results confirm the opinion that so far as the individual animal is concerned the relative weights and also the relative profits decrease as we recede from the birth period when a forcing ration is used.

The whole question is one of much importance as well as of great interest. The field for investigation along the lines entered upon is practically without limit. It is our intention to pursue it indefinitely in the hope of gleaning information that will be of much practical utility to the farmer, and in the pursuit of these investigations we shall give much prominence to the question of the economical production of beef.

45. Corn Ensilage for Making Beef.

This experiment began December 16th, 1891, and closed on May 13th, thus covering a period of 150 days. It is the third of a series of experiments conducted at this station with the same objects in view.

The chief of the objects of the experiment were (1) to ascertain the relative value of the following rations for making beef, viz., ensilage and meal; ensilage, hay and meal, and roots, hay and meal, and (2) to ascertain the cost of making beef when the values of food and meat are both considered. The animals selected were fairly good grade steers in which there was a predominance of Shorthorn blood. They were purchased by Mr. J. E. Storey, the farm foreman and brought to the farm July 25th. They were then put on grass pasture and so kept until October 12th, at which date they were put in the stables. During this period, viz., while they were on pastures the average gain per day on the whole lot was 1½ pounds.

Period of Preparation. On November 29th six uniform animals were chosen and divided into three groups, with two animals in each group. They were placed in double stalls, one group in each stall. They were fed for 16 days previous to the commencement of the experiment, on the same rations as were given them during its continuance. The object was to accustom them to the new diet.

Food and Feeding. The animals in group 1 were fed all the ensilage they would eat clean. The aim was to give them 10 pounds of meal per day per animal. Those in group 2 were given 30 lb. ensilage per day, the same amount of meal as the animals in group 1, and all the cut hay they would consume. Those in group 3 were given 45 lb. sliced roots per day, the same amount of meal as was given to each of the other groups, and all the cut hay they would consume. The hay was principally timothy, and the roots were turnips and mangels. The meal consisted of equal parts by weight of peas, oats and barley. The foods fed to the respective groups were mixed just before being fed, and were given in three feeds per day. They had salt and water at will.

Food Eaten. One of the animals in group 1 died on January 25th, forty days after the commencement of the experiment. He was observed off his feed on January 23rd, and died two days later. J. Hugo Reid, V.S., of Guelph, was called in the absence of Dr. Grenside. He at once gave it as his opinion that the steer would not recover, and furthermore that the ensilage fed was concerned in his illness. A post mortem examination was made by Dr. Reid the same day on which the steer died, and the next day, Jan. 26th, he forwarded the following report: "By post mortem held by me on steer that died on the farm yesterday, I wish to state that I found a rupture in the fourth or true digestive stomach, with an escape of a portion of the contents. There was inflammation of the peritoneum and slight inflammation of the small intestines. The rupture of the stomach was caused by gases formed from the food in the stomach, and such food when fed in large quantity appears to be of an indigestible nature. Death was no doubt caused by said rupture." One of the animals also in group 2 occasionally refused food. For 20 days in succession in the month of March he would not eat ensilage, and his gains in consequence were unsatisfactory. Because of these experiences we decided that it would be more satisfactory to use but one animal in each group for purposes of comparison. As we have thus far in this series of experiments used the term group, we shall continue to use it as a matter of convenience, although the reference in future will be but to one animal.

The following amounts of food were consumed daily by each animal:

	Ensilage. lb.	Roots. lb.	Hay. lb.	Meal. lb.
Group 1	53.50	....	....	9.64
Group 2	28.39	....	7.22	9.55
Group 3	....	41.43	10.39	9.67

Weights of the Animals. Fasted weights were used both at the commencement and the close of the experiment. The fast consisted in withholding food from 6 p.m., after the evening meal had been given, until the animals had been weighed the following morning. Natural weights were taken frequently throughout the experiment for the reason, among others, that in case of mishap we would have the necessary data for calculations. It may be mentioned here that the average shrinkage in weight from fasting was $42\frac{2}{3}$ lb. at the commencement of the experiment and 31 lb. at its close.

Table LXVIII. Analysis of weights of the animal in each group.

	Group 1.	Group 2.	Group 3.
	lb.	lb.	lb.
Weight at commencement	1298	1399	1364
Weight at close	1581	1601	1607
Increase per animal	283	202	243
Average daily increase per animal	1.89	1.35	1.62

For the animal in No. 1 group made the largest gains, notwithstanding that he was off his feed on two or three different occasions for a short season. That in No. 2 group was also off his feed occasionally, but only for a brief interval at one time. The steer in No. 3 group had uniformly good health all the time.

The Estimated Value of the Food. The meal, the roots and the hay were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. The home value put upon the oats therefore was 26 cents per bush., peas 50 cents, barley 40 cents, roots (sliced) 6 cents per bush., and hay when cut $9 per ton. Corn ensilage was valued at $1.75 as in the corresponding experiment of last year. The grinding of the grain was put at 6 cents per 100 lb. The cost of the daily ration given was: To the animal in group 1, 13.07 cents; in group 2, 14.04 cents and in group 3, 17.24 cents.

The ensilage ration, therefore, was the cheapest of the three. If that were the only consideration we have no hesitancy in recommending it before either of the others, but various weighty considerations claim our attention, such as its effects upon the life of the animals. On the other hand, if the cost only were to be considered we would pronounce against the root ration; but it has important advantages which must not be ignored. Further reference will be made to these points.

Table LXIX. Financial result of the experiment.

	Group 1.	Group 2.	Group 3.
	$ c.	$ c.	$ c.
Cost of animals at commencement of test	51 92	55 96	54 56
Cost of food	19 60	21 06	25 86
Cost of attendance	3 13	3 13	3 13
Total cost	74 65	80 15	83 55
Value of animals at close of test	92 88	94 06	94 41
Value of manure	6 75	6 75	6 75
Total value	99 63	100 81	101 16
Gain per animal	24 98	20 66	17 61

VALUES. At the commencement of the experiment the animals were valued at 4 cents per pound live weight, which was the average market price paid for steers of this class at the time. They were sold for $5\frac{7}{8}$ cents per pound on May 18th, 1892, two days after the experiment closed. The cost of attendance was computed on the assumption that one person, at $25 per month, would feed and care for 40 head under ordinary conditions. This was the estimate used in the corresponding experiment of the previous year. At the close of the experiment the animals were sold to go to Britain at $5\frac{7}{8}$ cents per pound, fasted live weight.

The manure was estimated at $1.50 per ton, as in the corresponding experiment of the previous years, and the value of the bedding was deducted therefrom in the same way as in the experiment referred to.

The total net cash gain on the 3 animals used in the experiment was $43, equal to a cash gain of 18.04 per cent. on the investment. The total gain on the five animals was $54.75, equal to a cash gain of 13.07 per cent. on the investment. The total loss on the six animals of the experiment, including the dead one, was $7.09. This estimate includes the food eaten by the animal that died, and all other outlay for the six animals, and for the food consumed by them, but it does not include the cost of attendance or the value of manure.

When the manure is included the total gain on the three animals of the experiment was $63.25, on the five animals sold at its close $88.50, and on the six animals $27.32.

The amount received for the three animals of the experiment when sold on May 18th, was $281.35, which was within 65 cents of being twice the sum paid for them on July 25th, 1891, when they reached the farm.

CONCLUSIONS FROM THE EXPERIMENT.

1. That the total cash gain on the investment when the three animals are taken into the account, without including the manure, and the cost of attendance, was $43, and the average gain on each animal $14.33. When these items are included the total gain is $63.25, or an average of $21.08 on each animal.
2. That in this experiment the cost of food in making 100 lb. of increase in live weight from the ration of ensilage and meal was $6.93, from that of ensilage, hay and meal, $10.43, and from the ration of roots, hay and meal $10.64.
3. That in this experiment an average individual daily gain was made of 1.62 lb., at an average cost of 14.78 cents for the food used.
4. That there is some hazard in feeding a full ration of ensilage to animals that are being fattened when it is fed in conjunction with meal only.
5. That in this experiment the value of the animals for beef purposes was increased by the fattening process an average of $1\frac{7}{8}$ cents per pound live weight.
6. That while the shrinkage in weight from a 12 hours' fast in the stable was $42\frac{3}{5}$ lb. per animal at the commencement of the experiment, it was but 31 lb. at its close.

CONCLUSIONS FROM THE THREE CORRESPONDING EXPERIMENTS CONDUCTED IN 1890, 1891 AND 1892.

These conclusions give the results from three experiments for three consecutive years, and from five animals with the three different rations used.

1. That the daily average cost of each ration was as follows:

Ensilage, hay and meal	16.78 cts.
Ensilage and meal	16.90 "
Roots, hay and meal	19.10 "

2. That the average daily increase of live weight from each ration per animal was as follows:

Ensilage and meal	1.88 lb.
Roots, hay and meal	1.74 "
Ensilage, hay and meal	1.63 "

3. That the average selling price of each animal fed on the different rations with the cost of food added, exceeded the buying price as stated below :

Ensilage and meal	$12 65
Ensilage, hay and meal	10 95
Roots, hay and meal	8 22

4. That from the behavior of the animals fed ensilage and meal we do not consider this ration a perfectly safe one for finishing live stock in beef-making, as, out of the six animals fed upon it, two died and three were occasionally off their feed.

5. That from the behavior of the animals fed ensilage, hay and meal, we conclude that these food factors form a much safer ration than one composed of ensilage and meal only, although the animals fed upon it gave some trouble by occasionally refusing to take their food.

6. That from the behavior of the animals fed roots, hay and meal, we conclude that this ration is a very safe one to use in finishing live stock for beef making, as the six animals fed upon it had uniformly good health all the time.

7. That steers 1,200 lb. and upwards shrink in the neighborhood of 40 lb. with a fast of 12 hours while standing in the stable during the finishing period; that the shrinkage decreases somewhat as the fattening period progresses; that it is considerably greater while they are at liberty in a yard while being fasted, and when thus fasted the shrinkage will be less when the animals are given exercise occasionally.

Note. The sources of the information from which these conclusions are drawn are Bulletin XLIX, the Annual Report for 1891, p. 106, and the experiment narrated above.

General Observations.

1. It will be apparent to the thoughtful reader of the reports issued on these experiments in beef-making for the past three years, that the principal object of the same has not been realized as yet. This leading object was "to ascertain the relative value of ensilage and meal ; ensilage, hay and meal ; and roots, hay and meal in beef-making." While they have shown that the ensilage and meal have produced the highest daily gains, and that they furnish a cheap ration relatively, they have also demonstrated that there is an element of danger in feeding them which in the end may make them too costly for beef-making. They certainly formed the dearest ration of the three if we take into account the animals which died through feeding it, and that is, of course, the proper way of reckoning. Unless we can adopt some mode of feeding it which will completely eliminate the element of danger, we cannot regard this ration as being either safe or profitable to use alone in beef-making.

While the ensilage, hay and meal furnished a cheap ration, and on the whole a safe one, it cannot be said that our experience with that ration has been completely satisfactory. Those occasional spells of temporary indisposition which some of the animals manifested, though of brief duration, are calculated to give some anxiety to the careful feeder. The explanation that heavy feeding may have been the exciting cause is not a sufficient one, for the animals to which the roots and hay were fed were getting identically the same meal ration as those getting the ensilage and hay, and yet the former maintained uniformly good health throughout the three experiments.

The excellent health maintained by the animals which were given the ration of roots, hay and meal is so far satisfactory, but this satisfaction is considerably lessened when we reflect that the five animals fed this ration come third in point of daily gains, and in reference to profit we cannot give them higher than a second place.

2. Some progress has been made in reference to the solution of the second object of these experiments, viz.: to ascertain the cost of making beef when the values of food and meat are both considered. These experiments have demonstrated that beef can still be made at a cash profit in Ontario when good grade animals about two years old are carefully purchased and judiciously fed, for in these experiments we have still a net cash profit of $37.03, throwing the two dead animals into the compost heap. This profit does not include the items of attendance, bedding and manure.

But these experiments have not succeeded in making meat at a profit on the actual increase in weight, that is to say, the increase in live weight alone will not in any case at the prices which it brought when sold pay for the food used in making it. The profits relatively were greater on the animals carried through experiments Nos. 2 and 3 than they were with those of No. 1. Notwithstanding, with those of No. 2 experiment 100 pounds of increase in live weight, required a cost of $8.86 for the food, and with those of No. 3 experiment a cost of $9.33, while the price realized in both cases was but $5.87½ per 100 lb. The profit was found in the increase in the value per pound of the live weight of the animals when they entered the experiment. Whether this feat can ever be accomplished during the finishing season under ordinary conditions is a question which the future alone can reveal.

This question also raises another, the solution of which is all-important in growing beef, viz: do the growers of store animals get compensation for their labor and the food used when they raise animals up to the age of two years or thereabouts, and then sell them for four cents per pound live weight, which was about the price paid for the animals used in these experiments. There is great room for valuable investigation in solving this problem.

Although these experiments have not accomplished all that we could wish, they have made two things very apparent, and both are important. First, they have made it pretty clear that ensilage and meal alone do not furnish a ration that is altogether safe for finishing beef cattle. We not only lost outright two animals out of six fed upon it, but three of the remaining four had periods of greater or shorter duration, when they were so indisposed that it was necessary to change the ration for a time to restore the equilibrium. It may be hinted that ensilage has varying degrees of sweetness, hence it may be possible to make ensilage that will not be attended with danger when thus fed. While this may be true, is the average farmer, we ask, competent to make it under all circumstances, or even in a majority of instances, so that all danger will be eliminated? And second, they have proved in a comparative sense the great safety in feeding a ration of which roots is an important factor. In a country so well adapted for growing roots as Ontario we feel like calling out "not so fast" to those who are advising the farmers to substitute corn for roots. We rather advise in the meantime, continue to grow roots and grow corn also.

Since these experiments have not accomplished all that we have been seeking, we think it would be a great mistake to bring them to a close at the present stage. Valuable facts remain yet undiscovered. It is clearly our duty to seek them further. From what we have done we feel like saying there is an element of great excellence in corn ensilage as a food factor in making beef. But we do not seem to have discovered the very best way of feeding it. Has anyone else? We shall therefore go on with some modifications. We want to learn how much fodder, as hay or straw, or hay and straw, must be added to render the finishing ration a perfectly safe one, and with this and kindred objects in view we shall continue these investigations.

46. Feeding Rape to Cows for Milk Production.

Much has been done at this Station in the past few years to test the real value of rape as a food for fattening sheep, but not until this season has this plant been used as a food for milch cows. There are those who claim that rape would be unsuitable for milk production owing to the taint which would likely be in the milk from the rape if fed to cows. To glean information upon this and other points in regard to the use of rape, an experiment was commenced on October 20th, 1892. Four cows were chosen and divided into two groups. The test, which lasted 53 days, was divided into four periods. During the second and fourth rape was given, and during the first and third no rape was fed. The cows each received 5 lb. of meal per day throughout the experiment. This along with pasture, formed the ration of the first period, and the meal along with hay and ensilage formed the ration of the third period. Group I was allowed 40 lb. of green rape per day and all the hay they would eat, and group II received all the rape they would take but got no hay in addition. The average daily amount of rape eaten by each animal in group II was 75.7 pounds. The following was the average daily amount of milk obtained from each animal in each group:

			milk.
Group I.	Ration	with rape	19.13 lb.
"	"	without rape	17.25 "
Group II.	"	with rape	18.20 "
"	"	without rape	17.74 "

From this it will be observed that the heaviest yield of milk was obtained from rape and hay, and the second heaviest from rape without hay. The lowest yields in both groups were when no rape was given.

The rape was fed both before and after milking, and the milk after being tested in several families was reported to be perfectly good with no perceptible taint of any kind. Mr. Rogers, the assistant in the dairy department, kindly tested the milk with the Babcock tester and found a slightly larger percentage of butter-fat in the milk from the rape ration than from the ration in which rape did not form a part. These facts point to the importance of a further study of rape as a food for milch cows.

47. Feeding Calves on Skim-milk, Skim-milk and Linseed Meal, and Whole Milk.

In this experiment which is still under way, six Shorthorn grade calves are being fed. They were selected in the spring of 1892, and were divided into three groups of two each. They were all fed a free and full supply of milk until they were five months old. Those in the first group were fed skim-milk without linseed meal. In the second group they were given skim-milk and linseed meal, and in the third group whole milk. Other adjuncts as hay, meal, etc., were given them as soon as they would take it, and they were all given the same adjuncts in kind. These adjuncts were continued after the milk period in such a way as to promote quick development, and it is the intention to finish them at about one year old. They will be fed heavily during the finishing months. The chief of the objects of the experiment are to ascertain the comparative cost of the rations used, and also their relative suitability, with the further object of determining the most economical rations in rearing young animals for meat-making.

48. Determining the Amount of Manure Made by a Cattle Beast.

This experiment has been going on for more than two years. It is the intention to carry it on until the animal is at least three years old. It is one of rare interest, and should prove of much value when completed, and more especially when confirmed by repeated experiment. We will then be able to use data which will be very near the truth as a basis for calculations relating to farm-yard manure. In the past these have been estimates made oftentimes with but little precision. On December 23rd, 1892, Prof. Shuttleworth handed to us the statement of the results of the analysis of the manure taken from the stall a short time previously. This analysis represents the average of several determinations which were in substantial agreement. The analysis is as follows:

	per cent.
Water	53.51
Nitrogen	.634
Phos. acid	.829
Potash (K20)	1.494

These results speak of high quality in the manure, but this is what we should look for from a grain-fed beast, kept in a box-stall. The experiment and also the lessons to be learned from it will be given in detail when it is completed.

49. Determining the Relative Value of Six Varieties of Clover Hay and Three Varieties of Sunflower for Milk Production.

Six varieties of clover hay were fed to a milch cow to learn something of the relative value of each in milk production. Three varieties of sunflower were grown and used for the same purpose. While the results are interesting it is considered unsafe to present them to the public until repeated tests have been made. The sunflowers were eaten readily, but when fed in large quantities caused the cow to purge. The milk from the cow when fed sunflowers was of good flavor and possessed good keeping qualities.

50. Determining the Effects of Constant Confinement Upon the Breeding Properties of a Cattle Beast.

To show the effects of constant confinement upon the breeding properties of a cattle beast an experiment was commenced in 1890 and closed in 1892. An Ayrshire grade heifer calf was chosen for the test. From the time she was born on May 20th, 1890, until December 20th, 1891, she was not allowed out of her stall except during the second summer when she became crippled in the limbs and was allowed exercise for a short time daily for about two weeks. On September 23rd, 1891, she was served by the Ayrshire bull, on October 12th again by the same bull. On October 31st she was served by the Holstein bull, and again on December 6th by the same bull, but these bulls were unable to get her in calf. On December 23rd the heifer was in season again but was not served. On December 24th she was turned out for exercise and this was kept up regularly. On January 9th, 1892, she was again served by the Holstein bull, and on January 27th by the same bull again. The last service was effectual and she gave birth to a calf on November 6th, 1892. This goes to show that constant confinement is apt to effect very materially the breeding properties of a cattle beast.

51. Fattening Lambs.

During the past three years we have been giving considerable attention to the subject of fattening lambs, as has been indicated in the respective Annual Reports issued in those years. We are still experimenting somewhat largely in the hope of gaining further knowledge in reference to this very important but hitherto very much neglected industry, as will be shown in the proper place. In the autumn of 1891, 666 lambs were purchased and brought to the Station with a view to fatten them on food nearly all of which had been grown on the farm. In the statement of the Farm foreman, given on page 139 of the Annual Report for 1891, the number of lambs is given as 676, but in this statement 10 lambs are included which of necessity were bought when securing a car-load. They were so light that they were considered unfit for shipment. They were therefore sold on the Island for what they would bring and the money received for them accounted for separately, without in any way mixing up the transaction with that relating to the 666 lambs actually brought to the Station.

The particulars relating to the purchase of these lambs are given in summary below:

Date of purchase.	Where bought.	Cost when laid down at the Station.
August 29	200 lambs in eastern Ontario	$669 10
September 14	200 lambs in Prince Edward Island	552 61
October 7	162 lambs in Prince Edward Island	483 98
" 20	104 lambs in Toronto	391 65
Total		$2,097 34

The cost of the purchase and transit of the 362 lambs from Prince Edward Island to Guelph averaged $0.95 per head, or 49⅓ per cent. of the purchase price of the lambs, the distance between the two places being from 1,100 to 1,200 miles. The average purchase price of each lamb was $1.92. The chief of the reasons which led us to purchase the lambs so far away from the Station include the following:

1. To encourage the system of finishing lambs in all parts of the Dominion in finer form than is usually done. In nearly all the provinces, and more so in the outlying provinces of the Dominion, lambs are put upon the market in the late summer or the early autumn months with no other finish than that furnished them by pastures which oftentimes are ill-adapted to the purpose at the seasons mentioned.

2. To demonstrate that such lambs as we have at present can be so handled that they will bring us a much better price than is ordinarily received for them. When lambs are put upon the market in a half-finished condition, the seller is, in a sense, at the mercy of the buyer, as the competition for a marketable article for daily consumption is usually in proportion to its excellence. When nearly all farmers are selling ill-finished lambs at the same season the price paid cannot be otherwise than discouragingly low. But we would have it distinctly understood at the same time that while we seek further improvement in the mode of handling such lambs as we have, we are convinced that every reasonable effort should be made to improve the breeding of our lambs, which in very many sections is deplorably low.

3. To demonstrate the helpfulness of rape as an aid in fattening lambs whether they are to be sold at the close of the pasturing season or carried on into the winter months and sold in even completer form and at higher prices. The growing of rape in Ontario even is as yet understood by but few farmers, while in the other provinces it is scarcely practiced to any extent. It is only fair to them that this station should endeavor to prove helpful to those provinces which send so large a number of students relatively to our College.

Character of the Lambs. The lambs purchased in eastern Ontario were a fairly good lot, though small. As will be seen by reference to the weights given below, they were considerably under the average of lambs of the central and western parts of Ontario which at the season indicated would probably average 80 to 85 pounds. They were of mixed breeding, with a goodly sprinkling of dark faces and feet indicative of the free use of the Down crosses. They consisted of ewes and wethers, as in purchasing, care was taken to reject all uncastrated males.

The lambs from Prince Edward Island were light and small, as will be observed by reference to the weights given further on. Some of them showed traces of the Down cross, a few were fairly plump grade lambs of the long-wooled breeds, but the major portion had those rusty, innocent-looking narrow faces which invariably speak of generations of a species of in-breeding which is done in an aimless way. Some were entirely black and some variously striped as we used to see in the days of long ago. In body they were rather light and too long in neck and limb, and lacked considerably in regularity of outline. The breasts were rather narrow, and the same was true of the backs. The heart-girth was somewhat lacking, the fore-arm a little light, and the thigh and twist rather deficient. In a word, they were lacking in that breadth and depth and rotundity and plumpness of form which are inseparably associated with robust lambs that cannot but give good returns for the food fed. But they had excellent appetites, and they had a decided propensity to creep through and under fences to gratify these on the crop of the adjoining fields.

The lambs purchased in the Toronto market were larger in body than those bought in eastern Ontario, and they were leaner in flesh. They were much mixed in breeding and variable in character, and might not unfitly be termed a "truck" lot put upon the market by some venturesome dealer.

In the lots from Prince Edward Island and Toronto there were 164 rams. These were without any exception castrated soon after their arrival, and but one died in consequence of the operation.

The matter of castration and docking at an early age are greatly important. Lambs that are not castrated are unduly developed in the parts of but little value as meat, as the head and neck. They are restless and do not fatten well, and when pastured with ewes to be carried on into the winter, the results are disastrous to all hope of profit from the latter. The quality of the meat is also intrinsically superior in the castrated males.

We would rather castrate the rams, which of course hinders growth for a time, than pasture them as rams; but the proper time to give castration attention is when the lambs are young.

MANAGEMENT ON ARRIVAL. The lambs bought in eastern Ontario, and which arrived at the Station on August 29th, were put in a grass paddock and were weighed singly on September 2nd, after having been duly fasted. They were kept on a grass pasture until September 16th, when they were put upon the rape. The first lot from Prince Edward Island arrived September 14th, and were put upon the rape on September 17th. On September 25th they were fasted and weighed singly the following day. Owing to the length of the journey it was thought but fair to allow them to recover from the effects of the long journey before weighing them. The second lot from Prince Edward Island arrived October 7th, and were kept in a grass pasture until October 15th, when they were fasted and weighed as the others had been, after which they also were put upon the rape. Those bought in Toronto, and which arrived 21st October, were weighed singly when they arrived, and were at once put upon the rape with the exception of the newly castrated rams, which were kept upon a grass paddock for several days. In each case the fast continued from 15 to 18 hours. The lambs were all purchased by Mr. J. E. Storey, the Farm foreman, except the second lot, which came from Prince Edward Island, and all the expenses connected with the purchase and transit are included in the statement of costs.

The average weight of the lambs in each group when weighed at the dates mentioned, the average cost per lamb when laid down at the farm, and the average cost per lb. of live weight, are given in TABLE LXX:

Date of weighing.	Place where bought.	Average weight of each lamb.	Average cost of each lamb.	Average cost per lb. of live weight.
		lb.	$ c.	cts.
September 2nd	Eastern Ontario	67.54	3 35	4.96
" 26th	Prince Edward Island	53.18	2 76	5.19
October 15th	" " "	59.70	2 99	5.08
" 20th	Toronto	77.74	3 76	4.83

The prices paid, therefore, when the expense of purchase and cost of transit are considered, were relatively dear. The price of lambs throughout the Dominion at the time that these were purchased was abnormally high, hence the material losses incurred by dealers whose terms of contract bound them to lift the lambs before the holiday season. Good lambs could have been purchased in Western Ontario at the same time at a price not exceeding 5 cents per lb. live weight, but our object, as stated before, was to experiment with very common lambs.

The lambs were allowed to remain upon the rape until it was all eaten. They had access at will to an old pasture, a part of which was woodland, the thick underwood of which afforded some protection for the lambs in times of the early snows. As many as 500 fed in one field at one time, and these are the lambs shewn in the sketch published in the Report for 1891, page 103.

The rape crop included 40 acres grown in drills after a crop of rye grown the same season. A part of the rye was made into silage, but the principal portion was cut with the binder early in June, and cured in the shock for winter fodder. (See Annual Report for 1891, p. 53 and 54.) There were also 6 acres grown as a catch crop after winter wheat, some of which was broadcast and some in drills.

WINTER QUARTERS. A lot of 100 lambs were shorn Oct. 13th-16th, and put into winter quarters at night and on stormy days. They were pastured on rape for 28 days after the date mentioned, and were then given 29 cart loads of rape in the sheds, getting a load each day. Full particulars relating to these are given in another part of the report. Two lots of 10 each were selected on Nov. 28th to be fed for experiment as shorn against unshorn, the details of which are also given further on. The remainder were put into winter quarters on Dec. 10th. As there was not sufficient accommodation for so many lambs we found it necessary to provide temporary shelter. For this purpose old fence lumber was used. Sheds were erected, involving but little cost and labor. They were divided into three lots, each lot having a shed and a yard in common. The cheaply-constructed feeding-racks and troughs were kept in the open yards. There were thus more than 150 lambs in each group. They would doubtless have fed better had they been less crowded.

The lambs were weighed on Dec. 10th, when first put into winter quarters. Owing to the glut in the markets at that time we could not obtain an offer of more than 4⅜ cts. per lb. for immediate shipment. We were strongly advised to sell, but did not do so from the firm conviction that lambs would rise in price as soon as the glut was over. The sequel shows the correctness of this opinion. On Jan. 1st, 1892, we refused an offer of 5¼ cts. per lb. live weight on the whole lot for immediate delivery. The difference between the first and second of these offers in the aggregate value of the lambs is $575, not taking into account food, manure, and attendance for the 21 intervening days. In this fact we have an excellent illustration of the effect of the fluctuation in market values upon the price obtained for any marketable commodity. Because of this it is greatly important that careful attention should be given to this feature of the farmer's work. The difference between the net result as a profit or a loss may easily arise in consequence of the season of the year in which an article is marketed. The aim should be to have live stock come into the market at those seasons of the year when a glut is not likely to occur. Toward the close of the year lambs are likely to be low for some years to come, as the tendency is to rush them into the market at that season to avoid winter feeding; hence those who give attention to the same will be far more likely to get better relative prices.

Food and Feeding. The food given to the lambs consisted of hay, some oats in the sheaf, roots, and a grain ration of oats and peas. The lambs in preparation for England, and those in the experiment as shorn against unshorn, were given in addition a small proportion of bran, and some ensilage. The hay was what may be termed clovery, and it was fed uncut. The roots were sliced, and turnips only were fed. The grain was fed whole. But two feeds were given per day, and water was given in troughs daily. Salt was plentifully supplied. The ration of roots and grain was increased from time to time, but it was found that these small lambs would not take a heavy grain ration.

Estimated Value of the Food. The fodder, the grain, and the roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. The bran was valued at the market price in Guelph, with the cost of delivery added. (See Bulletin LXVIII., p. 5.) The home value, therefore, put upon the hay was $9 per ton, the unthreshed oats $6 per ton, the roots sliced 6 cts. per bushel, the oats 26 cts. per bushel, and the peas 50 cts. per bushel. The bran was valued at $14 per ton, and the silage at $2 per ton.

Food Consumed. The amount of food consumed by the lambs, not including the rape from the time they reached the farm until they were delivered for shipment, and the respective values of the same, are as follows:

Food.	lb.	Value.
Hay	54,396	$244 78
Oats in sheaf	4,040	12 12
Oats	57,332	438 42
Peas	11,458	105 03
Bran	3,212	22 48
Roots	128,774	128 77
Silage	9,050	9 05
Total	268,262	960 65

Disposal of the Lambs. The lambs were delivered for shipment as stated in table LXXI. below.

It will be observed that some of the lambs were disposed of at a very low price in the home market. These were ill-doers which had to be sold for what they would bring. The 23 lambs which died from various causes were also charged against the experiment. It will also be observed that the price paid increases with the advance of the season. As statements have been circulated to the effect that the lambs were a losing venture, it may be mentioned here that the figures in the right hand column of Table LXXI, relating to the prices received, and also those in a previous statement relating to the cost of the lambs were compiled from the bursar's books, hence the sources of verification are easily accessible.

TABLE LXXI.

Dates of sales.	Markets.	Number of lambs in each sale.	Weight of each group sold.	Price per lb.	Total value of each group.
			lb.	cts.	$ c.
January 8th	Buffalo	160	13,573	5½	746 51
March 8th	Ontario	50	3,340	5⅝	187 87
" 9th	Halifax	126	11,450	5⅝	644 06
April 12th	"	63	5,900	6	354 00
May 9th	England	99	13,103	7	917 21
April 26th	Ontario	99	8,660	6	519 60
" 12th	Halifax	20	2,738	7	191 66
	Ontario	26	..	..	68 50
	"	17 (skins)	..	..	12 75
	Died on transit or strayed	6	..	..	....
Total					$3,642 16

The only exceptions relate to the lambs sent to England, and to a lot of 10 cull lambs included in those disposed of in Ontario and not yet delivered. The price put upon the lambs prepared for the English market is that which we were offered for them by Mr. L. O. Barber, Guelph, who bought all the others except the culls. This offer was made April 12th and was refused for the reason that we had prepared the lambs for shipment to England. It is the same price as was actually paid by Mr. Barber for a lot of 20 lambs, very similar in kind, which went to Halifax, and which are separately mentioned in the table.

Table LXXII contains a financial summary relating to the whole transaction.

	$ c.
Cost of lambs when bought	2,097 34
" shearing 120 lambs	5 40
" food, including rape and pasture	1,316 25
" attendance	125 00
Total cost	3,543 99
Value of lambs when sold	3,642 16
" wool	56 68
" manure	577 12
Total value	4,275 88
Gain	731 89
Gain per lamb	1 10

The net cash received for the 99 lambs shipped to England would reduce the above gain by $132.10.

The 120 lambs included in the table in the item cost of shearing were shorn for purposes of experiment. All the food given to the lambs from first to last is charged against them. The estimate put upon the rape was the cost of cultivation, as given on page 6, Bulletin LX. This makes the cost of growing the rape $8.46 instead of $11.77, as stated in the aforementioned bulletin, owing to the difference in the amount of the manure applied. The cost of producing the 6 acres grown as a catch crop, was estimated at $1.20 per acre, as nearly all of it was sown broadcast and after the necessary autumn plowing of stubble land. It should be remembered that all the rape grown was a second crop taken from the land during 1891, and that the cultivation given to it left the land in a very clean condition. The whole time of one person was occupied in caring for the lambs, but more than one half of it was given to those animals in the special experiments previously mentioned. But as we would rather understate than overstate results where there is an element of uncertainty, we have charged more than half the wages paid against the lambs. The wool was sold at 13 cents per pound. The manure was valued at half a cent per day per lamb. This estimate is much lower than the value put upon the manure from sheep and lambs by experiment stations which have made this question the subject of careful investigation. More definite information is given on this point where the contingent shipped to England are dealt with in a later portion of the report. As in former bulletins, no account is taken of interest on money, rent of land, exhaustion of natural fertility, or of its increased value resulting from the cleaner tillage.

We now give a concise summary statement of the whole transaction, without taking into consideration the value of the rape eaten, cost of attendance, or value of the manure.

Total cost of 666 lambs, when laid down at Guelph	$2,097	34
Cost of shearing	5	40
Cost of food	960	65
Total cost	$3,063	39
Total returns from 666 lambs and wool shorn	3,698	76
Net gain on 666 lambs	635	37
" " per lamb		95

The net cash profit received from the 99 lambs sent to England would reduce the aforementioned profit by $132.10.

52. Fattening Lambs for the British Market.

This experiment commenced with the arrival of the lambs at the Farm in the months of September and October, 1891. The whole lot of lambs purchased are more fully described in the experiment on fattening lambs which has already been given. It closed when the lambs were sold in Liverpool, shortly after the middle of May following. They left the Farm for the British market on May 11th. It was intended to be substantially a repetition of the experiment, the particulars of which are given in Bulletin LXIX. The principal objects of the experiment were to ascertain: 1. Whether lambs can be fattened at a profit in the autumn and winter for the English market; and 2, Whether the average grade lambs of Ontario and Prince Edward Island are suitable for the purpose.

The Animals Selected. The lambs from which those intended for shipment were selected were purchased by Mr. J. E. Story, the Farm foreman, in the eastern part of Ontario, and in Prince Edward Island. There were purchased in all 666 grade lambs, of which 200 came from eastern Ontario, 362 from Prince Edward Island, and 104 from Toronto. The selections for this experiment were made from the eastern Ontario and Prince Edward Island lambs, 55 from the former lot and 45 from the latter. The lambs were a mixed lot and somewhat below the average of Canadian grade lambs in quality, as will be apparent from the weights given further on. They evidently possessed but little improved blood, and were considerably below what the standard lamb of Ontario should be. In selecting, the preference was given to those having dark faces, although a considerable number were not of this class.

Conditions Governing the Experiment. The lambs selected from the lot purchased in eastern Ontario were weighed on Sept. 1st, two days after their arrival at the Farm. Thirty-seven of those selected from Prince Edward Island were weighed Sept. 26th, twelve days after their arrival, and the remaining 8 from the same place on October 15th, 8 days after their arrival. The average weight of the Ontario lambs was 77.5 lb., and of those from Prince Edward Island 67.9 lb. They were all ear-tagged on reaching the Farm, hence the behavior of each lamb could be traced without difficulty throughout the experiment. From October 13th to 16th they were shorn. They were then allowed to go together in a closed shed, with yards attached, until the latter part of December, although while the weather continued suitable they were pastured on rape during the day. The shed was then divided into four equal compartments and 25 lambs put in each of these to be fed on different rations. These rations and all the particulars relating to this sub-experiment will be given in connection with the experiment on feeding shorn and unshorn lambs, in a later portion of the report.

FOOD AND FEEDING. From the time of the first weighing until October 13th, the lambs were kept on rape all the time. They were then allowed access to the rape only on fine days and were housed at other times, as already mentioned. When inside, they received hay, roots and grain, until the latter part of December, at which time the experiment was commenced, to which reference has already been made. This sub-experiment continued until April 30th. During its continuance, the lambs in one group were fed a mixed grain ration, roots and hay, in a second a grain ration of whole oats with roots and hay, in a third a mixed grain ration with ensilage and hay, and in the fourth a ration similar to that given to the lambs in the first mentioned group, except for a short time at the first. From the close of the sub-experiment until the lambs were shipped on May 11th, they were all fed upon a mixed grain ration with roots and hay. The mixed grain throughout the experiment consisted of oats, peas and bran, fed in the proportions of 2, 2 and 1 parts. The oats and peas were all fed unground. The roots consisted of turnips sliced. The hay was all fed uncut. It consisted of clover and timothy. The grain ration was increased in quantity as the season advanced. It will be noticed that the period of pasturing rape was considerably curtailed by the shearing of the lambs, although some rape was carted to them, in addition to what they got when pasturing, and this is all accounted for in the computation. The ensilage was fed to but one group of lambs, and then only during the continuance of the sub-experiment.

The food consumed by the 100 lambs throughout the experiment was as follows:

Oats	14,344 lb.
Peas	5,099 "
Bran	2,594 "
Roots	43,560 "
Hay	26.587 "
Ensilage	9,050 "
Rape, which grew upon	4.52 acres.

The average daily consumption of food from October 16th to May 11th, exclusive of a very limited quantity of rape given them for a limited period at the first, was:

Grain	1.06 lb.
Roots and ensilage	2.54 "
Hay	1.27 "
Total	4.87 lb.

ESTIMATED VALUE OF THE FOOD. The food was estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. (See Bulletin LXVIII.) The home value put upon the food by this mode of reckoning was: Oats, 26 cents per bush.; peas, 50 cents; bran, $14 per ton; roots, sliced, 6 cents per bush.; ensilage, $2 per ton, and hay, $9 per ton. It will be observed that in all probability a profit has already been made on the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values, less the cost of marketing from an average Ontario farm. This profit would be represented by the difference between the cost of growing the food and the market value put upon it.

WEIGHTS. It will be observed (Table LXXIII.) that the lambs brought from Prince Edward Island increased more rapidly in weight than those from eastern Ontario, although they were lighter at the outset. They were somewhat leaner in flesh when the experiment started, and this may furnish the explanation. In any case the gains were very satisfactory for the food consumed.

TABLE LXXIII gives a summary and an analysis of weights.

—	The lambs from eastern Ontario.	The lambs from P. E. Island.	The whole lot of 100 lambs.
	lb.	lb.	lb.
Total aggregate weight at commencement	....	....	7,322
" " " at close	....	....	13,218
" increase in weight	....	....	5,896
Average individual weight at commencement	77.50	67.90	73.20
" " " at close	134.90	128.18	132.20
" " increase	....	....	58.96
" " daily increase	....	....	.25
" increase per month	6.78	9.99	8.39
" " " while on rape	....	....	8.51
" " " on winter ration	....	....	7.72
" " " without fleece	....	....	7.40
" " " with fleece	....	....	7.85

TRANSPORTATION. The lambs were put on board the cars at Guelph on May 11th, *en route* for Liverpool. They left in charge of the Farm foreman, Mr. J. E. Story, who accompanied them as far as Montreal, put them on board the steamship, along with the food necessary for the voyage, and secured a competent feeder to care for them on the way.

One of the lot had been sold before the date of shipment to a local butcher, as he was deemed unsuitable for the foreign market. The price obtained was $5. The whole number sent over, therefore was 99. They all stood the voyage well and arrived in Liverpool in good condition.

DISPOSAL OF THE LAMBS. On arriving in Liverpool the lambs were taken in charge by Mr. G. F. Frankland, of Toronto, who found a ready market for them. They brought the highest prices that were then being paid for choice lambs. The following is taken from Mr. Frankland's report:

"England stands pre-eminently first in the judgment of animal food, and when we remember that in her markets are found meats from every clime, besides what Britain furnishes, I feel a certain amount of pride that 99 lambs from the Ontario Government Farm at Guelph could successfully compete with the rich Welsh mutton, and the mountain sheep of Scotland, together with the noted breeds of many shires of England. These 99 young sheep stood in two commodious pens and made an earnest impression upon old sheep breeders as well as feeders from various parts of England, Ireland and Scotland; for most of the onlookers not unnaturally concluded that lambs which would show so good an appearance after having travelled over 3,000 miles by land and sea, must not only have been well nurtured by high class feeding, but that great care must also have been exercised with them throughout their journey. I never observed more careful handling. The dealers began by observing the loin, the tail and the ribs, then turning them over for a glance at the breast, and a careful scrutiny of the neck vein. Their long practice enabled them to fix the weight of the carcasses, very closely. They seldom varied more than one or one and a half pounds. These 99 lambs, which all arrived safely, weighed, I believe, at the College farm 132 lb. 5 oz on an average, and they sold to the highest bidder, a leading butcher of Manchester, for £2 7s. 6d. each. They made a shade over 8½d. per pound, sinking the offal, while sheep which came from South America and which slaughtered well, brought but 6d. per pound. You would have rejoiced to see the droves of good men of all ages who came to examine your lambs." It may be well also to mention here that these good prices were received in the face of a depressed market for beef. In reference to this Mr. Frankland remarks in the letter from which we have quoted: "In all the years I have been in the trade I never sold at such low prices."

VALUES. The value put upon the lambs at the commencement of the experiment was the actual cost per pound when laid down at the Farm. The actual weights were taken as the basis of computation, and the price per pound charged was the average paid for the lambs from Ontario and Prince Edward Island respectively. The cost of shearing was put at 5 cents per animal.

Table lxxiv. gives the financial results of the experiment.

	$ c.
Cost of 100 lambs when landed at Guelph	368 74
" shearing	5 00
" food	380 83
" attendance	25 00
" shipping to England	357 69
Total cost	1,137 26
Value of 99 lambs in England	1,141 60
" 1 lamb in Ontario	5 00
" wool	44 33
" manure	237 74
Total value	1,428 67
Total gain	291 41
Gain per lamb	2 91

All the food consumed from the time of the arrival of the lambs at the Farm until they landed at the Liverpool docks was charged at market values, less the cost of marketing, as previously stated in detail. The cost of growing the rape was put at $8.46 per acre. In Bulletin lx the cost of growing an acre of rape is put at $11.77. In that estimate, however, a liberal quantity of manure is supposed to have been used, while in the present instance no manure had been applied to the greater portion of the land for the past six years, and a portion of the rape grown was a catch crop. The basis of computation in both instances is exactly the same. The hay, which was the most expensive item of food, was charged at twice the price put upon it in the corresponding experiment of the previous year, owing to the advance in market values. The other food factors were not materially different in price.

The cost of attendance in the corresponding experiment of the previous year was an estimate. In the present instance it is based upon actual experience in caring for the lambs. One man cared for over 600 lambs, so long as that number was here on the Farm, and about half of his time while thus engaged was spent in work of a purely experimental character. We therefore feel safe in assuming that one man will feed and care for 800 lambs when the food is all prepared.

The cost of sending the lambs to England and of selling them there was $357.69, or $3.61 per head, which was 56 cents per head less than in the corresponding experiment of 1891. The following are the items:

Railroad freight charges to Montreal	$ 61 10
Charges of stockyards	4 91
Wharfage	3 28
Loading in ship	2 25
Caretaker on ship	10 00
Food sent from Guelph	19 98
Hay purchased in Montreal	14 95
One hatchet and one fork	1 15
Expenses Mr. Storey, Farm foreman	14 30
Ship's freight and charges, including insurance	170 10
Market charges	2 43
Keep and lairage, nights	7 05
Droving	3 03
Dock charges	7 29
Dues and entry	2 06
Gifts	1 21
Commission for selling, 9d. each	18 03
Cash to Mr. Frankland	14 57
Total	$357 69

The selling of the lambs in England was a purely commercial transaction, and was done on a strictly commercial basis, that is to say, they were sold in the open market and in the ordinary way to the highest bidder.

The autumn shorn wool averaged 3.41 lb. per fleece unwashed, and sold for thirteen cents per pound. The manure made by the one hundred lambs was accurately weighed during the continuance of the sub-experiment, which lasted for four months. The quantity for the balance of the time was computed from the data thus furnished. The amount made during the four months was 34 867 tons, which would give 69.516 tons as the amount made during the whole period. The average amount therefore made per day by each lamb was 5.81 lb., which, on the basis of the valuation given below would be worth .993 of a cent or practically one cent a day. This includes bedding which was not weighed separately. In the corresponding experiment last year the manure was valued at $\frac{3}{4}$ cts per day per lamb. If the cost of the bedding were considered it would somewhat reduce the value of the manure.

Prof. A. E. Shuttleworth, the chemist of the Station, made a careful analysis of the manure, and handed to us the following report in regard to the analysis, and also to the value of the manure:

Organic nitrogen, 12 lb. per ton, worth 17 cts. per pound; total phosphoric acid, 16 8 lb. per ton, worth 3 cts. per pound; muriate of potash, 19.4 lb. per ton, worth $4\frac{1}{2}$ cts. per pound. The commercial value of the manure therefore is \$3.42 per ton. By commercial value we mean the value based upon the market prices charged for the three ingredients mentioned when purchased in the form of artificial fertilizers. Since we have stated the amount of the manure made, the reader is given the opportunity of attaching that value to it which may seem proper to him. And here we desire to emphasize the fact that these lambs sold in Liverpool at a cash profit as stated below, without taking into account the value of the manure.

The average individual value of the lambs at the commencement of the experiment was	\$ 3 67
The average price for which they sold in Liverpool	11 53
The average advance in value therefore was	7 86
The cash profit which they brought in England without accounting for the manure was	53 67
Or a cash profit per head of.	54

The variations in the prices offered for lambs during the past season will be clearly apparent from the following statement:

The price offered per lb., live weight, for our lambs, in Guelph was:

On Dec. 10th, 1891	$4\frac{3}{8}$ cts.
On Jan. 1st, 1892	$5\frac{1}{4}$ "

The various lots disposed of brought the prices mentioned on the respective dates given, viz.:

Toward the close of January.	$5\frac{1}{2}$	cts.
In February	$5\frac{3}{8}$	"
Early in April	6	"
At Easter	7	"
In England (May)	8.74	"
Equivalent to in Canada	6	"

The above statement certainly tends to remind us of the importance of trying to so arrange our plans that we will not of necessity have to sell in a time of slaughter prices. Such a market is manifestly more likely to occur before the holiday season than after it, at least for some years to come. Owing to the relatively small number of lambs held over for winter fattening, work of this nature not only brings profitable employment in winter, but it tends to the enrichment of our farms.

Conclusions.

The following are some of the more important of the conclusions to be gleaned from this experiment:

1. That grade lambs can be purchased in eastern Ontario and Prince Edward Island respectively, shipped westward more than 300 miles in the one case, and 1,100 miles in the other, fattened, and then disposed of in England at a substantial cash profit.

2. That the average grade lambs of Ontario are well adapted for the work of this experiment.

3. That lambs shipped to England should sell for an advance of about two cents per lb., live weight, on the prices obtainable in Ontario to secure an equal profit.

4. That lambs may be fattened in winter in considerable numbers with but a small percentage of loss from disease or accident.

5. That grade lambs similar to those fed in this experiment can be fattened in good form in winter, when fed daily the following ration: Grain (oats and peas) and bran in the proportions of 2.2 and 1=1.06 lb.; roots, 2.54 lb., and hay 1.27 lb., or a total per day of 4.87 lb.

6. That the ration given in the above conclusion gave an average daily increase in weight of $\frac{1}{4}$ lb.

7. That a ration of rape pasture only, gave a larger increase per day in live weight, than the winter ration used in this experiment.

53. Experiment in Feeding Lambs on Different Rations.

This experiment relates to feeding lambs upon three different rations during the winter season. It may be fitly designated an experiment within an experiment. As the lambs used in conducting it were at the same time being fattened for the British market. The details relating to this experiment have already been given in an earlier portion of the report. The one hundred lambs used in the experiment were divided into four different groups, with twenty-five animals in each group. But for reasons to be given below, the experiment was confined to three lots.

On Dec. 31st, 1891, they were all weighed, and the test commenced the following day. It closed April 30th, thus covering a period of 120 days. The leading object of this sub-experiment was to ascertain the respective values of the various rations used for fattening lambs.

Conditions Governing the Experiment. The one hundred lambs were so divided that those in each of the four groups were nearly equal in quality. They were then put in the four equal sized compartments of the same closed shed, the internal divisions of which were made by feeding racks running across the building. The racks, except those at the two ends of the building were double, and had a close-fitting division adown the centre of each, hence the lambs in each division could take their food on the two opposite sides thereof at the same time. They were thus furnished with ample room for feeding without any crowding. The shed is 76 ft. long and 28 ft. broad, outside measure, hence each compartment was virtually 19 ft. x 28 ft., from which the room occupied by the feeding racks is to be deducted. The ceiling is 9 ft. high, and the food was kept on the loft overhead. Each compartment has a low, wide door, which was kept open all the time, except in the stormiest weather. The yards in front of the compartments, one for each, extended out about 16 ft. from the shed. All the food given them was accurately weighed, and it was given in two feeds daily. They were plentifully supplied with water and salt, but of the former they do not use much when they are fed a liberal ration of roots or ensilage.

Food and Feeding. The lambs in No. 1 group received a ration consisting of grain, bran, roots and hay. The grain ration consisted of oats, peas and bran, fed in the proportions of 2.2 and 1 parts. The roots consisted of turnips and mangels sliced. The hay was principally clover, and it was fed whole. Those in No. 2 group received the same quantity of whole oats by weight as were given of grain and bran to the lambs in group 1, and roots and hay also the same in character. The lambs in group 3 were fed mixed grains, similar in quantity and quality to those in group 1. In addition they received virtually all the corn ensilage they would eat and also hay. Those in group 4 were fed grain, bran and roots, the same as the lambs in group 1, and in addition all the pea-straw they would eat, but as the pea-straw proved of much poorer quality than was at first anticipated, the experiment with this lot was abandoned. The same quantity of roots was given to the lambs in groups 1 and 2, and the hay was given without limit in each instance, that is to say, they were given all the hay that they would eat clean.

The experiment therefore was a test of the comparative value of a mixed grain ration in one case, as against oats in making mutton, and of the value of ensilage as against roots, for the same purpose in the other. Both objects are unquestionably important, as roots are easily grown anywhere, and corn ensilage can readily be grown in some sections where oats cannot. Table LXXV gives the amount of the various factors consumed by the animals of each group during the experiment.

TABLE LXXV gives the comparative cost of the food consumed by the animals of each group, and also of the increase in live weight made by them.

—	Group 1.	Group 2.	Group 3.
	$ c.	$ c.	$ c.
Total cost of food per group	66 50	65 94	60 17
Average cost of food per day per lamb	2 22	2 20	2 01
Total live weight increase per group	31.46 lb.	33.74 lb.	30.80 lb.
Average weight of increase per lamb per day	.262 lb.	.281 lb.	.257 lb.
Cost of food to produce one pound live weight increase	8.47 c.	7.93 c.	7.82 c.

CONCLUSIONS.

The following are the chief of the deductions to be made:

1. That in this experiment the ration with oats simply made mutton more quickly and more cheaply than the ration with oats, peas and bran.

2. That in this experiment, while the ration with ensilage did not make mutton quite so quickly as the corresponding ration with roots, it made it more cheaply.

3. That in this experiment the rations given to the lambs in groups two and three, viz: the oat ration with adjuncts, and the ensilage ration with adjuncts, proved about equally valuable for fattening lambs, cost considered.

4. That in this experiment an average daily increase per lamb per group of .267 lb. was secured at a cost for food of 2.14 cts. per day. In other words, every pound of mutton added to the live weight cost 8.07 cts., food only considered.

In the above experiment some of the conclusions are rather surprising, and if confirmed by future experiments they cannot fail to prove of much value. Who, for instance, would have looked for better results from the simple grain ration of oats, than from the time-honored mixture of oats, peas and bran? If it should be conclusively proved that a grain ration of oats is even as useful for making mutton as the mixed grain ration mentioned, not to say more useful, the gain would be distinct, for it may be fed with less labor. Oats can be grown upon any arable farm in Ontario. This cannot be said of peas, and bran for feeding purposes has to be bought in a majority of instances.

Nor was it to be expected that in fattening lambs a ration of ensilage would be as useful as one of roots. Of course succeeding experiments may give different results, but the result of this one augurs well for the use that may be made of this food factor in the future in fattening lambs. If it shall turn out that corn ensilage may be used with safety and advantage in fattening sheep and lambs, it opens wide the door of opportunity to many who may be desirous of securing more satisfactory prices for the lambs which they raise and sell from year to year.

54. Experiment in Feeding Shorn and Unshorn Lambs in Winter.

This experiment began on Dec. 3rd, 1891, and closed on April 12th following, thus covering a period of 131 days. It is the second of a series of experiments having similar objects in view. The results of the first experiment are given in Bulletin LXVIII, issued in 1891.

The objects of the experiment include the following, viz: (1) To ascertain whether shorn or unshorn lambs will give the best returns for the food consumed in winter. (2) To ascertain the relative gains that will result from liberal feeding at such a time. (3) To ascertain the cost of feeding lambs for fattening purposes in the winter season on the ration used in this experiment. (4) To ascertain the adaptability of the work to the conditions of Ontario.

The Animals Selected. Twenty lambs were chosen from those obtained in eastern Ontario and which reached the farm Aug. 29th, 1891. These lambs are more fully described in the experiment given in an earlier portion of the report which treats of fattening lambs. These lambs, as will be apparent from the weights, were above the average of the lot from eastern Ontario, although they were not above the average of Ontario lambs, speaking in a general way. They were grade lambs of mixed breeding, the blood of the long wools probably being in the ascendant.

Conditions Governing the Experiment. On Nov. 30th the lambs were divided into two groups of ten each. The fleeces were then removed from those of one group. On Dec. 3rd they were all weighed separately and the experiment was then begun. The pens in which they were fed and the yards attached were the same as those used in the the corresponding experiment of the previous year, and which are described in Bulletin LXVIII, p. 4. The lambs in both groups were given the same kinds and the same quantities of food, except in the item of hay, of which they were given all they would take. They were weighed every month.

Food and Feeding. The food fed to the lambs throughout the experiment consisted of hay, grain, bran and roots. The hay was principally clover, and it was fed uncut. The grain and bran rations were made up of 3 parts oats, 2 parts peas, and 1 part wheat bran by weight. The oats and peas were fed whole. The roots consisted of turnips and mangels fed at different seasons, and they were sliced before being fed. The whole was given in two feeds per day, morning and evening. They had water and salt at will.

Estimated Value of the Food. The hay, grain and roots were estimated at the current market values in Guelph, less the cost of marketing from an Ontario farm under average conditions. (See Bulletin LXVIII, p. 5.) The home value put upon the hay, therefore, was $9.00 per ton, the oats 26 cents per bushel, the peas 50 cents per bushel, the roots sliced 6 cents per bushel, and the bran reckoned as delivered at the average Ontario farm was put at $14 per ton. It will also be observed, as stated in previous bulletins, that in all probability a profit has already been made on the marketable food used, providing it has been grown upon the farm, as in this experiment the food was charged at the full market values less the cost of marketing from an average Ontario farm. This profit will be represented by the difference between the cost of growing and the value put upon the food.

Food Eaten. The total amount of food eaten by the lambs of each group was the same, except in the case of hay, each group consuming 1,665 lb. grain and bran and 6,550 lb. roots. The unshorn lambs consumed 1,832 lb. hay, and the shorn lambs 1,885 lb. The amount of food eaten per day, therefore by the average lamb was:

Oats	.635 lb.	1.271 lb. grain and bran.
Peas	.424 "	
Bran	.212 "	
Roots		5.000 lb.
Hay		1.418 lb.
Total		7.689 lb.

The ration was uniform and constant throughout, with the exception of the grain portion of it, which was increased at the end of sixty days. It should be remembered that all the hay they would eat was given to the lambs.

In the corresponding experiment of the previous year the average daily consumption of food was 8.81 lb., and with the 100 lambs fed for the British market in the winter of 1891-2 it was but 4.87 lb. The marked difference in the amounts eaten is caused in part by a difference in the size of the lambs, and in part by aiming to finish them in a short season in the one case and in a more prolonged period in the other. It will be interesting to compare the results, when we get sufficient data from which to draw conclusions safely.

WEIGHTS. The unshorn lambs weighed on an average 104.25 lb at the commencement of the experiment and 141.6 lb. at its close. The shorn lambs weighed 101.15 lb. and 132.3 lb. respectively at the corresponding dates. The increase in weight was considerably greater (a trifle over 6 lb) in the case of the unshorn lambs. Had they been shorn earlier in the season the results might have been different. In the corresponding experiment which is to follow, the lambs will be shorn at a period considerably earlier. The average daily

TABLE LXXVI gives a summary and an analysis of weights.

——	Unshorn.	Shorn.
	lb.	lb.
Weight at commencement	1,042.500	1,011.500
Weight at close	1,416.000	1,323.000
Increase per group	374.500	312.500
Average daily increase per group	2.858	2.385
Average individual increase	37.450	31.250
Average individual daily increase	.286	.239

gain of each lamb was 2.62. lb or a little more than $\frac{1}{4}$ lb. per day. While these lambs consumed daily 2.82 lb. more of a ration very similar in kind to that fed to the lambs in preparation for the market of England, they gained very little more rapidly. This would seem to intimate that we can easily go too fast in our aim to reach results quickly in fattening animals. But there are various other considerations to be taken into the account before we draw any hard and fast conclusions.

VALUES. The lambs were valued at 5 cents per pound, live weight at the commencement of the experiment. We received an offer of $4\frac{3}{8}$ cents per pound for all the lambs at that time, but they were put at the price named as they were somewhat superior in quality to the average. The cost of shearing was put at 5 cents per head. The attendance was reckoned on the basis that one man would care for 800 lambs when the food is all prepared.

TABLE LXXVII gives the financial results of the experiment.

——	Unshorn lambs.	Shorn lambs.
Cost of animals at commencement of test	$52 10	$50 55
" of shearing	....	50
" of food	27 73	27 97
" of attendance	1 36	1 36
Total cost	81 19	80 38
Value of animals at close of test	99 12	92 61
" of wool	....	5 85
" of manure	32 68	32 68
Total value	131 80	131 14
Total gain	50 61	50 76
Gain per cent. on the whole transaction	62 33	63 15

(See experiment in another portion of the Report on Fattening Lambs for the British Market). At the close of the test the lambs were sold to Mr. L. O. Barber, live stock dealer, Guelph, for 7 cents per pound, live weight, who sent them to the Halifax market. The wool from the 10 shorn lambs weighed 45 lb and was sold at 13 cents per lb.

The quantity of the manure was estimated from that made by the lambs sent to Britain, and the major portion of which had been weighed. (See Bulletin LXXVIII.) The estimate was further based on the respective quantities of food consumed daily by the two lots respectively. This gave the output of the manure from 20 lambs as 12.025 tons, or 9.17 lb. per lamb per day.

Professor A. E. Shuttleworth, the chemist of the Station, made a careful analysis of the manure, and handed to us the following report as to the analysis and the commercial value of the three ingredients which are chiefly useful in the same:

Organic nitrogen 9.8 lb. per ton, worth 17 cents per pound.

Total phosphoric acid 12.6 lb. per ton, worth 3 cents per pound.

Muriate of potash 15 lb. per ton, worth $4\frac{1}{2}$ cents per pound.

The commercial value of the manure, therefore, is $2.75 per ton, which would give the value of the amount made per day per lamb as $1\frac{1}{4}$ cents. The manure in this case did not give so high an analysis as in the case of the lambs fattened for the British market, where it is $3.42 per ton. In the latter instance it did not contain so much water as in the former. A due allowance for bedding would somewhat lessen the value of the manure, but as we have given an approximate estimate of the amount of the manure made, the reader can put that value upon it which may seem best to him.

It will also be observed that there was a net cash gain of $38.73 on the 20 lambs fed or a gain of $1.94 per head, without taking into the account the cost of the attendance or the value of the manure.

Conclusions.

The following are the chief of the conclusions to be drawn from this experiment :

1. That good grade lambs when being fattened in winter may be made to increase .263 lb., or a little more than $\frac{1}{4}$ lb per day on a daily ration of 1.271 lb grain and bran, 5 lb roots and 1.418 lb. hay, or a total of 7.69 lb.

2. That when the prices of food are as charged in the experiment, such lambs can be fattened at a cost for food per day of 2.12 cents.

3. That in this experiment the autumn shearing of the lambs was of no material advantage, practically.

4. That where there are facilities for the work, good grade lambs can be fattened in the winter at a substantial cash profit.

55. Feeding Swine upon Rape and Meal in the Pen, Rape and Meal in the Field, and Rape alone in the Field.

This experiment was undertaken to learn something regarding rape as a food for swine. Twelve pigs averaging 111 lb. each were selected and divided into three groups on October 11th, 1892. No. 1 group was kept in the pen and fed green rape and 12 lb. of meal daily. No. 2 group was turned into a paddock of green rape and also received meal in the same quantity as those kept in the pen, and No. 3 group was turned into a paddock of rape and received no meal. The animals were all weighed on October 19th and again on November 15th, at which time those from the paddocks were brought into the pens. From November 15th until December 11th each group received all the meal they would consume, but no rape was given. Much of the time that the animals were on rape the weather was very cold and blustery, and the rape was several times frozen. As these animals had been in warm pens previous to the commencement of the experiment and had received meal and slops, rapid gains could not be expected. Notwithstanding the drawbacks the group on rape alone made a gain of 19 lb. and the group on rape and meal 61 lb. The group in the warm pen which received rape and meal made a gain of 122 lb.

Considering the whole period of 53 days which extended from October 19th until December 11th, and leaving the rape out of the calculation we have the results as follows :

	Meal eaten (lb.	Increase in live weight (lb.)
Group 1	881	265
" 2	1,037	240
" 3	627	160

These figures go to show that group 2 consumed 156 lb. more meal than group 1, and made a live weight record of 25 lb. less. This difference must have been caused by the warm pen as against the cold weather and frozen rape, and not by the food given the two groups of animals, as this was the same in both cases. Leaving the rape out of the calculation we find that group 1 gave an increase of 100 lb. live weight for 332 lb. of meal consumed. This is a rapid gain and shows that the rape must have exerted a considerable influence in the fattening process. The hogs ate the rape well, both in the pen and in the field, and future experiments may prove more definitely the best mode of handling this crop to get the most out of it as a food for swine.

III. CO-OPERATIVE EXPERIMENTS.

56-57. One hundred and fifteen plots were grown at this Station in 1892 in conjunction with 5,088 plots grown by ex-students and other farmers throughout Ontario. The results of the work will be found in the Experimental Union Report at the end of this volume.

IV. WEEDS, AND MODES OF DESTROYING THEM.

(Issued as Bulletin lxxxv.)

That weeds prevail to an alarming extent in the Province of Ontario is patent to every one who has given the subject any attention. That they are on the increase is more than probable. The complete eradication of the more noxious forms of weed life has come to be looked upon as an impossibility by many engaged in tilling the soil, a view which tends to paralyze the efforts that would otherwise be put forth to destroy them. The loss which they cause to the farmers of this province in the large amount of plant food which they take from the soil every year is very great, and the labor expended in efforts to destroy them, often to little purpose, probably represents a still greater loss. Some of them, as the Canada thistle, are pretty generally distributed over the country, and are known to every one, but others, as wild flax, are as yet confined to certain sections, from which they are continually being distributed by the various agencies concerned in their propagation, and frequently they obtain a foothold from which it is difficult to dislodge them, before their presence is known.

Objects of the Bulletin. The chief of the objects of this Bulletin include the following, viz.: 1. To furnish information, through illustrations and otherwise, as to the appearance and habits of growth of the more troublesome forms of weed life which infest this country, that their presence may be at once detected when they are brought into centres where hitherto they have been unknown. 2. To outline certain important general principles that apply, though not always equally, to the destruction of all forms of weed life; and 3. To give specific modes of destroying the more troublesome forms of weed life which infest this province, that are not necessarily costly, and many of which have been proved in our experience at this Station.

Possible Achievement. In reference to the destruction of the more noxious weeds, our contention is, first, that the more troublesome forms of weed life can be eradicated on every farm in Ontario, if the farmers decide that so it shall be. Second, that this can be accomplished without heavy outlay when it is done in a certain way. Third, that when weeds are once eradicated it will be easily possible to keep them so with but little outlay. And, fourth, that the profits will be much larger where the farms are kept free from weeds. When we say that the more troublesome forms of weed life can be eradicated, we mean that they can be removed so completely, that they will cease to interfere with any rotation that may be desired, that they can be completely banished from every farm, except in so far as the seeds are brought again by natural and other agencies, and that when so brought, with the necessary vigilance these in turn can be easily destroyed. That this work can be accomplished without heavy outlay has been fully demonstrated by our experience at this station, as stated more fully in the Annual Report for 1891, wherein we claim that the whole farm was brought to a clean condition in three years without the loss of a paying crop, and without resorting to the bare fallow, while in a number of instances two crops were grown the same season. The only outlay for which there was no direct return was labor spent in hand pulling and spudding, which in the three years amounted to not more than $250. The assumption that when weeds are once well overcome, it will not be difficult or costly to keep them at bay, is surely reasonable. That they will come again and keep coming is certainly true. But to affirm that it will cost more to keep them wholly at bay than only partially so, as is sometimes done, is certainly illogical. Our experience during the past year has taught us, that a one hundred acre farm when once in a clean condition may be kept so where the general methods of cultivation are good, without expending a larger sum than $25 per year in spudding and hand pulling. That the profits will be much larger when farms are kept free from weeds is also apparent, since they then use less of the nutriment in the soil that should go to sustain the plants, they injure them less through crowding and overshadowing, and there is certainly less labor involved in subduing them.

Agencies in Weed Distribution. The various agencies by which weeds are distributed are well worthy of attention. Sometimes they are wafted incredibly long distances by the winds of heaven, and are in this way distributed over areas widely separated from one another; at other times they are violently shaken out of the seed pods in which they grow, and driven along over the crusted surface of the snow for miles at a time. Birds carry them to and fro in their innocency in seeking supplies of food for themselves and their young. Sometimes the seeds are carried by wild animals when seeking their winter stores. At other times the seeds are carried in the droppings of domestic animals from field to field, and those which adhere to the coat are in this way carried to other centres. Some varieties are borne down npon us by the floods which swell the watercourses coming down from infested farms; oftentimes we buy them in the seeds we purchase from abroad, and very often they are brought to us by the threshing machine from a neighbor's farm. And yet again we buy them in the manures that we purchase in cities, towns and villages, and in fodder supplies that come from distances more or less remote, while many carry them from field to field in the manure made upon the farm. It should be kept in mind at the same time, that there are but two ways in which weeds may increase through their own inherent powers, viz., by maturing their seeds, and by means of creeping rootstocks which push their way through the soil, and in this way form new plants. Happily these are both under under our control, so that where weeds are allowed to multiply, it is because suitable measures are not taken to destroy them.

General Principles to be Observed in Destroying Weeds.

There are certain general principles to be observed in destroying weeds, which will be found very helpful in conjunction with the more specific modes that may be required. These include the following:

1. *Study their Habits of Growth.* We should not only study the habits of the growth of weeds, but we should adapt our methods of subduing them accordingly. Weeds are classed as *annuals*, *biennials* and *perennials*. Annuals complete the cycle of their existence in a single year. When annuals are prevented from ripening their seeds upon any farm from year to year, the time must come when that class of weeds will be

completely destroyed. They would be destroyed in a single year, but for the fact that many of the seeds, because of the oily coating in which they are encased, have great power to resist the influences of decay, hence they may remain in the soil for years, and yet retain their vitality. The effort then in destroying annuals should be, first, to prevent them from maturing seeds, and second, to adopt such modes of cultivation as will most quickly force them into germination, that they may be destroyed. These modes include autumn cultivation and the growing of root crops. Biennials complete the cycle of their existence in two years. Many of them are characterized by a tap root, which goes deep into the soil. During the first year large quantities of starch are stored up in the root, and this is utilized during the second year in producing an abundance of seed. It follows, therefore, that any mode of destruction that may be adopted that will prevent this class of weeds from reproducing seeds, will also, in time, effect their destruction. This class of weeds cannot well resist the influence of good cultivation, hence we find them most common in old meadows, pastures, along road-sides, and in by-places generally. In such places persistent cutting must be resorted to.

Perennials live from year to year. Of these there are two classes—the simple, and the creeping perennial. The simple perennial is reproduced from seed only. The ox-eye daisy is a type of this class. The creeping perennial is not only reproduced from seed, but is also propagated by means of rootstocks, which push through the soil. These rootstocks are filled with latent buds, each one of which is capable of sending up a fresh plant under favorable conditions. These favorable conditions are heat and moisture, and a fresh impulse is also given to growth when any disturbing influences, as breaking off from the parent stem through cultivation, is brought to bear upon the roots. Hence it is, that cultivation in moist weather is more likely to promote than to hinder their increase. The Canada thistle furnishes a familiar example of a creeping perennial. In destroying perennials, we must labor to smother them, or to bring the roots to the surface by cultivation, where they wlll perish by exposure. Any mode of destroying them will be found effective in one season, that will prevent them from breathing through the leaves for several months in the season of growth. But where the attempt is made to destroy them by cultivation which is only partially effective, the residue of the plants left in the land are given exceedingly favorable conditions for development, owing to the loose condition in which the soil is left. Whenever the attempt is made, therefore, to destroy creeping perennials, they should be crushed out, root and branch, in one season. They will come up again through seeds that will linger in the soil, but due watchfulness will soon succeed in removing them.

2. *Drop Certain Crops out of the Rotation.* In the war with weeds it is usually greatly advantageous to drop out of the rotation for a time such crops as allow the weeds which infest them to ripen. Some weeds, as for instance pigeon weed and wild flax, ripen their seeds early, as in winter wheat and hay crops. Others, as ragweed, ripen their seeds late, as in the second cutting of clover. In combatting these various classes of weeds, therefore, the work will be greatly facilitated by dropping the crop out of the rotation for a time in which the weed ripens. As many weeds, however, grow in every variety of crop, this mode is not so applicable to them.

3. *Adopt Methods of Eradication to Conditions of Soil and Climate.* These conditions have an important influence on the growth of weeds. The Canada thistle, for instance, can be destroyed in clay soils with a stiff subsoil, by turning the land into pasture and mowing them twice a year at certain seasons for a limited number of years. On other soils of more open texture, this mode of eradicating them would not succeed.

4. *Allow no Seeds to Mature.* We should not allow any seeds to mature where it is possible to prevent it. It may be very difficult to accomplish this at first, when we undertake to clean a farm, but generally speaking it may be largely prevented by modifying the rotation for a time. The specific modes of hindering weeds from ripening will vary with the species of the weed, and also with the crop. These will be given, in part at least, in a subsequent portion of this bulletin.

5. *Exercise Care in Purchasing Seeds.* The necessity for exercising great care in the purchase of new seeds will be apparent, when we call to mind that it was through this medium that nearly all the foreign weeds came to us that we now possess. They should not only be purchased from reliable seedsmen, but where their presence is detected, they should at all hazards be removed before sowing the grain. They are oftener carried in the seeds of clovers and grasses than in those of cereal grains, hence a particular care should be exercised in the introduction of these.

6. *Give Threshing Machines due Attention.* When these come from farms infested with weeds they should be thoroughly swept before commencing their work, and also allowed to run for a little time when empty to further clean them. Sometimes it is thought advisable for a number of farmers to protect themselves from invasion, by clubbing together and purchasing machines to do their own threshing.

7. *Give Attention to Screenings from the Fanning Mill.* It may be wise in many instances to burn the chaff and screenings which are of little or no value, that have come from winnowed grain. The inferior portions of the grain, usually termed screenings, may be boiled or ground before being fed.

8. *Grow Hoed Crops as far as Practicable.* Hoed crops should be freely grown as far as possible, more especially during the cleaning period. Opportunity is thus given for combatting almost any form of weed life, at almost any period of the growing season. The frequent stirring of the ground is very helpful to the germination of the seeds in the same. Hoed crops are much more effective as aids in destroying weeds, when due attention is given to the cultivation as late as this may be done without injury to the crop.

9. *Grow Clover and Lucerne.* Of the different varieties of clover, the common red is decidedly the most useful for purposes of weed destruction. But few kinds of weeds ripen before this variety of clover, and as it may be cut twice in the year, it is specially helpful in the fight with perennials. Its smothering tendencies are no less helpful when it is a good crop. Lucerne is even more valuable than clover for the purpose indicated, as the cuttings of the lucerne are more frequent than with clover. Sometimes it may be cut as frequently as four times a year, but not always. But it can only be grown on certain kinds of soil, hence its use for the purpose indicated is somewhat circumscribed.

10. *Keep the Land Growing Crops.* In the conflict with weeds the land should be kept busily at work. With some kinds of soil we can easily get two crops a year, and where this is practised, the process will be found very helpful in destroying weeds. The nature of these crops will depend upon climate, soil, and the requirements of the farm.

11. *Stimulate Growth.* Weeds can much more easily be kept in check where the land is stimulated to a vigorous production. When the growth of the crops is strong, more especially early in the season, many forms of weeds are left behind in the race. Growing good crops is another name for good farming, hence good farming is in itself a great hindrance to the multiplication of weeds. The spread of weeds is always much more rapid in impoverished farms.

Growth may be stimulated by improved cultivation, by the application of manures, artificial or homemade, and by growing catch crops for turning under.

12. *Give Attention to Autumn Cultivation.* By autumn cultivation we mean the tilling of the soil after harvest, with a view to the destroying of weeds. No other mode of destroying weeds will probably be found so efficacious for the outlay as this. As soon as the crops are removed, the land that is not sown to grass should be gang-plowed. All weeds that are then growing above the surface are turned under. The seeds of others lying in the soil are encouraged to germinate, and these in turn are again destroyed by harrowing or cultivating, or by the late autumn plowing that precedes the advent of the winter. Catch crops may sometimes be grown on lands plowed at this season.

13. *Do the Work Thoroughly.* When the eradication of weeds is undertaken, it should be as complete as possible, and done in the shortest possible time. The cheapness of the process is usually in direct proportion, first to its completeness, and second, to the brevity of the period occupied in doing it.

14. *Maintain Cleanliness when Secured.* When cleanliness has been secured, it should be maintained from year to year. To effect this two things at least require to be done. The general management of the farm must be good, that good crops ordinarily may be grown, and every portion of it must be gone over once or twice a year with the spud, except the part devoted to hoed crops. When lands have once been made fairly clean, one person will have no difficulty in going over ten acres a day with the spud, and removing from the same all noxious forms of weed life. We have proved this over and over again in our own experience.

15. *Costly Methods.* Two modes of destroying weeds are frequently adopted which are good in themselves, but which we do not favor, because of their costliness. We refer to the bare fallow process, and to the destroying of the seeds through the fermentation of the manure. Both are very expensive, the former in the labor involved, and the latter in the loss of much nitrogen in the manure.

Specific Modes of Destroying our Most Troublesome Weeds.

Nearly all the modes of destroying the different weeds treated of under this heading we have proved in our own experience. Sketches of each weed have been prepared from living specimens, which show the habits of root growth as well as of the portion above ground. We shall speak of eleven of the more troublesome weeds that disturb the agri, culture of Ontario. These are the Canada Thistle, the Corn Sow Thistle, Ox-Eye Daisy, the Burdock, Blueweed, Wild Mustard, Couch Grass, Wild Flax, Pigeon weed, Ragweed and the Wild Oat.

The Canada Thistle.

The Canada Thistle (*Cnicus arvensis*), is a creeping perennial, which grows to the height of two to four feet, according to the character of the soil. It is so universally known in this country, that nothing more needs to be said in regard to its appearance.

This weed comes up early in May, and continues to grow until the time of severe frost in autumn. It comes into blossom in July and August, and also matures its seed in these months, but more especially in August.

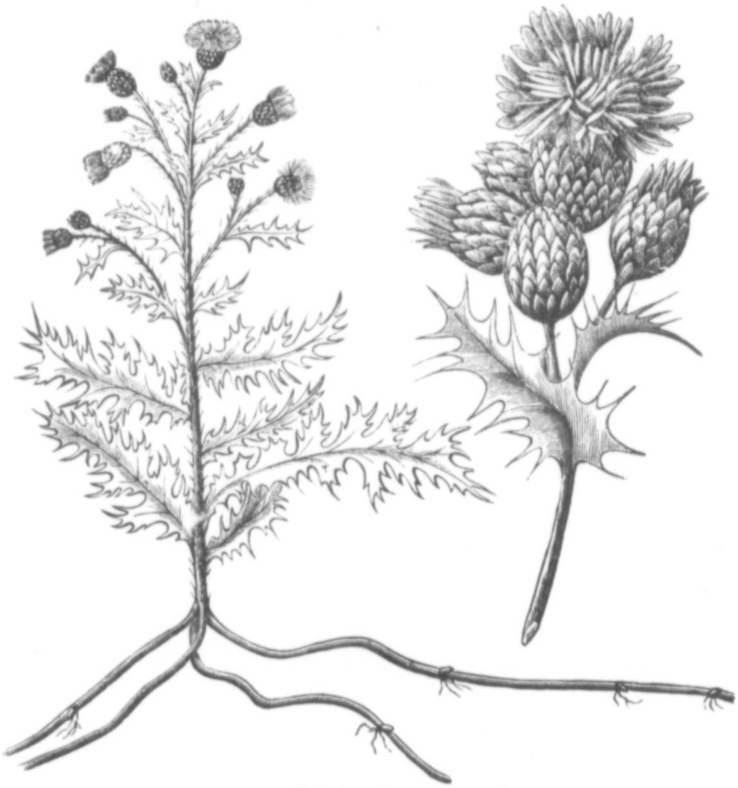
The Canada Thistle will grow in nearly all kinds of soils, but in mucks, with moist bottoms, it does not find a congenial home. It grows amid all kinds of crops, and the seeds ripen along with all the cereal grains, several of the clovers, timothy, and other grasses. It is propagated by means of the seeds, and also through the medium of rootstocks, more especially the latter. The rootstocks, which penetrate the soil horizontally to great distances, are filled with latent buds, which, when the roots become broken, as by the disturbing influences of cultivation, at once spring into vigorous life. The seeds are not only wafted incredible distances with the wind, but they are also scattered through the medium of the seeds of all kinds of cereal grains and some of the clovers and grasses. They are also carried in the manure.

The following are some of the modes of dealing with this intruder:

1. Drop out of the rotation so far as practicable all such crops as allow the thistle seeds to ripen before these are cut, until infested fields have been dealt with.

2. Plow the land immediately after harvest. Plow shallow with any kind of plow that will cut the thistles off clean without breaking off the creeping rootstocks. Keep the thistles from breathing above ground until the late autumn plowing, which should be deep, for the sake of the crop which is to come after. In the spring keep the thistles under by the use of a suitable cultivator, until the time of planting a crop of corn, roots or rape. Give the crop thus planted the horse hoeing necessary to keep down all weed growth, and also keep the thistles cut out of the line of the rows by hand hoeing. Go over the crop if necessary once or twice after the horse cultivation ceases, and there should not be one thistle left. The most effective part of the work has been done the preceding autumn providing the weather at that time has been dry.

3. Plow the ground deeply in August. Sow rye early in September at the rate of $2\frac{1}{2}$ to 3 bush. per acre, and cut the following spring for winter fodder. Then plow the ground deeply with any kind of plow that will effectually bury the stubbles. The jointer with skimmer will answer very well. Then roll at once to conserve the moisture. Harrow once a week until it is time to drill the ground for rape. Drill about the last of June or first of July by using the double mould board plow. The drills may be 22 to 24 inches apart. Sow at once with rape by using the ordinary turnip drill and then cultivate and care for as described in section 2 above. In our experience at this farm we have found this mode of destroying the Canada Thistle to be very effective.



Canada Thistle (*Cnicus arvensis.*)

4. Plow under pasture land in June, or land from which a crop of hay has been removed early in July. Work the land thus plowed upon the surface, so that all thistles will be kept under until the time of sowing winter wheat. Sow the wheat with clover and repeat the process if necessary, after having cut one, two or three crops of the clover. This method is applicable to stiff soils, where winter wheat can be grown. In sections where winter wheat will not grow, substitute for it rye, spring wheat or barley, as may be desired.

5. Where the land has been sown to clover, cut the crop twice for hay, or once for hay and once for seed. Then follow with a hoed crop properly cultivated. The smothering influences of the two crops of clover in one season, and then two cuttings, are very helpful in reducing the thistle.

6. When the thistles are well brought under they should be kept so by the use of the spud. The grain fields should be gone over before harvest to prevent the thistles from blossoming, and after harvest the meadows and fields sown to grass. So far as the destruction of the thistle is concerned, spudding after the blossoming season is more effective than when this is done sooner. Two or three cuttings with the spud after harvest punish the thistles very badly. We have found that by spudding two or three times a

year in the autumn, the thistles soon disappear from the fence borders and bye-places generally.

7. In removing thistles from permanent pastures, we must be governed by the character of the soil and sub-soil as to our mode of procedure. On stiff clays two or three cuttings a year with the scythe or mower for a limited number of years will suffice, but in open sub-soils the spud will have to be resorted to. The first cutting however may be done with the scythe, just before the thistles reach the blossoming stage.

The Sow Thistle.

There are several varieties of this weed, some of which do not give serious trouble to cultivation. It is not an easy task to classify the different varieties, but it will be sufficient for our purpose here to confine our remarks to the variety known as the Corn Sow Thistle (*Sonchus arvensis*), which is by far the most troublesome of this family of plants. The Corn Sow Thistle is a creeping perennial. The plant has an upright habit of growth. It grows to the height of one to three feet, and sometimes it attains to a greater height when the soil is congenial. Like the Canada Thistle it is somewhat branched toward the top. The stems are rather hairy or bristly, especially the flower stems. The prickles upon the leaves are harmless. The stems are hollow, and when wounded a milky juice exudes from them. The blossoms are yellow and the plants are great producers of seed

Sow Thistle (*Sonchus arvensis.*)

The Corn Sow Thistle makes its appearance in May, and continues to grow until autumn. It blossoms in July, and matures its seeds in July, August and September. It will grow in any kind of soil, but is most at home in rich moist loams, and it gives the least trouble in stiff clays.

This weed infests all kinds of crops, and it ripens its seed somewhat earlier than the crops amid which it grows. The only exceptions probably are red clover and lucerne. It is propagated by means of the seeds which float about in the air, owing to the downy attachment which they possess, and as the seeds are very numerous, they increase very fast in the neighborhood of where they are allowed to ripen. This plant also propagates rapidly by mean of its numerous rootstocks, which contain a very large number of buds, as shown in the sketch. The seeds are also conveyed in those of grains and grasses.

The modes of destroying this intruder are essentially the same as those given for the eradication of the Canada thistle.

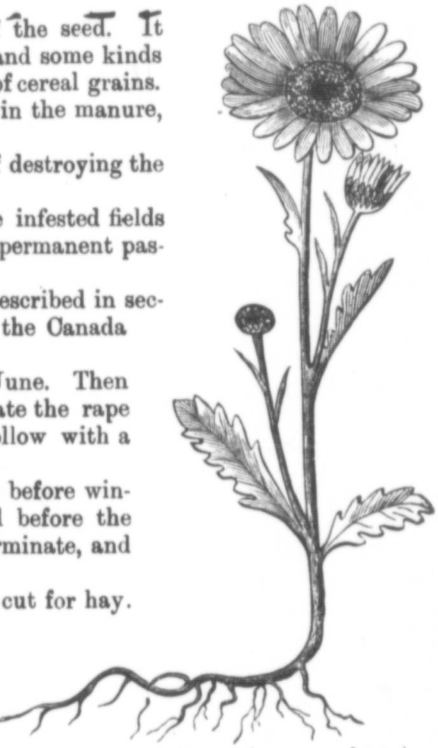
The Ox-eye Daisy.

The Ox-eye daisy (*Leucanthemum vulgare*), is a simple perennial, with a branching habit of growth. It grows from one to two feet high, according to soil and crop conditions, bnt it is usually not more than one foot in height. It produces large flowers, bordered by white rays. The fancied resemblance of the disc in the center to the eye of an ox has probably originated the name.

The Ox-eye daisy is a very hardy weed. It commences to blossom early in June, and under some conditions, will bloom as late as September. The seeds possess the power of maturing on the stalk, though the latter be cut before they are quite ripe. Although the plants appear singly at first, if allowed to ripen their seeds, they fall and grow again so thickly, that spudding is impossible, hence in pastures, along road sides, and in bye-places where cultivation cannot be introduced, this weed is extremely difficult to eradicate. Live stock will to some extent browse it off when it is young, but they do not relish it, owing to its woody character.

It grows in all soils, but is more vigorous and troublesome in those of loose texture. It infests all kinds of crops, and also road-sides and pastures. It is more difficult to dislodge it from meadows than from any of the other crops of cultivated soils, and more especially as they grow older, as the roots of the plants become interlaced. It is least troublesome in hoed crops.

This weed is propagated entirely by means of the seed. It is more commonly brought in the seed of timothy and some kinds of clover, but is also conveyed through the medium of cereal grains. It is often taken from field to field on the farm in the manure, and is carried to some extent by birds.



Ox-eye Daisy (*Leucanthemum vulgare.*)

The following include the principal methods of destroying the Ox-eye daisy :

1. Drop meadows out of the rotation until the infested fields have been dealt with. Adopt the same plan with permanent pastures where this may be at all practicable.

2. Grow a crop of rye, followed by rape, as described in section 3, when treating of the modes of destroying the Canada thistle.

3. Pasture meadow-land until the middle of June. Then plow deeply, and sow with rape in drills. Cultivate the rape with sufficient care. It may be necessary to follow with a crop of corn or roots.

4. Plow lightly after harvest, and then deeply before winter. Give one or more harrowings in the interval before the final late plowing, to destroy weeds that may germinate, and follow with one or two hoed crops well cared for.

5. Sow with rye and pasture until June, or cut for hay. Follow the rye with a crop of millet, or if desired, work the ground on the bare fallow system until winter wheat may be sown in September.

General Observations : 1. After cultivation with a view to the destruction of the daisies, the ground should be sown with grass seeds in the crops which come after. These crops should be gone over with the spud, and any daisies found in them destroyed. The same course may be necessary in the meadow which comes later, more especially the first year. 2. In places which cannot to be cultivated, and along fence borders, it is difficult to deal with this pest. Any plan that will prevent it from maturing seeds will doubtless prove effectual, but several years would probably be required to eradicate it by this method.

The Burdock.

The burdock (*Lappa major*), is so common, and at the same time so easily managed, if the work of destroying it is gone about properly, that it would seem almost superfluous to write about the modes that will prove effective in exterminating it. Notwithstanding,

Burdock (*Lappa major.*)

it is one of the most universally widespread weeds that we have. The burdock is so well known, that we need not dwell upon a description of it. The sketch illustrates its habits of growth.

As the burdock is a biennial, the first year it does not produce any seeds. It sends a strong tap root down into the soil, hence it is not easily injured by dry weather. It comes into flower chiefly in the months of June and July, but more especially in July. When cut above the crown, even after seed pods are formed, young shoots will be thrown up around the parent stem, and seed matured in some instances within a few inches of the surface of the ground, and long after the usual time for producing seed.

This weed will grow in nearly all soils free from ground water. It is much prone to get a foothold along the fence borders and in bye-places of the farm, but does not give very much trouble where the land is well cultivated. It is propagated solely by means of the seed. It is more commonly carried from place to place through the medium of domestic animals, to the hair and wool of which the burs have become attached.

The burdock may be destroyed as follows:

1. In grain and hay fields the reaping or mowing, as the case may be, will prevent the plants from maturing seeds at the usual season. If the fields are gone over later with the spud or some such implement, and the plants are thus cut below the crown, they must die.

2. In bye-places, as fence sides, lanes, around buildings, and in pastures, they should be destroyed by the use of the spud. The cutting may be done at any time of the year when the ground is not frozen, and will in all cases prove effective in destroying the plants, when they are cut below the crown. Farmers who go over their fields twice a year with the spud will soon have no burdocks.

Blue-weed.

Blue-weed (*Echium vulgare*) is a biennial. It is upright and spreading in its habits of growth, as it has several branches, and it grows to the height of one to three feet, according to the character of the soil. The leaves and stems are covered with numerous hairs, which stiffen with the advancing growth of the plant. The blossom is a deep blue.

Blue-weed sends a strong tap root down deep into the ground the first season, and from this branch off several smaller roots. During the second year the strong plants come into bloom in June, and the weaker ones later, hence the period of bloom extends into the closing days of September. When cut off above the surface during the second year, new shoots at once branch out, and some of them hug the ground so closely, that they are not easily cut clean with the scythe or mower.

This weed grows in various kinds of soil, but its favorite feeding grounds are those which contain much lime. It grows vigorously in gravelly soils, even in some of those used in road making. It is not very troublesome in cultivated areas, but along highways and in pastures, and bye places, it is sometimes a great pest.

Blueweed is more commonly propagated through the agency of the winds, which blow the seeds over the crusted snows both far and near, as the seeds frequently remain in the receptacles wherein they grew on into the winter.

Blue-weed (*Echium vulgare.*)

The following methods will be found effective in combating this weed:

1. Really good cultivation will keep it from getting a foothold to any great extent in cultivated fields. When stray plants put in an appearance, the spud is the most efficient agent in removing them, unless the ground is to be broken up the same season. When cut off at any stage of its growth below the crown the plant must die.

2. In permanent pastures, along roads, and in bye places, any mode of cutting that will prevent the plants from going to seed will remove them in a few years.

3. When fields containing blueweeds are pastured closely during the early part of the season, the growth of seed will be very much hindered. But this agency will not alone suffice to eradicate it.

Wild Mustard.

Wild Mustard (*Brassica sinapistrum*), is one of the most difficult of weeds to dislodge where the plants get an extensive foothold. Owing to the extraordinary vitality of the seeds, it requires many years to destroy all the plants, as they continue to come up in the successive crops. This plant is more or less branched, and has a bright yellow blossom,

Wild Mustard (*Brassica Sinapistrum*).

which can be seen long distances away. In the early stages of the growth, the plants resemble those of the radish or fall turnip. The seeds cannot easily be identified from turnip or rape seed.

Wild mustard is an annual. It comes up early in the season and grows rapidly. The seeds continue to germinate as long as the season of growth lasts. It matures an immense number of seeds in pods about an inch in length. The first flowers appear early in June, and the late plants will produce seeds on into September. Usually it is about eighteen inches high, but sometimes it grows considerably higher. As it cannot withstand severe frosts, it is not found to any considerable extent in meadows, or pastures, or winter grains as wheat or rye.

This plant will grow in any kind of land, but not equally well. It is most at home in friable limestone soils, that possess good drainage, but it will also grow in great luxuriance on praires containing much humus.

It grows vigorously in all kinds of grain crops sown in the spring, and it usually ripens its seeds before the grain is ripe amid which it grows.

Wild mustard is propagated by means of various agencies. Some of the seeds are carried by birds, but usually they find their way to new centres in seed grain. The threshing machine carries them from farm to farm. They are also carried in the droppings of cattle and in the manure.

The following are among the more effective modes of fighting this weed:

1. Drop out of the rotation, as far as possible, the spring crops amid which the mustard grows, until the infested fields have been subjected to a cleaning process. Grow hoed crops at the same time to the greatest extent possible.

2. Grow rye followed by rape, as described in section 3, when speaking of modes of destroying the Canada thistle. Follow the rape with barley or spring wheat sown with grass seeds. If the mustard plants in the spring grain are not too numerous, remove them by hand, otherwise cut the crop for fodder before the mustard is ripe. Where necessary, follow the meadow or pasture as the case may be, with a crop of corn. Spring grains sown with grasses should follow the corn.

3. Give careful attention to autumn cultivation. This reduces the number of the seeds in the upper layer of the soil. Plow deeply before winter for the sake of the crop that comes after, and to expose another section of the soil. Cultivate carefully in the spring until time to plant corn or to sow rape. Follow the hoed crop with spring grain sown with grasses. If thought necessary, a second hoed crop may follow the first before sowing with grass seeds.

4. Sow with rye in autumn, as described in section 2. Cut the rye for hay or ensilage, or plow it under for a green manure. Then cultivate occasionally after the ground has been plowed until the time for sowing winter wheat or rye. The wheat or rye, as the case may be, should be sown with grass seeds. The few plants which may grow in the wheat or rye, may be removed by hand. Whatever method may be adopted at first, hand pulling must be resorted to before the work can be completed.

Couch Grass.

Couch grass (*Triticum repens*) is known by a great variety of names, of which quack grass is the most prominent. It is a creeping perennial, the rootstocks of which are so numerous that they soon fill the soil. They resemble considerably the roots of June grass (*Poa pratense*), but they are much larger and stronger and more vigorous in every way, and they are very much more tenacious of life. The rootstocks are so strong and unyielding that they have been known to push their way through the tuber of the potato. The stems grow about as high as those of timothy, and each one is terminated by a slender spike or head, from two to several inches long. The leaves bear much resemblance to those of timothy, but are somewhat larger.

Couch grass makes a good growth early in the season, and it also furnishes considerable aftermath. It matures it seeds in August. It will grow in almost any kind of soil, but is much more partial to loams and soils of a decidedly open texture. It is least at home in stiff clays, and in these it is much more easily destroyed.

This weed grows in all kinds of crops from early spring until late autumn, and so long as the period of growth continues, the work of propagation goes on through the medium of the roots. Its power to crowd out other crops where it gets a footing is very great.

Couch grass is propagated through the medium of the seeds as well as through that of the rootstocks. As the seeds ripen along with those of nearly all the cereal grains, it is distributed by means of these, and also through the medium of the seeds of various clovers and grasses. The seeds are also distributed in the manure. When the attempt is made to destroy couch grass, effective work should be made of it in a single season.

The following mode of dealing with it will be found successful, unless in seasons that are unduly moist:

Plow lightly after harvest, then harrow with the ordinary harrow, and if necessary use the spring tooth cultivator to shake the roots of the grass free from the soil. Then draw them into light winrows with the horserake, and when dry enough burn them. If the weather should not be dry enough for this, the rootstocks can be carted into the compost heap. Repeat the process a second time, and even a third time the same autumn if the weather will admit of it, plowing more deeply every time to bring up fresh rootstocks. But in any case do not continue the work in wet weather, else the labor will be lost. When the late autumn arrives, rib the land by turning two furrows together from opposite directions, or plow so that the largest possible amount of surface will be exposed to the action of the frost in winter. The frost has the effect, first, of killing the roots of the

Couch Grass (*Triticum repens.*)

exposed portions, and second, of freeing them from the adherent soil. In the spring, use the harrow and cultivator occasionally in time of dry weather, and in case of need also the horserake, until it is time to plant corn, roots or rape. Cultivate this hoed crop properly, giving it what hand work may be necessary along the line of the rows, and by the autumn the couch grass should be all gone, unless the season has been a wet one.

In the fence borders it will be difficult to dislodge this grass without removing the fence for a time, and subjecting the ground to a cleaning process by means of cultivation. Another way when it is found in but small patches would be, to pile manure or straw upon it, and leave the same on long enough to smother it.

Wild Flax.

Wild Flax (*Camelina sativa*), sometimes known as False Flax, is an annual which usually grows about eighteen inches high, but sometimes it grows considerably higher, and when in thick masses many of the plants attain the height of only a few inches. After the blossoming stage the upper portion of the plant consists mainly of stems and seed pods, as shown in the sketch. The blossoms are small, and of a pale yellow color.

This plant is very hardy, and can well withstand the influences of frost. It is more inclined to come up in the autumn. The seeds, which are very numerous, are easily shed. They have some resemblance to the seeds of the common flax, but are much smaller. It is a weed that will grow in any soil adapted to the growth of winter wheat or meadows.

Wild flax infests winter wheat, rye, meadows and pastures. It does not usually grow to any considerable extent in spring crops. When thus found the plants may have germinated in the autumn.

False Flax (Camelina sativa).

This plant is propagated in the seeds of the crops amid which it grows, in the farm-yard manure, and also to some extent in the droppings of cattle. But the seeds are carried to a greater extent in timothy seed than in that of any other crop.

The following include the principal modes of destroying it :

1. Modify the rotation by dropping out of it for a time in the infested fields such crops as winter wheat, rye and meadows. Grow spring crops instead. One of those may be a hoed crop.

2. Grow two hoed crops in succession when the other conditions will admit of this.

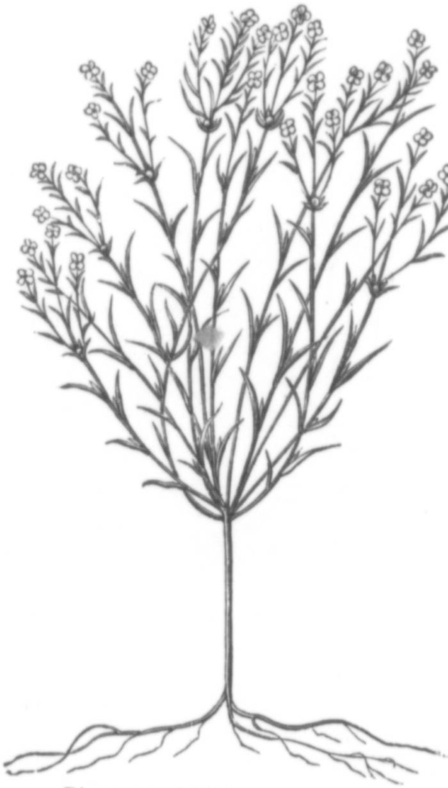
3. Grow rye followed by a hoed crop ; but the rye must not be allowed to ripen.

General Observations. 1. In the conflict with this weed grass seeds should invariably be sown along with spring grains, as wheat or barley. 2. Autumn cultivation is all-important, owing to the natural tendency of the weed to germinate at that season. 3. When wild flax is found only in certain patches in meadows, the infested parts may be cut and used for soiling purposes. 4. When Lucerne can be substituted for meadow, the first cutting would take place before the flax is ripe.

Pigeon Weed.

Pigeon weed (*Lithospermum arvense*), sometimes called Redroot, like wild flax is an annual. It usually grows from eight to sixteen inches high, but sometimes in rich soils it is considerably taller. It is more or less branched in its habits of growth. The leaves have a somewhat lighter tinge than those of cereal grains and grasses. The flowers are small, and of a pale white color. The seeds are abundant. They cluster along the stems, and they are possessed of much vitality.

Pigeon weed, like wild flax, usually comes up in the autumn of the year previous to that in which it matures its seeds. The blossoms appear during the latter part of May and early in June, hence the seeds rip before our meadows and winter cereals are cut. Its presence is most easily detected just when it is coming into bloom. It will grow in any kind of soil that is dry, but is most partial to sandy loams.



Pigeon weed (*Lithospermum arvense*).

This weed is troublesome only in crops which mature their seeds early, and which have been sown the previous year. These include winter wheat, rye and meadows, and it is also found in pastures.

Pigeon weed is more commonly propagated through the medium of seed grains, as those of wheat and rye, and of grass seeds, as those of timothy, mammoth clover and alsike clover. It is not carried in the seeds of common red clover. Other agencies in this work are birds, quadrupeds, and threshing machines. It is also distributed in the manure.

The more effective modes of fighting this weed are essentially the same as those given when treating of wild flax, as these two weeds bear much similarity to one another in the crops which they infest, and also in their habits of growth.

Ragweed.

Ragweed (*Ambrosia Artemisoefolia*) is an annual which possesses a slender and much branched stem. There are several varieties, but the one shown in the sketch is by far the most troublesome. It more commonly grows to the height of 15 to 21 inches, though in some soils, under favorable conditions, it will grow to the height of four feet. The leaves are much serrated in the outer edges, hence the name. The blossom has something of a yellowish tinge. The buds are small and round and dark in color when ripe, are very numerous, and are chiefly produced on the outer portion of the branches. They are so light that they float readily in water, and are possessed of great vitality.

Ragweed grows late rather than early in the season, so much so that it does not usually ripen its seeds in the cereal crops or in meadows before they are reaped. But in the stubbles of these the plants continue to grow if not disturbed. They blossom from July onward until the time of frost, according to the attendant conditions of growth.

Ragweed (*Ambrosia Artemisiæfolia.*)

Ragweed will grow in all soils free from stagnant water, but it very much prefers friable and loam soils, containing a large amount of humus. It revels in black loams and mucks, but does not make much headway in stiff clays. It matures its seeds in the stubbles after the crops have been removed, in late grain crops, and in clover cut for seed.

It is propagated in the seeds of late maturing cereals, mammoth and alsike clover, and timothy, but more especially in common red clover. The seeds are also distributed by threshing machines, birds, the domestic animals of the farm, and in manures. But no agent is probably more potent in distributing it than water in the time of freshets.

The following include the more effective modes of destroying ragweed:

1. Modify the rotation suitably, and give special attention at the same time to autumn cultivation. As soon as the cereal crops are reaped, the ground should be gang-plowed, or plowed in any way that may be desired. It may then be stirred occasionally before the late fall plowing. Autumn cultivation is particularly helpful in the destruction of ragweed.

2. Grow hoed crops as described in section 3, when treating of wild mustard.

3. Use the mower in the autumn. This can be done when fields are newly sown with grass seeds. Pastures and meadows may be treated in the same way. This will prevent the seeds from ripening in these.

General Observations. 1. When infested meadows or pastures are to be broken up, this may be done, where practicable, before any of the seeds ripen. 2. When the plants are well reduced, hand spudding will soon complete the extermination of this weed. 3. Sheep may be made to render substantial service in cropping this weed while it is yet tender.

The Wild Oat.

The wild oat (*Avena fatua*) is an annual. It bears considerable resemblance to the common oat, but there are some distinctive points of difference. In the wild oat the chaff scales which adhere to the grain are thick and hairy, while in the cultivated varieties, they are not so coarse and are hairless. The wild oat has a long, stiff awn, usually twisted near the base; in the cultivated varieties this is entirely wanting, or if present, is not so stiff and is seldom bent. The grain itself is light, being chiefly made up of hull.

Wild Oat (*Avena fatua*).

This plant matures its seeds in crops of winter wheat, rye and all kinds of spring cereals. It so closely resembles the cereals amid which it grows until the time of coming out in head, that it is practically impossible to remove it by hand before that time, unless when found growing in a crop of peas. It luxuriates in soils well adapted to the growth of cereals, as clay loams, but will grow in nearly all kinds of land. The seed possesses great vitality.

This weed is brought to new centres chiefly through the medium of the seeds of cereal grains, but it also comes down at time of high water from infested fields to lower levels. It is further distributed to some extent in the manure, in the droppings of cattle and through the medium of the threshing machine.

The following modes of combating the wild oat will be found effective:

1. Grow hay, pasture, fodder crops and hoed crops as much as possible until the oats are much reduced, and drop cereal grains out of the rotation so far as practicable for the time being.

2. Break up sod land in the month of June. Cultivate and harrow occasionally until the time of sowing winter wheat, that the seeds of the oats may be induced to germinate

in the upper section of the soil. Sow the wheat with grass seeds, and when the meadow is broken up again repeat the process.

3. Give attention to autumn cultivation, and follow with a hoed crop, as described in section 3, when treating of wild mustard.

4. Grow a crop of rye for fodder, ensilage or pasture, as the case may be, plow the land in June, and manage as described in section 2, above.

5. Cultivate in the autumn, sow early in the spring with oats, peas and vetches, and cut and cure as a fodder crop, and follow this with autumn cultivation, or with a crop of rape grown in drills.

V. GRAIN EXHIBITS.

Exhibit for Ontario during 1892.

The fourth annual exhibit from the Station was presented at the leading exhibitions of Ontario during 1892. At Toronto, London and Kingston the following varieties were shown:

Winter wheat	68	varieties.
Spring wheat	63	"
Barley	67	"
Oats	116	"
Peas	62	"
Corn	76	"

Nearly all of these were shown in the straw, except the peas and corn, and were the growth of 1892. The greater portion of them represented the fourth year's crop from seed imported from Germany, Italy, Sweden, Russia, England, Scotland, Switzerland, Hungary, Greece, Sicily, Egypt, Japan, New Zealand, Australia and the United States. Besides the grain in the straw, glass jars containing samples of grain of the varieties mentioned above were also exhibited.

The exhibit in Toronto occupied the whole end of the Agricultural Hall, being in width fifty feet and in height sixteen feet. In London the display was placed in the dairy building extending along one side for seventy-five feet and in centre reaching a height of about twenty-five feet. The exhibit was made as practical as possible and at the same time was also arranged as neatly as time would permit. Much interest was taken in the exhibit throughout. Those in attendance were kept very busy answering the many questions which were asked by farmers regarding the different varieties presented, the work of the Station and the course of instruction given at the College.

Exhibit for the World's Columbian Exposition.

The Hon. John Dryden, Minister of Agriculture, and Mr. N. Awrey, M. P. P., Commissioner for Ontario at the World's Columbian Exposition, have requested that an exhibit be taken from the Experimental Department of the Agricultural College, and placed at the Exposition to be held in Chicago in 1893. The material for this exhibit is now nearly prepared, and the names of about five hundred varieties of grain and corn have been forwarded to Mr. Awrey to be entered in the catalogue now under preparation. All the varieties forwarded for exhibition have been grown at this Station from one to four years.

VI. EXPERIMENTAL BUILDING.

During the year 1892 upwards of 1,500 plots were devoted to experimental work at this station, over 5,000 packages of grain, seed and fertilizers were distributed among the farmers of Ontario, a large exhibit was prepared for the leading exhibitions of Ontario and another is now under preparation for the World's Columbian Exposition, as already stated. It is almost impossible to do this work in a truly satisfactory manner with the present accommodation. About 1,000 distinct lots of grain and potatoes are now stored in the cellars and upper rooms of six of the buildings located on the College grounds where, in spite of our efforts, mice are doing serious injury. We are compelled to use nearly the whole of the basement of the chemical laboratory for work rooms and an upper compartment as an office. These are far too small for our work and besides are now greatly needed by the chemical department. Farmers and others visiting the College during the winter season have but a poor opportunity of examining the various products which have been grown upon the experimental plots during the year previous.

It is of great importance that an experimental building be erected upon the College grounds where work would be accomplished during the winter months in preparing grain, seeds, fertilizers, etc., to be used the following season for sowing upon the Station plots, and also for distributing among the farmers of Ontario; where the various products of the experimental plots could be preserved for close examination and for testing in different ways; where the reports could be prepared with the different products close to hand for reference; where an exhibition of all the varieties of grain both in the straw and in the sample jars could be neatly arranged for the benefit of farmers and others visiting the College; and where a general office, a private office, a dark photographic room, and a storage room for fertilizers, etc., could be provided.

THOMAS SHAW,
Professor of Agriculture.

C. A. ZAVITZ,
Experimentalist.

REPORT OF THE MECHANICAL FOREMAN.

To Thos. Shaw, Professor of Agriculture:

SIR,—In writing up the report of the mechanical department for the year ending September 1st, 1891, to October 1st, 1892, I find by turning to the labor journal at page 261, the first record of students' name is dated October 3rd, 1891. The special work on hand was making shipping crates, or in other words, preparing for the annual sale which took place on the 8th of the month, and from that date up to the 21st November we were completing the wire fence along the Dundas road, which was reported upon a year ago. After this was completed we turned our attention to the outside windows about the College and other buildings requiring it. When we had made everything comfortable in this direction about the dwelling-houses, we were then engaged until after Christmas in erecting sheep-racks and grain-bins for experimental feeding. From the 15th December until the 21st there is no record of any student labor in the department—these were the inside examination days—after which there were two of the more advanced students employed in the department during the holidays to complete the grain-bins and erect bookcases in your office. On the 25th January, 1892, the regular College work was resumed. Only two names are entered on that day in the department; they were employed repairing the coach-house doors that had been broken by a wind-storm. From this time up to the 15th February our time was mostly employed in making some repairs about the farm and College buildings and work required for the garden. The record gives the following items: Repairing College ice-house, repairing horse stable doors, repairing weigh scales, repairing windows in bull shed, making gravel screen, etc. On the 16th we began to prepare for the field fences that were to be erected on the middle lane. There were over 1,000 cedar posts peeled and trimmed, and also 28 posts for 14 gates hewn and cased. During the month of March there were some alterations about the horse-stables preparatory to erecting a patent device for feeding. You gave also an order for 500 staking pins for experimental plots and a quantity of marking labels for same. About the 1st of April the outside windows were removed from the College buildings and some necessary repairs attended to. The principle work, however, for this month was taking down the old fences and re-sawing the old lumber to erect hurdles along the road line in order to protect the fields until the permanent fences should be built. During the month of May the students working in the department were, to a great extent, employed building these hurdles, as there were over 500 rods required.

Some time in May I was instructed by you to confer with President Mills and Prof. Dean about transmitting motion from the engine in the boiler-room at the experimental dairy to the work in class-rooms, a distance of about forty feet. After some deliberation and conference I decided to adopt the Dodge system of transmission, which is now in operation, and I believe giving every satisfaction, being smooth and noiseless in its action, and is in every way well adapted for the purpose, especially where public speaking is required while machinery is in motion. The first week in June was taken up partly by putting fly-screens on the windows of the dwelling-houses, and partly by putting the mechanical tools in proper order required for the examination of the second-year students which took place on the 7th. The number examined this year was 28, and in our usual way, viz. : by performing a piece of mechanical work in a given time. A pattern is shown of what is required, and the test of proficiency is not only that the work will be similar to the pattern, but also that the tools shall be used in a workmanlike manner. For proficiency in every detail there are 60 marks given. There are, besides, several questions to be answered regarding the proper uses and application of mechanical tools such as the following : "1st. The length of the base of a right angle triangle is 16 feet, the perpendicular is $10\frac{2}{3}$ feet, give the extreme ratio of inches on blade and tongue of the steel square that will determine the angles of either end of the third side, and the number of applications that will produce the length. 2nd. Describe the condition of the teeth of a ripping saw when it is at its best for cutting medium hardwood, and give the important points that distinguish between a ripping and cross-cutting saw. State also the reasons for the difference." The above is a fair example of the way in which the mechanical examination is conducted. The article or implement made will vary from year to year according to the requirements of what may be needed for actual use, and, except in one or two instances, the showing this year was very creditable, some of the students taking as high as 95 per cent. of marks.

There was some repairing done this month on the sidewalk leading to the city, and on the 24th I commenced to erect the permanent fence on both sides of the middle lane, and from that date until the 15th of August, with the assistance of two men digging post-holes and with sometimes two and sometimes three students, there were about 1,000 fence posts set up, and also posts for fourteen gates, and from that time up to the 1st September we were engaged building a kitchen and wood-house at one of the dwelling houses. This summary will give a general idea of how the students were employed in the mechanical department from 1st October, 1891, to 1st September, 1892. In closing, I would make the request that $150 be appropriated for the purchase of tools over and above the usual grant for lumber and hardware.

Following is a list of tools in the mechanical department with their present values : 1 turning lathe, $70 ; 1 vertical drill, $20 ; 1 small vice, $5 ; 1 set stocks and eyes, $35 ; 1 ratchet drill, $3 ; 1 grindstone, $1.50 ; 4 work benches, $16 ; bench planes, $18 ; other planes, $20 ; saws, $15 ; squares, $10 ; rules, $3 ; boring braces, $2 ; augers, $3 ; boring machine, $4 ; 1 anvil, $7 ; tonges, $1 ; cold-chisels, $1 ; 2 4-inch slecks, $4 ; 3 framing chisels, $3 ; firmer chisels, $2 ; nail hammers, $6 ; screw wrench, $1 ; hand screws, $2 ; saw sets, $1.50 ; glue pot, $1 ; spirit levels, $1 ; 4 crampits, $1 ; screw drivers, $2.40 ; 1 chopping axe, $1 ; 3 hand axes, $4 ; 2 adzes, $4 ; 2 broad axes, $5 ; 5 draw knives, $5 ; 4 spokeshaves, $3 ; 2 oil stones, $1 ; gimlets and brad-awls, $3 ; paint brushes, $1.80 ; tool baskets, $3 ; ladders, $4 ; block and tackle, $12 ; fencing tools, $19. Total value, $325.20.

Your obedient servant,

JAMES McINTOSH,
Mechanical Foreman.

REPORT OF THE FARM FOREMAN.

To Thos. Shaw, Professor of Agriculture:

SIR,—I have the honor of presenting to you my sixth annual report of farm operations and student labor. The crops, so far as we can report, are showing a medium yield only. This, I believe, is owing to the excessive rains which fell during the months of June and July, causing an extra growth of straw which, before maturing, became lodged and broken down to a large extent. I believe fully two-thirds of the crop was broken down at the time of cutting, causing much extra labor in harvesting.

We find it impossible to finish threshing the crops before the end of the year for two reasons. 1st. We can only thresh as the straw is used up for feed and litter from lack of room. 2nd. We can utilize the student labor in making improvements on the roads and farm before the ground is frozen, and in the months of February and March, when it is impossible to do such work, we find it more convenient to do the threshing.

We also found it very difficult to keep the root and corn crops properly cleaned and cultivated during the wet weather of June and July. During the greater part of the month of June the fields were not firm enough to carry a horse, so that we had to employ extra labor in order to eradicate the weeds and cultivate the ground properly when the fields became dry enough to work upon.

As we had no frost before October 1st, the corn crop on the whole was well matured, and is now coming out of the silo sweet and good. The root crop was extra large, especially carrots and Swede turnips. The potato crop suffered seriously from rot.

The student labor for the past year has been very satisfactory, the majority of the class being the sons of practical farmers who take a deep interest in all work entrusted to them. They have been distributed so as to have a direct rotation around nine distinct departments, viz.: Farm proper, experimental, horticultural, mechanical, dairy, live stock, botanical, chemical and engineering, including the running of the portable engine, thresher, grain crusher, cutting boxes and root pulper.

CROPPING.

Field No. 1 (20 acres) was sown to barley on April 22nd. It was divided into six plots of three acres each and sown with the following varieties: Oderbrucker, Mandscheuri, Chevalier, Duckbill, Hallet's Pedigree and selected Canadian Goldthorpe.

On the 27th the remaining two acres were sown with common six-rowed barley. The field was seeded down with a mixture of tall oat and red top grasses, lucerne and alsike clover, which grew up very tall and promises to be a heavy meadow if not injured by winter frosts. The barley promises a very large crop, but is yet nnthreshed.

Field No. 2 (17 acres). As I stated in my report of 1891, thirteen acres of the north-west side of this field were sown with rye. The remaining four acres were planted with ensilage corn, two acres of which were used by the dairy department for green fodder. The balance being fairly well matured was put in the farm silo. The rye was cut on June 16th and bound into small sheaves and shocked up, but owing to the excessive rains which followed for about three weeks its usefulness as fodder was destroyed, consequently we were obliged to stack it. We are now passing it through the cutting box and using as litter. The field was plowed and cultivated as soon as the rye shocks were removed, and sown with Dwarf Essex rape in drills twenty-five inches apart. The rape proved a splendid crop, affording feed for one hundred lambs from Oct. 15 to Dec. 15.

Field No. 3 (20 acres). Four acres on the east side were sown with rye last fall, which was cut on the 18th of June, and, like that in No. 2, it was so badly damaged by constant showers that we were obliged to stack it and use it for bedding. Four acres of this field are planted in small trees and are cared for by the horticultural department. The remaining twelve acres are in meadow. It was mown in the first week of July and yielded 2 tons per acre. It was again mown in the last week of September, yielding $1\frac{1}{2}$ tons per acre. On the 8th, 9th and 10th of December we plowed this field in preparation for a corn crop for 1893.

Fields Nos. 4 and 5 (20 acres). This field properly consists of parts of two fields. It is in meadow, and yielded about 2½ tons per acre. As we were favored with fine weather this hay was saved in splendid condition. The plan followed was to cut in the forenoon of each day with two mowers. In the afternoon the tedder was passed through it twice in succession, then late in the evening all the force was put on to cock it. We usually let it stand in cock for three days, and we found it cured with the color and flavor almost as good as when it was growing.

Field No. 6 (20 acres). Ten acres off the south side of the field were sown with eight different kinds of winter wheat, which was put in, cut and threshed by the farm department, and is reported on by the experimentalist, Mr. C. A. Zavitz. The remaining ten acres were sown to rye, which was intended for early cutting, but owing to the continued wet weather of June and July we allowed it to become ripe, when it was cut and threshed in the field. It yielded 27 bushels per acre and is a splendid sample of grain. A portion of it was shipped to different parts of the Province for seed this fall. The field was plowed, cultivated and drilled and sown with rape, which, although sown late, made a fair growth and pastured 240 lambs for three weeks.

Field No. 7 (20 acres) was sown in four plots of five acres each, with the following varieties of oats: Golden Giant, Probsteier, Poland White and White Abundance. The crop was badly lodged by the storms except the Golden Giant, which appeared to have a much stiffer straw, and though a few days later in ripening, was, to all appearance, the finest crop. The Poland White is the only one threshed, and yielded 42 bush. per acre.

Field No. 8 (20 acres) was plowed from sod in October, 1891, being the field in which the Provincial plowing match was held. During the winter months we hauled manure from the barn-yard and piled it in eight large flat piles of not more than 2½ feet in depth, and in the spring we carted and spread it with student labor. We then put on two teams with disc harrows and thus mixed the manure thoroughly with the surface soil. On the 27th of May we commenced seeding it with ensilage corn by using a 12-hoe seed drill. By stopping all but two tubes we were enabled to sow in rows about 42 inches apart, and an average of three grains to the foot. We think it best to sow somewhat thickly as corn is a very uncertain grain in germinating, and if too thick is easily thinned out at the time of hoeing. The varieties of corn were Wilson's True Leaming, Wisconsin Earliest White Dent, Compton's Early, Smut Nose, and Mammoth Cuban. The Smut Nose and Compton's Early, although a much lighter crop, became almost fully matured before being put in the silo. Mammoth Cuban was the earliest of the three large varieties.

The crop of corn was equally divided between the silo belonging to the dairy department and the silo in connection with the farm stables by counting the number of rows of each variety and dividing them equally. The corn was mostly cut by the process of hauling a sled between the rows with a large knife projecting on each side.

Field No. 9 (20 acres) was cropped as follows:

1 acre improved short white carrots, yield 31.9 tons; 1 acre white sugar beets thinned out to about 14 inches apart, yield 18 tons, 52 lb.; 1 acre white sugar beets thinned out to about 7 inches apart, yield 13 tons, 1,634 lb.; ½ acre mammoth red mangels, manured with nine ordinary wagon loads manure from barn-yard, yield 11 tons, 1,968 lb.; ½ acre mammoth red mangels manured with 18 ordinary wagon loads manure from the barn-yard, yield 11 tons, 1,930 lb.; ½ acre Sutton's Champion Swede turnips, manured with nine ordinary wagon loads manure from barn-yard, yield 10 tons, 1,370 lb; ½ acre Sutton's champion Swede turnips, manured with 18 ordinary wagon loads manure from barn yard, yield 12 tons, 1,670 lb.; 1 acre gatepost mangels, which were not weighed, but would, to all appearance, average 10 tons; 5 acres potatoes which suffered from rot so badly that only 66 bags were dug from the plot; 4½ acres Sutton's Champion Swede turnips, which we did not weigh, but which would average 10 tons per acre; 4½ acres Carter's Elephant which was a very heavy crop, but of coarse quality, the turnips having dark streaks through them, and do not promise to keep well.

Field No. 10 (20 acres). About five acres of this field were used for orchard and small fruits, and about two acres for dairy buildings, the balance being used as a pasture for dairy cows.

Field No. 11 (23 acres) was divided off into one-acre plots and sown with spring wheat and oats, except two acres at the east end. The one-acre plots were cultivated and seeded by farm labor and are reported on by the experimentalist, Mr. C. A. Zavitz. Two acres off the east end were sown with Early Bonanza oats, which were so badly rusted and broken down that we were obliged to cut them with a pea harvester and gather them with a hay-rake.

Field No. 12 (17 acres) is meadow and yielded about three tons per acre. It consists of a mixture of timothy, alsike clover, and lucerne and was an extra heavy crop. It grew a splendid aftermath which was pastured off by cows of the dairy department.

Field No. 13 (20 acres) contains five acres now used by the horticultural department for growing small fruits and as orchard. The fifteen acres belonging to the farm department were sown with rye last fall and grew a very heavy crop, averaging five and one-half feet in height. On the 4th of June we commenced cutting it with the binder, making small sheaves. We shocked it in straight rows as far apart as it was convenient for men to carry the sheaves, and immediately started three teams plowing between the rows of shocks. As each land was plowed we cultivated, rolled and drilled into light drills 25 inches apart and sowed rape at once.

Before we could get the rye sufficiently dry to store away the weather became so wet that some of the shocks remained in the field for three weeks, which completely spoiled the rye for feeding purposes and we were obliged to use it for litter.

The rape proved an exceedingly heavy crop, but unfortunately was not the kind ordered. It grew about three feet high, and early in August went into flower resembling a field of wild mustard. In the latter part of August we put in the plows and turned down four acres of that which we thought to be as near to maturity as we could allow it to go lest the seed should fall. We then brought 186 lambs from West Durham Co. and turned them on. We were agreeably surprised to see them attack the flower and seed pods and strip them completely in a few days. When well pastured down we removed the lambs to field No. 3 and plowed No. 13 in preparation for ensilage corn for 1893.

Field No. 14 (24 acres) contains 19 acres controlled by the experimental department and five acres of meadow controlled by the farm. It was seeded in the spring of 1888, with a mixture of one pound each per acre of the following grasses and clovers: Timothy, Orchard, Meadow Fescue, Kentucky Blue, Tall Oat and Italian Rye grass; Alsike Lucerne and common Red Clover. This is not an expensive seeding, and although we can not find a blade of Kentucky Blue or Italian Rye, the other seven varieties have made a splendid showing each year. It was cut on the 5th of July this year and again on the 9th of September, yielding in the two cuttings about four and one-half tons per acre, afterwards growing a fine aftermath. We have had eight cuttings on this field during four years.

Field No. 15 (20 acres) was laid down to permanent pasture by Prof. Brown a number of years ago. A large number of the grasses have disappeared during the past two years, and although still a fine pasture and convenient to the farm buildings, the time has arrived when it should be either broken up or renewed by re-seeding.

Field No. 16 (26 acres) was sown with peas of the following varieties: Twelve acres Prussian Blue, 4 acres Prince Albert, 4 acres D'Auvergne, 1½ acres Canadian Cluster, 3 acres Tall White Marrowfat, 1½ acres Golden Vine.

Field No. 17 (20 acres) was thoroughly drained this year by putting a five-inch pipe diagonally almost across the field in the hollow of a slight watercourse and running in small drains about sixty feet apart, from both sides. It was then sown with rape in drills 25 inches apart, and as in field No. 13 it proved to be the Hybrid rape instead of Dwarf Essex. After pasturing off the north-west half it was plowed by the experimental department in preparation for their experiments next year. They purpose dividing it into small plots. The south-east half was completely pastured off, but not in time to have it plowed.

Field No. 18 (13 acres) is entirely controlled by the experimental department as a field for testing grains.

Field No. 19 (30 acres) was this year sown with oats of two varieties, viz.: Eight acres Black Joanette, 32 bush. per acre; 22 acres White Bavarian, yet unthreshed.

A portion of the ground sown with Black Joanette is high and gravelly, and as this oat requires strong land the yield was below its usual average.

Field No. 21 (12 acres). This field was sown with Oderbrucker barley, one bushel per acre, and seeded with Lucerne clover, 12 lb. per acre. The clover grew almost as high as the barley, and promises, if not winter-killed, to yield a fine crop next year. Barley yielded 27 bush. per acre.

LIVE STOCK.

The live stock at present on the farm represents the following breeds of cattle, sheep, and pigs, and also the horses used on the farm:

Horses.

Ten horses for farm work, $1,400; 1 horse for general purposes, $60.

Cattle.

Shorthorns. 1 bull (imported recently), $200; 3 cows, $600.

Herefords. 1 bull, $100; 2 cows, $300; 1 heifer calf, $50.

Galloways. 1 bull (imported), $175; 2 cows (imported) $300; 1 heifer calf (imp. in dam), $50.

Polled Angus. 1 bull (imp.), $200; 1 cow, $200; 1 heifer calf, $55.

Sussex. 1 bull (imp. recently), $150; 2 cows (imp.), $300; 1 heifer calf (imp. in dam), $130.

Norfolk, Red Polled. 1 bull (imp.), $200; 2 cows (imp.), $200.

Jersey. 1 bull, $150.

Guernseys. 1 bull (recently imported), $75.

Holsteins. 1 bull, $250.

Ayrshires. 1 bull (imp.), $50.

Grade Cattle. 9 cows, $360; 1 Galloway grade steer, $25; 6 Shorthorn grade calves, $66; 6 $2\frac{1}{2}$ year old steers, now fattening, $200; 1 Holstein grade calf, $5.

Total value of cattle, $4,391.

Sheep.

Dorset Horns. 1 ram, $40; 8 ewes, $200; 1 young lamb, $10; 2 ewe lambs, $25.

Oxford Downs. 1 ram, $75; 4 ewes, $40.

Cotswolds. 1 ram, $40; 4 ewes, $100.

Lincolns. 1 ram, $40; 1 ewe, $25.

Shropshires. 1 ram, $75; 9 ewes, $240; 3 ewe lambs (2 at $3, 1 at $4), $10.

Hampshires. 1 ram, $5; 4 ewes, $120; 1 ewe lamb, $10.

Suffolks. 2 rams, $40; 4 ewes, $200; 1 ewe lamb, $4.

Leicesters. 1 ram, $40; 3 ewes, $60.

Southdowns. 1 ram, $10; 5 ewes, $120.

Grades. 110 grades, being fattened, $600.

Total value of sheep, $2,129.

Swine.

Berkshires. 1 boar (imp.), $20; 1 sow $100.

Tamworths. 1 boar, $30; 2 sows, $100.

Improved Yorkshires. 1 boar, $40; 3 sows (imp.), $150.

Grades. 11 grade pigs, $77.

Total value of swine, $517.

Total value of live stock, $8,497. Total value of farm implements, $1,921.

Your obedient servant,

J. E. STORY,

Farm Foreman.

PART VIII.

REPORT OF THE PROFESSOR OF DAIRYING.

To the President of the Ontario Agricultural College :

SIR,—I have the honor of submitting the report of the Dairy Department for the year 1892. I shall present it under the following heads:

I. BUILDINGS FOR THE DAIRY.
II. CO-OPERATIVE DAIRYING.
III. DAIRY STOCK.
IV. INSTRUCTION AND EDUCATION.
V. EXPERIMENTAL WORK OF 1892. (1) Feeding; (2) Milking; (3) Testing Milk and Cream; (4) Creaming and Churning.
VI. TRAVELLING DAIRY.
VII. MISCELLANEOUS MATTER.

BUILDINGS FOR THE DAIRY.

Considerable changes and additions have been made in these during the past year. What was formerly the creamery has been changed into a cheese room, with full equipments for the manufacture of cheese. An addition was made to the butter department, and one of the rooms in the old building fitted up for an office. A new piggery, with accommodation for forty hogs, was erected early in the year, while extensive additions to our stabling gives room for thirty milking cows and a number of young stock. This number of cows will furnish us with sufficient milk to carry on experimental work in both butter and cheese. It will also enable us to give better instruction to students. In the past this department has had too limited a supply of milk to give practice to our students in the dairy, with separators, butter extractor, churns, and the manufacture of butter and cheese.

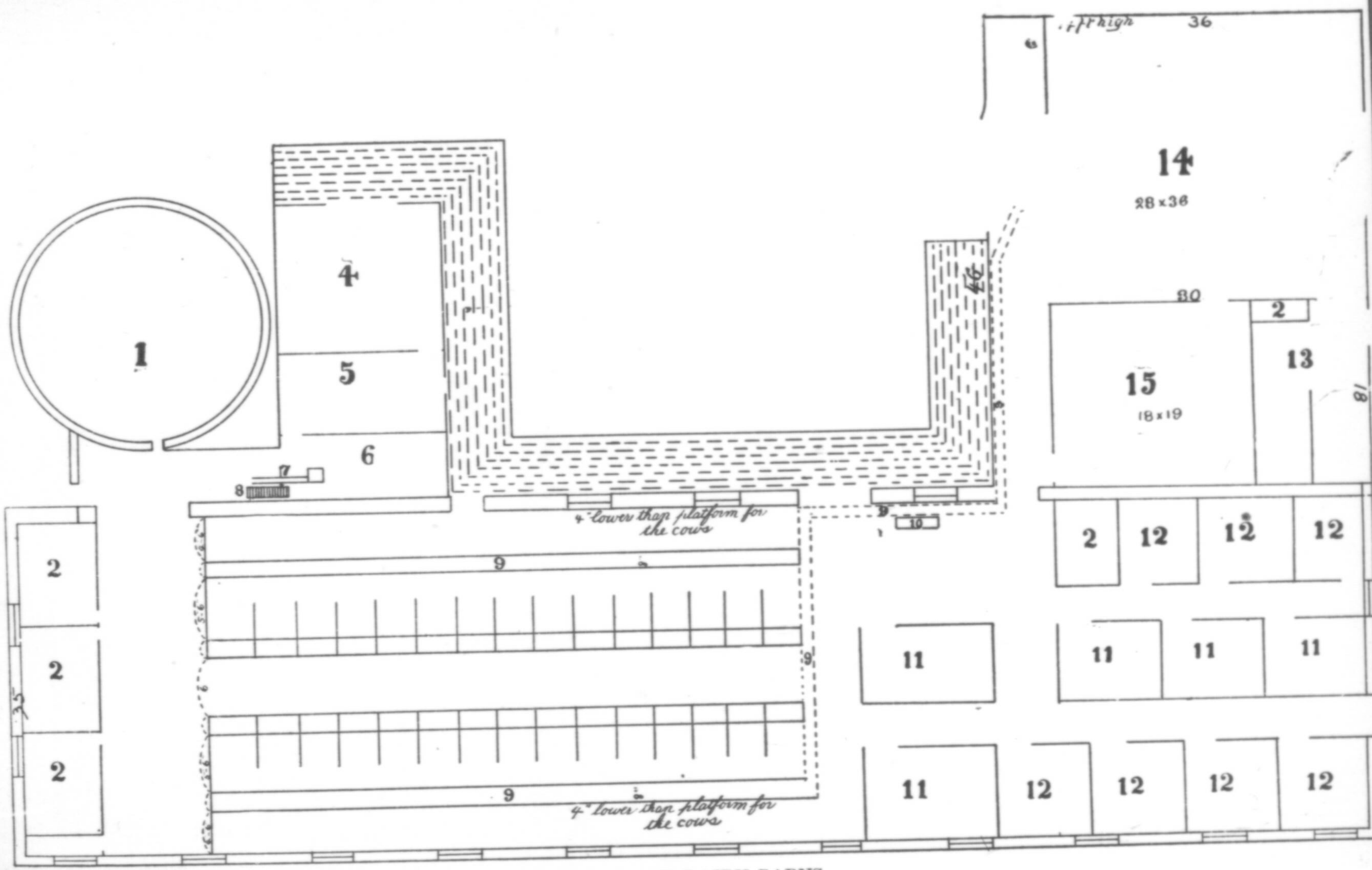
PLAN OF DAIRY BARNS.

1. Silo, 24' diameter and 29' deep.
2. Grain bins.
3. Room for cattleman.
4. Tread power. } Root-cellar underneath.
5. Separator room. } Root-cellar underneath.
6. Cut feed. } Root-cellar underneath.
7. Root pulper, with carrier.
8. Stairs leading to root cellar from silo passage.
9. Gutter, with slant to manure shed.
10. Scales,
11. Box stalls.
12. Calf pens.
13. Horse stalls.
14. Covered manure shed.
15. Calf yard (covered).

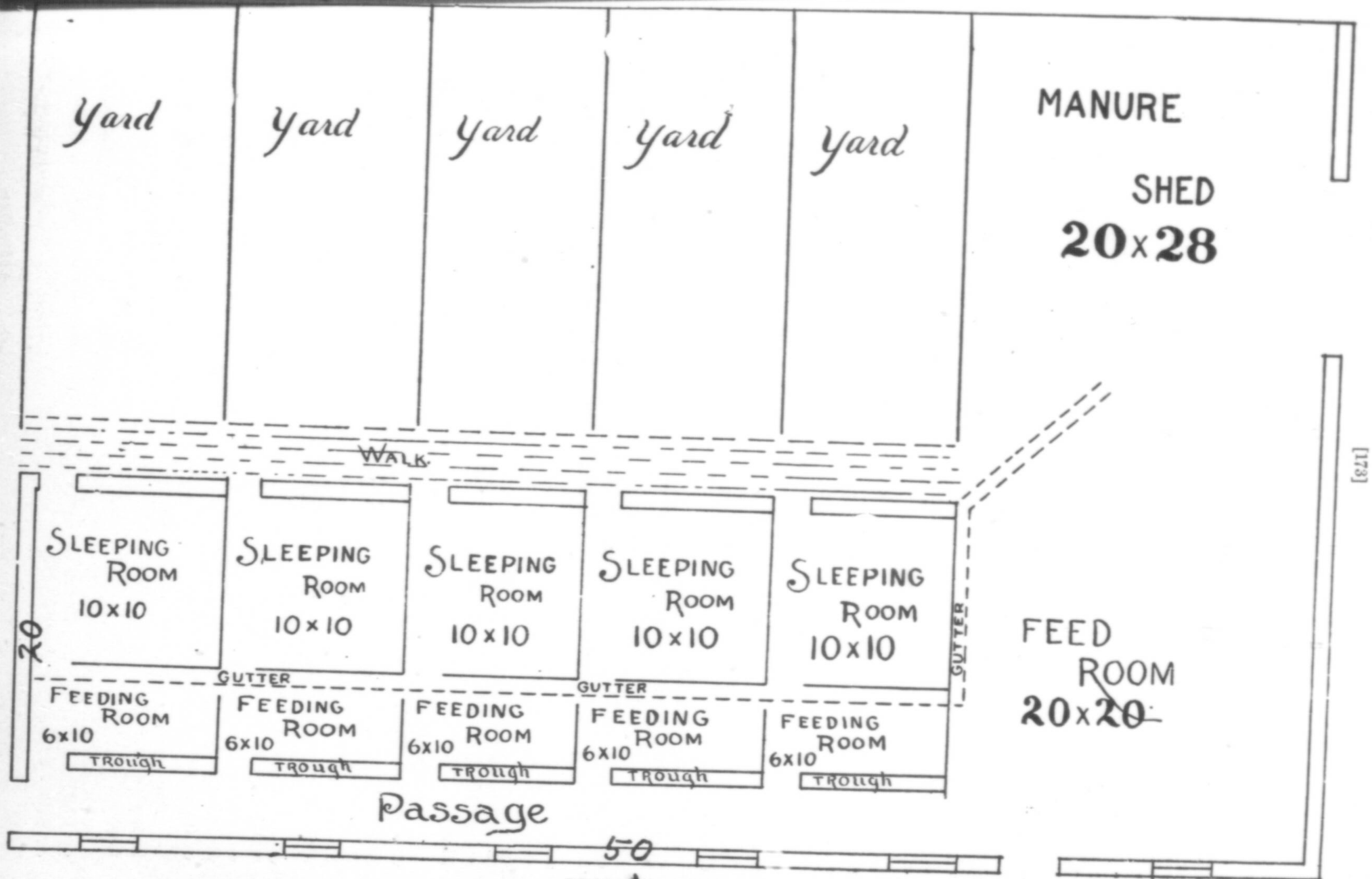
Stalls are single, width 3', 8" centres. Mangers 10" deep; 22" wide on top and 20" in bottom. Salt box and iron water box for each stall.

PLAN OF PIGGERY.

The height of ceiling is 8 feet, with loft overhead, except over the manure shed. The floor is laid with with 2-inch plank. On the inside of the studding of the walls is nailed tar paper, thin boards and battens; on the inside, tar paper and matched lumber. For further particulars see diagram.



PLAN OF DAIRY BARNS.



PLAN OF PIGGERY.

CIRCULAR SILO.

The changes in our dairy stabling made it necessary to remove the silo built in 1889 by my predecessor. This silo was built somewhat differently from the ordinary silo. I quote from the report of that year :

"SILO CONSTRUCTION.

Besides the silo, built in the new main barn buildings, one was constructed in the corner of an old frame barn, all above ground, which was being remodelled for cows for the Experimental Dairy. The plan of its construction was made to differ in some particulars from the directions given in Bulletin XLII on BUILDING A SILO. The finish an the inside of the studs was different on each side of the four sides of the silo.

On one side of the silo, a lining of inch lumber dressed on one side, was nailed on the studs ; this was covered with a sheeting of tar-paper ; on the tar-paper was put a lining of inch lumber dressed on one side, tongued and grooved.

On another side of the silo, the construction on the inside of the studs was similar, with only this difference, that the inside lining of lumber was not tongued and grooved.

On the third side of the silo, the studs were lined on the inside with tar-paper ; on that was nailed horizontally a sheeting of inch lumber tongued and grooved and dressed on the side next the inside of the silo.

On the fourth side of the silo, the finish on the inside of the studs was made by the use of only one thickness of inch lumber neither dressed nor tongued and grooved ; it was nailed on the studs horizontally.

The following concise statement may help to make the difference of inside finish clear to the minds of the readers who have had no experience in silo building :

First side ; studs 2″ × 10″ ; inch lumber dressed on one side ; tar-paper ; inch lumber dressed on one side, tongued and grooved.

Second side ; 2″ × 10″ ; inch lumber dressed on one side ; tar-paper ; inch lumber dressed on one side but *not* tongued and grooved.

Third side ; studs 2″ × 10″ ; tar paper ; inch lumber dressed on one side and tongued and grooved.

Fourth side ; studs 2″ × 10″ ; inch lumber as it came from the saw.

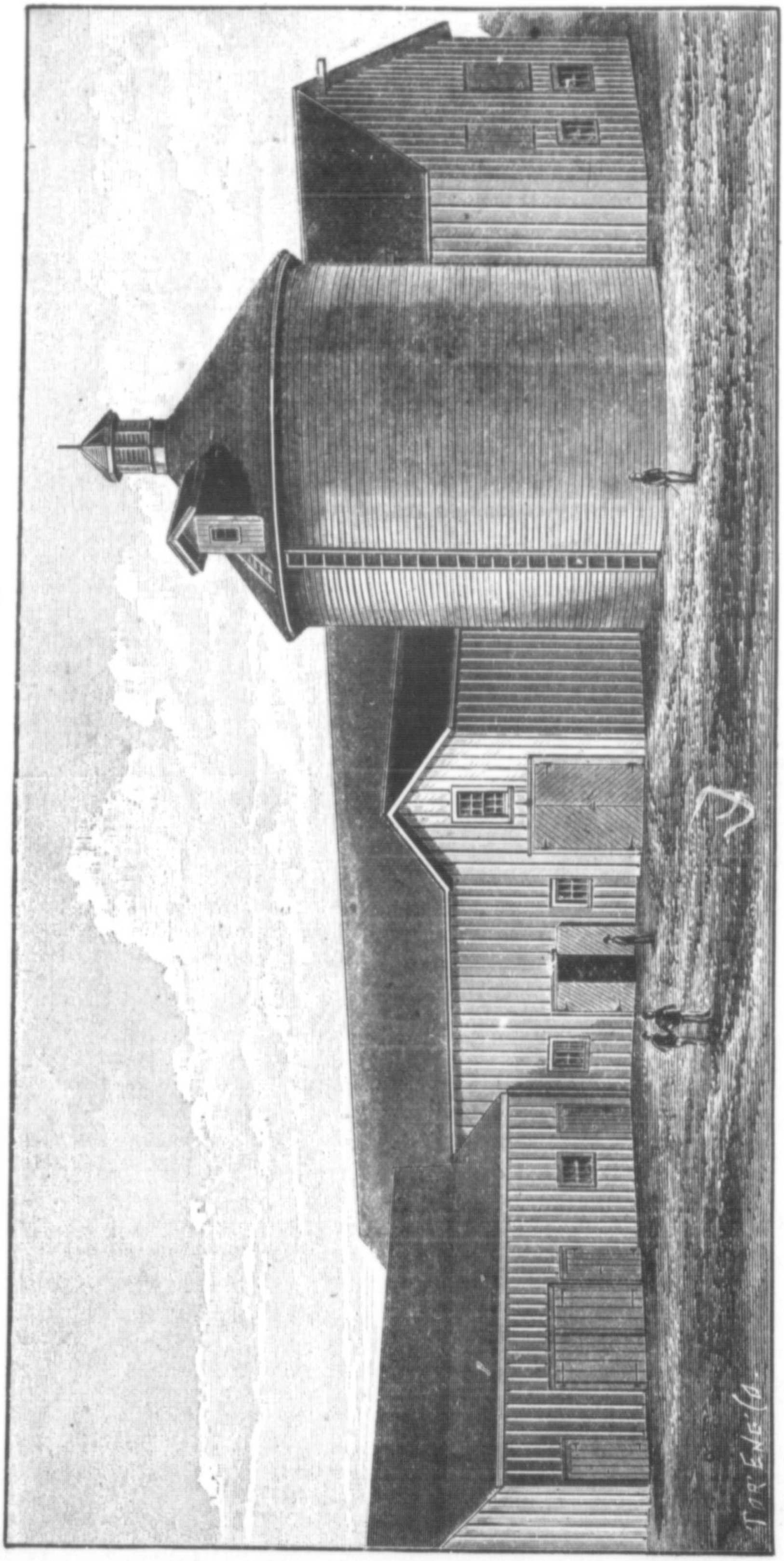
The lumber on all the sides was put on horizontally. The purpose of the DIFFERENCES in the construction of the sides was to discover the cheapest way of building one that would preserve the silage.

I may here anticipate by reporting that up to the time of writing, with the exception of a short distance from the top of the silage, there was practically no waste or spoiling against the *first*, *second* and *third* sides. Against the *fourth* side, the silage was decayed or moulded for a space of from 4 to 6 inches in from the side, for the first six feet from the top of the silage ; below that the waste was confined to a space of about 4 inches around the seam between each two boards."

I may say that after two years' experience with this silo, the side on which there was tar paper and matched inch lumber ("third side") gave as good results as any. The ensilage on the "fourth side" (rough lumber from the saw) was good to the boards—practically no waste—in the bottom six feet of the silo. Above this there was a waste of from two inches to a foot at the top.

After careful examination we could see no difference in the soundness of the lumber in any part of the silo, although it will be noticed that two substances were used with the view of preserving the lumber. It was all sound after three years' use.

To take the place of the one torn down, a circular silo 24 feet inside diameter and 29 feet deep was built. This silo will hold about 250 tons, and cost in the neighborhood of $400, all finished in good style.



DAIRY BARN AND CIRCULAR SILO AT ONTARIO AGRICUTURAL COLLEGE, GUELPH.

Foundation of Circular Silo.

Foundation. The wall is built of stone 18 inches thick and $3\frac{1}{2}$ feet high, being 3 feet under the ground and 6 inches above. The inside of the foundation is flush with the wooden walls above, and projects about one foot on the outside. The earth was excavated to within 6 inches of the bottom of the foundation, giving 3 feet for ensilage below the woodwork. The wall is plastered with Portland cement about $\frac{3}{4}$ inch thick. The bottom of the silo is coated with gravel, and made perfectly level.

Sills. The sills are 2 inches thick and 4 inches wide, made in sections about 4 feet long, sawn out of 2-inch plank to suit the diameter. They are set flush with the inside of the stone wall, and nailed to pieces of wood which were built in the stone work to catch each joint. A trammel attached to a pivot in the centre was used to get the circle exactly true.

Plates. The plates are built of double inch cut similar to the sills, and nailed together on top of the sills in four sections or quarters. The spaces for studding were then marked on each before commencing to raise.

Studding. The studding are $2'' \times 4''$, sized the 4-inch way, the ends being simply butted with a piece about 7 feet long, spiked over the joint. Twelve and fourteen foot studding was used, making 26 feet in all. They are spaced to 16-inch centres; toe nailed to sill and plate, and spiked through on top. In raising the studding, two studs were nailed to one section of the plate, and two ropes were attached to help in raising and to hold in place until properly stayed and supported.

Roof. The rafters are $2'' \times 6''$, sawn from one pattern, and connected to a circle-header at the top $3\frac{1}{2}$ feet in diameter. The boarding is one inch thick, running up and down, and nailed to headers 4 feet apart. The cornice projects 16 inches over the siding.

Walls. Inside the studs was nailed $\frac{1}{2}$-inch lumber, not dressed; on top of this tar paper, and then $\frac{1}{2}$-inch lumber, dressed on one side. Outside is the same, except that the outside layer of lumber is rabbeted.

Ventilator. This is octagon-shaped, $4\frac{1}{2}$ feet inside and 5 feet high to cornice. It can be opened or closed by means of a trap door on hinges, which lies flat on the header where the rafters connect. It is worked by means of sash cord.

Doors. The outside doors are made of $\frac{7}{8}$-inch matched lumber, hung with T hinges, and fastened by means of a button. The inside doors are made with same sweep as the inside of the silo, of double half-inch, with tar paper between, and set without hinges. There are three doors for taking out the ensilage. These are placed at suitable distances apart, one above the other. The filling is done at one door placed at the top of the silo and on the opposite side from the doors where the ensilage is taken out.

Cost of Lumber. Following is the bill of lumber for silo 24 feet diameter and 26 feet high:

Studding.	80 pieces $2'' \times 4'' \times 14'$ long.
	80 " $2'' \times 4'' \times 12'$ "
Rafters.	35 " $2'' \times 6'' \times 14'$ "
Boarding.	6,000 feet $\frac{1}{2}''$ siding.
	2,000 " " rabbeted.
	800 " $1''$ roof boards.
	8 squares of shingles.
Hardware.	200 lbs. wire nails, $3''$.
	200 " cut " $2\frac{1}{4}''$.
	35 " shingle " $1\frac{1}{2}''$.
	8 rolls of tar paper.

Capacity of silo, about 250 tons. Total cost, about $400.

CO-OPERATITE DAIRYING.

Hints Regarding the Establishing and Equipping of Combined Cheese Factories and Creameries.

It would be quite within the mark to say, that no branch of general agriculture has been so remunerative as the dairy during the last five years, consequently there has been a demand from all parts of the Province for information relative to the establishment of these factories and creameries, and also as to the equipment and management of cheese factories as winter creameries.

At the suggestion of the Minister of Agriculture the following data has been collected te meet this general demand.

Brief History of Co-operative Dairying.

The first cheese dairy on the continent of America managed on the co-operative plan was, that owned by Jesse Williams, a farmer of some repute as a cheese-maker, who lived in Oneida County, New York State. He and his son were the first patrons during the year 1851. In 1857 the first factory was erected by Mr. Williams near Rome, N.Y. In 1864 the factory system was introduced into Oxford County, in this Province, by Mr. Harvey Farrington, of Herkimer County, New York State. In 1866 the first factory was started in Hastings county by Mr. Ketchum Graham, and about the same time the first factory in Northumberland county was started by Mr. John Wade and his son Mr. Henry Wade. During the year 1864 to 1867 there was a great development of the co-operative system of cheese-making in the east and west, and more particularly in the west. In 1891 there were reported to the Ontario Bureau of Industries 838 cheese factories and 39 creameries.

1867 saw the Dairymen's Association formed at Ingersoll, Ont. In 1877 the Association divided by mutual consent of its members into the Eastern and Western Dairyman's Association. The dividing line of the territory is that of the agricultural divisions east and west of Toronto. In 1886 the Creameries' Association was formed, whose special care is the development of the butter industry, while the other two associations look more particularly after the cheese interests, although winter butter-making in cheese factories is now becoming so important that it is receiving a great deal of attention at their hands. These associations are supported by money grants from the Ontario Government, amounting altogether in 1892, to $6,000, and by fees paid in by members.

Advantages of Co-operative Dairying.

1. A better average article may be produced and also goods of more uniform quality which will consequently bring a higher average price than private dairy goods.

It is possible to make a better quality of cheese or butter in a private dairy than in a factory, in case a person has the necessary skill and conveniences, but only under special circumstances will it pay the dairyman to employ the labor and buy the utensils required. Consequently for the mass of farmers it will be wiser to adopt the co-operative or factory plan in the manufacturing of dairy goods.

2. Butter and cheese can be produced more cheaply, because there is less outlay for labor and capital on the co-operative plan than there would be if each dairyman would buy the utensils and employ the labor necessary to manufacture the milk in his own dairy. The running expenses are also less.

The object of each person engaged in the business should be to produce goods as cheaply as possible. The profits in dairying lie between the price obtained and the cost of producing and marketing. For instance if cheese sells for 10 cents per pound, and it costs 6 cents to produce and market it, a profit of 4 cents per pound is made. But if it sell for 15 cents and it cost 13 cents to produce it a profit of but 2 cents is made on each pound of cheese. *Profits do not depend upon getting a high price*, but in producing as cheaply as possible and then getting the highest available price for the goods.

3. Skilled labor may be employed in manufacturing. This is a day of specialties. A farmer is not expected to be an expert in growing foods, in breeding and rearing dairy stock and also be an expert cheese or butter-maker. Life is too short to accomplish all this. "This one thing I do," holds good in agriculture also. Some one has said that it will soon be one man's business to hold a nail and another man's to drive it.

4. It is possible to extend co-operative dairying to that branch of farming known as the hog industry, which is so closely allied with the dairy. Instead of hauling the whey, skim milk and buttermilk back to the farm for feeding hogs it will be more profitable to feed these hogs at the factory, where there are sufficient by-products to warrant the erection of suitable pens and the engagement of a competent person to feed and care for the animals.

5. There will be more wealth to the mass of farmers, more comfort in the home, less tired, worn-out farmers' wives and daughters, who are already overworked, and lastly, if co-operative dairying is more largely adopted, there will be built up a national industry that will be a source of national pride. This last cannot be accomplished so long as private dairying takes the lead. This is exemplified in our butter trade at present, which is a source of shame and regret to every Canadian, while our cheese trade is pointed to as the pride of the nation, because of its co-operative principles.

Cheese Factory or Creamery?

This question is frequently asked. Several times we have received a postal card with something like the following written upon it :

"We are thinking of starting a cheese factory or a creamery in this neighborhood. Which would you advise us to build?"

The answer to this depends upon circumstances. Of course those who ask are anxious to know which will pay them best. It is money the average farmer is after. A farmer said to me recently, "We are not farming for fun, but farming to make money and we want you to tell us how we are going to make the most money." Judging from the experience of the Province as a whole we should conclude that the cheese factory has paid better than the creamery, as we have over twenty times more cheese factories than creameries. But there are some districts where a cheese factory could not be successfully carried on unless it would be for a short time during the summer, and even then it would be under difficulties. Sections such as parts of Wellington county, Waterloo, Huron, Bruce, a portion of Brant, parts of Simcoe and York, where beef raising and fattening have been a specialty for years—in these sections cheese manufacturing would be difficult, owing to the fact that all the milk would be taken from the farm and there would be none to rear steers for fattening. In such places the creamery will be found more satisfactory, as the skim milk is either left at the farm or returned after separation at the factory.

In other localities where the population is scattered, roads are bad and the cost of transportation high, the creamery would meet with more favor than the cheese factory, and would be more profitable. It is a question that each place must decide for itself after taking into consideration all the circumstances. A general answer would be to build cheese factories in cheese factory sections, creameries in creamery sections and where there are neither, establish according to the local surroundings; but in any case it would be advisable to build so that either cheese or butter may be manufactured without much additional expense, as the future of this industry is to be largely cheese in summer and butter in winter owing chiefly to climatic conditions.

To give an idea of the amount realised for milk at the factories of the Province, I quote the following from the report of Bureau of Industries for 1891:

Value of product of 100 lb. milk,—

	1891.	1890.	1887-91.
	cents.	cents.	cents.
Creameries (exclusive of buttermilk)	87.0	79.6	83.2
Butter and cheese factories	103.1	90.2	98.5
Cheese factories	88.5	86.0	90.0

Establishing Factories in New Places.

In localities where the people know very little about the management or requirements of a cheese factory or creamery it is a good plan to secure the services of some competent person to address a public meeting on the advantages and essentials of co-operative dairying. Seek to get the support and influence of some prominent men in the locality, as the majority are apt to wait and see what action half a dozen leading farmers are going to take. If these men support it, then nearly all are likely to fall into line. It would be well at this or some other meeting to divide the territory into say four sections, and appoint a committee of two in each section to canvass the neighborhood and find out the number of cows within a radius of five or six miles, and the number of men who will pledge the milk from their cows for a term of three or five years, if the factory is erected. After this committee reports there will be some data to proceed upon for future operations. Unless the milk from about 300 cows can be secured, or a probability of having this number in the near future, it would not be advisable to build a factory and equip it on a very extensive scale.

The next step would be to select a couple of suitable men to go into cheese and butter districts and gather all the information possible in reference to feeding cows, care of milk and cream, methods of conducting the business, plans of buildings, and all matters pertaining to the dairy. Twenty-five dollars spent in this way may save one hundred and twenty-five dollars in future operations.

The next point to decide is the

Method of Conducting the Factory.

There are several ways of starting and conducting the business, but usually it is either what is known as "private enterprise" or the "joint stock company" plan. In the first, some person or persons agree to build a suitable building, equip it properly, and manufacture the milk or cream at a certain rate per pound, the patrons contracting to furnish the milk from a certain number of cows for a certain number of years. In this case the private individual, running all risks as he does, usually charges a higher rate than the joint stock factories. For cheese the rate usually varies from $1\frac{1}{2}$ cents to $2\frac{1}{2}$ cents per pound, the patrons delivering the milk on the milk stand or at the factory, usually the former. For butter the rate varies from three to five cents per pound.

In the joint stock company method the patrons (and others also) subscribe all or a portion of the money required to build and equip the factory, thus becoming owners of the building and plant as well as the cows. This method has several advantages, chief of which are—

1. The shareholders, who are chiefly patrons of the factory, have an interest in its welfare, and are more likely to give it hearty support than if it is owned by some one else.

2. The patrons receive the benefit of the profits of manufacture, which may be applied in reducing the cost of manufacture to shareholders to its lowest limit, after all encumbrances have been paid; or a dividend may be declared each year after paying running expenses, cost of repairs, etc.

Some cheese factories are able to haul the milk and manufacture the cheese of shareholders for one cent per pound. (It is usual to charge non-shareholders an excess rate of about one-quarter cent per pound). Unless there are men in the neighborhood likely to succeed as managers, and who will undertake the work, it would be better to start a factory on a private enterprise plan.

To form a joint stock company it will be best to proceed under the Ontario Act of 1888, which provides for the incorporation of cheese and butter manufacturing associations in a very simple manner.

AN ACT TO PROVIDE FOR THE INCORPORATION OF CHEESE AND BUTTER MANUFACTURING ASSOCIATIONS.

[*Assented to 23rd March, 1888.*]

HER MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1.—(1) At any time hereafter, any five or more persons who desire to associate themselves together for the purpose of manufacturing cheese or butter, may make, sign and acknowledge before a notary public, commissioner, or justice of the peace, in duplicate, and file in the office of the registrar of the registry division in which the business is to be carried on, a certificate in writing, in the form mentioned in the schedule to this Act, or to the same effect, together with the rules and regulations, signed by such persons respectively.

(2) The signatures to the rules shall be verified by the affidavit of a subscribing witness thereto, made before a notary public, justice of the peace, or commissioner authorized to take affidavits, or before the registrar or deputy-registrar.

(3) Upon the filing of the certificate and the rules as aforesaid, the members of the association shall become a body corporate, by the name therein described, with the power to hold such lands as are required for the convenient management of their business.

(4) The registrar or deputy-registrar shall, if desired by the person filing the certificate, endorse on the other duplicate certificate and upon the duplicate of the rules certificates of the other duplicates having been filed in his office, with the date of filing, and every such certificate shall be *prima facie* evidence of the facts stated therein and of the incorporation of the association.

(5) All rules made by the association may be repealed, altered or amended by other rules passed at a regular meeting called for that purpose, provided no such new rule shall have any force or effect until a copy, proved by the affidavit of the president or other head officer of the association to be a true copy of the rule or rules passed by the association at a meeting specially called for the purpose of considering the same, has been filed in the registry office in which the certificate of incorporation was filed.

(6) The association shall cause a book to be kept by the secretary, or by some other officer especially charged with that duty, wherein shall be kept,

(*a*) A duplicate of the certificate and of the rules filed as aforesaid in the office of the registrar, so that persons becoming members of the association may sign the said certificate and rules.

(*b*) Any person so desiring to become a member of, or a stockholder in the said association after incorporation as aforesaid, may sign the said certificate and rules in the said book and shall thereupon become such member, and he shall be entitled to the rights and privileges thereof, and shall become liable as such member as fully as though he had signed the certificate prior to the said incorporation of the association.

2. No association shall be registered under a name identical with that by which any other existing association has been registered, or so nearly resembling such name as to be likely to deceive the public.

3. Any certificate so to be filed may designate any one or more places where the business is to be carried on; but if in different registry divisions, a duplicate must be filed in the registry office of each division.

4. A member of an association incorporated under this Act may have shares therein to an amount mentioned in the by-laws of the association not to exceed $1,000.

5. Before an association commences operations under this Act, they shall agree upon and frame a set of rules for the regulation, government and management of the association, which shall contain—(1) a mode of convening general and special meetings; (2) provisions for audit of accounts; (3) power and mode of withdrawal of members; (4) appointment of managers and other officers and their respective duties, and a provision for filling vacancies caused by death, resignation and other causes.

6. The rules of every association registered under this Act shall bind the association and members thereof to the same extent as if each member had subscribed his name and affixed his seal thereto; and all moneys payable by any member to the association, in pursuance of said rules, shall be deemed to be a debt due from such member of the association.

7. The capital of the association shall be in shares of such denomination as mentioned in the rules.

8. The shares of the association shall be transferable subject to the consent and approval of the association.

9. All elections shall be by ballot, and each member shall have one vote for each share held by him, in respect of which he is not in default for any calls made thereon.

10. Every dispute between members or between members and the association established under this Act, or any person claiming through or under a member or under the rules of the association, and the directors, treasurer, or other officers thereof, shall be decided by arbitration in manner directed by the rules of the association, and the decision so made shall be binding and conclusive on all parties without appeal.

11. The liability of the shareholders shall be limited, that is to say, no shareholder in such association shall be in any manner liable for or charged with the payment of any debt or demand due by the association beyond the amount of his share or shares subscribed for, and any shareholder having fully paid up the amount of his said share or shares shall be absolved from all further liability.

12. The fees to be charged by the registrar for filing any certificate shall be fifty cents, and for any search relating thereto ten cents.

Norwich Junction Cheese and Butter Manufacturing Co.

The following is a copy of the certificate of the Norwich Junction Cheese and Butter Manufacturing Co. :

Certificate.

Province of Ontario, } To Wit: } We, Henry S. Moore, James Barr, Adam J. Stover, William Stover, Michael R. Stover, do hereby certify that we desire to form a company or association pursuant to the provisions of the "Act to provide for the incorporation of Cheese and Butter Manfacturing Associations."

The corporate name of the association is to be "The Norwich Junction Cheese and Butter Manufacturing Company, and the objects for which the association is to be formed are the purchase, manufacture and sale of cheese, butter and milk. The number of shares is to be unlimited, and the capital is to consist of shares of twenty-five dollars each, or of such other amount as shall from time to time be determined by the rules of the association. The number of the trustees who shall manage the affairs of the association shall be five, and the names of such trustees are Henry S. Moore, James Barr, Adam J. Stover, William Stover, and Michael R. Stover, and the names of the places where the operations of the said association are to be carried on are the township of North Norwich and the village of Norwich.

Dated Norwich, the 3rd day of September, 1892.

On the back of the certificate are two statements, as follows :

No. 1.—On the 3rd day of September, 1892, before me personally appeared Henry S. Moore, James Barr, Adam J. Stover, William Stover, and Michael R. Stover, to me known to be the individuals described in the written certificate, and they severally before me signed the said certificate, and acknowledged that they signed the same for the purposes therein mentioned.

T. Brown,
A Com'r for taking affidavits.

No. 2.—I hereby certify that a duplicate of the within instrument is filed in the Registry Office of the County of Oxford at 12 o'clock and 40 minutes p.m., the 5th day of September, A.D. 1892.

Geo. W. Pattullo,
Registrar.

RULES AND REGULATIONS.

Following are the Rules and Regulations of the Norwich Junction Cheese and Butter Company:

Shareholders and Shares.

I. The company shall consist of shareholders holding one or more shares of $25 each, who have enrolled their names in a book kept by the Secretary of the company for the purpose.

II. The payment of shares shall be made in such manner and at such times as the directors of the company shall from time to time direct, but in each case the directors shall give at least thirty days' notice in writing to each holder of a share or shares in the company, of such a call upon the stock, and not more than twenty per cent. of the value of the subscribed stock shall be called in at any one time, and not more than thirty per cent. shall be called for within twelve months.

III. The directors shall call in at least ten per cent. of the subscribed capital stock of the company at or before the last distribution of the proceeds from the sale of products in each year until all indebtedness of the company which is not provided for by mortgage or otherwise is paid and satisfied.

IV. In default of payments of all or any such calls upon stock the directors shall proceed to enforce the payment of same by an action of law, or they may in the exercise of their powers sell any such shares and apply the proceeds of the same toward the payment of any unpaid calls or call due in respect of such stock or shares, and the surplus, if any remains after the payment of such arrears and all expenses incurred by the directors of such actions, shall be deposited in some chartered bank to the credit of the defaulting shareholder, and all liability of the directors shall thereby cease.

V. No subscriber for stock shall be accepted as a shareholder or be entitled to hold stock in the company until the same has been duly allotted to him by the board of directors.

VI. Stockholders may sell or transfer their shares, but such sale or transfer must be made with the consent and approval of the directors of the company.

VII. The books of the Secretary for the transfer of stock shall be closed during fifteen days preceding each annual meeting of the shareholders. The Secretary shall register all transfers of stock in the books of the company, or where furnished with duly executed instruments of transfer signed by both transferor or transferee. A fee of twenty-five cents for each share transferred shall be paid into the general funds of the company. No transfer shall be considered valid until it has been made on the books of the company.

VIII. Each shareholder shall be entitled to one vote for every share which he or she may hold, and shareholders may vote by proxy duly appointed. No person shall be entitled to act as a proxy who is not himself or herself a shareholder of the company.

IX. No shareholder shall be entitled to vote upon any share or shares on which any regular instalment or call has become due and remains unpaid. No shareholder shall be entitled to vote on any stock unless the same has been registered in his or her name in the stock-book of the company at least fifteen days prior to such general or annual meeting of the company.

X. No person shall be entitled to subscribe for or vote upon more than ten shares of the company, either in his or her own right or by proxy.

Officers.

XI. The officers of the company shall consist of a President, Vice-President, Secretary and Treasurer and three Directors. The directors shall be elected at the annual general meeting of the company and shall hold office for one year and until their successors are elected. Shareholders only shall be eligible as directors in the company.

XII. The President, Vice-President and Directors shall constitute the board of directors. All the members shall retire every year, and an election shall take place at the annual general meeting for the appointment of their successors, and all the members of the retiring board of directors, if otherwise qualified, shall be eligible for re-election.

XIII. The President and Vice-President of the company shall be elected at the annual general meeting of the company, or shall be elected from the directors at the first meeting of the board of directors which is held after the annual general meeting of the shareholders.

Powers of Directors.

XIV. The presence of four directors shall constitute a quorum for the transaction of business at a meeting of the directors. The President, or in his absence any director who may be chosen by a majority of those present at such meeting, shall preside, and decide all questions of order subject to an appeal to the board.

XV. If the annual meeting of the shareholders and patrons has not appointed a salesman, then the board of directors shall appoint from their own number or from the shareholders or patrons of the factory a person who shall be salesman of the product of the factory.

XVI. The directors shall also appoint a Secretary and Treasurer, which two offices may be held by one person if the directors so decide, and the President, Vice-President or anyone may hold either office of Secretary or Treasurer or both.

XVII. The President shall have a vote as a director at all meetings, and in addition to that vote in the event of a tie shall have a casting vote as a chairman.

XVIII. The board of directors shall have full power to enter into agreements or contracts with any person or persons to carry on the business of the company, and such person or persons shall have their salaries and remunerations determined by the board of directors, to whom in all cases they shall be directly responsible.

XIX. The directors shall also have full power to determine all salaries and remunerations to officers of the company. But directors shall not be entited to receive more than   for each meeting which they attend, unless the same be authorized at the annual general meeting of the shareholders.

XX. The directors may borrow money for the purpose of the company in any manner which seems to them expedient, and their bond, promissory note or other obligation shall bind the company, and they are authorized to hypothecate, mortgage or pledge the real and personal property of the company in order to secure any sum or sums borrowed for the purpose of the company.

XXI. The corporate seal of the company and the signature of the President or other person designed for that purpose at a regular meeting of the board of directors, countersigned by the Secretary and Treasurer, shall be attached to all such instruments or documents pledging the credit of the company, except in the case of promissory notes, which shall be signed by the President and countersigned by the Secretary and Treasurer without attaching the corporate seal.

XXII. The board of directors may appoint from their own number an executive committee, to whom may be added the salesman and Secretary of the company, to whom they may designate executive powers to be exercised under the directions of the board, and they may also appoint standing committees.

XXIII. The directors shall also appoint one auditor to act in conjunction in the auditing of the accounts of the company with an auditor to be elected at the annual general meeting of the shareholders.

XXIV. In case of any vacancy or vacancies accruing in the board of directors between the annual general meetings of the company they may be filled by qualified shareholders by the board of directors.

Duties of Salesman.

XXVII.—(1) The salesman shall use his best endeavors to sell the products of the factory so as to further the interests of the patrons to the best of his judgment and ability.

(2) As soon as practicable after the completion of any sale he shall notify the President and Secretary the quantities sold, the price agreed upon, particulars of sale, date of shipment, or any other condition or element in the transaction which affects the patrons or manufacturer.

Annual Meetings.

XXVIII. The annual meeting of the shareholders shall be held at Town Hall, Norwich, or at such other place in the vicinity as the directors may determine on the first Saturday in February in each year.

XXIX. Notice of time and place of holding of such annual meeting shall be given at least ten days previously thereto in a newspaper circulating in the neighbourhood, and also by postal notice to that effect mailed to each shareholder's address as last registered in the office of the company.

XXX. The rules of order for the annual general meeting shall be :

(1) The meeting call to order by the President or acting President.
(2) The reading and disposal of the minutes of the last meeting.
(3) The reading and disposal of communications.
(4) Reports of standing committee appointed by the general meeting of the shareholders.
(5) Reports of special committees appointed by the general meeting of the shareholders.
(6) Reports of officers including the report of the salesman.
(7) Report of Auditors.
(8) Unfinished business.
(9) Nominations and election of officers for the ensuing year.
(10) Appointment of one Auditor.
(11) New business.

Special Meetings.

XXXI. Special meetings of the shareholders may be called by the President or any four of the directors or on the requisition in writing of ten shareholders of the company who may hold one-fourth of the stock (subscribed) of the company, and in every such call or requisition for a special meeting a statement shall be made of the definite purpose for which such special meeting is called, and no other business shall be transacted at such special meeting than shall be mentioned in the notice or notices which have been given calling the same.

XXXII. At least ten days' notice of every special meeting shall be given by advertising the same in a newspaper circulating in the neighborhood, and also by mailing a notice to the same effect to the address of each shareholder as last registered in the office of the company.

XXXIII. Any alteration in the by-laws of the company shall be made only by a two-third vote at the annual general meeting of the shareholders.

XXXIV. A copy of the by-laws shall be at all reasonable hours open for inspection by shareholders at the factory where the business of the company is carried on.

XXXV. If from any cause the annual general meeting shall not be held, or due and legal notice thereof shall not be given, then it shall be the duty of the directors to cause a special general meeting of the shareholders to be called as soon as may be, for the purpose of transacting the business of the annual general meeting, and all matters may be dealt with and acted upon as if such meeting were in effect the annual general meeting of the shareholders of the company.

Dated, the 3rd day of September, 1892.

Duties of a Secretary of a Cheese or Butter Association.

1. The Secretary shall keep an accurate record of the minutes of the annual meetings, special meetings of shareholders, and of meetings of the Board of Directors.

2. He shall keep an accurate account of all financial transactions of the Company.

3. He shall keep a stock book for the proper recording of the ownership and transfers of shares in the Company

4. He shall render an accurate statement to each of the patrons of the Company of his or her account therewith from time to time.

5. He shall prepare an annual statement of the business of the Company, for the annual meeting and also for each patron. He shall also send an account of the affairs of the Company to the Ontario Bureau of Industries at Toronto.

Duties of Treasurer.

1. The Treasurer shall deposit all moneys received by him in some reliable bank, as Treasurer of the Company.

2. He shall pay the same always, and only, on the order of the President, duly countersigned by the Secretary.

3. He shall present vouchers for all expenditures to the Auditors and shall present a statement of receipts and expenditures of the Company to the annual general meeting of the shareholders.

Hints to Patrons.

1. Keep none but the best cows, such cows as will give at least 6,000 pounds of milk in a year, or produce 225 pounds of butter-fat. To secure such, select the best

grade cows in the herd and breed them to pure bred males of a milking breed. Rear the heifer calves, giving them special feeding and training for the dairy. Breed these heifers to drop their first calf at from two to two-and-a-half years old. Manage the herd in such a way that at least half the cows drop their calves between October 1st and February 1st, for the winter dairy.

2. Provide a succession of green crops during the summer to partially or wholly supplement pastures. Rye sown in the autumn makes an early green crop. The clovers follow, after which peas and oats, or tares and oats, sown two or three times at intervals of ten days. Corn comes next, and is most valuable in the dairy for fall and winter feeding. This crop should never be sown thickly, but in rows or hills about three feet apart, that it may be thoroughly cultivated. Such a system of feeding will prevent the cows drying up at a time when butter and cheese bring the highest price. A supply of pure water and access to salt at all times is necessary to obtain the best results.

3. Send to the factory, nothing but clean, healthy, pure milk, of good quality, and then demand pay according to its value, or the per cent. of fat contained, instead of in proportion to the poor milk, skim-milk, or water furnished by other patrons.

4. Cleanliness in the pasture field, stable, in milking and in care of the milk is very important, while neglect to strain the milk through a good strainer should not be allowed. Milk for cheese factories and separator creameries should be aerated by pouring, dipping, or by the use of one of the many aerators in the market. The can of milk should be protected from rain and sun, and be free from bad odors of any kind.

5. It will be better to have the whey fed at or near the factory, but where it is returned to the farm see that the can is emptied and washed immediately on its return. Hogs should not be fed within 100 feet of the milk stand.

6. Where cream is supplied to a creamery the milk should be set in deep cans in ice water, or in water that will cool the milk to 45 degrees in less than twelve hours. If ice is not used the water surrounding the cans should be changed at least twice within two hours after setting. Aim to keep the cream sweet by keeping it in cold water until the driver calls for it. Where ten or more good cows are kept it will pay to use a small cream separator especially in winter.

Mottoes.

For Milk and Cream Haulers:

Cleanliness, despatch, carefulness, honesty and punctuality.

For Cheese Factories and Creameries:

Cleanliness inside and outside, with goods of finest quality on the shelves, or in the store-room, and honest dealing with every patron (It will pay manufacturers to send a small pamphlet once a year to each patron, setting forth the proper methods of caring for milk or cream.)

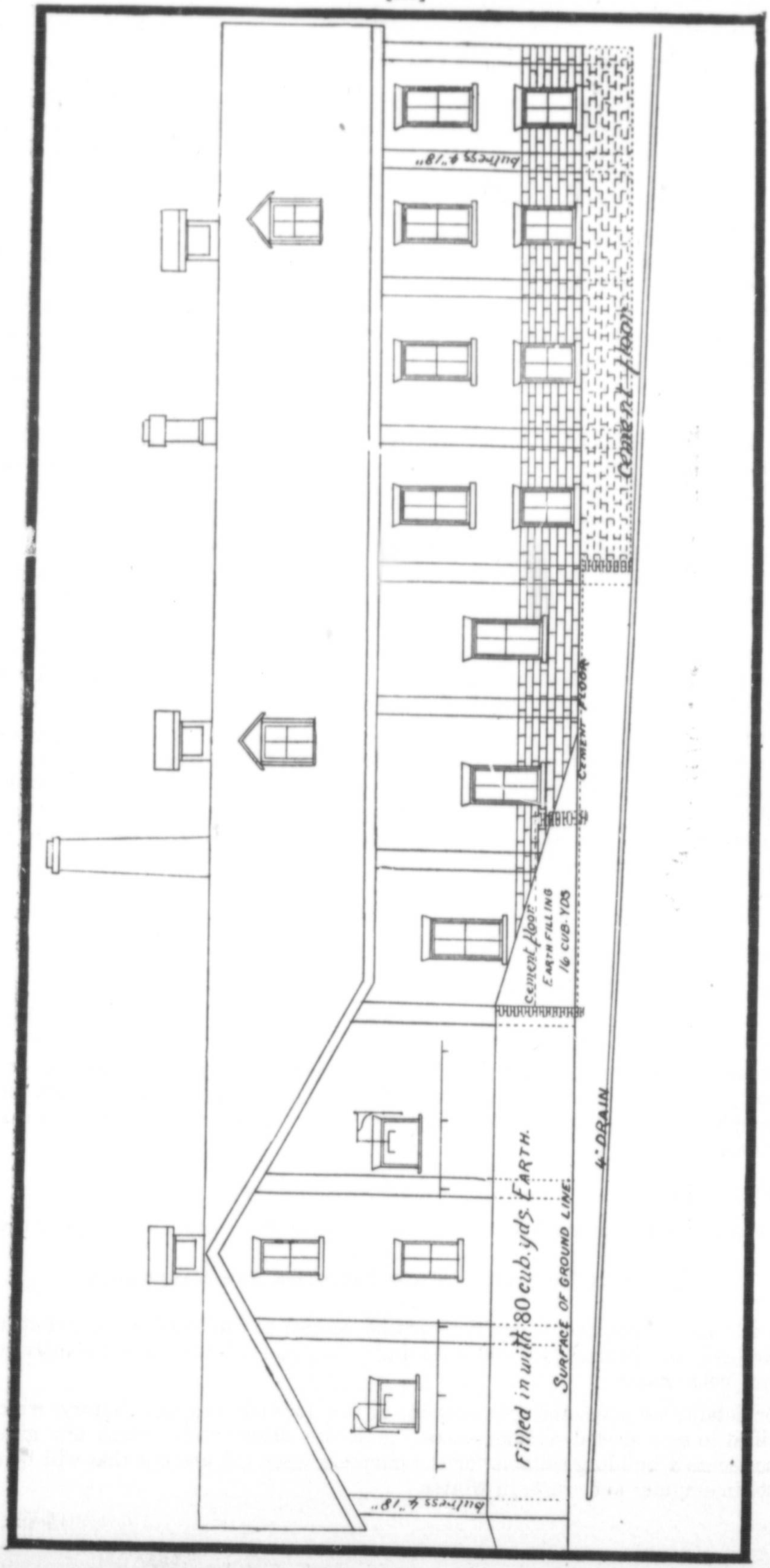
For all concerned:

We are bound to produce the best goods made in any factory in the Province.

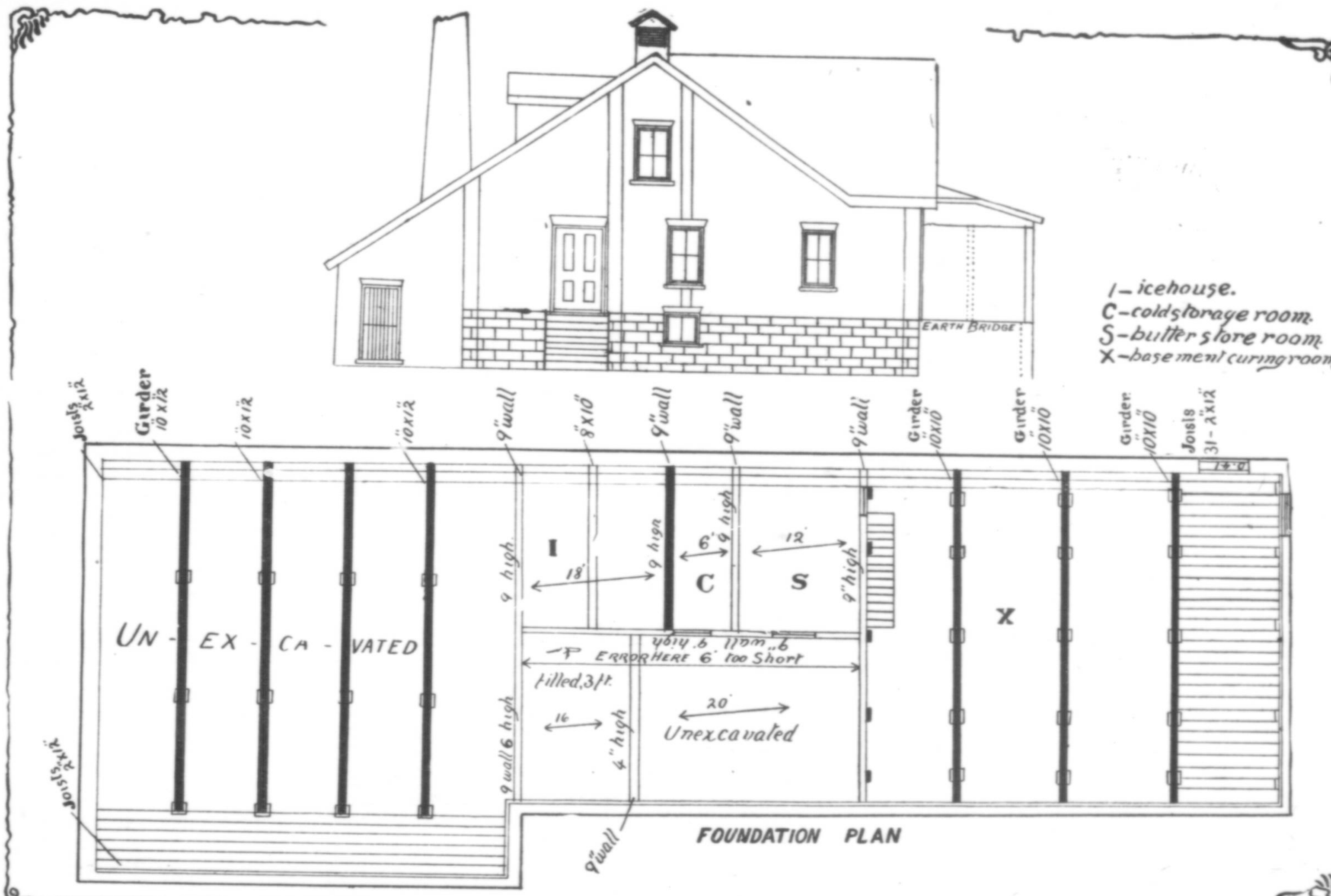
Hints on Building Cheese Factories and Creameries.

In selecting a site, choose one that will be central to the locality; one that may be easily drained, and having good roads leading to it; and one that is abundantly supplied with pure cold water.

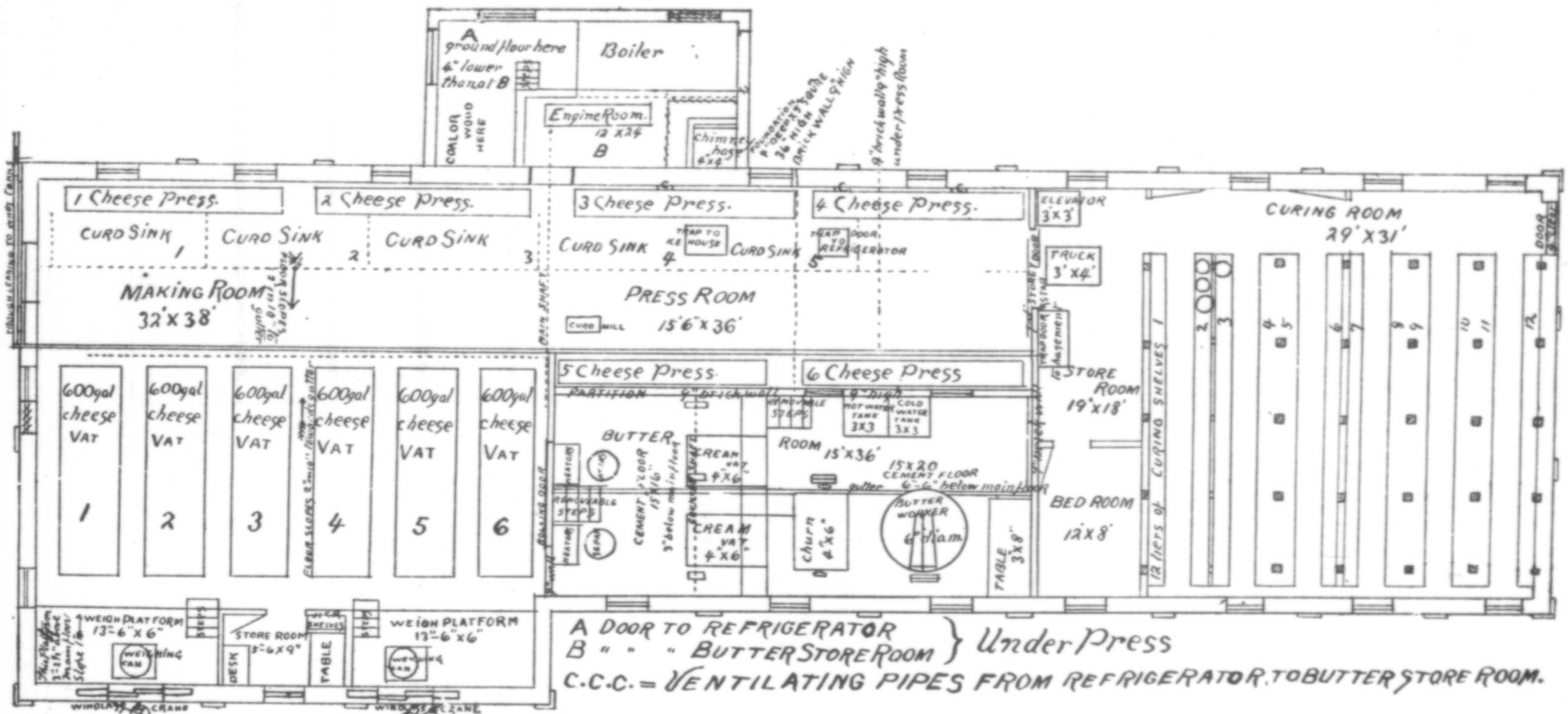
For details, see plans and specifications of the Norwich Junction factory, which may be modified to suit special circumstances. Also see other plans which are given. In any case secure a building suitable for the purposes intended, and one that will be convenient, cool in summer and warm in winter.



NORWICH JUNCTION CHEESE AND BUTTER FACTORY—SIDE ELEVATION.



NORWICH JUNCTION CHEESE AND BUTTER FACTORY—FOUNDATION AND END ELEVATION.



NORWICH JUNCTION CHEESE AND BUTTER FACTORY—GROUND PLAN.

The walls outside, may be made of brick or stone, and inside of lath and plaster, or of one thickness of inch lumber nailed horizontally, on which building paper should be laid, and finish with matched lumber tongued and grooved. Where brick, terra-cotta or stone are not convenient, the outside walls may be made by nailing inch lumber on the studding, then building paper, and finish with boards and battens (dressed), the whole to be neatly painted white, with brown or some dark colour around doors, windows and cornice. The floors of the make rooms should be of 1½-inch red pine, tongued and grooved, laid in white lead, and finished with two coats of hot oil. They should have suitable slants to gutters, for convenience in cleaning. The floor of the cheese-curing room should be double, with paper between, matched lumber on top of paper. The store-room floors for butter may be of cement (domestic cement will make a good floor), hard earth, or an ordinary floor.

Provision should be made for ventilating all parts of the building.

Specifications of Norwich Junction Cheese and Butter Manufacturing Co.

The following is the principal part of the specifications of material to be used and work to be done in the erection of a cheese and butter factory for the use of the Norwich Junction Cheese and Butter Manufacturing Company:

Excavations and Drainage. That part of the building which has a basement to be excavated to a depth of about four feet below average surface of ground on which factory is to be built. About twenty-seven cubic yards of earth shall be used to raise that part where separators and cream vats stand to a height of about three feet above average surface.

That part of engine room marked "B" in plans shall be filled to a level with main floor of making room, requiring about 16 cubic yards.

The balance of earth excavated and not required for filling in against walls shall be used in building elevated roadway and approaches to delivery platform.

Trenches shall be dug where and as deep as required for the walls to rest on firm sub-soil, and be safe beyond the reach of frost.

An excavation five feet square and four feet deep shall be made for foundation of chimney to boiler, and all footings of butments shall be excavated for, so that they shall rest on firm sub-soil.

A drain which shall average two feet deep, and laid with 4 in. tile, shall run lengthwise through centre of basement, beginning at the north end of the factory, and running with an even slope to the south until within the south wall; thence to curve and run easterly to the railway culvert. The part of drain running easterly shall be laid with 5 in. tiles.

A drain of 4 in. tiles shall be laid about a foot outside of foundation on either side, and parallel with central drain, and shall form a junction with the 5 in. drain. These drains shall be laid at least one foot below basement floor.

Foundations. Foundations shall all be put below frost and on firm sub-soil.

All outside foundation walls shall be 18 in. thick, and well built of broken stone, and well laid in good mortar.

The walls on west, south, and east sides of basement curing-room (making a total of 114 ft. lineal) shall be 9 ft. high above basement floor. The east wall shall be continued 36 ft. further north to the making-room to the full height of 9 ft., thence it shall be laid well below frost around to north-west corner of curing-room (200 ft.), which makes a total of 314 ft. lineal around main part of building.

The foundation of the three sides of engine room shall be laid below frost.

The foundations for chimney shall be built of stone, 5 ft. square at base, and taper in 4 ft. of height to 4 ft. square, which is the size of chimney base where the brick shaft begins.

All inside basement walls and partition wall in engine room shall be built of good hard arch brick 9 in. thick. Twelve butments (13 in. square, with 30 in. square footings shall be built under making room.

Fifteen 24 in. square footings, tapering up to about 13 in. square, about 18 in. high (6 in. of which shall be above cement floor), shall be built under curing room, and one 24 in. square footing shall be built in centre of room marked "I" in foundation plan.

Four in. by 18 in. buttressess shall be built.

Brick Work. The brick work shall be 9 in. (or length of one brick) thick, with 4 in. buttresses 18 in. over, and carried up 12 ft. high above stone work. Every fifth course shall be headers.

Only good red face brick to be used in face of wall, and all bricks to be well and evenly laid, and well bedded in good mortar, care to be taken to keep all joints well filled. There shall be no soft or unsuitable brick placed in face of wall, and sufficient care shall be taken to secure a substantial, neat, and workman-like job.

All doors and windows frames, lintels, bond timbers, and other wood work, shall be set and bedded as directed by carpenters or other authorized persons, special care being taken to exclude air at junction of brick work and jambs.

Chimneys. Special care shall be taken to ensure a good and safe chimney to curing-room, which shall be lined with 8 in. smooth hard tiles. It shall extend downwards 4 ft. below ceiling of curing-room, and have an 8 in. thimble built in 2 ft. below ceiling. Beneath the thimble a suitable pocket for the accumulation of soot shall be built, with a suitable thimble and cap for cleaning out.

The large chimney from boiler shall be carried up, and be built in connection with main walls of factory, sufficient care being taken to ensure a safe and substantial structure, 36 feet above foundation.

All arches over door and window frames shall be 9 in. deep, and done in thorough workman-like manner, to ensure strength and durability.

Pointing and Plastering. All stone work shall be pointed and well trowelled to ensure hardness. No earth to be filled in against walls until they are thoroughly dry.

The basement walls shall be pointed and plastered smoothly on the inside as high as the earth is to come against the walls on the outside, with mortar well gauged with cement.

The balance of walls in the basement curing-room to be smoothly plastered with good lime mortar, and well trowelled.

The making-room, press-room, butter-room and curing-room, and all other rooms shown in plans, shall be lathed and plastered from wainscot to ceiling, two coats good hard finish; the ceiling shall be of suitable wood, with felt paper between it and joists.

All stone work above ground shall be lined off in block work on the outside, as shown in elevation plan.

Cement Floors. Basement floor and floors in butter-room and store-room to be made of good cement laid on broken stone and brick-bats, and to be thick enough (2 in.) to ensure durability.

The surface in butter-room must be very smooth and slope to a gutter made in the cement. The cement gutter to run across storage-room out through wall on east side of factory.

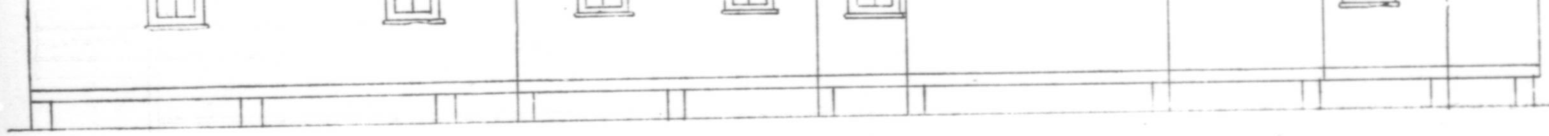
Carpenter Work. All material shall be well suited to the special requirements for which it is used. No unsound or poor timber, lumber, or other material to be used as a permanent part of the building.

Girders and joists to be of sound green pine or white oak for first floor. Girders to be 10x12 in. under making-room, and 8x10 in. under curing-room and press-room. All joists under first floor 2x12 in.

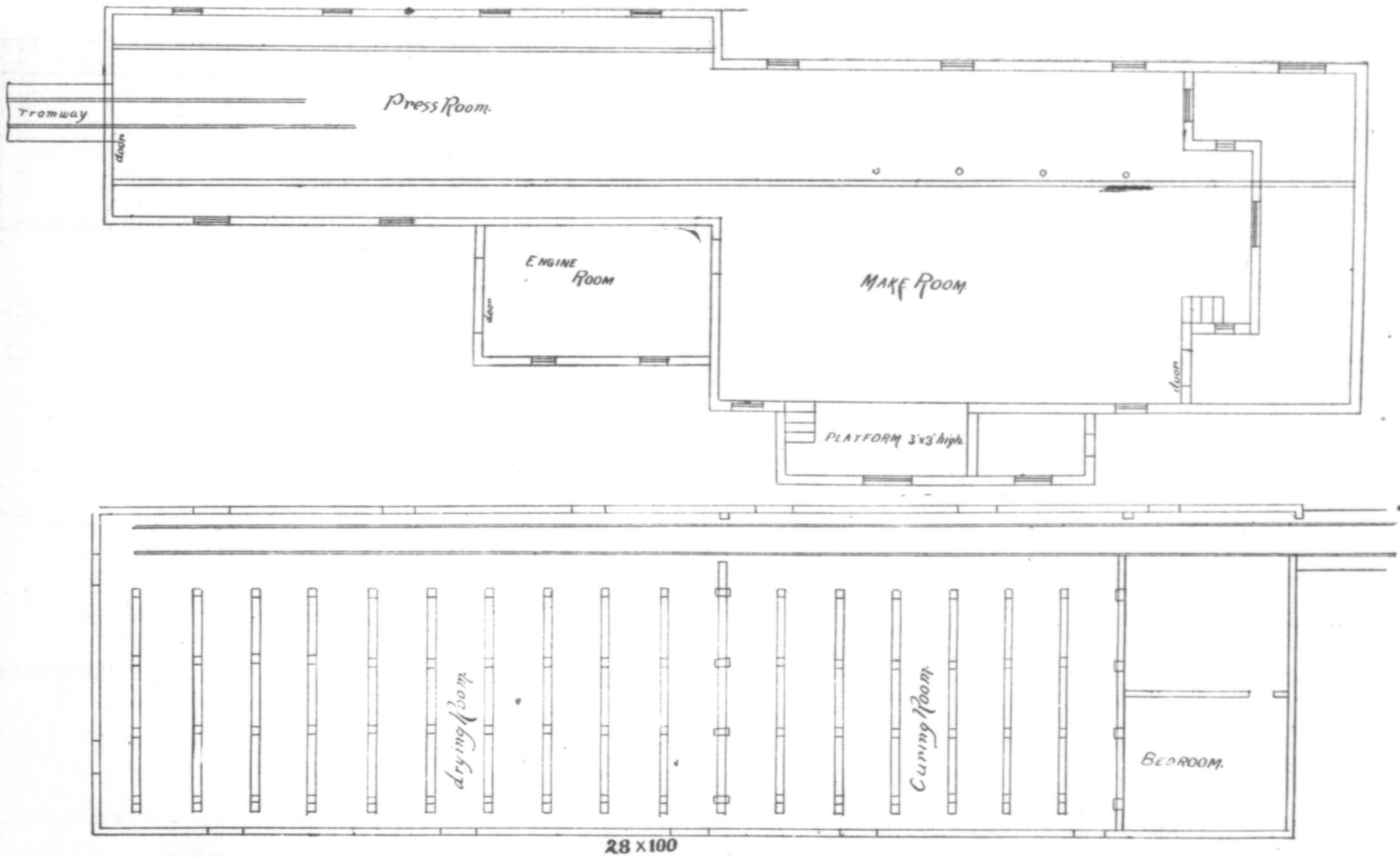
Joists for ceiling shall be of pine 2x10 in., strongly spliced in centre and supported, as shown in margin, by nailing a pine or ash board of good quality 1x12 in. to the rafters at their junction at ridge of roof and across splice of ceiling joists as shown, and the rafters shall be 2x8 in. of pine, and well collar tied.

Ceiling joists and rafters shall be placed two feet apart between centres, and first floor joists shall be 12 in. apart; and the 10x12 in. girders on which they rest underneath making-room may be in two pieces, with a splice under gutter, and supported by a butment; joists to be graded so that the floor shall have a slope of two inches in ten feet towards gutter as shown in plans. All joists to be well bridged. Suitable stripping shall be nailed to the under side of ceiling joists for lathing to, unless the direction decide to ceil with wood.

STRATHALLAN CHEESE FACTORY—SIDE ELEVATION.



STRATHALLAN CHEESE FACTORY—SIDE ELEVATION.



STRATHALLAN CHEESE FACTORY—GROUND PLAN.

A rough board floor of pine or hemlock to be laid and nailed on ceiling joists to make a suitable store-room for cheese boxes, etc.

Wall plates to be 2x10 in., laid double and joints broken.

Floors. All flooring used in making-room, press-room and curing-room shall be of a suitable quality of red pine to ensure a good tight floor. The stuff shall be thoroughly seasoned or kiln dried $1\frac{1}{2}$ in. dressed and matched, not more than 6 in. wide. The floor when laid to receive two good coats of linseed oil, applied hot. The top edge of floor joists to be painted or tarred.

Interior. The interior of all the walls in the making, press, butter and curing rooms shall be plastered with rough mortar, then strapped with $1\frac{1}{2}$ in. strips, with tar paper between strips and plastered wall, then to be lathed and plastered as before mentioned. Four feet in height is to be wainscotted with thoroughly seasoned or kiln dried pine. The walls behind wainscott to be felted same as behind strapping, with dead air space between.

Frames, etc. All doors and window frames shall have 2 in. jambs of suitable material (pine or oak).

Windows. Two windows, two lights 12x18 in. shall be placed in foundation walls under making-room.

Eight 4-light 12x24 in. windows shall be placed in walls of basement curing-room, as shown in plans, and one window same size to be placed in wall for filling ice cellar.

Twenty-three 4-light 12x28 in. windows shall be placed as shown.

Two milk delivery windows, 8 lights 12x14 in. to be placed as shown. The frames and sash to be strong and well made, and firmly secured in wall. The jambs shall be wide enough for sash, which is to be in one piece, to slide in boxed case built to frame on inside of wall. These buildings to have heavy soild sub-sills shaped to fit circle of cans when dumped.

Five dormer windows 4 lights 12x20 in., shall be placed as shown.

All sashes shall be fitted with some good, cheap lifts and locks, so that both top and bottom sash can be raised or lowered and firmly held at any point.

All frames to be made and so finished as to exclude air, and present a plain and neat appearance.

The windows to curing-room to be fitted with plane battened shutters, hinged at top, to open outwards like an awning, and to be secured when open or shut with a suitable hook or other fastening.

The three windows to butter-room to be fitted with double sash.

One large and suitable window to be placed in wall of engine-room as shown.

Doors. The outer door to making-room to be a heavy panel door 4 ft. 6 in. wide in clear and well proportioned. Outer doors from curing-room to be 3 ft. 6 in. wide, otherwise same as above.

The inside door to small store-room shall be a panel door 2 ft. 8 in. by 6 ft. 8 in. and $1\frac{1}{2}$ in. thick.

Double rolling battoned doors to butter-room.

Singly rolling doors from press-room to store room, and same between store and curing-room.

A panel door 2 ft 8 in. by 6 ft. 8 in. to bed-room as shown.

Three battened doors to cold store-room as shown.

Ventilators. Ventilators shall be provided as shown in plans. Wooden pipes 12 in. square to run down through ceiling in curing-room, making-room and butter-room. Also a 12 in. square pipe to run down the floor to basement ceiling. A ventilation pipe 6x12 in. to run from ceiling to floor in each of the cold storage rooms as shown in plans.

Shelving, etc. Curing-room to be fitted with shelves as shown in plans. Shelves to be $1\frac{1}{2}$ in. by 16 in. by 12 ft. pine, dressed on both sides. Posts, pine 5x5 in. (dressed) in upper story and basement, except those with support girders, which shall be of white oak 6x6 in., or pine 6x8 in. Feet of all posts in basement to be dipped in thick paint, or cold tar and gasoline.

Roofing. Roof to be of the best quality of galvanized shingles, except roof of shed over roadway, which may be tar, felt and gravel. Roof to be first-class in every particular.

Painting and Glazing. All outside woodwork which is exposed is to receive two good coats of best brown oxide paint and raw linseed oil, except sashes, which are to be painted well with best lead and oil.

All inside woodwork except floors and curing shelves and posts shall receive two good coats of suitable paint.

The windows shall be all well glazed with good quality common glass, except the 14 x14 in. lights to delivery windows, which shall be double thick glass.

Cornice and Eavetroughs. Projection of roof at gable and eaves to be 16 in., and to be plainly and neatly finished with matched pine, which shall be first painted, and then best galvanized eavetrough shall be put up and have sufficient leaders connected with drains to carry off all water from roofs.

Hanging and Fitting Doors. All doors shall be well fitted to close tightly. Good hinges and locks to be used on outside doors, and good rollers used on the outside doors.

Trusses. The ceiling joists over delivery platform shall be supported across the spans by trusses above.

Stairs. Suitable stairs shall be provided where needed as shown in plans.

Intent and Meaning. The whole of the work to be done according to the true intent and meaning of the plans and specifications, and to finish and construct everything in a proper and workmanlike manner, notwithstanding every item or detail may not be particularly mentioned.

Shed over Driveway. The shed over driveway shall be as follows: A stone wall resting on firm sub-soil shall be built to support elevated earth driveway. On the wall, planks for studding to rest on shall be laid and secured by bolts built in wall.

A light but sufficiently strong frame work shall rest on wall made of suitable posts 6x6 in., and girted to receive upright planed and battened boards. The rafters shall be secured to brick wall of main part and be sufficiently strong to carry gravel roof. Suitable double doors shall be firmly hinged as shown in plans.

Plan of Ayton Creamery.

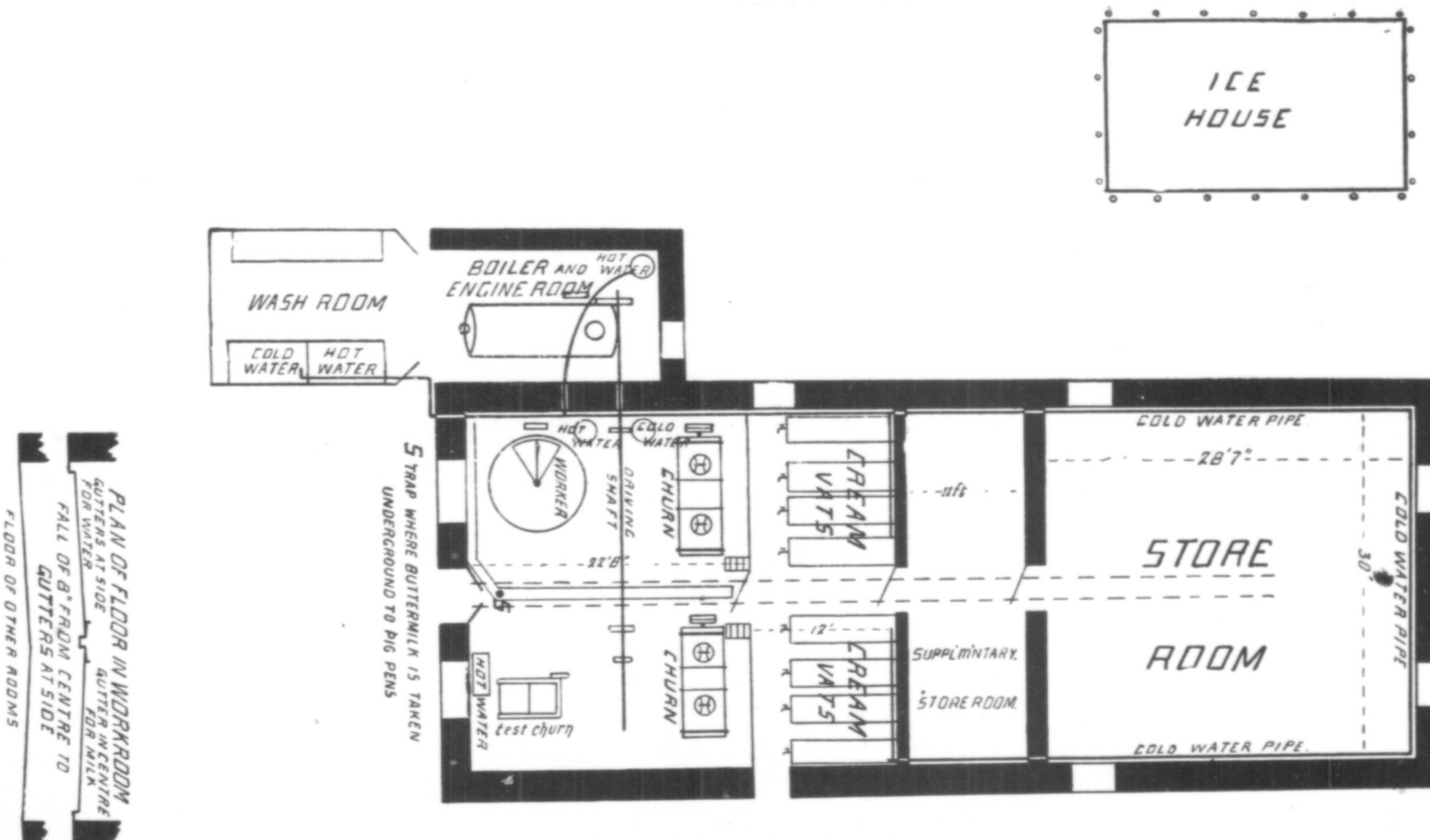
Through the kindness of Mr. A. Wenger, of Ayton, we are able to present a plan of this excellent creamery. The front or north side is on level with ground. The south end is possibly 6 ft. under ground, which gradually slopes to the front. Cream vats are raised on trestle-work, about 4 feet from the floor, so that the cream flows into the churns. The store-rooms are cooled with cold water. There is a large pan made of galvanized iron which should cover the whole size of the storage-room. This pan is 12 inches deep and the bottom bends down between the joists. Under the apexes of the pan are small wooden troughs which carry away the drip into a trough leading into the gutter. Three pipes ($\frac{1}{2}$ in.) run from the main pipe and empty into the pan. When the pan becomes full the water passes out in an overflow pipe into the gutter. This keeps the storage room at about 55° to 56° during summer. Occasionally it may rise to 58°.

Walls are of stone two feet thick. Ceilings plastered, except where cold water pan is. Floor in cream-room and work-room is maple, well oiled. Storage-rooms, cement floors.

Back of creamery there is a hill of considerable size. A spring rises out of this hill, which supplies water to all points where it is wanted.

Cost of Constructing Buildings.

The contract price for building the Norwich Junction cheese and butter factory was $4,095. A factory similar to the Strathallan cheese factory can be erected for from $3,000 to $3,700, according to material used. Buildings for a creamery on the Ayton plan would cost about $1,600.



AYTON CREAMERY—GROUND PLAN.

Changing Cheese Factories into Winter Creameries.

Instead of closing the cheese factory as soon as cold weather commences, a number of the leading factories are being equipped with utensils for the manufacture of butter in winter. The plan which appears to give most satisfaction is that of separating at the factory and returning the skim milk to the patrons. Where a number of small factories are near each other it would be advisable to put a separator in two or three factories and ship or haul the cream to a central factory, which might be equipped with both separator and butter-making apparatus. This plan would lessen expenses and save labor, as but one factory would need to go to the expense of churns, etc., while the milk would not have to be carried such long distances.

To give an idea of the cost of converting a cheese factory into a creamery for the winter, I have much pleasure in quoting from a couple of letters received from parties who have been engaged in such work this season.

The first is from a letter received from Mr. Ogden Hinch, who owns a factory near Napanee, in Eastern Ontario :

"Dear Sir,—Replying to yours of 23rd instant, *re* conversion of cheese factory into creamery, I utilized one of the receiving vats used in the cheese factory, and which we elevated about 3 ft. 6 in., and underneath which we placed one of the pans out of another vat, to receive the skimmed milk. The balance of the apparatus had to be entirely new, consisting of one No. 1 Alexandra separator, $400 ; two cream vats, $75 ; one, power butter-worker, $70 ; one trunk-lid churn, $60, (300 gal. capacity) ; one 15-horse power boiler and 10-horse power engine, $500 ; setting the same, $50 ; shaftings, pulleys and belting, $150 ; butter-ladles, packers, etc., $3 ; one 24-bottle Babcock tester, $22 ; cream pails, $2.50 ; one Newton's computator, $6 ; two skimmed-milk tanks, with plate glass sections running from top to bottom, costing $7 each ; steam ejectors, $15 ; rubber hose, $6 ; steam piping, taps and fitting, $15.

"As to the extra fitting to keep the building warm, my building was almost new, and being well-built, having matched lumber inside and outside, with building paper between, it was almost frost-proof, so that with the addition of double windows and doors, and a coal stove in the making-room, my building is very complete and comfortable. I also had doors put up in the shed where the teams stood, and had to enlarge my boiler-house and line it with felt paper and matched lumber, costing about $35, in all about $1,450. The cost of the creamery has been very much enhanced in my case, as it was an entirely new venture in this section."

It will be noticed that Mr. Hinch has an item of $500 for boiler and engine, which expense most factories could save by utilizing the factory boiler and engine.

The second is from W. S. Campbell, Secretary of the North Brant Cheese and Butter Co., Brantford :

"Dear Sir,—No two cheese factories would cost alike to change into butter factories. Our engine room was too small at first. It cost us $100 to enlarge it and board around underneath, to make our factory warm enough, and about $750 for separator, vats, shafting, belts, hangers, etc., and perhaps $50 more for many small articles and utensils. The following is a list : One 3,000 lb. per hour Alexandra separator ; one trunk-lid churn (400 gals.) ; one tempering vat ; one small vat ; one pump for elevating milk ; one twin cream vat (400 gals.) ; one 300-gallon buttermilk vat ; one 300-gallon skimmed milk vat. It took a lot of extra shafting, hangers, belting, etc., for all of which we contracted to pay a firm $720. We use one of our cheese vats to receive the milk. I should say that it would cost from six to eight hundred dollars to fit up, or change from cheese to butter factory, but would certainly advise building a separate room in which to make butter. There is a lot of work changing from one to the other each season."

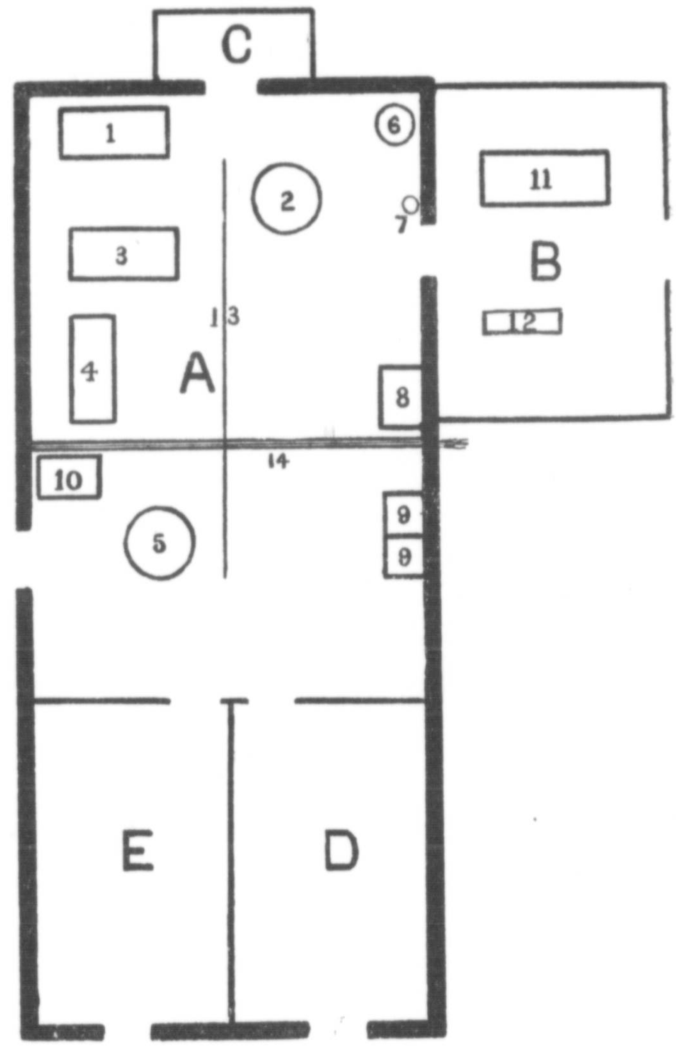
I wish to call attention to the fact that Mr. Campbell advises a *separate* room for the manufacture of butter, and this is being erected by some factory owners. A building 20x30, convenient and warm, would answer the purpose.

List and Approximate Cost of Utensils for Cheese Factories and Creameries.

A leading firm supplied us with the approximate cost of utensils for cheese factories and creameries as follows. They say in all cases, "these figures are only approximate, and can be modified in many ways, and reduced according to location and circumstances."

PLAN OF A CENTRIFUGAL CREAMERY.

CAPACITY, 500 COWS.

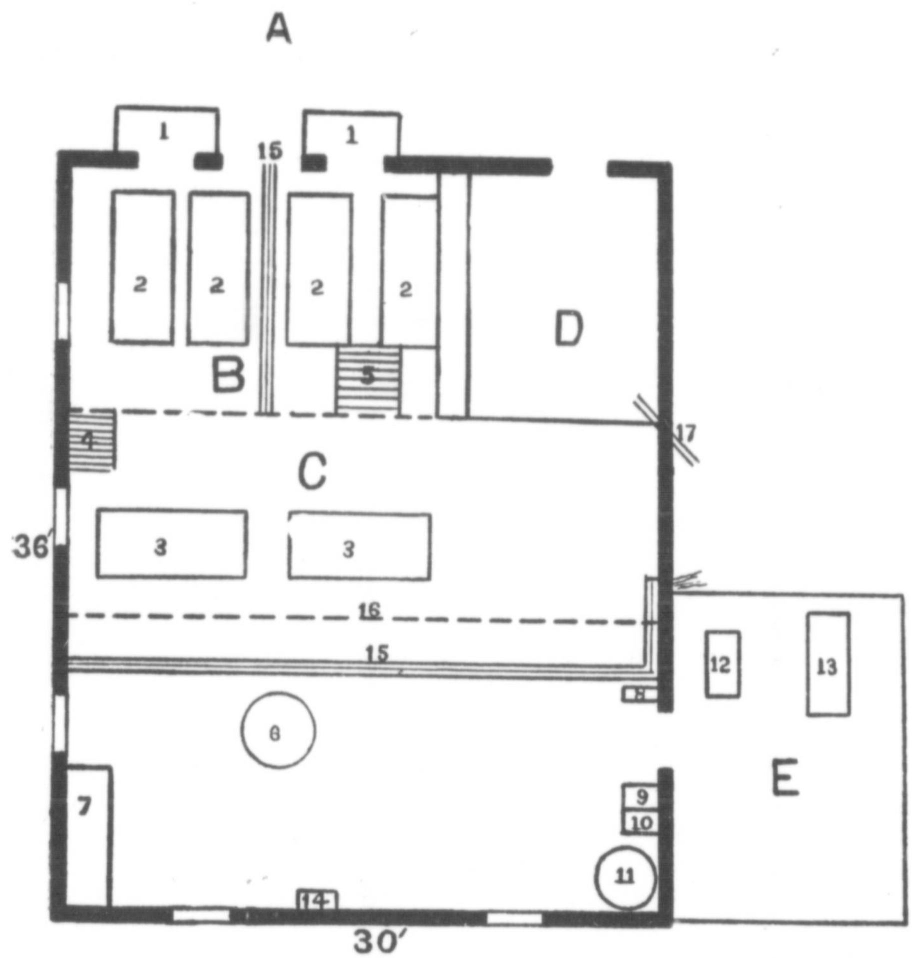


A. Working room, 20 x 30.
B. Boiler-room, 12 x 16.
C. Weighing platform, 4 x 8.
D. Ice house, 10 x 16.
E. Store room, 10 x 16.

1. Receiving vat (elevated 3 ft., or by using pump it may sit on floor).
2. Separator.
3. Cream vat.
4. Churn.
5. Worker.
6. Water tank overhead.
7. Babcock tester.
8. Skim milk tank (elevated).
9. Cold and hot water boxes.
10. Buttermilk tank.
11. Boiler.
12. Engine.
13. Line of shafting.
14. Gutter.

PLAN OF CREAMERY ON CREAM GATHERING PRINCIPLE.

CAPACITY, 500 TO 700 COWS.



A. Covered drive way.
B. Cream platform raised 3 ft.
C. Churning floor.
D. Ice house.
E. Engine and boiler room.

1. Platform for delivery can.
2. Cream vats.
3. Churn.
4. Steps to platform.
5. Steps to storeroom underneath.
6. Worker.
7. Salt table.
8. Oil test churn.
9. Hot water.
10. Cold water.
11. Cold water tank elevated.
12. Engine.
13. Boiler.
14. Desk.
15. Gutter.
16. Line of shafting.
17. Drain from ice house.

Floors in B to slant one inch to gutter, in C to slant two inches to gutter.

Cheese Factory Outfit for 500 Cows, Exclusive of Buildings.

1 boiler and engine	$300 00	Curd scoop, dipper, pails, thermometers, etc.	$4 00
2 600-gallon vats	120 00	1 24-bottle Babcock tester	20 00
1 12-hoop Fraser gang press	85 00	1 curd mill	20 00
1 6-gang upright press	60 00	Steam pipes, shafting, pulleys, hangers, etc.	50 00
1 14-foot curd sink	25 00		$730 00
1 800-lb. scale, double beam	20 00		
1 50-gallon weigh can	10 00		
Milk conductor, head and pipe	4 00		
2 Curd knives	12 00		

Sundries.

1 hoisting crane	$11 00	Stencils, brush, etc	$2 00
1 small pair of scales	10 00	1 cheese trier	1 50
1 8-oz. graduating glass	75	1 water tank, 10-bbl	9 00
1 10-oz. graduating glass	1 00	1 water barrel	....
2 rakes for stirring	1 00	1 whey tank, 55-bbl. cap	20 00
1 bandager	2 00	1 pump for whey	10 00
2 floor brushes	1 50		$70 25
1 rubber scraper	50		

Outfit for a Creamery on the Separator Plan for 500 Cows (Exclusive of Buildings).

1 boiler and engine	$300 00	1 24-bottle Babcock tester	$20 00
1 Alexandra separator	400 00	Dippers, pails and thermometers	5 00
2 300-gal. cream vats	100 00	Butter-ladle and packer	2 00
1 400-gal. churn and worker	120 00	1 tempering vat or heater	20 00
1 400-gal. receiving vat	50 00	Shafting, bolts, and pulleys	75 00
1 800-lb. scale	20 00	1 240 lb. scale	10 00
1 50-gal. weigh can	10 00		$1,137 00
1 conductor, head, and pipe	5 00		

Sundries.

Strainers for cream vat	$1 00	1 scraper	$ 50
1 hair sieve	1 00	1 water tank, 20 bbls. capacity (hot)	13 00
1 butter printer	1 50	1 cold water tank	....
1 8-oz. graduated measuring glass, for color	75	1 skim-milk pump or ejector	10 00
Stencil plates and brushes	2 00	1 tank (6,000 lb. capacity)	10 00
1 butter trier	3 50		$44 75
2 floor brushes	1 50		

Cream-gathering Outfit for a Creamery of 500 Cows (Exclusive of Buildings).

1 boiler and engine	$300 00	5 Drivers' cases	$12 00
2 300-gal. cream vats	100 00	Pails, ladles, packers, etc	5 00
1 300-gal. churn and butter worker	100 00	Shafting, pulleys, belts, etc	50 00
1 800-lb. scale	20 00	Sundries (pails, dippers, etc.)	10 00
10 Curtis refrigerator carrying cans	100 00	1 50-gal. weigh can	10 00
1 240-lb. butter scale	10 00		$777 00
1 No. 2 oil test churn (Curtis)	60 00		

Sundries.

1 cream conductor	$4 00	1 butter trier	$3 50
1 strainer for cream vat and churn	1 00	Water tank (20 bbls. capacity)	13 00
1 hair sieve for buttermilk	75	1 cold water tank (20 bbls. capacity)	....
1 butter printer	1 50	1 hot water tank	....
1 8-oz. graduating glass	75	1 buttermilk tank	....
Stencils, plates, and brush for branding	2 00	Steam and water pipes	....

Outfit for Cheese Factory and Creamery Combined, with Separator for 500 Cows (Exclusive of Buildings).

1 boiler and engine	$300 00	2 600-gal. cheese vats	$120 00
1 Alexandra separator	400 00	1 Fraser gang press	85 00
1 400-gal. receiving vat	50 00	6-gang upright press	60 00
2 300-gal. cream vats	100 00	1 14 ft. curd sink	25 00
1 400-gal. churn and worker	120 00	2 curd knives	12 00
1 830-lb. scale	20 00	Curd scoops, pails, etc	5 00
1 50-gal. weigh can	10 00	Curd mill	20 00
1 conductor, head, and pipe	5 00	Shafting and pulleys	75 00
1 24-bottle Babcock tester	20 00	1 240-lb. butter scale	10 00
Dippers, mops, thermometers, etc	5 00		
Butter-ladles, pails, and packers	5 00		$1,467 00
1 sep. temp. vat	20 00		

(See sundries for cheese factory and creamery on separator plan.)

Outfit for Combined Cheese and Butter Factory on Cream Gathering Plan for 500 Cows (Exclusive of Buildings).

1 boiler and engin e	$300 00	1 conductor, head, and pipe	$5 00
2 300-gal. cream vats	100 00	1 24-bottle Babcock tester	20 00
1 400-gal. churn and butter worker	120 00	2 600-gal. cheese vats	120 00
1 800-lb. scale, double beam	20 00	1 Fraser gang press	85 00
1 240-lb. butter scale	10 00	1 6-gang upright press	60 00
10 Curtis refrigerator carrying cans	100 00	21 by 14 ft. curd sink	25 00
1 No. 2 Curtis oil test churn	60 00	2 curd knives	12 00
5 Drivers' cases	12 00	Curd mill	20 00
Pails, ladles, packers, etc	5 00	Curd scoops, pails, etc	5 00
Shafting, pulleys, belts, etc	50 00		
1 50-gal. weigh can	10 00		$1,139 00

(See sundries for cheese and butter on cream gathering plan).

DAIRY STOCK.

At present our stock numbers 18 milking cows, composed of three imported Ayrshires and one Canadian bred; one imported Guernsey and three Canadian bred; one Jersey; three Holsteins; and the rest grades. There are also seven calves and yearlings—1 Jersey, 1 Guernsey, 2 Ayrshires, 1 Holstein and 2 grades—all heifers except the Guernsey. A horse and seven pigs complete the list. The following cattle have been sold during the year: 4 grade calves, 2 grade cows, 1 Ayrshire cow, 1 Ayrshire bull calf and 2 heifer calves; 2 Holstein bull calves.

We are indebted to the Farm department for about 150 tons of corn ensilage, 1,300 bushels of turnips, $2\frac{1}{2}$ acres of fodder, 15 acres of pasture, straw for bedding for which they receive the manure, and miscellaneous help at different times.

The rest of the food used by the department was purchased with the money granted by the Legislature for that purpose. The increase of our stock for the coming year will necessitate provision for a larger quantity of feed—nearly double that of other years—as our stock will be doubled.

During the year we have weighed the milk from each cow morning and evening. Samples have been taken from each cow's milk two days in the week. We are thus able to tell what each cow has been doing for us during the year. Our standard, and the standard which I would urge upon every owner of cows to adopt, is 6,000 pounds of milk in a year or 250 pounds of butter. A standard is a limit below which no cow should go. Too many have set their standard at 3,000 pounds, and a cow seldom does any more than you expect of her. The owners of cows have adopted a 3,000 lb. standard and the cows think, "If that is all that is expected of us, why we will not disappoint our owners. That would be ungrateful." Dairymen, double your standards and you will soon see the cows begin to double theirs! Those that do not, let the butcher beef them.

Test the Cows.

Breeders of pure-bred dairy stock should test their cows. Some time ago I visited a somewhat noted herd of pure-bred cattle with the intention of buying one or two of the cows if the prices and animals were suitable. Although I have made a study of the points of a dairy cow, I would rather have her record than all the "points" a cow could carry. My belief in the importance of a record over form is strengthened by the fact that in our own stable we have two cows standing side by side, one of which (a blue "scrub") shows all the points that any one could desire, while her companion is a tidy, neat, fat red cow that has the beef form to a large extent. The record of the old blue cow last year was 9,028 pounds of milk containing an average per cent. of fat of 3.86, or a total of 348.5 lb. of fat for the year, which would be about 380 lb. of butter. The tidy red cow gave 8,798 lb. of milk, with 3.73 per cent. of fat, or 328 lb. of fat for the year.

I cite these facts to show how easily one might be deceived in judging cows from appearance only. Having looked these pure-bred cows over, I asked the person in charge if they kept a record of the quantity and quality of the milk produced by the cows, which, I judged, were the best in the herd. "No," he said, "we do not keep any record, except that in a general way we note how much milk each cow gives."

This matter of weighing milk and of testing it for quality is so important that I wonder that more of our breeders of pure-bred dairy stock have not practiced it in the past. What a great advantage it would be if a breeder could say to a buyer: "This cow gave so many pounds of milk last year, containing a certain per cent. of fat," and what additional value would be given to young stock or male animals if the owner could point to an excellent record of the dam. I think I am quite safe in saying that it would mean many dollars to the breeders of first-class dairy stock. What care I if the animal that I thought of purchasing traced its pedigree back to famous ancestry if the individual itself is a poor performer? Individuality, quality and performance are what we require in all animals for the dairy, and these points can only be determined by placing each animal on its own merits. Buying cows without knowing what they have done at the pail is like buying a pig in a bag—you never know what you have until you open the bag.

Breeders of common stock should test their cows. I fancy I hear some one say "It is all right for the Model Farm or breeders of fancy prize animals to test their cows, but it will never pay an ordinary farmer to do so." Are you sure of that? No one who keeps cows can afford to neglect to test them, using for that purpose one or other of the methods in vogue. You need not go so fully into every detail, but you should keep ome kind of a record. How many cows there are which do not give enough milk to pay for their keep! Taking an average herd of cows, I think I should be quite within bounds in saying that one-quarter of them are non-paying, and require to draw from the other three-quarters that do pay for one-half of the cost of their own maintenance and care.

Better keep only five good cows than five good ones and five poor ones, or than ten poor ones. Why? Because the five poor ones reduce the profits on the five good ones, and the ten poor ones are a continual source of loss. It takes just about as much to maintain a poor cow as a good one, sometimes more; but the latter gives a profit from the food fed, whereas the former is fed at a loss. It takes about two-thirds of what we feed to a cow to keep the body alive, while the milk, butter and cheese that we get from her comes from the other third. I am satisfied that nothing that can be done would prove of more value to the dairy industry of the province than the weighing and testing of the milk from the individual cows of the herd. At the end of one or two years there would be a glut of cow beef in the market.

How to Keep a Record.

I shall first give an outline of our methods, and then suggest some modifications suitable for ordinary farm practice.

In the stable, just above the scales is tacked a sheet ruled and headed in the following manner :

Date.	No. 1.		Artis.		Rose.		No. 13.	
June.	M.	E.	M.	E.	M.	E.	M.	E.
13	20	23	31	27	18	17	19	18
14	20	20	30	31	17	17	18	18
15	20	19½	30	29	18	19	18	19
16	18	23½	30½	29½	17	17	18	21
17	19	19½	28½	30½	18	19	19	19½
18	20	22	32	29	18	18	19	19
19	21½	20	30	29½	18	18	19	19
Total lb. for week.......	138	147	212	205	124	125	130	133½

The above is the record of the quantity of milk given by four of our cows during the week ending June 19th. Each sheet records the milkings for two weeks. Twice a week, morning and evening, samples are taken from each cow for testing with the Babcock tester. The record of each week is then entered in a book kept for that purpose. This book is ruled, and has the following headings for each cow :

Record of Rose.

Week ending	a.m.		p.m.		Total lb. milk.	Average °/o fat.	Remarks.
	lb. milk.	°/o fat.	lb. milk.	°/o fat.			
June 19......................	124	5.2	125	4.9	240	5.05	Heifer calf March 31st. Served June 24th.

The average per cent. of fat for the same week of the other three cows mentioned was: No. 1, 4.82 ; Artis, 3.20 ; and No. 13, 3.22.

At the end of the year each cow's record is before us ; and that our many visitors may see at a glance what the performance of the respective animals has been during the previous year, we put a neatly printed card in front of each cow's stall recording their success or otherwise. This card contains data as follows :

Name.. Breed..................................
Age.. Record for year ending..................189 ....

Total lb. milk given in the year......................................	....
Total number days milking..	....
Average lbs. milk per day..	....
Highest percentage fat..	....
Lowest " "..	....
Average " "...	....
Total lb. butter-fat..	....
Pounds milk producing one pound fat, or about one and one-tenth pounds butter	....

Now, to most dairymen, this may seem like too much trouble ; but I can assure you that there is very little in this world that is worth getting that is obtained without some trouble, care and forethought. To the owner of cows who will take the necessary amount of care to test each of his cows, there will come a satisfaction second only to that which he experiences when he receives the dollars earned by his herd, and *knows* that it is paying good interest on the capital invested.

Record of Our Dairy Herd.

The record of our herd for the year 1892 is as follows:

Yearly record of Dairy Cows, ending December 18th, 1892.

Name of cow.	No. days milking	Calved.	Bred.	Total lb. milk.	Per cent of fat.			Total fat.	Lb. milk to 1 lb. fat.
					Highest	Lowest.	Average		
No. 1	280	1892 April 15	1892 June 28	7696	5.18	3.08	3.89	299.37	25.70
No. 2	329	1891 Jan. 13	1892 June 25	5413	6.20	3.63	4.38	237.09	22.83
No. 4	308	1891 Dec 20	1892 April 28	7788	4.72	3.62	3.91	311.51	25.00
No. 5	182	1892 June 16	1892 July 4	4827	5.20	3.17	3.85	185.84	25.95
Susie	259	1891 Dec. 18	1892 June 15	5451	4.25	3.03	3.42	186.42	29 19
Nellie	217	1891 April 16	1891 June 17	4848	5.20	3.10	3.49	169.20	28.65
Kassie	280	1892 May 19	1892 July 17	9913	3.29	2.32	2.82	279.55	35.4
Alvo	336	1892 Sept. 20	1892 Dec. 18	7956	4.32	2.50	3.16	250.61	31.75
Milne	343	1892 July 24	1892 Sept. 9	6765	4.92	2.90	3.92	265 18	25.51
Rose	259	1892 Mar. 31	1892 June 24	6299	5.92	3.77	5.18	323.14	19.49
Patience	273	1892 Mar. 2	1892 June 26	6275	6.35	3.58	4.59	288.02	21.78
Dairy Queen	325	1892 Mar. 27	1892 June 6	8845	4.70	2.76	3.78	334.34	23.46

Method Modified.

Weighing the Milk. To those who do not wish to weigh the milk every day, or to test it twice a week, I would submit a modification of the method previously given.

We will take two cows mentioned in the table given above and apply different methods for computing the amount of milk given during a certain period of time, and note how the results compare with weighings made every day. From May 30th to June 26th, No. 1 gave 1,128 lb. of milk, and Rose gave 928 lb. If we had weighed the milk of No. 1 on the 5th, 12th, 19th and 26th of June, multiplying each day's milk by seven, the amount she would have been credited with would be 1,106 lb., 22 lb. less than her actual yield. If it had been weighed on the 12th and 26th, and the daily yield in each case had been multiplied by 14 (days), she would have been credited with 1,134 lb., 6 more than her yield. If it had been weighed on the 26th only, to ascertain her probable yield for the four weeks previous, she would have been credited with 37 multiplied by 28, or 1,036 lb., 91 less than her yield.

By weighing Rose's milk once a week on the same date as No. 1, and calculating in the same manner, she would have been credited with 896 lb., her actual yield being 928 lb. Twice per month would give 1,038 lb. Once a month, on the 26th, 924 lb.

By weighing the milk once a week on the same day each week, and multiplying the weight by seven, fairly reliable data may be obtained; but for all the time and expense required (scales for weighing milk may be bought for five dollars), it would pay to weigh the milk every day.

Testing for Quality. For quick, accurate testing, there is nothing equal to the Babcock method. Every dairyman with ten or more cows ought to have one of these testers and know how to manipulate it. Other tests, such as the lactoscope, pioscope, lactometer, cream gauge, lacto-butyrometer, etc., help to guess at the quality of milk; but other than the chemical analysis, there is nothing like the shorter methods of the Babcock and Beimling testers.

The average per cent. of fat for the four weeks, May 30th to June 26th, was 3.64 for No. 1, and 5.57 for Rose, the determinations being made four times each week. By giving their daily tests during this time, we shall be able to form some idea as to how far astray we should be if we tested only on one or more days during the period, and allowed that to be the representative test of the quality of their milk.

	No. 1.		Rose.	
Date.	Per cent. fat.		Per cent. fat.	
	p.m.	a.m.	m.	a.m.
May 30	4.3		6.5	
" 31		4.0		5.2
June 2	3.2		5.8	
" 3		2.2		—
" 6	3.6		6.0	
" 7		2.9		5.4
" 9	2.8		6.5	
" 10		—		5.2
" 13	4.5		4.4	
" 14		4.3		4.6
" 17	3.9		6.0	
" 18		4.6		5.2
" 21	3.7		6.6	
" 22		3.4		5.0
" 24	3.6		6.4	
" 25		3.6		5.2
Average	3.70	3.57	6.03	5.11

Looking at the daily tests, we find a considerable variation. In the case of No. 1, the morning milk varied from 4.3 per cent. on May 30th, to 2.8 per cent. on June 9th, and 4.5 per cent. on June 13th. The evening milk shows a still wider variation, from 2.2 to 4.6 per cent. Rose varied from 4.4 to 6.6 in the morning, and from 4.6 to 5.4 per cent. in her evening milk. This variation we find in all our cows; but by testing each cow at different intervals, say, once a week, or once in two weeks, or even once a month, owners would be able to arrive at a fair conclusion as to the quality of the milk produced by each cow. If every owner of cows would test them during the coming year to see how much milk and butter each cow produces, the results would surprise no one more than themselves.

INSTRUCTION AND EDUCATION.

From six to nine students are sent each week to the dairy to receive instruction in testing milk, setting and separating milk, handling cream and churning butter. With our increased facilities we are able to accommodate a class of 25 in the testing and butter departments. The same number may be accommodated with work in the cheese department. We shall thus be able to give our regular students a pretty thorough course in the practical part of dairying. I am much indebted to Mr. T. C. Rogers, our dairyman, for the great pains taken in giving the students these lessons, and for the tidy, orderly way in which the dairy is kept; also for the good quality of butter made during the year and the careful, painstaking manner in which he has conducted the various experiments.

Farmers' Institute and Special Dairy Meetings.

Besides attending a portion of the regular Institutes in January, and the annual meetings of the three Dairy Associations, I also attended a number of special institutes and dairy meetings throughout the whole year. These have brought me into touch with outside dairy work and have been of great profit to myself. I trust they have also been profitable to those who attended these gatherings.

Short Dairy Course.

As intimated in my last report, provision has now been made for a short course in dairying in connection with this department. This announcement met with great favor from buyers, salesmen and makers. Before our special circulars had been distributed three weeks' applications sufficient to fill our accommodation were received, while a number (about 50) were unable to gain admission for lack of room. While it is perhaps too soon yet to speak of the success of this new step, yet I feel warranted in asking that a building and equipment be provided for 100 students. If those who are directly interested in this great industry ask for instruction and help I think it is our duty to provide such at the very lowest cost and in the best manner possible. We already have several applications for 1894 from those who have been disappointed for 1893.

The circular sent out to leading dairymen, secretaries, presidents, manufacturers, etc., of butter and cheese, throughout the province, appears in the report of the President.

EXPERIMENTAL WORK OF 1892.

FEEDING.

Early in the year we repeated the experiment of last year to see the effect of food on the quality of milk and butter. This is a question that is frequently discussed at farmers' institutes and dairy meetings generally. Can I feed fat, or cream, or butter into milk? is a question that numbers of dairymen are asking themselves, especially those who are supplying milk to a town or city and wish to gain a good reputation; and those who supply milk to a factory or creamery where it is paid for according to test or percentage of fat. Most feeders think they can, and view with distrust any one who preaches any other doctrine. One man during a conversation about this matter, said, "I wouldn't believe that milk could not be made richer by feeding high if ten professors said so." My own opinion, based on two years' experiments with six cows each year, is that while flavor, aroma, a nice taste, and all such things may be put into milk and butter with feed, and people delude themselves by thinking it is cream, yet from the same number of pounds of milk no more butter-fat will be obtained from the same cows, whether fed on a poor or a rich ration, for a period of, say, six weeks.

The results of the experiments for both years are found in Bulletin LXXX, following:

Effect of Food on Milk and Butter.

During 1891 we conducted an experiment similar to the one here reported.

The cows used in the experiment were six in number, divided into three lots—two cows in each lot. The general plan was to feed each lot for four weeks on one ration, note the quantity and quality of the milk and butter, then change to another ration and feed for four weeks until each lot had been fed each ration for the same length of time. The rations were:

No. 1. Ensilage, 30 lb.; oat straw, 20 lb.; hay (cut), 10 lb.
No. 2. Hay (cut), 20 lb.; linseed oil meal, 4 lb.; cottonseed meal, 5 lb.
No. 3. Hay (cut), 20 lb.; pea meal, 4 lb.; oatmeal, 5 lb.; corn meal, 8 lb.

The effect on the fat and solids not fat was as follows:

The average per cent. of fat given in the milk by the three lots when fed on ration No. 1 was 3.67; on No. 2, 3.49; and on No. 3, 3.25.

The average per cent. of solids not fat from all the lots when fed on No. 1 was 7.79; on No. 2, 8.62; and on No. 3 it was 8.37.

In every case there was a slight decrease in per cent. of solids not fat when the cows were fed the poor ration.

Some conclusions from the experiment of 1891:

1. When there is a deficiency of fat or albuminoids in the ration, the animal draws from her own body to make up this lack, maintaining about the same *quality* of milk, though the quantity may be greatly reduced.

2. When an excess of nutrients is fed these are doubtless wasted to a considerable extent, and if fed for a length of time might do injury to the animals, though these cows ate their full ration for a period of 21 days without apparent injury.

3. Judging from the returns from the winter ration we may expect to receive profit from a much wider ratio and on less nutrients than the German standard calls for.

4. In answer to the question, Was the fat fed in the food recovered in the milk these experiments show that on ration No. 1 more fat was recovered in the milk than was fed in the food, and on Nos. 2 and 3 the returns of fat in milk were about the same as the fat fed, but whether it all came from the fat of the food or not was undecided.

5. The general conclusion would seem to be, that *the food does not affect the quality of milk to any appreciable extent so long as the animals are in good condition.* This applies more particularly to rations fed for short periods—from 21 to 28 days—but in the case of Lot III it may be said to be true for 49 days.

6. It is a waste of food to give more than the animal can assimilate. Find the capacity of the cow for economic production and feed to that capacity.

7. A poor ration may give profitable returns for a while, but will end in depletion of the cow's vitality and injure milk secretion.

8. The cost of food fed is an important item in the profitable returns from a dairy, and an extra amount of some cheap food in the ration, such as ensilage or bran may prove a profitable investment. For instance in the case of Lot I, by putting 20 lb. straw in the place of 6 lb. hay and 5 lb. bran, and reducing the ensilage from 50 lb. to 30 lb. per day, we reduced the cost of the weekly food from $1.78 to $1.22, but we also decreased the value of their production in butter-fat (besides loss of skim-milk) from $3.98 to $2.31; in other words by reducing the cost of the food 32 per cent., the value of fat was reduced 42 per cent., besides causing the cows to lose in weight. (For details of this experiment see College Report for 1891.)

EXPERIMENT OF 1892. This experiment was conducted somewhat differently from that of last year. The number of cows was the same, but they were divided into two groups instead of three, and two rations only were used. The experiment lasted from April 4th to June 12th, a period of ten weeks. The cows used were H. No. 2, A. No. 3, and No. 13 in Lot I. A. No. 2, No. 4 and No. 2 comprised Lot II. The rations were: No. 1, 50 lb. ensilage, 1 lb. bran, 5 lb. hay (uncut). No. 2, 50 lb. ensilage, 5 lb. pea meal, 3 lb. oatmeal, 2 lb. barley meal, 5 lb. hay (uncut).

No. 1 ration cost 6.35 cents per day and No. 2, 15.83 cents.

Lot I was fed for five weeks on ration No. 1, then changed to ration No. 2, which was fed to them for five weeks. Lot II commenced on ration No. 2 and were then changed to ration No. 1. They were fed on each ration for five weeks. The milk from each cow was weighed morning and evening. The per cent. of fat, water and solids not fat in the milk of each cow was determined on four days of each week. On two days of each week the milk from each lot was set in the Cooley creamer. The skim-milk was tested; the cream from each lot was churned separately; the butter-milk was tested; the quality of the butter was noted and a sample sent to the laboratory for analysis, determination of melting point and Iodine number. The cows were weighed at the beginning and close of each period of feeding.

Table showing effect on quality with lot I (3 cows):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
							No. 1.
April 17	3.50	8.90	12.40	21.21	5.0	23.0	
" 24........	3.34	8.71	12.05	20.74	6.1	25.2	50 lb. ensilage; 5 lb. hay (uncut); 1 lb. bran.
May 1........	3.31	8.77	12.08	19.73	4.1	27.8	
" 8	3.36	8.65	12.01	18.85	5.5	26.7	
Averages.......	3.38	8.76	12.14	20.13	5.2	25.7	
							No. 2.
May 22........	3.10	8.85	11.95	20.00	....	....	50 lb. ensilage; 5 lb. pea meal; 3 lb. oatmeal; 2 lb. barley meal; 5 lb hay (uncut).
" 29........	3 31	8 90	12.21	20.65	5.5	28.9	
June 5........	3.37	8.86	12.23	20.08	4.9	25.1	
" 12........	3.43	8.81	12.24	20.03	6.9	21.9	
Averages.....	3.30	8.86	12.16	20.19	5.8	25.3	

Table showing effect on quality with lot II (3 cows):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
							No. 2.
April 17..........	3.69	9.20	12.89	18.84	4.0	26.3	50 lb. ensilage; 5 lb. pea meal; 3 lb. oatmeal; 2 lb. barley meal; 5 lb. hay (uncut).
" 24........	3.63	9.20	12.83	18.36	5 6	23.9	
May 1........	3.65	9.29	12.94	17.54	5.3	24.3	
" 8..	3.65	9.12	12.77	17.42	5.4	25.7	
Averages.... ..	3.66	9.20	12.86	18.04	5.1	25.1	
							No. 1.
May 22..... ...	3.71	8.76	12.47	13.69	....	....	50 lb. ensilage; 1 lb. bran; 5 lb. hay.
" 29.....	3.81	8.89	12.70	11.66	2.9	24.8	
June 5........	4.00	8.20	12.20	11.48	3.6	24.7	
" 12*.... ..	....	....	....	....	....	....	
Averages	3.84	8.62	12.46	12.28	3.3	24.8	

*A. 2 was sick during the latter part of the third week of this period, and hence the results are not reported for the last week. The average per cent. of fat for this week from cow No. 2 was 4.30, and from No. 4 was 4.08. For the last week of period I. the average per cent. of fat from the same cows was respectively 3.67 and 3.77. The average per cent. of total solids from these two cows during the last week of period I, on the rich ration was 12.88, and during the second period on the poor ration, the average was 12.33.

Conclusions as to Quality.

1. The average of four weeks on a poor ration with Lot I was 3.38 per cent. of fat. With one week intervening, during which time they were changed to a rich ration containing the same amount of coarse fodder, but having 10 lb. meal in addition, the average per cent. of fat in the milk from the same cows for four weeks was 3.30—practically the same as in the previous period. Lot II gave milk containing 3,66 per cent. of fat during the period on which they were fed the meal ration, and 3.84 per cent. of fat while receiving practically no meal for three weeks. Again we must conclude that for a short period of time with these cows meal did not affect the per cent. of fat or quality of the milk to any great extent.

2. Last year the poor ration gave results which showed a slight decrease in per cent. of solids not fat. The same is true for this year. The average of both lots is 8.69 per cent. on the poor ration and 9.03 on the meal ration.

Table showing effect on quantity :

Date.	Total lb. of milk given.	+Gain or —loss.	Weight of cows at beginning of period.	Weight of cows at close of period.	+Gain or —loss.	Ration.
Lot I.						
April 11—May 8..	2,384	....	3,265	3,068	−197	Ensilage and hay.
May 16—June 12..	2,450	+66	3,068	3,114	+ 46	Ensilage, hay and meal.
Lot II.						
April 11—May 1..	1,486	....	2,918	2,967	+ 49	Ensilage, meal and hay.
*May 16—June 5..	962	—524	†1,941	†1,770	†—171	Ensilage and hay.

*One cow sick for two days in this period. †Two cows only.

Conclusions as to Quantity.

1. With Lot I the extra amount of meal did not appear to have much effect on the quantity, as they gave but 66 lb. more milk in four weeks while getting meal than during the same length of time without meal. This may be accounted for in some degree by the fact that two of the cows in this lot had calved recently. Those in Lot II had been milking for a longer time when the experiment commenced.

2. Both Lots lost heavily in weight while getting ration No. 1, and gained considerably on the ensilage, meal and hay. One ration was not sufficient to sustain the live weight of the animals while giving milk, and the other caused them to lay on flesh without a corresponding increase of milk.

3. The cost per 100 lb. of milk from both Lots on ration No. 1 was 55.8 cents, while the cost when No. 2 was fed was $1.18 per 100. Such a large quantity of meal could not be profitably fed to these cows.

Analysis of butter :

Lot.	Ration.	Water.	Fat.	Casein.	Ash.	Iodine number.	Melting point.
I	No. 1—1st period	*9.36	87.06	0.99	2.59	32.00	32.25
II	No. 2—1st period	*9.74	86.49	1.04	2.74	28.32	34.15
I	No. 2—2nd period.............	*11.36	85.20	1.06	2.38	30.52	32.61
II	No. 1—2nd period.............	†11.90	84.78	1.01	2.31	33.32	33.33
	Average on Ration No. 1	10.63	85.92	1.00	2.45	32.66	32.79
	Average on Ration No. 2	10.80	85.85	1.05	2.56	29.42	33.38

*Average of four analyses and determinations.
† " three " "

It was observed in the practical handling of the samples, that the butter from Lot II was always firmer than that from Lot I, due doubtless to the influence of the animals composing this lot. It is rather remarkable what a difference one or two degrees in the melting point makes in the physical properties of butter. Both lots gave firmer butter or butter with a higher melting point when they were fed meals in addition to the ensilage and hay. Last year when the cows were fed ensilage chiefly it produced a butter with a low melting point (31.75°). "Taking the average melting point (32.4°) of the butter produced from the ensilage, hay, straw, and grass rations as a standard, we find that it was increased 2.3°C. when a mixture of oil meals and hay was fed; 1°

when linseed meal alone was fed; 4.1° on the cottonseed meal ration." If it is possible to feed something which will produce firmer butter, a butter that will "stand up" better in hot weather, the question becomes of much practical importance.

There appears to be little difference in the average composition of the butter produced by the two rations. I repeat what was stated in the last College Report, p. 169: "That the varying per cent. of fat, water and other substances found in butter, is likely due more to the method of manufacture than to the influence of food."

Losses of fat in skim-milk and buttermilk:

Number of trials.		Average p. c. fat in skim-milk.	Average p. c. fat in buttermilk.	Ration
Lot I	4	0.26	0.1	Ensilage and hay.
	3	0.33	0.1	Ensilage, hay and meal.
Lot II	4	0.72	0.19	Ensilage, hay and meal.
	3	0.48	0.15	Ensilage and hay.

Both Lots appear to have given slightly better creaming results on the ration composed nearly altogether of ensilage. The average per cent. of fat in the skim-milk from both, in seven settings being 0.37 of one per cent., while the average of the same number of settings, under exactly the same conditions, was 0.53, when the meal ration was fed in addition to the ensilage.

Practical Points for Farmers.

1. For practical use I would not recommend either of the rations used in this experiment. No. 1 I consider deficient in milk-producing substances, and No. 2 is too rich for our ordinary cows, as they did not appear to be able to digest and assimilate so much meal. I would also warn against feeding much more than 50 lb. ensilage per day to cows weighing under 1,000 lb. We have found the following ration to give good results: 50 lb. of corn ensilage, 6 lb. of hay, 4 lb. of bran, and 2 lb. of pea and oatmeal mixed in equal proportions. If these latter become too high-priced, I would recommend the use of 2 lb. of cottonseed meal (in place of the bran or meals) per day to each cow, when it can be bought for about $30 per ton.

Feed *liberally*, though not wastefully, bearing in mind that although the *per cent.* of fat may not be increased by liberal feeding, the total amount of fat or butter may be largely increased by causing the cow to give a larger *quantity of milk*. Three things determine the value of a cow: *the quality of her milk, the quantity she gives*, and *the economical use she makes of her food.*

2. During the hot weather buttermakers are frequently troubled with soft butter. This is largely due, in most cases, to improper handling of the milk, cream and butter, but there is a tendency during hot spells for the butter to be soft no matter what the care taken. From the experiments here reported I am led to believe that the addition of a small quantity of meal, especially cottonseed meal, has a tendency to make the butter firmer, or as we say, raise the melting point from one to four degrees Centigrade. Last summer we fed about 1 lb. per day to each cow, while at pasture, and our butter-maker informs me that he did not have a churning of soft butter during the whole season. Whether this was due altogether to the cottonseed meal, I am not prepared to say, but I think it had something to do with it. In feeding cottonseed meal it should be mixed with bran, cut hay, or some grain meal.

MILKING.

Milking Three Times a Day.

To see what effect milking three times a day would have we selected two of our largest milkers, and milked them at 5 a.m., 11 a.m., and 5 p.m. of each day for 2 weeks, beginning June 23rd. Previously, each cow had been getting one pound of bran and two pounds of barley meal a day in addition to good pasture, but when we began milking three times a day their daily meal ration was increased to 2 lb. cottonseed meal, 2 lb. pea meal, 2 lb. bran, fed one-third in the morning, one-third at noon, and the balance in the evening.

The yield of the two cows for the two weeks previous to the experiment was:

Artis, 819 lb. milk; 2.93 per cent. fat, 24 lb. fat.
No. 13, 531, " " 3.50 " " 18.59 " "

When milked three times a day their record for two weeks was:

	No. 13.		Artis.	
	Lb. milk.	Av. p. c. fat.	Lb. milk.	Av. p. c. fat.
Morning	263.5	3.27	357.5	2.70
Noon	141.5	4.18	180.0	3.42
Evening	144.0	4.16	172.5	2.96
Totals and averages	549.0	3.87	710.0	3.03

The total fat given by No. 13 in the two weeks was 20.27 lb., and by Artis was 20.80.

For the two weeks following July 6th, when the milking three times daily ceased, these two cows were fed the same quantity of meal twice a day as they had been previously getting three times a day, and were milked but twice a day at 5 o'clock morning and evening. Their record was:

	No. 13.		Artis.	
	Lb. milk.	Av. p. c. fat.	Lb. milk.	Av. p. c. fat.
Morning	250	3.47	308	2.72
Evening	239	3.62	299	2.80
Totals and averages	489	3.55	607	2.76

The total fat given by No. 13, was 17.06 lb., and by Artis 17.87 lb.

It may be interesting in this connection to note what difference there is between the total amount of fat credited to our cows by testing them two days in the week, and the actual amount of fat produced as shown when testing the cows every day.

In our regular dairy work the per cent. of fat in each cow's milk is determined on Monday evening and Tuesday morning, and Friday evening and Saturday morning, which tests represent the quality of milk produced during the week. Taking the tests of these two cows on the days mentioned from July 7th to 20th, No. 13 would have been credited with 18.39 lb. fat—actual yield, 17.06—and Artis 17.85 lb. fat—actual yield, 17.87. In the case of the one cow it gives almost exactly her yield and the other .79 lb. more than her yield.

By taking the average total lb. of milk and fat given during the two weeks previous to, and after the milking three times a day, we should have a fair basis on which to compare the results of milking twice and three times. No. 13 gave 510 lb. milk and 17.83 lb. fat as the average of the periods preceding and succeeding the experiment. During the experiment she gave in the same length of time 549 lb. milk and 20.27 lb. fat—an increase of 39 lb. of milk and 2.44 lb. fat. Artis gave 713 lb. milk and 20.44 lb. of fat as the average of the two periods when milked twice a day, and when milked three times a day she gave 710 lb. milk and 20.80 lb. fat—a decrease of 3 lb. milk and an increase of .36 lb. fat—in other words her yield was about the same when milked three times a day as when milked twice.

This experiment would seem to indicate :

1. Frequent milking increases the per cent. of fat, as both cows gave a higher percentage in their milk at noon and evening than in their morning milk. The average of these two and also of the three milkings per day was higher than their general average when milked twice a day. The effect on the total fat was to increase it in the case of one cow, while it remained about the same in the other.

2. One cow gave more milk when milked three times a day and the other gave less, presuming that the extra meal balanced the failing pasture.

3. It would not pay to continue milking these cows three times a day for any length of time, as they seemed to regulate themselves to normal production in a short time. It might pay for a short time by keeping the cow at high pressure.

Gland Milking vs. *Quarter Milking.*

The two cows used in this experiment (which commenced Nov. 14th, 1892, and continued two weeks) had been milking for some time. One, calved April 15th and consequently had been milking about seven months, while the other calved March 27th, and had been milking about eight months. We would naturally expect these cows to decrease in their milk owing to the advanced period of lactation. During the two weeks previous to the experiment Cherry gave 267 lb. milk, containing 4.67 % fat, or 12.47 lb. fat (about 13½ lb. butter). For the same length of time, during which gland milking was practised, she gave 266 lb. milk and 4.56 % fat. This would be 12.13 lb. fat, or about 13⅓ lb. of butter. Practically the same as for the two weeks previous.

Dairy Queen gave, previous to the experiment, 250 lb. milk, with 4.62 %=11.55 lb. fat—about 13 lb. of butter in two weeks. When gland milking was done for two weeks she gave 228 lb. milk, with 4.07 % fat=9.27 lb. fat—about 10¼ lb. of butter.

The effect of eight months' milking showed itself markedly on this cow. Some might say, you should teach your cows to milk ten or eleven months in a year. In reply, I would say that we do not care if a cow milks but four months, *if she will give us from* **6,000** *to* **9,000** *lb. of milk in that time and make* **250** *to* **400 lb. of butter.** A cow that gives 8,000 lb. of milk in six months is more valuable, other things being equal, than a cow that gives 8,000 lb. of milk in ten months, because she saves four months stripping, and time is money. As a matter of fact, however, we usually find that the cows which milk for the longest periods, say nine to eleven months, give the most milk in a year.

TESTING MILK AND CREAM.

Composite Samples.

The most common method of making composite samples is to take a certain measured quantity each day and put aside into a jar properly labelled. At the end of a week, or for whatever time the tests are allowed to run, the milk, which is usually thick and sour, especially in hot weather, is dissolved or thinned with potash or what is commonly known as powdered lye. This saves the risk of using poisonous substances, such as corrosive sublimate, to preserve the sample.

In eleven trials, the average percentage of fat in milk tested every day was 4.01. The composite sample of the same milk tested 4.10. In ten trials where the average of single tests was 3.96, the composite tested 4.00 In eight trials where the average was 4.11 taken every day, the composite from the same tested 4.05. These experiments confirm the results of last year, showing the composite test to be accurate where approximately the same amount of milk is being delivered each day, and where the same quantity is taken each day for the composite test.

In factory work, however, there is considerable variation, both in the quantity and quality of milk delivered each day during the week. This is especially so where patrons send perhaps Sunday morning's, and in some cases Saturday night's milk, to the factory on Monday morning, making about double the usual amount.

It will readily be seen that the composite sample should always bear definite relation to the quantity and quality of milk delivered each day. Where the same amount is taken each day from the milk delivered and put into the jar for a composite sample, this relation is not preserved, and consequently I have suggested the following plan :

Take a glass cylinder (with a lip) graduated to 50 or 100 c.c., which can be bought of dealers in chemical glassware, for about $1. Use according to the following directions :

For patrons sending less than 50 lb. of milk, take out 2 c.c. (medium marks) for every 10 lb. of milk.

20 lb., take out	4 c.c., or	4 medium marks.
30 "	6 "	6 "
40 "	8 "	8 "

50 lb. and over, up to 500 lb., take 1 c.c. (medium mark) for every 10 lb. of milk.

50 lb., take out	5 c.c., or	5 medium marks.
60 "	6 "	6 "
70 "	7 "	7 "
100 "	10 "	10 "
125 "	13 "	13 "
130 "	13 "	13 "
200 "	20 "	20 "
400 "	40 "	40 "
490 "	49 "	49 "

500 lb. and over, take one-half a c.c. (short mark) for every 10 lb. milk, or 1 c.c. (short mark) for every 20 lb. of milk.

500 lb., take out	25 c.c., or	25 medium marks.	
510 "	25½ "	25 "	and one short mark.
520 "	26 "	26 "	

In case a patron who usually sends less than 50 lb. should deliver *50 lb. or more* on one or more mornings during the week, *take 2 c.c. for each 10 lb. of milk*

In case a patron who usually sends more than 50 lb. should deliver *less than 50 lb. take 1 c.c. for each 10 lb of milk.*

In case a patron who usually sends less than 500 lb. should deliver *500 lb. or more, take 1 c.c. for each 10 lb. of milk.*

In case a patron who usually sends more than 500 lb. should deliver *less than 500 lb take 1-2 c.c. for each 10 lb., or 1 c.c. for each 20 lb. of milk.*

I sent one of these graduated cylinders, together with directions, to the maker of the Elma factory, with a request that he give it a trial and report results. Their method of measuring samples is to take out a small dipper-full (about 50 c.c.) from each man's milk after it has been poured into the weigh-can, and put it into a pint gem jar labelled with the patron's name. This composite sample is tested about once a week.

He took samples of milk from a patron sending about 350 lb. per day. The results were .

Sept. 26—Test was		4.30 per cent.
" 27	"	4.35 "
" 28	"	4.30 "
" 29	"	4.10 "
" 30	"	4.00 "
Average		4.21 per cent.

(Quantity of milk not given).

The composite sample taken with graduated measure tested . . 4.20 per cent.
" " " dipper in usual way " . . 4.10 "

In another trial of a different patron's milk, one sending about 40 lb. per day, there was also a difference of $\frac{1}{10}$ of one per cent. in favour of the measuring glass.

There is no doubt about this being the most accurate way to take samples for composite test, but Mr. Gray adds in his letter, "I can assure you I hope we will not have to take samples that way, as it is a great deal more trouble."

The cheesemakers are so driven with work that any extra labor is viewed with disfavor by them. If further experiment should prove the necessity for using a more accurate method of taking samples, there is no doubt but the directors of the factory will see that the maker has extra help for this work. As the salesman of the Elma factory said to me, "We are bound to do this thing right if it does cost some extra labor and expense."

In any case I would advise those using the composite test to take a double quantity for a sample on Monday morning, where patrons deliver two days' milk instead of one.

Paying for Milk According to Percentage of Fat.

In addition to what is given in Bulletin 76 on this subject, I should like to add the report of an experiment conducted by Mr. James Gray, cheesemaker in the Elma factory, near Attwood, in the Listowel district. At this factory they have been paying according to the test during the past season. Being requested to visit this factory during the summer, I spent a part of two days there, observing results and discussing the new plan with the maker and directors of the factory. All expressed themselves as well pleased with the results, and said they would not go back to the old plan under any considerations. True, there are difficulties in the way, but these may be overcome by a persistent endeavor to do justice to each patron. The maker says that he has never been troubled with a "gassy" curd all summer, owing to the fact that patrons take better care of the milk to secure a higher test.

On August 30th Mr. Gray weighed into a vat 2,100 lb. milk, which tested 3.80 per cent. fat. This amount of milk produced 216 lb. of green cheese. Ratio of milk for one pound of cheese, 9.72 lb. September 1st into the same vat he weighed 2,100 lb., testing 3.55 per cent. fat. Product, handled in the same manner, was 200.5 lb. green cheese. Ratio milk to cheese, 10.47 lb. After one month there was still an advantage of 15 lb. in favor of the 3.80 per cent. milk, and yet some people say that all milk is about alike for cheesemaking. Buyers and judges pronounced the 3.80 per cent. cheese of better quality.

The composite test plan is adopted, the thick sample being dissolved with a small quantity of potash or powdered lye, and tests made once a week—sometimes five times during a month. As this method makes some extra work for the secretary, it is but natural that the shortest way of arriving at results should be chosen. Sometimes, however, the short way is not the correct way. The plan at first adopted was to multiply the average percentage of fat for the month by the total pounds of milk delivered during the month. This would be just did patrons send the same amount of milk each week. But they do not. The following example taken from the milk books of the Elma factory for July will illustrate:

Patron A sent during the 1st week	1,426 lb.	milk, testing	3.75	per cent. fat.	Total fat,	51.475 lb.
2nd "	1,336	" "	3,60	"	"	47.096 "
3rd "	1,348	" "	3.80	"	"	51.224 "
4th "	1,601	" "	3.60	"	"	60.838 "
During time of 5th test,	919	" "	3.40	"	"	31.246 "
Total lb. milk,	6,630 lb.	Average fat,	3.63		Total fat,	241.879 lb.

If we multiply 6,630 by 3.63 this patron will be credited with 240.669 lb. fat, whereas he sent in 1.21 lb. more; hence the correct way is to multiply the pounds of milk delivered by the percentage of fat *each week* to determine the total pounds of fat delivered.

How to Determine the Fat at the Factory.

Milk chemists, dairy commissioners, cheese factorymen, creamerymen and dairymen generally nearly all acknowledge that what is known as the Babcock test is the most simple, inexpensive, accurate and rapid test now in use. Nearly all the experiment stations in both the United States and Canada, and the method is spreading to Europe and Australia, are using this test for the fat determinations in connection with a great deal of their work. This test, together with the lacto-thermometer, is also able to give approximate results as to per cent. of water and solids not fat present in a sample of milk.

To find out the amount of fat delivered by patrons of a factory in a month, or for any given time, weigh each patron's milk as formerly, take a sample each day and test it. The pounds of milk delivered, multiplied by the per cent. of fat found will give the total pounds of fat delivered that day. For instance:

T. Skimmer..........	delivers 150 lb.	milk.	Test 2 per cent. =	3 lb.	fat
John Fair............	" 200	"	" 3 per cent. =	6	"
Wm. Good	" 200	"	" 5 per cent. =	10	"

Or it may be done in this way:

Take a sample from Mr. Skimmer's milk each morning—do so with each patron—place in a jar numbered so as to correspond with his name. At the end of the week take a sample from this jar, which will be his average quality of milk for the week. Suppose that it tests $2\frac{1}{2}$ per cent. fat. Suppose further that he sent in 150 lb. each morning for six mornings, then altogether that week he sent 900 lb. milk, which contained $900 \text{x} 2\frac{1}{2}$, or $22\frac{1}{2}$ lb. fat. And so on with each patron.

How to Distribute the Proceeds.

At the end of the month, or whenever the books are made up, instead of adding up the pounds of milk sent in by each patron for the month, add up the pounds of fat delivered as found in the manner previously indicated. Having done this for each patron, total the pounds of fat delivered by all the patrons. Then divide the dollars to be distributed by the pounds of fat delivered, which will give the value for each pound of fat sent in by the different patrons.

Some time ago I wrote Mr. I. L. Farrington, of Norwich, Ont., who owns and operates a number of factories in that section, asking for his method of distributing proceeds to his patrons. He sent me the following illustration:

Month of June.

Total lb. milk delivered	312,259
" cheese manufactured	30,321
Total value cheese	$2,609 54
Cost of manufacturing	363 85
Amount to be distributed	$2,245 69

Value 1 lb. milk $= \frac{2,245\ 69}{3,122\ 59} =$ .719c

John Smith	Cr.	4,804 lb. @ .719c. =	$ 28 28
T. Jones	Cr.	200,000 lb. @ .719c. =	1,438 00
A. Barber	Cr.	107,455 lb. @ .719c. =	772 60
			$2,245 14

(Mr. Farrington sent but one name, but for the sake of completing the distribution I have assumed that the rest of the milk was supplied by two patrons, while as a matter of fact it was doubtless supplied by 40 or 50 patrons).

By distributing proceeds on the basis of its fat contents, assuming that the pounds of cheese made, cost of manufacturing, etc., were the same as in the instance previously cited, and everything similar except that the milk has been tested, the account would stand thus:

John Smith, Cr. 4,804 lb. 3 per cent. milk =	144.12 lb. fat
T. Jones, Cr. 200,000 lb. 3½ " =	7,000.00 "
A. Barber, Cr. 107,455 lb. 4 " =	4,298.20 "
Total lb. fat delivered	11,442.32

Value one pound fat $= \frac{\$2,245\ 69}{11,442.32} =$ 19.62c.

John Smith's share	144.12 lb. fat	× 19.62 =	$ 28 28
T. Jones' "	7,000.00 "	× 19.62 =	1,373 40
A. Barber's "	4,298.20 "	× 19.62 =	843 30
			$2,244 98

(To be very exact it would be necessary to carry the decimal point to the third place instead of to the second as I have done in calculating the price per pound for the fat).

In conclusion I would quote the opinion of Mr. A. T. Bell, of Tavistock, who had charge of the Dairy School last year, and who is not unknown to Ontario dairymen:

"In answer to yours *re* distribution of proceeds at a factory, would say that after the experiments which have been made here and elsewhere with the different qualities of milk for cheese, and noting the different yields of cheese from same, I am strongly in favor of paying according to the butter-fat, considering it much the fairest way. I am very much pleased that some of our factories are adopting that plan the present season."

Butter-fat in Milk and Cream.

Variation in Fat of Milk from the Herd and from Individual Cows of the Herd.

How wide a variation one may expect to find in the fat of milk from individual cows and from a whole herd is a question not yet settled. For over a year we have been testeach of our cows twice a week (morning and evening), some four times a week and some eight times a week and some every day. We find that while individual cows may and do vary widely in the per cent. of fat from day to day yet the milk from the whole herd does not exhibit such wide variation in quality—in fact tests made during the month of January, February, March and April show that the per cent. of fat is quite constant.

The following table gives the amounts of fat (per cent.) found in the milk of eight cows, morning and evening, as determined in eight days :

—	—	January 11.	January 27	January 28.	January 29.	February 19.	February 20.	February 29.	March 8.
No. 2	Morning	5.3	4.0	4.6	4.6	3.8	3.5	4.2	4.1
	Evening	4.2	4.8	4.5	3.9	4.4	.....	5.0	4.2
No. 4	Morning	3.8	4.2	4.4	4.4	3.5	3.2	3.8	3.7
	Evening	3.2	4.6	4.2	4.3	4.4	......	4.5	4.2
No. 6	Morning	3.5	3.9	4.0	4.0	3.6	3.4	3.5	3.5
	Evening	3.5	4.0	4.0	3.7	3.8	......	3.8	3.4
A. 2	Morning	2.5	3.0	3.7	3.3	......	3.1	3.5	3.0
	Evening	3.6	3.8	4.0	4.2	4.6	.....	3.5	3.1
H. 1	Morning	2.7	2.9	3.2	3.0	....	3.2	......	......
	Evening	2.6	3.5	2.8	2.5	3.6	.....	......	......
H. 2	Morning	2.8	3.0	3.0	3.0	......	2.8	3.2	3.1
	Evening	3.1	3.0	3.2	2.6	3.2	......	3.2	3.0
J. G. 1	Morning	2.8	4.5	4.8	4.6	......	4.0	4.0	4.1
	Evening	4.2	4.8	4.9	4.4	4.8	.....	4.4	3.7
No. 13	Morning	2.3	4.0	4.6	4.4	......	......	......	......
	Evening	4.8	5.3	4.6	4.4	......	......	......	......

The following statement gives the highest, the lowest and the average per cent. of fat found in *the mixed milk from the whole herd* tested during the months of January, February, March and April. For a part of the time the fat was determined separately in the morning and evening milk, and in sixteen tests made in March the mixed milk of morning and evening was used.

—	Highest.	Lowest.	Average.
Morning milk, 43 trials	3.90	3.05	3.53
Evening milk, 25 trials	4.15	3.40	3.63
Morning and evening milk mixed, 16 trials	3.90	3.30	3.60

From this statement it appears that the widest variation in the morning milk during 43 trials was 0.85 per cent., in the evening milk during 25 trials 0.75 per cent., and in the combined morning and evening milk during 16 trials 0.60 per cent.

Total Solids in Milk estimated from the Per Cent. of Fat and the Lactometer Reading.

With our present short methods of determining the fat of milk, this part of dairy work has become comparatively easy. In cases where it is thought advisable to determine the solids-not-fat in the milk as well as the fat, it may be done approximately by the use of the Quevenne Lactometer (together with the fat per cent.) by the following formula recommended by Dr. Babcock:

$$\text{Solids not fat} = \frac{L + .7F}{3.8}$$

$$\text{Total solids} = \frac{L + .7F}{3.8} + F$$

L is lactometer reading at 60° F.
F is the per cent. of fat.

A shorter rule, which will give approximately the same results, is to add the per cent. of fat to the lactometer reading and divide by 4—this gives the solids-not-fat. The total solids are then found, by simply adding together the fat and the solids-not-fat.

Comparing results obtained by the use of this formula with those obtained by chemical analysis, we have found the following results in the milk from six cows, the average of the trials of each cow being given:

—	Cow No. 2.	No. 4.	A. No. 2.	H. No. 2.	No. 13.	A. No. 3.	Average.
Number of trials	5	7	7	7	6	7	39
Lactometer reading	30.6	33.3	32.62	31.96	31.76	33.10	32.22
Fat according to Babcock test	4.14	3.86	3.34	2.89	3.22	3.86	3.55
Solids not fat by formula	8.77	9.48	9.20	8.94	8.83	9.41	9.11
Solids not fat by chemical analysis	8.29	9.37	9.10	8.72	8.83	8.98	8.83
Total solids by formula	12.91	13.34	12.54	11.83	12.05	13.27	12.66
Total solids by chemical analysis	12.43	13.23	12.44	11.61	11.75	12.84	12.38
Difference between formula and analysis	0.48	0.11	0.10	0.22	0.30	0.43	0.26

The average difference in the thirty-nine samples between the total solids are determined by the formula and by chemical analysis was only 0.26 *of one per cent.*, almost within the limits of error. This method promises to prove of value in ordinary experimental work or in the rapid analysis of milk, as thereby we may obtain approximately the per cent. of water, of fat, of solids not fat, and of total solids, in a few minutes and at small cost.

Pay for Milk according to per cent. of Fat.

Quality is of more importance than quantity in nearly everything. Quality or per cent. of fat is what the butter-maker desires most of all in the milk designed for the manufacture of butter, because butter is largely composed of fat—about 84 per cent. Therefore the fat in milk is an index of its value for butter.

It is also a proper basis on which to value milk for cheese-making, because—

1. The serum or pure skim-milk is worth only from 15 to 20 cents per hundred pounds, while the fat is worth from 15 to 30 cents per pound whether in cheese or in butter.

2. The casein or curd is fairly constant in all milk, while the fat varies widely in different samples.

3. The richer the milk in fat up to a certain limit the more pounds of cheese may be made from a given number of pounds of milk.

This method will give to each patron more nearly what is just than any other system that has yet been tried, besides taking away all temptation to tamper with milk designed for the manufacture of cheese or butter.

Testing Milk.

The testing of each patron's milk involves considerable labor; hence, we should study how to lessen the labor as much as possible. A device which we have used in the dairy building here for over a year makes the work of measuring and adding the acid very slight. A gallon bottle is kept full of acid. This bottle has an ordinary cork containing three openings—one for a glass syphon having a glass stop-cock, one for a glass funnel, and one small opening to allow the air to escape when the bottle is filled with acid. Such a bottle and syphon has been in use for about two years and requires no attention, neither has it given any trouble. With two acid measures, one of which is filling while the acid from the other is being poured into the test-bottle containing the milk, the work proceeds very rapidly.

Several inquiries have been made as to the cause of "curdy, crumbly matter" in connection with the fat when making tests with the Babcock tester. The causes are, I think, two:

1. Insufficient mixing of the acid and milk, or in some cases the acid is too weak.

2. Not keeping the bottles properly cleaned. If these become greasy they should be washed with soap-suds or sal-soda water. A small brush should be used for cleaning the neck of the bottle.

Testing Whey.

Every cheese-maker should test the whey each day from the vats, and thus check any losses of fat from this source. The drippings from the cheese ought also to be tested, as frequently there is considerable loss of valuable constituents by improper handling and pressing.

To test whey take the same amount as for new milk (17.6 c.c.), but only half the usual quantity of acid; or better still, get bottles which are specially made for testing whey, butter-milk and skim-milk. These bottles require twice the ordinary quantity of whey, butter-milk or skim-milk, and the ordinary quantity (17.5 c.c.) of acid for whey—twice the usual amount for skim and butter-milk.

Keeping Whey and Skim-milk sweet.

A question was asked of us recently: "Can skim-milk be treated so as to keep sweet for twenty-four hours?"

The answer was, yes, both sweet whey and sweet skim-milk may be kept sweet twenty-four hours in the hottest weather by heating to 150° or 160° Fahrenheit. This treatment kills the germs which cause the souring of milk and milk products. Most factories have steam, and the cost of heating the bye-product to a sufficiently high temperature to preserve them sweet would cost very little.

It has been demonstrated that *sweet* whey for feeding hogs is worth from eight to ten cents per hundred pounds compared with middlings and corn. What sour, stinking whey is worth has never been shown. We doubt whether it more than pays for the labor of hauling it to the farm and the feeding of it to the only class of animals that can thrive on it at all.

The Fat of Cream.

The present system of distributing proceeds to patrons of both cheese factories and creameries is causing distrust in the minds of operators and patrons. That it does not do justice in a cheese factory is conceded by nearly all. That the paying for milk according to quality or on its fat basis is much more just is also pretty well established. That the fat basis is the proper one to adopt at a centrifugal or separator creamery none deny. Whether the test for fat, or the Babcock test, is likely to supplant the "oil test" in cream-gathering creameries is a query among creamery men at present. A leading firm sent the following to this department recently: "We have had several inquiries with regard to the practicability of applying the Babcock tester with the bottles made to test cream, and we have been asked our opinion as to whether this will answer for factories which are working on the cream-gathering principle. We have the bottles, which will show twenty-five per cent. of butter-fat, and we suppose they can be made to go still higher. What is your opinion about this matter? Do you think that the Babcock with these cream bottles can be made to take the place of the oil-test churn?"

In testing cream the following points require attention:

1. It is difficult to sample sour, thick cream properly. In this case it is best to dilute it with an equal volume of water and multiply the readings by two. For cream containing over twenty-five per cent. of fat a bottle with a detatchable neck reading to thirty-six per cent. of fat may be used (for description see Maine Report, Part II., 1891), or the sample may be divided into two bottles.

2. Sweet cream raised by cold, deep setting process may be sampled without difficulty. The pipette should be rinsed into the test bottle with a small amount of water.

3. The cream bottles cannot be used in one of our machines which has swinging pockets, but can be used in another in which the pockets are stationary.

4. In adding hot water after the whirling, care should be exercised that the bottom of the column of fat does not come in the bulb, which is not graduated.

5. If creameries adopt this plan great care should be observed in taking the samples that they may be fair representatives of the whole of the cream.

6. Owing to the fact that fat expands on the average .078 for every degree centrigrade, it is important that all samples be read at approximately the same temperature—140° to 150° F.

7. This test gives the *absolute* amount of fat in the cream, and judging from the trials previously noted we may expect more pounds of butter than there are pounds of fat in the cream.

We have made several determinations (by the Babcock method) of the fat contained in cream, with the following results: In testing cream a pipette measuring 18 c.c. is required. The bottles we use are graduated to read up to 25 per cent. of fat. The neck has a bulb and the same amount of acid is used as for whole milk.

Date.	Per cent. fat in cream.	Total pounds fat in cream.	Pounds butter yielded.	Pounds fat for one pound butter.	Per cent. of fat in butter-milk.
May 18	18.9	9.64	10.25	0.94	....
" 21	18.1	4.98	5.50	0.91	0.10
" 21	17.2	3.10	3.60	0.86	0.10
" 21	20.0	3.49	3.40	1.03	....
" 23	20.6	16.10	20.20	0.79	....
" 26	27.2	9.52	12.00	0.79	....
" 28	16.6	4.15	5.50	0.76	0.10
" 28	15.0	4.28	5.50	0.78	0.10
" 28	14.6	2.34	3.00	0.77	0.05
June 4	17.0	4.08	4.90	0.83	0.20
" 4	18.2	3.09	3.60	0.86	....
Average	18.5	5.89	7.04	0.84	....

To divide the cash proceeds at a creamery the following plan may be followed:

A	delivers	500 lb. cream	containing	25 per cent.	fat, or	125 lb. fat.
B	"	600	"	20	"	120 "
C	"	400	"	15	"	60 "
					Total delivery is	305 "

Sale of butter gives 350 lb. at 20c. or $70.

The net value of each pound of fat delivered therefore is $70 divided by 305 or 22.95 cents.

Therefore—

A's	share is	22.95 × 125	or $28.68
B's	"	22.95 × 120	" 27.54
C's	"	22.95 × 60	" 13.77
		Total divided,	$69.99

CREAMING AND CHURNING.

Effect of Temperature in Creaming.

Ten trials were made with milk skimmed at an average temperature of 41°. The average per cent. of fat in the whole milk was 4.05, and in the skim-milk there was an average of 0.25 per cent. when set for 14.5 hours.

In ten trials, where an equal quantity of the same milk as in the previous experiments was used and skimmed at an average temperature of 51°, the percentage of fat in the skim-milk was 0.80. This means a loss of about one pound of butter in every 100 pounds of skim-milk. As a result of numerous experiments we are led to conclude that it is necessary to cool milk down to 45° or below to obtain the best results from cows fresh in milk, and with strippers it is almost impossible to obtain good creaming results by deep-setting methods. When the milk is set in ordinary well water and the water is not changed at least twice soon after setting, great loss of cream results. In fact to get satisfactory creaming with deep pails or creamers, ice or cold spring water is necessary.

I estimate the loss of cream and butter throughout the Province to be about 25 per cent. owing to the lack of requisites to obtain good results with the various deep-setting methods.

Delayed Setting.

Milk containing an average of 3.92 per cent. fat, set at an average temperature of 82° for ten to twenty-four hours, when skimmed at a temperature of 40° had 0.14 per cent. fat in the skim-milk as an average of ten trials.

An equal quantity of the same milk was set for the same number of times and under the same conditions, except that it was delayed for some time cooling down to an average of 71°, and contained as an average of ten trials 0.21 per cent. of fat in the skim-milk. These experiments corroborate the results of last year, when a difference of but 0.14 per cent. was found in favor of immediate setting.

In six trials with the same milk where it was cooled to an average of 45° before setting, by keeping the milk stirred in ice water and then set for the usual length of time, there was an average of 0.42 per cent. fat in the skim-milk when skimmed at 40°. This would seem to indicate that the cream will rise fairly well even under adverse conditions if it be cooled to the proper temperature before being skimmed.

Effect on Creaming of Heating Milk and the addition of Hot Water.

From September 12th to 28th ten trials were made with mixed milk from the whole herd to see the effect of heating and the addition of hot water to milk for creaming purposes.

The average temperature of the milk, set as soon as possible after coming to the dairy, was 84° ; temperature when skimmed at from ten to twenty-four hours, 43° ; per cent. fat in skim-milk, 0.29.

The average per cent. of fat in the skim-milk, when lots of the same milk were heated from 93° to 110° (average 98°), was 0.295.

When 10 to 25 per cent. of water, at a temperature of 118° to 160° (average 138°), was added to ten lots of the same milk the average percentage of fat in the skim-milk was 0.22 (corrections made for water added). The three lots in each case were, set in the same creamer and skimmed at the same temperature, about 43°. There was a slight difference in favor of the addition of hot water, but not enough to pay for the trouble.

Skimming Close to the Cream Line.

In sixteen trials the average per cent. of fat in the first pint of skim-milk drawn from the bottom of the can was 0.26. In the last pint, or in the skim-milk next to the cream line, the average per cent. of fat was 0.34. In some cases there was more fat in the first pint of skim-milk drawn than there was in the last pint next to the cream line. In other trials this was reversed. Most frequently there was a larger percentage in the skim-milk next the cream. The highest per cent. of fat found next the cream line was 0.7, the lowest a "trace." The highest found in the bottom of the can was 0.4, the lowest .05. The greatest difference between the two portions of skim-milk was 0.3 per cent.

Lesson: Do not skim too close to the cream line, although we did find so great a difference between the skim-milk at the bottom of the can and that next to the cream line as others have done.

Aerating Milk for Butter-Making.

The object of these experiments was to determine the effect of aeration on the creaming of milk, churning of the cream, and the quality of the butter. The plan of aerating was to pour from one vessel to another. The milk from the herd was equally divided after thorough mixing, one-half was aerated and the other not, and both lots were then set in the same creamer under exactly the same conditions.

Date.	Not aerated.						Aerated.			
	Number settings.	Hours set.	Average temperature.		Per cent. fat skim-milk.	Per cent. fat buttermilk.	Average temperature.		Per cent. fat skim-milk.	Percent. fat butter-milk.
			Set.	Skimmed.			Set.	Skimmed.		
October 20-22	4	22	83	40	.20	.20	82	40	.15	.30
" 27-28	4	22	84.2	41	.12	.20	84.2	41	.15	.20
December 1-3	5	22	85	40	.55	.50	85	40	.50	.50
" 9-11	5	20	86	39	.21	.20	84	39	.21	.20
Averages	......	.....	84.6	40	.27	.28	83.8	40	.25	.30

The churnings from each lot were packed in two separate tubs, and at this date (December 21st) when examined there was no difference in the quality of the butter so far as we could tell.

Sweet *vs.* Ripened Cream.

The object of this experiment was to see the effect of ripening cream on the time required to churn, the loss of fat in the butter-milk, and the quality of the butter. In each trial the cream was thoroughly mixed and divided while sweet. One-half was ripened and the other churned sweet. The results of four churnings are :

Date.	Sweet cream.							Ripened cream.						
	Pounds cream.	Temperature churned.	Time in minutes.	Per cent. fat in butter-milk.	Temperature butter when finished.	Temperature room.	Size churn.	Pounds cream.	Temperature churned.	Time in minutes.	Per cent. fat in butter-milk.	Temperature room.	Temperature butter when finished.	Size churn.
October 26	43.25	53	39	.40	58	63	No. 5 Daisy.	44	59	30	.30	63	60	No. 2 Daisy.
November 5	26	47	38	....	59	62	"	26	58	40	....	62	58	"
" 26	36	52	45	.40	60	61	"	36	63	20	.20	61	....	"
December 1	35.25	52	90	.40	61	56	"	35.25	64	45	.20	56	66	"
Averages	......	51	53	.40	59.5	60.5	....	......	61	33.7	.23	60.5	61	....

In each case there was a greater loss of fat in the buttermilk from the sweet cream churnings. The average time required to churn was also greater. It will be noticed that during the last churning the temperature of the room was 56°, and the time required to churn was one hour and thirty minutes. It will also be noticed that in every case the temperature of the cream rose to about 60° before butter was made. The ripeness of the cream, the temperature of the cream, churn and room, the size of the churn and the speed of the churn, all have an influence on the time required to churn.

The butter from each lot of cream was examined on December 21st, having been placed in two separate tubs, and the ripened cream butter is of good quality and fine flavor, while that of the sweet cream is off in flavor and is not nearly so valuable. A pound print of each lot was wrapped in parchment butter paper on October 21st, and kept in the refrigerator. When examined on December 21st, the print of ripened cream butter was pronounced of better flavor than the sweet, although not so good as the tub (tin-lined) of ripened cream butter.

TRAVELLING DAIRIES.

At the commencement of the work I took charge of the western division of the travelling dairy for a few days to assist Mr. Linfield. Being relieved almost wholly of the management of this dairy during the past year, I had more time to devote to other lines of investigation. For fuller accounts of the work done, see the reports of the instructors, which follow.

This work needs no defence this year. It speaks for itself. The following, clipped from a Toronto daily under the head of "Items from Belleville," shows how the work has been appreciated in this district :

> "Since the travelling dairy has visited this section, an impetus has been given to local dairying. Ogden Hinch has instituted a winter creamery in Lennox County, and at a largely-attended meeting, the farmers in the county unanimously decided to give the factory every support."

Instead of being a hindrance to the establishment of creameries, as some persons predicted, experience has proven the effect to be the very opposite. It has created a stir among dairymen such as has never been done before in the same length of time and for the same outlay of money. It could scarcely be otherwise from the character of the meetings.

REPORT OF MR. PALMER.

To Prof. H. H. Dean :

SIR,—I have the honor to submit the report of my work with the travelling dairy in Eastern Ontario during the season of 1892.

About the latter part of April I returned from the States of Wisconsin and Illinois, where, in accordance with your advice, I had spent nearly three months studying the scientific and practical side of the dairy business, so that I might be better fitted to give instruction in the different lines of dairy work.

On arriving in Guelph I got ready the outfit necessary for the travelling dairy, which was substantially the same as that used by you at the dairy meetings last summer. The apparatus consisted of an eight-bottle Babcock milk tester, with the necessary accompaniments to make tests of milk; a No. 3 Daisy barrel churn, a tin-lined water tank, a No. 1 Lever butter worker of about 15 lb. capacity, a pound butter printer, parchment butter paper for covering prints, a refrigerator butter box of about 48 lb. capacity, weigh scales, cream can, deep setting cans, thermometers, a supply of good dairy salt, and such utensils as are used by butter-makers who aim to make the finest butter with the least labor.

Everything being arranged according to your instructions, on the 2nd day of May I left Guelph for Gananoque in Leeds county, being accompanied by John A. McTavish, a butter-maker who had spent the previous six years working in butter factories owned by Mr. John Hannah, of Seaforth. Arriving in Gananoque we found ready for us a fine team of bay mares, weighing about 1,100 lb. each, and a large express waggon with buggy top, which had been made for the purpose by order of the Minister of Agriculture. To protect the utensils when travelling from place to place, a large piece of water-proof canvas was provided, which completely covered the load, and afforded protection from the sun and rain. After getting our outfit together, we started for Seeley's Bay, the first place on our list, at which we were to hold a meeting.

GENERAL PLAN OF WORK.

On first starting out, President Mills directed us to drive from place to place as mentioned on our list, and hold meetings at the hour named, according to the arrangements that he might make with the officers of the Farmers' Institutes in each county. The institutes would also attend to the advertising, and the arranging of the necessary details for the meetings. This plan was the one followed during the season. The names of the places in each county at which meetings were to be held were furnished us beforehand so that we could drive on to the next point in the morning in time for the meeting at 2 p.m., the usual time of commencing.

Owing to the fact that the advertising in some places was not properly attended to, nor the arrangements at all satisfactory, it was deemed advisable to send out a man from the College to confer with the secretaries of the institutes as to the advertising and the arranging of the details. This was done during the latter part of the season. It is with pleasure that I can testify to the thorough work of F. C. Harrison, B.S.A., who, under the direction of President Mills, travelled over part of our route, directing the secretaries as to the best way of advertising and arranging the meetings. This made it much more pleasant and satisfactory for us when we came into that part of the country.

WORK ACCOMPLISHED.

Our season's work extended from May 2nd to Dec. 15th, a period of seven and a-half months. During that time we covered fourteen counties, holding meetings from five to twenty-five miles apart. These meetings were arranged at different places, so that every farmer in the county could attend if he so desired.

The counties travelled over, the places visited, the number of meetings held, the pounds of butter made, and the samples of milk tested in each county were as follows :

Counties.	Places visited.	Meetings held.		Pounds butter made.	Samples milk tested.		
		Afternoon.	Evening.		New milk.	Skim milk.	Butter-milk.
Leeds	15	15	13	95½	176	6	20
Grenville	11	11	10	88	235	11	12
Dundas	12	11	4	85¼	256	10	12
Stormont	8	8	2	77	90	2	8
Glengarry	9	9	1	57	118	2	9
Carleton	9	9	..	59¼	38	3	9
Lanark	12	12	1	70¾	86	..	17
Renfrew	19	19	..	141¼	131	4	19
Frontenac	13	13	..	88¼	96	10	13
Lennox	7	7	1	41¼	84	4	7
Addington	6	6	..	53	22	1	14
Hastings	14	14	..	81½	147	12	14
Prince Edward	8	8	..	52¼	122	12	13
Northumberland	8	8	..	59¾	178	15	14
			..				
	151	150	32		1,778	92	181

From the above it will be seen that we held meetings at 151 different places : 150 meetings were held in the afternoon, when the practical butter-making and milk-testing were illustrated, and 32 in the evening. During the entire season we drove 2,057 miles, the team of horses bought for the purpose proving well suited for the work.

Mode of Conducting Meetings.

Arriving at the place of meeting, we unpacked our utensils in the hall or building provided for the purpose, and were ready to begin proceedings at the hour advertised usually at 2 p.m. About three gallons of ripened or soured cream (and some ice in the summer) were arranged for ahead to be delivered at the hour of meeting. If the people supplying this cream had in every case followed the directions sent out to them, we should have had much better satisfaction in the making of the butter. As it was, in many cases, sweet cream was brought to be churned, while sometimes, the condition or flavor was such that it would be impossible for anyone to make a good quality of butter from it. In a few instances, the cream failed to turn up, but in only three places, during the entire season, was it found impossible to obtain any.

In my opening remarks I found it necessary to lay especial stress on several points in connection with the dairy, viz.:

1. That we were not agents, nor had we any private interest in the sale of the utensils we used, but we would be very pleased to give the addresses of reliable dealers who handled them.

2. That we were not sent out to induce people to make butter at home, instead of taking the milk to butter or cheese factories.

3. That we did not know all about butter-making, but had simply come to discuss the matter and help those interested in dairying in every way possible.

4. That we had no new patent process of making butter, but simply made it, in somewhat the same way as it was made in butter factories and on some farms, aiming to make it with the least labor and in the shortest time possible, and at the same time produce an article that would suit the market.

The value and importance of the cheese industry was then touched on and the need of carrying on dairy operations during the winter, when the best butter could be made, and when the price was high. The importance of adopting the factory system in butter-making as in cheese-making was always brought prominently before the meeting.

While Mr. McTavish conducted the practical part of the work, such as the straining of the cream, the churning, washing, working and printing of the butter, I endeavored to give a practical talk on the subject of butter-making, from the care of the cows, to the marketing of the butter, taking up the different methods of setting the milk, the best way to handle the cream, the best style of churn, etc., at the same time inviting discussion and criticism from all present. The audiences were also invited to inspect the butter when it first broke, and to note particularly the advantage of washing it when in the granular state, instead of gathering it in a lump and washing after removal from the churn. The salting and working of the butter was a point that received especial attention, also the putting up in neat shape for the markets. The Babcock tester was used at all the meetings, and its value and use thoroughly explained. The afternoon meetings lasted from one and a half to nearly four hours.

During the first part of the summer, the people attending in the afternoon were so anxious to have a second meeting, that it was found advisable to have an evening session. Thirty-two of these evening meetings were held in all. They were conducted somewhat on the plan of an institute meeting, but the Babcock tester, operated by Mr. McTavish, was an additional item. We found, however, that two meetings per day made the work altogether too hard for two of us, so we discontinued them. During the season I delivered one hundred and eighty-three lectures, those in the evening relating to some department of dairy farming, such as "Winter Dairying," "The Care and Feeding of Dairy Cows," "The Markets for Dairy Products, etc," and those in the afternoon to the more practical part of butter-making.

The Babcock Tester.

One of the most important parts of the apparatus we carried with us was the Babcock tester. It is really marvellous what an interest this tester has created throughout the country! And rightly, for it is designed to work a vast change in dairy farming in the next few years.

People were invited in the posters or bills to bring samples of milk to the meetings. This they did, and sometimes in such numbers that it was found necessary to test many after the meetings were over. The highest number of samples brought to one meeting was eighty-six.

Four points were mentioned in referring to this tester:

1. Its use in cheese factories as a means whereby to pay patrons according to the quality of the milk.
2. Its use in testing individual cows so as to weed out the unprofitable ones.
3. Its value in pointing out the effect on the milk of different feeds, harsh treatment, exposure, etc.
4. Its use in testing the skim-milk, butter-milk or whey to note and correct the losses that might occur.

The Dairy Cows.

The number of samples of milk tested amounted to over two thousand. Occasionally people brought in milk to test which showed by the excessive amount of fat it contained, that it must have been strippings or part cream. The results of tests such as these were not recorded, but only those which appeared to have been accurately taken, with a view to finding out exactly what the cows were doing. The number of tests of new milk recorded amounted to 1,778. Those tested the first part of the season ranged from about 2.7 per cent. fat to over 4 per cent. In the autumn when most of the cows were strippers the percentages of fat ran considerably higher and were rarely under 4.0 per cent. When in the county of Glengarry, about the middle of July, I made a careful test of a herd of cows belonging to a prominent farmer near Martintown. We first weighed the milk from each cow, evening and morning, and then mixed a sample of the evening and morning milk, which was tested with the Babcock. The results given below, are, I think, both interesting and instructive, in that they show perhaps about the average production of a herd of cows at that season. They were chiefly Ayshire and

Shorthorn grades, and were the result of breeding from thoroughbred sires for a few years without any definite aim and with no especial weeding out of the unprofitable ones.

No.	Pounds milk per day.			Per cent. fat.	Pounds fat.
	Evening.	Morning.	Total.	Evening, morning, milk mixed.	
1	10½	9½	20	3.5	.7
2	11¼	8½	19¾	3.5	.7
3	9	7½	16½	4.0	.7
4	9½	8	17½	3.7	.6
5	15	12¾	27¼	3.7	1.0
6	19½	15	34½	3.1	1.0
7	12	11½	23½	3.0	.7
8	18	18½	36½	3.3	1.2
9	8½	7½	16	3.7	.6
10	14	11	25	3.3	.8
11	9	7½	16½	3.5	.6
12	12	9¾	21¾	3.4	.7
13	14	9¾	23¾	3.7	.9
14	15	12	27	3.6	1.0
			325½	3.5	11.4

The total amount of milk produced was 325½ lb., or an average of slightly over 23 lb. per day from each cow. The average per cent. of fat was 3.5 and the total amount of fat produced per day 11.4 lb., equivalent to 13.6 lb. butter (reckoning butter to contain 84 per cent. fat).

The difference between the production of the poorest and best cows was .6 of a pound of fat, or slightly over .7 of a lb. of butter per day. Supposing the butter sold for 20 cents per lb., that would simply mean that cow No. 8 would bring in just 14 cents more per day than cows Nos. 4, 9 or 11, if all the butter-fat were recovered from the milk. There would of course be more or less of a loss in the skim and butter-milk, but that would probably be just as heavy with the poor as with the good cow.

In the case of cow No. 1, the evening milk was not weighed. I put it down, however, as 10½ lb. A test of the herd milk in the evening showed 3.4 per cent. fat; in the morning 3.8 per cent. The fact that there were strangers in the stable during the evening may have excited the cows and lowered the quality of the milk.

After carrying on this work of testing the milk cows in different parts of the Province I am more than ever convinced of the need there is for the dairyman to devote especial attention to this part of his business. Four things seem necessary: 1. To provide warmer stables; 2. To feed better; 3. To breed with more care; 4. To keep continually testing and weeding out the poor cows.

There is not one dairyman in a hundred who feeds his cows up to their full capacity for producing milk. In many cases about the only time that the unfortunate animals get enough to eat is in the months of June and July when the pasture is at its best.

Breeding with a definite aim in view is also a point that requires attention, while the testing and weeding out of the poor cows is a very important part of the business. A man asked at one of our meetings, "At what price can I sell my milk per 100 lb. to realize a profit on it?" That man, like many others, "put the cart before the horse." He looked to the markets but neglected the home end. He did not take into account at all, the cost of producing, but thought only of the price obtained. Cheap foods and good cows, in fact *cheap production* is a prime necessity among dairymen at the present time.

Losses in Skim and Butter-milk.

Twenty-two samples of skim-milk brought in by farmers, and one hundred and eighty samples of butter-milk were tested during the season. Of the latter thirty were brought in by farmers, the rest were from our own churnings.

The skim-milk averaged 7/10 of 1 per cent.fat,the butter-milk from the farms 1.1 per cent., and from our own churnings 7/10 of 1 per cent. The lowest test of skim-milk was 2/10 of one per cent., the highest 2.5 per cent. fat.

We found in the autumn, except in a very few cases, that the skim-milk tested very rich in fat. The reason was that most of the cows were then strippers, and hence the milk did not cream well. In two or three cases, when there were one or more fresh calved cows in the herd, we found the loss in the skim-milk much less. A very important factor in the cheap production of butter is the amount lost in the skim-milk. Great care should therefore be exercised in the setting of the milk. In order to obtain all the cream in the fall, it was recommended: 1st, To have some of the cows calve at that time, or 2nd, To dilute the milk before setting, at the rate of one quart warm water (100° to 120°) to every 3 gallons of milk. By adding this amount of water, the milk is thinned and still the relative difference between the specific gravities of the skim-milk and cream is not decreased to any extent. A large amount of water would of course lessen that difference; then the tendency would be for the cream not to rise.

The practical value of this plan was shown in the case of Mr. B. Mallory, of Frankford, who on November 20th set two cans of milk from stripper cows in ice cold water for 12 hours, one diluted as mentioned above, the other set as it came from the cows. The former tested seven-tenths of one per cent. fat, the latter one per cent. Mr. T. B. Carlaw, of Warkworth, practises warming the milk in the fall to 130° before setting. We found in his case on December 8th, that when the milk was set at 98° in deep cans in ice water the loss was 1.1 per cent., when it was warmed to 130° before setting, the loss was only six-tenths of one per cent. In cases where turnips are fed this warming has also the effect of driving off the turnipy odor to a certain extent.

My experience in regard to the use of shallow pans *vs* deep cans by the farmers is, that by using the latter intelligently, not only more cream is obtained, but the cream is also of much better quality. There is not one farm house in thirty, where a suitable place can be found to set the pans. The labor in connection with them is also much greater than it should be. It will certainly be a vast improvement when the cream separators come into general use.

In the case of the butter-milk we also found in many of the samples from private dairies a heavy loss, the lowest was three-tenths of one per cent. fat; the highest 2.5 per cent. In one churning the lowest test of butter-milk was two-tenth per cent.; the highest 2.4 per cent. Sweet cream was sometimes brought to the meetings to be churned and very often sour cream that had not been sufficiently stirred, hence there was a heavy loss in the butter-milk.

We could generally trace the losses in the butter-milk brought to the meetings to one or more reasons, such as:

1. Keeping the cream in different vessels. To have it all evenly ripened it should be mixed at least 12 hours before churning.
2. Insufficient stirring.
3. Adding sweet cream just before churning.
4. Churning in too short a time.

We often met with people who warmed the cream to such a high temperature, that the butter came in five, ten or fifteen minutes. A poor practice if it is desired to get all the butter from the cream.

Accurate Thermometers.

In view of the fact that butter-makers have a great difficulty in getting good reliable thermometers, I recommended the following plan of testing one before buying, as given by Lynch in his "Scientific Dairy Practice," page 59, and as found practical by myself.

"When making a selection in the store place several of the thermometers in a dish of water. If three of these indicate exactly the same temperature, one of them may be selected with considerable certainty that it will prove correct. If they all show a different temperature, then try several more in the same way. If none of them show the same temperature, it would not be wise to purchase any of them." The thermometer used by us during the latter part of the summer and the best one I have yet seen, is called the "New Floating Dairy." This thermometer is tested when made and can be relied on as being correct. It costs 75 cents and can be obtained from any of the reliable dealers.

Attendance at the Meetings.

The meetings on the whole were largely attended, not only by representatives of the farming community, but by manufacturers, buyers of butter and cheese, and consumers as well. Cheese-makers came out in large numbers, especially to the evening meetings to witness the practical work with the Babcock tester and to pick up points in butter-making.

The attendance varied from about fifteen up to over four hundred people. The average attendance ranged from about fifty to one hundred.

Although we visited the counties of Stormont, Glengarry and Lanark, just at the busy season when the farmers were hard at work saving their hay and grain crops, it was surprising what large audiences we had sometimes. People attended once, and then drove many miles so as to be present the second time.

On the whole the poorest meetings we had during the whole season were in parts of Dundas and in Carleton. The poor attendance in these districts was largely due to the fact that the secretaries of the institutes did not take enough trouble to advertise the matter properly, nor were the arrangements at all satisfactory in some instances.

The Country and the People.

It would be impossible in the small space allowed here to give a correct description of the different sections of the country passed through, or the people met with.

From May 3rd to July 15th, we were busy holding meetings in the counties of Leeds, Grenville, Dundas, Stormont and Glengarry. This section of Ontario is settled by live energetic dairymen, men who are anxious to obtain information and not afraid to show their desires in that respect.

The land is rolling in some parts, affording excellent pasturage, with abundance of pure cold water. Down through Dundas, Stormont and part of Glengarry there are stretches of almost perfectly level land that needs only a good system of under-draining to make it equal to any section of Ontario for producing crops suitable for the production of milk.

It is simply incredible the number of cheese factories one meets with in this part of the country—too many altogether for the amount of cheese manufactured. It would be much better for the patrons and the manufacturers if these factories were larger and situated at greater distances apart. As it is now, owing to the close competition in some districts, if the milk is rejected at one factory, the patron promptly takes it to another, where it is not refused.

Finishing Glengarry we next proceeded to Carleton and Lanark where the people as a whole give more attention to general farming. From Lanark to Renfrew up the Ottawa as far north as Pembroke, then down the western side through the townships of South Algona, Brudenell, Sebastopol, Griffith, Grattan and Matawatchan, a portion of Ontario once famous for its timber, now noted for its scenery, minerals and bad roads. We had some very large meetings in Renfrew, especially in the townships of Horton, Ross and Westmeath. In the western portion of the county which is much rougher we did not expect very large meetings, and were not disappointed in that respect, but those who came appeared deeply interested in all that was done. From Renfrew down through Frontenac as far south as Kingston and over to Wolfe Island, next through Lennox, then up north again through Addington, as far as Flinton in Kaladar township. Across to

Hastings county and down through that immense county stretching from the Bay of Quinte up to Nipissing and which is second only to Oxford in its yearly output of cheese. The northern parts of Frontenac, Addington and Hastings are decidedly rough and broken, but the farmers are alive to their best interests and gave us a warm welcome wherever we held a meeting. After holding meetings at fourteen different places in Hastings county, we next proceeded to Prince Edward and from thence to Northumberland. In the two latter counties we had probably the largest meetings of any held during the season, those in Lennox perhaps excepted. After holding our last meeting at Roseneath on December 15th, we drove back to Guelph, a distance of one hundred and twenty-six miles.

Conclusions.

When the travelling dairy was first sent out by order of the Minister of Agriculture it was thought by some of the cheese and butter manufacturers, that its influence would tend to bring the factories into disrepute and thus undo the work of many years, by which the farmers have been induced to adopt co-operative methods in cheese and butter-making. The results of two years' work have surely proved the contrary. Speaking for the eastern division of the dairy, I may say that in every case we urged the adoption of co-operative methods in making butter. In districts where cheese factories were already established, we showed the advantages of making butter in the same building during the winter, at the same time advising the people not to go into the matter too hurriedly, but to discuss the advantages of a system among themselves, also to prepare for it by growing cheap feeds and by providing suitable stables for the cows so that winter dairying could be profitably carried on.

In districts where creameries were already established we urged the operating of these creameries all the year through, instead of only for six or seven months.

As mentioned before, the results of the work prove the contrary to what was expected by some, for in the very districts that we travelled through last season, there were at least twelve cheese factories operated as butter factories during the winter. Had the influence of the dairy extended in the opposite direction, this would not have happened.

As a help to the cheese and butter factories, in improving the condition of the cows and the condition of the milk delivered at the factories, as a help to the private dairymen, as a factor in improving the butter made in Ontario and increasing its sale, the travelling dairy must certainly prove a power for good.

Many people may come to such meetings and go away without apparently having taken much interest in what was said or done, but they begin to think and in time work out their own salvation by adopting those principles which they have actually seen in operation or heard spoken of. One needs to attend several of such conventions as those held in connection with the travelling dairy, to realize fully the interest that is aroused. This not only refers to the farmers, but to their wives also.

Before closing this report, I desire to express my appreciation of the services rendered by Mr. McTavish as butter-maker in connection with the dairy. Always neat and tidy in his work, he did it in such a manner as showed to the ladies present, that he was a practical butter-maker in every sense of the word.

In conclusion, allow me to tender my sincere thinks to those members of the Provincial Legislature who so willingly helped us along in our work, also to the officers of the different institutes who in some cases went to a great deal of trouble to have all the arrangements satisfactory, and lastly to the hospitable people of eastern Ontario for the manner in which they received us in their midst.

I have the honor to be, Sir,

Your obedient servant,

W. J. Palmer.

REPORT OF MR. LINFIELD.

To Prof. H. H. Dean:

SIR,—I hereby submit a short report of my season's work with the travelling dairy.

Mr. Hume, (my assistant and butter-maker) and myself, started from the College on the morning of the 4th of May. Our outfit consisted of the same as that of last year, viz. A No. 3 "Daisy" churn, a lever butter-worker, ladles, and a mould for printing the butter, a pair of scales, tin pails, cream pail and dippers, one of them with a perforated bottom for straining the cream when putting it into the churn. We also had a Babcock test machine and the appliances necessary to work the same. For facility in getting to each township in the different counties visited, as well as for economy, a team and strong spring wagon were bought and everything packed securely. It was thus readily moved from place to place. The meetings were arranged ahead, as those of last year, by communication with the secretaries of the Farmers' Institutes and the members of the Legislature. The cream required at each place was supplied by some one in the neighborhood, instructions being sent to them as to its care and preparation.

We started the season's work in the county of Wentworth. Meetings were held at Freelton, Waterdown, Bullock's Corners, Rockton, Lynden, Jerseyville, Ancaster, Mt. Hope, Binbrook, Tapleytown and Stoney Creek. In Lincoln, at Grimsby, Smithville, Beamsville, Campden, Jordan, at Grange Hall in Louth and Virgil. In Welland, the dairy visited Niagara Falls South, Netherby, Stevensville, International Bridge, Ridgeway, Humberstone, Welland, Crowland and Allanburg. In Monck County, at Pelham Centre, Marshville, Wellandport, Dunnville and Canboro'. In Haldimand County, at Cayuga, Nelles, Corners, Selkirk, Jarvis and Caledonia. In Brant, at Onondaga, Cainsville, St. George, Glen Morris, Paris, Falkland, Burford, Mt. Pleasant and Oakland. In Norfolk, at Waterford, Windham Centre, Simcoe, Port Dover, Vittoria, St. Williams, Langton, Delhi and Courtland. In Elgin, at Straffordville, Calton, Springfield, Orwell, Sparta, St. Thomas, Fingal, Lawrence Station, Iona, Dutton, West Lorne and Rodney. In Kent, at Ridgetown, Thamesville, Bothwell, Dresden, Wallaceburg, Eberts, Dover township hall, Raleigh township Union hall, Valetta, Wheatly and Blenheim. In Middlesex, at Newbury, Glencoe, Appin, Napier, Delaware, Strathroy, Adelaide Village, Parkhill, Ailsa Craig, Nairn, Coldstream, Lucan, Ilderton, St. John, Lambeth, Thorndale, Dorchester Station and Harrietsville. In Oxford, at Tilsonburg, Brownsville, Otterville, Norwich, Burgessville, Oxford Centre, Sweaburg, Ingersoll, Thamesford, Embro, Woodstock, Innerkip, Drumbo and Tavistock. In Perth, at the separate school house, Gore of Downie, St. Marys, Avonton, Kirkton, Staffa, Fullerton, Mitchell, Bornholm, Rostock, Amulree, Milverton, Atwood, Listowel and Gowanstown. In Waterloo, at Linwood, Wellesley, Elmira, Winterbourne, Bloomingdale, Berlin, New Hamburg, New Dundee, Ayr, Galt, Hespeler and Doon. In Wellington, at Aberfoyle, Arkell, Morden, Guelph, Rockwood, Oustic, Erin, Hillsburg, Belwood, Fergus, Elora, Alma, Arthur, Drayton, Glen Allen, Moorefield, Palmerston, Harriston and Clifford, finishing on the 15th December; 154 meetings altogether.

Cream was supplied and butter made at all these meetings except four, and at these I talked on the care and management of the milk and cream, and explained as best I could our method of work. Samples of milk have been tested at nearly all the meetings, the largest number in any one day being at Erin, where sixty tests were made. In all, 1,685 samples were tested during the season, mostly whole milk, but a few samples of skim-milk and butter-milk were also tested, and if the samples of the two latter that have been brought to us this summer are an average of the skimming and churning the people generally are doing, between a quarter and a third of the butter is being thrown away in the butter-milk and skim-milk. In fact, if the farmer had only four or five cows and had a Babcock tester, and used it and followed its teachings intelligently, the saving on this item alone would pay for two or three testers in a year. The test for whole milk has ranged from 1.4 per cent. to 16 per cent. fat, but I would not guarantee the correctness of the samples. One sample that we tested read 2.5 per cent. fat, and a second sample from the same cow, tested a few days later, after giving special instructions as to how it should be taken, read the same. The highest test, from a sample the correctness of which I had a chance of verifying, read 9 per cent. fat. This was from a cow that had been milking about eleven months, and was giving a small quantity of milk. From the fact that it was difficult to tell if the sample was correctly taken, and also impossible to find out how long the cows had been milking, it was a very difficult thing, indeed to form any opinion as to the average.

The meetings on the whole were very well attended, and very much interest has been taken in them. The attendance ranged from 14 to over 400, the average being from 60 to 75. Welland, Monck, West Elgin, South Perth, and Centre and West Wellington greeted us with the largest audiences, taking all the meetings held in each county into consideration. Our meetings were very small during the month of July, as the haying and fall wheat harvest was calling for every energy from the farmers, and it was impossible for them to attend. I think another year it would be advisable to drop out a few weeks at this time, as even those who wish to attend cannot do so at such a busy season of the year.

The majority of the meetings were held in halls in the various places. Some few were held in the open air, and a few on fair grounds, but I think these latter should be discontinued as far as possible. It may be a good thing for the fair, but people are out for amusement, and do not care to listen to a practical talk of 1½ to 2 hours in length. The most of the meetings were held at 2 o'clock in the afternoon, a few, however, in the evening.

The method of conducting the meetings was as follows: When the meeting was called to order I generally began by making a few introductory remarks about our work, and Mr. Hume started with the churn. Proceeding, I called attention to the work at various stages in the manipulation of the churn, as the occasion arose; referred briefly to the advantages of dairying, and to the dairy cow, but dwelt more particularly upon the care of milk, cream and making of butter, everything as far as possible being illustrated from the practical work in operation. A circular, "Hints on Butter-making," of which the following is a copy, was distributed at each meeting:

HINTS ON BUTTER-MAKING.

Cleanliness Important. In order to insure success in butter-making it is necessary that great cleanliness should be observed. The cow should be kept clean, the food should be clean, the stable must be clean, the milk, cream, pails, strainer, churn, worker—in fact everything about the dairy, including the person or persons working in it, should be a model of cleanliness. Cleanliness and intelligence are two requisites for successful butter-making.

The Cow. Keep none but good cows, each of which will make at least 250 pounds of butter in a year. Feed the cows that you have liberally, house comfortably, care for kindly, and milk regularly. Give pure water only, and keep salt where it can be reached by the cows at all times. Having done all this, dispose of those that do not attain the standard.

Utensils. Procure proper utensils, because with the best there is a great deal of labor in making butter. Among them be sure to include a good dairy thermometer. (A glass one preferred). The following is a list of most of the articles required in an ordinary farm dairy, together with their probable cost:

A barrel or box churn, size to suit herd	$ 6 00 to	$ 11 00
A lever or roller worker	6 00 to	9 00
A butter mould—size, one to two pounds	1 50 to	3 00
A shipping box, with ice box in center and wooden trays	4 75 to	6 00
A thermometer (glass)	0 20 to	0 50
A salt sieve (hair)	1 00 to	1 50
A pair of scales, to weigh quarter ounces	5 00 to	10 00
A butter-milk strainer—size, 2 to 4 quarts—with perforated tin bottom	0 25 to	0 50
A butter ladle	0 25 to	0 50
A cream pail (tin, with handles on sides and tin stirring spoon)	1 00 to	2 00
Creamer cans and box for cold water (8 cows)	5 00 to	40 00
A hand cream separator (10 or more cows)	100 00 to	125 00
A stiff brush for cleansing utensils	0 20 to	0 30
A supply of washing soda or borax		
A supply of good butter salt, per sack	0 70 to	2 00
Butter color, if thought advisable to use it, per bottle	0 25 to	1 00
or per gallon	3 50	

MILK HOUSE. A dry, cool cellar of uniform temperature, free from bad smells or smell of vegetables, is a very good place in which to keep milk. Milk or butter, when kept for any length of time where such smells exist, quickly becomes tainted and lessened in value. A milk house with double walls may be constructed quite cheaply. A pantry or a cupboard is not the best place in which to keep milk.

MILKING. Milk only where the air is pure; brush the cow's udder before commencing; milk rapidly and quietly; strain immediately, and get to the place of setting or separating as soon as possible.

SETTING. Set the milk while it is warm. Set in creamers or deep pails. These are better than shallow pans, especially in summer. Put the cans in water at from 40 to 45 degrees—keep it at that temperature—and skim at the end of 12 hours in summer and 24 hours in winter. A water tight box about two feet deep will be a convenient place in which to put the pails where a creamer is not used. Cans may be used which are either put wholly under the water or set in water which is as high as the milk in the can.

If shallow pans are used, skim at the end of 24 hours in summer and 36 in winter, and always before the milk becomes sour and thick. Keep the temperature of the milk room even at from 50 to 60 degrees. A hand cream separator will pay with a herd of 10 or more cows.

THE CREAM. The cream should be kept sweet until 24 hours before churning by keeping it cool, either in the creamer box or in a cool cellar. Get a cream vessel (tin is preferable) large enough to hold the cream for a whole churning. If there is not sufficient for a churning from one skimming, stir the cream thoroughly at every addition of fresh cream.

In summer warm the cream to 63 or 65 degrees, 24 hours before you wish to churn and it will be about the right degree of sourness or ripeness in that time, but as soon as it becomes slightly thickened and sour churn it. It is not advisable to allow the cream to become warmer than 63 degrees in warm weather. In winter the ripening temperature will be from 64 to 70 degrees. In case the cream does not sour properly in 24 hours, it is a good plan to add a small quantity (about 2 per cent.) of sour milk or sour cream to act as a starter.

All changes in cream should be effected gradually. Never add hot or very cold water directly to the cream to warm or cool it. To effect this set the cream vessel in another vessel containing warm or cold water, and stir the cream all the time it is being warmed or cooled. Do not allow the milk or cream to freeze. If the butter is white a small amount of good butter color may be added to the cream, just before commencing to churn.

CHURNING. Strain the cream into the churn and you will not be troubled with "white specks." Use a churn without paddles or dashers on the inside. Churn often in the summer, not less than twice a week. In winter do not churn less than once a week. The churning temperature for summer will be from 56 to 60 degrees, and in winter 64 to 68 degrees. Everyone must find out for himself what is the best temperature. Start the churn slowly (50 turns to the minute, increasing to 60 or 70 after a few minutes) and if a close covered churn such as the "Daisy" be used, it will be necessary to remove the plug at the bottom of the churn two or three times during the first ten minutes. When the butter "breaks" add one quart of cold water (if the day is hot, and warmer water—55 to 60 degrees—if it is colder) to the churn for every pailful of cream, and then continue churning until the butter is about the size of grains of wheat, when the churn should be stopped, the butter-milk drawn off and as much water added as there was cream at the commencement. Give the churn a few rapid turns and draw off this water; repeat the operation, when the water should come away quite clear. If it is not, then a third washing may be given to the granular butter.

Never "gather" the butter in a solid mass, as this method leaves too much butter-milk in the butter. It also makes the "even salting," so requisite in good butter, more difficult to perform.

SALTING. Fine salt at the rate of from ½ ounce to 1 ounce to the pound of butter may now be sprinkled on the granular butter in the churn; or the butter may be salted by means of brine put on the butter while in the churn; or the granular butter may be removed to a cool room and placed on a slanting table which has butter cloth spread on it, and there salted and allowed to drain for three or four hours, or over night. Afterwards work very slightly and pack or print at once if for immediate use. Or the granular butter may be removed from the churn as soon as washed and drained, placed on the worker, salted and printed at once, or be packed in tubs or crocks for market.

WORKING. Be careful not to overwork the butter, injuring the grain and making grease of it. Work by pressure and not by friction. A slanting worker with a movable roller or with a lever attached at one end will be found to lessen the labor, and is much preferable to the bowl and ladle.

MARKETING. Put up in a neat and attractive form, and get it to the consumer as quickly as possible. If it is thought better to do so, it may be packed solidly in tubs or crocks and covered with butter cloth, or parchment paper and salt-plaster so as to exclude the air. To this salt-covering, fresh brine should be added from time to time.

To prepare ash or spruce tubs to be filled with butter, they should be soaked with brine for one or two days, afterwards rinsed, scalded, and have salt sprinkled on the inside before packing in the butter. Tin-lined butter tubs are used by a number of butter-makers.

The final work of the meeting was the explanation of the Babcock test, and the testing of the samples of milk brought to us.

All the utensils for handling the butter were put to soak in cold water a few hours before the time of meeting, to prevent the butter from sticking to them. When the cream came it was tested immediately, as regards temperature and acidity, and warmed or cooled as required to bring it to the temperature at which we desired to churn. When we first started out in May the temperature for churning was about 63° to 64°; then we gradually lowered it till during June and July the temperature ranged from 57° to 62°; fresh cream at the higher temperature to churn in a short time; ripe cream at about 60°, and sour cream lower, depending on the acidity. The latter part of August and during September we churned at 61° to 62°; October, 63° to 64°; November, 64° to 67°; December, 67° to 70°, and over, for ripened cream and other stages, higher or lower as required. Our average time of churning was about 20 minutes, and only eight times longer than half an hour, and then not quite an hour, except in two or three instances when the the cream foamed in the churn. We made from 1½ to 15½ lb. butter at the meetings, and from 5 to 15 lb. from three gallons of cream. Mr. Hume occasionally did the work, from the time the cream was put in the churn till everything was washed up, in one hour. In every instance we got the butter out in the granular form upon the worker, but during the hot weather this could not have been done without ice.

The butter when put up in neat squares or oblong prints, and wrapped in parchment paper, reminded very many people of soap, it looked so neat and shop-like; but I pointed out that most of the soap-makers put up their soap much more attractively than some of the butter-makers put up their butter. They had studied the art of pleasing the eye, and it was time the butter-makers were studying the same point.

In travelling around the country from place to place as we have been this summer, we have had an opportunity of learning many things with regard to what the people are doing and what they are not doing in this dairy business. The counties of Wentworth, Lincoln and Welland we find are well fitted for making a success of dairy farming; but it has not been developed. Grain-growing and selling out the farms by the bushel has kept many with their noses on the grindstone, but a few have awakened to the fact that the crops are getting smaller year by year; they see that something must be done, and are looking to dairying as the hoped-for remedy, and not without success. But it takes considerable to move some people. The great majority cannot see any money in cows, and I am quite sure they are right, as three parts of them do not put enough intelligent thought into the production, care and feed of their cows to make anything out of them. It would do some of those people a world of good to transport them to such a fine dairy district as we found in some parts of Oxford county, where they might feast their eyes on some good cows, and also on their owners' account with the factory, as well as with their banker.

Monck and Haldimand are in many places well fitted for dairying, but in others there is a scarcity of water, and the artesian wells are nearly all sulphurous. A few cheese factories have been started, though so few cows are kept by each patron that neither they nor the maker receive all the profit that might follow from an increase in dairy stock.

In Brant county we found an intelligent people who have gone into fattening cattle, and have made a success of it. However, the dairy business has not been neglected, a few cheese factories being in operation. They are giving good satisfaction to the patrons, though laboring under the disadvantage of having a small supply of milk.

In Norfolk and Elgin we found a fine district, but a great variety of soil, very much of it light or loamy. It is a soil eminently adopted for dairying, and yet the majority have followed the ruinous policy of grain-growing and selling off those farms that which should have been fed. We found them also committing another crime against their farms, as well as their pockets, and Kent county is also a transgressor on this point, and that is raising young stock till it is two or three years old, weighing from 900 to 1,100 pounds, then selling the animal at from $20 to $35 each. I want now to tell those people what we promised them we would: We found in Middlesex county some eager buyers for those steers, and they calculated to clear from $10 to $15 on each animal, besides enriching the soil by feeding all the grain they grow, as well as some grown elsewhere. You have built the most costly part of the animal, and why not get a good price for your grain by building the most profitable part; that is, fatten or finish the animal. We found that the dairy business had received some attention, but butter-making was mostly in private dairies. A few cheese factories have been started, some of which have collapsed, due to lack of faith on the part of many of the patrons, either in the dairy industry or in each other. Others have held their ground and are growing in favor; but such instances as a man sending 70 lb. of milk per day to the factory from seven cows; or a factory with 145 patrons with nine teams on the road and receiving only 10,000 lb. of milk in the flush of the season, show that there is yet much room for improvement. Those seven cows would be wonderfully helped by a little green fodder, such as peas and oats, or green corn, and so would their owners' pockets. In fact we found that those who are making the most out of their cows, and who are best satisfied with the dairy business are those who exercise a little forethought and grow some soiling crop to tide their cows over the dry time. Those, therefore, who say that they cannot afford the time to feed this green fodder, even if they did grow it, are talking nonsense, as the facts are all the other way.

Those southern counties are also eminently adapted for corn growing, even the M. S. S. coming to maturity. With a soil easily worked, what a heritage those people have if they would only waken up to their possibilities, and direct their energies aright into the building of good dairy herds to turn their genial climate into glittering gold.

Kent county, with its rich bottom land, a county almost without a stone, and as level as the western prairies, where nature has not provided rivers, but the energy of the people has made them—here we found friendly and energetic people. But nature has seemed almost too indulgent; there appeared to be no exhausting such rich and fertile soil. But a few illustrations point to danger ahead. Continuous cropping is removing the humus from the soil; the plow is yearly turning up bigger and harder lumps; the soil is rebelling against the loss of its virgin fertility and pointing out to man the necessity of restoring the same by converting all the grain and fodder grown into animal products, and getting the manure out on the land as soon as possible.

In Middlesex and Oxford counties we found a stranger mixture of progressiveness and the reverse. Here we found some of the finest and wealthiest districts we have visited; some of the greatest points in the west for the shipping of export cattle; some of the greatest milk-producing and cheese-making districts; but here we also found districts utterly indifferent to the making of good butter; utterly indifferent to the fact that every pound of butter they made added to or deducted from our reputation as a butter-making country. Even loyalty to our country should demand that we make the finest article of product, and the finest only. Through the work of dairy missionaries from abroad, as well as of progressive dairymen in their midst, a great many have "figured down" to the fact that a cow has to milk longer than seven to eight months to pay for her feed, and so cheese factories are being started to run as creameries in the winter with eminent satisfaction to the patrons, as the cows even surprise their owners as regards their capabilities for work in the winter, when well fed and cared for.

In Perth county we found an inquiring people, which is a very good sign indeed. The soil and the plentiful supply of good water makes the place well fitted for dairying, and cheese and butter-making are receiving considerable attention in some parts. It is acknowledged by all that those townships that have made a specialty of dairying are the wealthiest in the county, and yet how much of truth it takes to convict some people. They will acknowledge that these things are so and yet fold their hands in helpless indifference, instead of bestirring themselves with intelligent energy and starting along the same road to prosperity.

Waterloo and Wellington counties are directing their energies along the line of mixed farming, with a leaning toward the fatening of cattle for export. But the dry, rolling land, the plentiful supply of good water, and the limestone formation which, with the intelligence of the people, has given this district such a reputation for good cattle would also if applied to the dairy business add very much to the income of the farmers. Quality is what the market demands, and here we have conditions well fitted to give it.

In conclusion, I would put down a few practical thoughts deduced from my observations during the season's work.

One hundred and fifty churnings, from May 1st to December 17th, of all kinds of cream, in all sorts of conditions, has shown me that there is no necessity for any person churning longer than a half to three-quarters of an hour. Carelessness or ignorance causes nine-tenths of the longer churning.

It would seem, not from what people say, but from what they are doing, that many persons kept cows for the fun of it, or because some other person kept cows. In 1,685 tests made, only five or six persons could tell definitely how much milk their cows were giving in a day, let alone in a year. Such indifference to business methods in farm work and the consequent ignorance of what the individual factors of the farm are doing, has very much to do with the unsatisfactory position of many farmers.

One-half the cows of the country are living off the farmer, instead of the farmer off them, and an account opened with the butcher for the carcasses of the same would add materially to the wealth of their owners.

Respectfully submitted,

F. B. LINFIELD.

MISCELLANEOUS MATTER.

VISITORS TO THE DAIRY.

During the past year we have had a great number of visitors. Some dairymen in the neighborhood also have come in and spent a part of the day with us to see how we manage the cream and butter. During the month of June, when hundreds of farmers and others visited the institution, we usually arranged to have a separator and Babcock tester in operation, also a churning. We found the raised platform, with chairs, which commands a full view of the working dairy, very convenient, except that for times of excursions it is not nearly large enough. While the work was progressing an address was given on the objects of the department and the requisites of a dairy, together with a full explanation of the process of butter-making from a farmer's standpoint.

"BLACK PEPSIN" IN CHURNING.

Many readers have doubtless seen the article in the press which states that 150 per cent. more butter may be made by adding a substance called black pepsin to the cream. We sent to the Concord Chemical Company, New York, for a sample of the wonderful stuff, and received in a few days a small sample of a reddish-looking powder, accompanied by a printed letter and two circulars. The letter stated that the directions, or recipe, are copyrighted by Cloud, Harlin & Co, of Toronto, Canada, and cost $30 per hundred, and retail at $2.50 each. We wrote Cloud, Harlin & Co. (?) Nov. 4th, requesting further particulars and more of the pepsin, saying we wished to give the matter the fullest investigation. Our letters were returned, stamped by the P. O. Department as follows: Supposed to be of a fraudulent character." One of the circulars is headed in the following manner:

A FORTUNE FOR FARMERS.

AND A GREAT CHANCE FOR AGENTS TO MAKE MONEY. CANNOT $32 A DAY BE EASILY MADE?

Here are a few of the sentences:

"What could be more desirable for the farmer than to know how to double the yield of butter without additional expense or labor? Will not every person that makes butter pay $2.50 for directions and the right to use them as soon as they see that the yield of butter can be more than doubled by the use of black pepsin as directed? If as much butter can be made from five cows by using black pepsin as from ten cows without its use, can any person that keeps cows afford to be without it?" etc., etc.

"The trouble with most people is that they won't try, and consequently they *can't expect to succeed. Don't be afraid to try. Don't hesitate. Don't wait. Go to work*, and when you have accumulated a fortune you will point with *pride* to the time you *acted for yourself.*"

"All we ask you to do is to get some directions, and *try our business one day*. We have never yet had a person try our business who did not succeed *better* than they expected. Remember the price of directions is $30 per hundred, or 15 directions for $5, or $2.50 for a single direction. Black pepsin is worth $2.50 per box, and a box will make 500 lb. of butter; a dozen boxes are worth $24.

Address, Cloud, Harlin & Co.,
Toronto, Canada."

The above is a sample of the whole circular.

November 7th we took 8.5 lb. of cream, testing 15.4 per cent. of fat, and containing 1.31 lb. of fat, which would make about $1\frac{1}{2}$ lb. of butter. The cream was treated according to directions. When finished, we had $3\frac{1}{2}$ lb. of butter, or no increase after deducting the two pounds of melted butter, which was added in accordance with the directions given. The butter-milk contained 0.9 of one per cent. of fat. November 12th we divided equally 18 lb. of cream, which tested 17.4 per cent. of fat. One-half was churned in the usual way, and the other half was treated with melted butter and black pepsin. Result, from pepsin cream there was $1\frac{1}{2}$ lb. of butter, after deducting two pounds of melted butter. The butter-milk contained 1.6 per cent. of fat. The other lot gave $2\frac{1}{4}$ lb. of finished butter, and the butter-milk contained 0.4 of one per cent. of fat. There thus was no increase whatever in these two experiments, while the extra labor involved was considerable. I may say that in the second experiment we added 6 lb. of skim-milk to the cream, thinking that possibly this might help, as they say the more skim-milk the better. The quality of the butter from the pepsin lot is inferior

As there have been several inquiries in reference to black pepsin, from druggists and others, I would advise persons to spend their money in something more profitable than buying a compound that will only delude.

As a matter of fact, no compound can increase the yield of butter 150 per cent. It is possible that a substance may incorporate more of the solids of milk than is obtained by making butter, but such a compound would not be butter, but something that more nearly resembles cheese.

The following is given as the average composition of milk: Water, 87; fat, 3.6; albumen, 0.7; casein, 3.3; sugar, 4.7; and ash, 0.7 per cent. There is thus 13 per cent. of solid matter in milk. In butter-making we want but one of the solid constituents, and as little as possible of the others. It has an average composition of, fat, 84; water, 11; salt, 3; and curd, 2 per cent. In cheese-making, we make use of more of the solids. A Cheddar cheese consists of, water, 31; fat, 31; curd, 31; sugar, etc, 3; and ash, 4 per cent. We may discover a new method of manufacturing cow's milk, but the product will not be either butter or cheese, but possibly lacto-solidine. If such a compound can be made wholesome for food, and made from cow's milk, all dairymen will welcome it as a new feature of this already great agricultural industry, dairying.

This is not the first time that a compound which claimed to materially increase the quantity of butter that could be made from a given amount of milk has been brought to the attention of the public. A few years ago, what is known as the "Gilt-edge Compound" was investigated by a chemist at the Department of Agriculture at Washington. Tests showed it to contain pepsin, and the butter made with it contained about 40 per cent. of water, while it was apparently merchantable butter. This was truly a fraud on the consumer.

To show how eagerly some people will bite at anything of this nature, one of the leading druggists of Guelph tells me that he has had a number of inquiries for black pepsin. He informed them that it was a fraud, and advised them not to waste any money on such stuff. How long, oh! how long, will it take some persons to think and act sensibly? One would expect that hayforks, hulless oats, marvellous fruits, and rich, fast butter ought soon to teach people that there is but one way to prosperity. This way is characterized by three things: think, act, work.

Butter-Making on the Farm in Summer.

Many enquiries have recently been received by this department as to printed matter dealing with butter making, which shows that there is a desire for something of that nature. To aid the overworked farmers' wives and daughters in the difficulties which constantly arise in the handling and care of milk and cream, and also in the churning of the butter, we thought that we could not do better than to give a simple outline of how our dairy at Guelph is managed in the summer time. We might here say, however, that we think it would be far better for our butter-making industry if the manufacture of the butter were done more largely in creameries or factories as in the case of cheese. The chief advantages of such a system are, a more uniformly good quality of produce and a lessening of labor at the farm.

Our dairy herd at the present time numbers fourteen cows, twelve of which are now giving milk. We are raising eight calves, which are fed chiefly on warm, sweet skim-milk containing a little oil cake. Each calf has a small box in which dry oatmeal and oil cake are placed, and which they soon learn to eat with a relish. Some cut grass fed in the stable completes their ration.

In the Stable. At present the cows are at pasture. Night and morning they are brought into the stable to be milked, and are fed a small quantity of bran—about one pound a day. At the side of each manger is a small box, which is kept full of salt, and in front of each animal is a water trough, where they may obtain drink at will. Before commencing to milk the *men* wash their hands, for which purpose we keep a wash-basin, soap and towel in the stable. Milking begins at five o'clock morning and evening. Each cow's udder is well brushed before commencing to milk, and the milking is done as quickly and quietly as possible. As soon as the cow is milked her milk is weighed, and the weight recorded on a sheet. (Twice a week, morning and evening, each cow's milk is tested for the per cent. of fat or butter therein.) The milk is then strained into shot gun cans through a gauze strainer having three or four thicknesses of butter cloth fastened on the under side by means of a tin ring, which slips over the rim on the bottom of the strainer, thus securely fastening the cloth, and making an almost perfect strainer. The milk is removed from the stable to the dairy as quickly as possible after it is milked, and again strained before it is run through the cream separator. When all the cows are milked they are taken to the pasture. The stable is thoroughly cleaned out after each milking and the floor sprinkled with land plaster, the windows and doors being kept open as much as possible to give the stable a good airing.

Later in the season when the pastures begin to dry up we shall feed to each cow *in the stable* from twenty to thirty pounds a day of green peas and oats, of which we have about three quarters of an acre growing vigorously at the present time. Later we shall feed about the same quantity of green tares and oats, of which we have about an acre and a-quarter, sown ten or twelve days after the peas and oats. Later still we shall feed green corn, of which we have about two acres. We are thus prepared for a dry season if it comes, and if we do not require these to feed in summer they will be cured and kept for the winter.

In the Dairy. We have been using a Laval "Baby" separator, No. 2 (hand power), for over a year, and like it very much. Recently we have purchased an Alexandra No. 8, and it is giving good satisfaction. It is a cheaper machine than the Laval. Our method of using is as follows: After the speed of the bowl has been attained the tap is opened from the supply can, and the warm milk allowed to flow into the machine. *It is very important to attain the normal speed of the machine before allowing any milk to flow into the bowl.* Some have had trouble from lack of care in this particular. When the last of the whole milk is out of the supply can we run about a gallon of skim-milk through, and lastly about the same amount of warm water, to clean the cream out of the bowl. The cream is then cooled down to about 45° Fahrenheit, the machine and all utensils thoroughly washed, and the dairy made neat and tidy—as every dairy should be. The skim-milk is then taken back to the stable for the calves, and the cream put into the cream pail and kept cool until twenty-four hours before we wish to churn. (I may say that I think a preferable plan would be to have a neat, clean room in or near the stable, where the separator might be set, and when separated the cream could be taken to the dairy or cellar, while the skim-milk would be where it is wanted for feeding.) The cream is kept in one large (ten gallon) tin can, which has a *tin* spoon in it for stirring at every addition of fresh cream, and also for stirring when the cream is either cooled or warmed.

Sometimes the milk is set in deep cans or creamers, in cold or ice water. When this is done the milk is put in the cans while warm, and cooled to at least 45° Fahrenheit before skimming, which is usually done at the end of twelve hours. After skimming the cream is handled in the same way as from the separator, except that it is not cooled, it being already cold enough.

Those who still use the small shallow pan should set where the air is pure, the temperature even (fifty to sixty degrees), and skim always before the milk becomes thick. Do not be afraid to take off some skim-milk along with the cream.

CHURNING. We churn three times a week—Monday, Wednesday and Saturday. The night before we churn the cream is warmed to about 65° by setting the cream can in another vessel containing water at about 90° to 100°. We use a large can, but a wash-tub will answer the purpose very well. The cream is kept stirred until it gets to the proper temperature, when it is either placed in a "Boyd Ripening Vat," or set in a room where the temperature is about the same as the cream. The next afternoon the churning is done, but when the weather becomes very warm we shall churn in the morning while it is cool. The cream will also be set to ripen earlier if necessary. This matter of ripening or souring of the cream is a very important one in preparing butter for the present market, and to get a profitable yield of butter. The only rule that I can give at present as to when the cream is ripe or sour enough is that as soon at it gets about as thick as good maple syrup, tastes slightly sour, and has begun to separate into small particles it is ready to churn, and we then churn it without allowing it to stand any longer.

Our average temperature for churning during summer is 58°—ranging one or two degrees higher or lower according to circumstances. The cream is brought to this temperature in a manner similar to preparing it for ripening; it is then weighed and strained through a perforated tin strainer into the churn. The cream can is then rinsed out with a little water. For every ten pounds of cream we add one dram (about half a teaspoonful) of Hansen's or Yorkshire butter color. This is done before starting the churn, and for the purpose of imparting a "June grass color" to the butter.

The churn we use is a No. 5 "Daisy." Two or three times during the first ten minutes of churning the plug at the bottom is removed to allow the gas to escape. Churning usually occupies from fifteen to twenty minutes—seldom over half an hour. The churn revolves at the rate of sixty or seventy turns to the minute. As soon as the butter "breaks," which we can tell by the swishing sound, or by the clearing of the glass in the cover, we add a quart or two of water for each pailful of cream, the temperature of the water varying with the day and the condition of the cream. On a warm day one can scarcely have the water too cold, as it will then chill the particles of butter and make them firm, while at the same time the water dilutes the butter-milk, allowing a more perfect separation of the butter. The churning then continues until the butter granules are about the size of grains of wheat or a little smaller, when the churn is stopped, the butter-milk drawn off from below and strained through the strainer previously mentioned for the cream. This strainer serves to catch any particles of butter which may come out with the butter-milk; but if the separation has been complete the butter will float on the top and none appear in the butter-milk until the very last. We next add cold water or weak brine in quantity sufficient to float the butter and wash out the butter-milk. We usually half fill the churn with water, give it a few rapid turns, and draw off the milky water. The operation is repeated with pure cold water, which generally comes away clear. If it is not clear, water is added the third time. The butter is then allowed to drain in the churn for fifteen minutes or half an hour, and sometimes the salt is added while still in the churn; but as a rule the butter is removed from the churn, placed in a butter-tub and weighed. It is then spread upon a V-shaped worker that slants towards the front and has a lever fastened at the lower end. Fine salt at the rate of one ounce for each pound of butter as it comes from the churn is now sifted on by means of a hair sieve. After sifting on about half of it the butter and salt are gently stirred, when the rest of the salt is added, and the butter worked by means of the lever. We work sufficiently to remove the excess of water, to thoroughly incorporate the salt in every particle of butter, thus preventing "streaks," and making a firm, compact body. The butter is then put up in pound prints made by means of Carver's butter mould, or a mould made by Moyer & Son, Toronto. These may be gauged so as to print a pound quite accurately, and their use saves a great deal of labor. Each print is then wrapped in parchment butter paper—one sheet wrapping a pound. On these sheets is printed, in such a way that when folded the words appear on the top of each block, the following, which serves as an advertisement:

FRESH BUTTER.

MADE AND PUT UP BY TH

EXPERIMENTAL DAIRY,

GUELPH.

We never had enough at one churning to make a shipment, so the blocks of butter are put in a box. The box is made of wood, containing four *wooden* trays, with an opening down the centre in which is placed a tin vessel filled with ice, and the whole is kept in a cool room until the box is full, when it is taken to a commission merchant in the city of Guelph.

There are perhaps fifty ways of making good butter, and I do not claim that ours is the best. There are scarcely two persons that pursue exactly the same method in all the details, but I think the plan here outlined will, if carried out in any dairy, give butter that no one need be ashamed to have a buyer examine.

Things we do not do.

1. We do not consider that we know everything about butter-making, as something new is being discovered every month. Not only from our own work are we continually learning, but also from the observation and research of others.

2. We do not keep a cow that makes less than 200 pounds of butter in a year;

3. Nor put the dry cow on a starvation ration;

4. Nor expect a cow to make something out of nothing;

5. Nor keep our cows in an ice-house, hog-pen or dungeon;

6. Nor allow them to go a whole year without carding or brushing them;

7. Nor depend upon pasture alone for a supply of summer feed.

8. We do not allow the milk to stand very long in the stable to absorb foul odors.

9. We do not neglect to strain the milk at once after milking;

10. Nor set the milk in deep cans in well water without changing the water at least twice, or without ice;

11. Nor mix sweet cream with cream to be churned less than twelve hours before churning. (The cream is ripened in one vessel which holds the cream for a whole churning);

12. Nor add scalding water to the cream; nor guess at the temperature with the finger; nor take two or three hours to churn;

13. Nor gather the butter until the "dasher stands on top," and then dip it out of the buttermilk;

14. Nor add coarse salt by guess; nor work the butter into grease.

15. And finally, we do not send our butter to market wrapped in old rags that may have seen other service in the home.

THOUGHTS FOR THE WINTER DAIRYMAN.

THE STABLE. The stable should be made snug and comfortable before the cows are brought in permanently. If any boards are off they should be tacked neatly on again. If the hinges are broken have them repaired, as it will save much time and trouble during the winter. Ventilate the stable—not by means of cracks in the side, where cold winds may enter, but by means of a box leading from the floor above to the roof. This is specially necessary in basement stables. If the floors are leaking repair them at once. The liquid manure is worth a great deal more per ton than is the solid, yet in many stables it is lost, and at the same time it is injurious to the health of the animals to have it beneath the floors. We use constantly on our floors a liberal quantity of land plaster or gypsum, which has three effects :

(1) It fixes the ammonia, and makes the manure more valuable.

(2) It sweetens the stable, absorbing bad odors.

(3) It gives the stable a better appearance, and looks neat and tidy. In fact, an hour after our cows are turned out you would scarcely know that a cow had been in. This is accomplished by a liberal use of plaster and whitewash. Both are cheap.

If you can possibly arrange it so as to have water in the stable, you will find that it will pay a handsome profit on the money invested.

FEED. If feed is likely to be scarce, it will be better to sell a portion of the stock and feed the remainder well. Better keep five cows well fed than ten poorly fed ; there is no profit in the latter method. Where there is no ensilage provided, it will pay to feed some roots. They give tone to the system, and provide that succulency which seems so beneficial in milk production. Turnips should be fed after milking, to prevent taste in the butter. In feeding ensilage, we have found that it is not wise to feed this alone in large quantities, as the acid, which all ensilage contains more or less of, seems to have a deleterious effect on the digestive apparatus. Some bulky food, such as hay or straw will be found valuable.

COWS. Half the herd should be freshly calved for the winter dairy. This will produce a better article of butter than if the milk of strippers only be used. They should be fed liberally. Try two or three pounds of oil cake per day to each cow for a while, and note the result ; pea and oatmeal are also useful. Our standard ration last winter was :

Ensilage	50 lb.	(25 lb. morning and night).
Hay	6 lb.	(uncut), fed at noon).
Bran	5 lb.	(mixed with ensilage).

Towards spring we substituted for a portion of the bran two pounds of pea and oatmeal, mixed in equal proportions. Do not forget the dry cows. If they are to milk well next season, they must not be starved and exercised too much this winter. The best cows, only, pay. Others are kept at a loss. Find out which are the best cows, and keep them.

DAIRY. If living near a cheese factory or creamery, induce the proprietor to run all the season if possible. It will pay better than private butter-making, unless you have special customers. This will relieve the "women" of a great deal of hard labor. If it must be manufactured at home, provide suitable utensils for making butter with, and also a proper place in which to keep milk and butter. For obtaining the cream from ten or more *good* cows, I would recommend the use of a separator, as more butter will likely be obtained, and the skim-milk will be in the best condition for feeding. For churning, a box or a barrel churn without dasher or paddle will give best results. Calculate exactly the size of churn that will be required, and then get it one size larger. Do not fill over half full. Be careful the creamer milk does not freeze. Use a dairy thermometer, and churn at the proper temperature to obtain butter in twenty to forty minutes. Sixty-five to seventy degrees will be about right for cold weather, if the cream is properly ripened. Keep the butter in the granular condition until salted; then work once with a lever worker, which will save a great deal of wrist work and wry faces. Put up in neat pound packages for market. A butter mould that prints a pound in less time than you can think about making one by hand may be purchased for $1.50, or be made by a "jack-knife carpenter." Parchment butter paper may be bought at the rate of seven sheets (each sheet will wrap a pound) for a cent, and it is cheaper than old rags, old window curtains, or any cast-off garments. Better to give the latter to the poor, whom you have with you always, than to send your butter to market in them and become poor yourself because of poor judgment in satisfying a market overstocked with poor goods. Put your name or brand on each pound of butter, that consumers may know whose butter they are buying and eating. If it be first-class, you will soon have a greater demand than you can supply. This is the best means of advertising your business that I know of, and does not cost much either. Market regularly, and as soon as possible after milking.

Building a Dairy. In case you cannot afford to build a special house for the abode of the aristocratic dairy family, see that they are not compelled to live in the same part of the cellar with low-caste turnips, potatoes, and those occupants with bad-smelling breaths, viz., the onions. Nor yet should they abide in a pantry or cupboard along with pickles, cinnamon, nutmeg, or any of these highly-perfumed fellows.

If milk is to be kept in the cellar, keep it clean and sweet. Have a room partitioned off from the rest. If it is to be kept in the house, set apart a room airy, well-ventilated, and kept for dairy products only.

Where a suitable place may be obtained in or near the stable, and sufficient cows are kept to warrant the expense, a separator at the *barn*, run by tread power, will prove economical. The advantages of this method are:

(1) Cream only is carried to the dairy, while the skim-milk is at the place where it is required for feeding. This lessons the labor.

(2) The bull or an idle horse may be used to do the work, and this lessens expenses. Result, more profit.

(3) The separating may proceed while the milking is going on without any one specially to look after it. With a quiet animal on the tread this part may proceed without any special attention, while a supply of new milk and the reception of the skim-milk and cream may be attended to by the milkers. By the time the milking is done the cream will be ready to take to the dairy or house, and the skim-milk be ready for feeding. This may sound Utopian, but we are preparing to do this in our new dairy barn, and will report results later.

Select a site suitable for *good drainage*, and conveniently located. Excavate $2\frac{1}{2}$ to 3 feet below the surface. Have a stone wall come to the top of the ground. Posts or a balloon frame of such a height as to make the ceiling ten feet high may be set on the wall. For the outside sheeting, building paper, on which planed lumber is put up and down, with battens, will be found to do well and give good satisfaction. For the inside, put on building paper and matched lumber. An ordinary roof will suffice, the ceiling being finished with paper and matched lumber. The floor may be made of cement. Windows and doors should be double.

We have a floor in our dairy made in the following manner, which has proved a success so far: After levelling, a coat of three or four inches of broken stone was well rammed into the ground, and then it was levelled with Georgetown cement, in the proportion of four parts of coarse sand to one of cement. The finishing coats were made by using cement and sand in the proportion of one to two. I think, however, that the plan given below, which is taken from Bulletin 18, Iowa Experiment Station, will prove more satisfactory, although it is probably more expensive.

The floors of all the work rooms are made of cement, after the following manner: They were reduced to grade, then covered with fine sand, so as to gain as even a surface as possible. On this surface was spread a slushing of domestic cement (presumably, home manufacture) to a depth of four inches; the cement being mixed in the proportion of one to four, with coarse, unsifted sand. The spreading was done in sections with a common hoe, each section being levelled with a straight edge. After this coat was thoroughly dry, one of German cement, one-half inch thick, was thoroughly spread with a trowel. Immediately following this, another half-inch coat was applied, and dressed repeatedly as the cement set. The first half-inch coat was mixed one to one with medium fine, sharp sand. The second was also mixed one to one with sand, and about one-sixteenth part of yellow ochre added to the mixture. The ochre increases the plastic condition and improves the color. The color may be further improved by mixing a little red ochre and cement together, wetting it to the consistency of paint; then sprinkle over the fresh-laid cement, and use the trowel sufficiently to give it a cloud-like appearance. The finishing coats should be laid wet enough so that water will rise to the surface of the cement while being dressed. Then the repeated trowelling works out all the air, gives a polished finish, and there is no risks of cracks by reason of shrinkage or uneven settling. This finished coat must be laid in alternate sections of two feet in width.

The cost of laying cement in the above manner is about ten cents per square foot. A barrel of cement, when mixed one to one with sand, will lay nine square yards one inch thick.

The essentials for successful winter dairying are good cows, good stables, proper utensils, and a place for keeping milk, cream and butter where the air is pure, and where they will not freeze; and above all it is required that there should be the right kind of a man or woman to manage the business—one who will see that everything is done at the right time, at the right place, and in the right manner.

Bacteria in the Dairy.

Bacteria. What are they? They are not a new breed of cows. They are not a new kind of cheese. Bacteria are organisms which do a great deal of good, and also a great deal of harm. When these first began to be studied, "it was not agreed what place should be assigned to this new form of life. Some saw in it a fungus without a mycelium; others looked upon it as one of the algæ. . . . It is now, therefore, very generally admitted that ferments (bacteria) are fungi." (Low Forms of Plant Life.) (Schutzenberger).

For a long time there were a great many changes going on in different materials which scientists were unable to explain. The bread "rose" when yeast was added. Why, we did not know. The cider turned into vinegar. Why, we did not know. The barley and rye when properly treated made beer and whiskey. Why, we did not know. The milk went sour. Why, we did not know. A number of persons were attacked with typhoid fever or diphtheria at the same time. Why, we did not know. Now we know that the cause of all these phenomena, and a great many more, are due to what are known as bacteria—invisible organisms that are all around us.

Bacteria of Milk. When milk is first drawn from a healthy cow it is almost free from bacteria, but when allowed to stand for a while they increase marvellously. Milk which has stood for some time contains a great deal of bacteria, which produce changes resulting in various forms of abnormal milk. L. Adametz divides the bacteria commonly found in milk into three classes, according to their effects. The first class changes the sugar of milk into a syrupy acid, soluble in water. The name given to this acid is lactic or milk acid. It has the effect of coagulating or curdling the milk. This is the most common form of bacteria in milk, and is both the friend and foe of the dairyman. If allowed to work just so long in milk and curd for cheese-making, they are a great help to the cheese-maker; but if they get the start of him, the result is poor cheese. They also assist the butter-maker in producing a fine flavored butter; but if allowed to develop too much, the cream spoils or decays, and the butter soon goes off flavor and becomes rancid.

The second class produces a curdling of the milk by the formation of a rennet-like ferment (not by acid), and the curdling of the milk is soon followed by a solution of the curd. There would seem to be too distinct ferments produced by this second class of bacteria. One like rennet curdles the milk, and another similar to trypsin (found in the pancreatic juice), or pepsin (found in the gastric juice of the stomach), appears to have the power of peptonizing (rendering soluble) the casein or curd. This latter is considered to be of great importance in the ripening or curing of cheese. As we are all aware, a cheese properly made improves in digestibility and palatability with age, and the explanation of this fact is doubtless found in the action of these ferments on the matters present. Cavities in cheese are sometimes produced by bacteria, which decompose the milk sugar, and possibly some of the albuminous matter, producing gases which fill the cavities

A third class appear to have no visible effect. They grow in the milk, but produce no very marked changes.

The ultimate sources of bacteria, according to this authority, are the earth, the air, or water. They get into milk from five different sources :

(1) From the hands of the milker while milking.
(2) From the air of the stable, which is always well supplied with germs.
(3) From milk vessels not properly cleaned.
(4) From water used to dilute milk.
(5) From diseased animals, especially where the udder is affected with any contagious disease.

Milk is an excellent nourishing medium in which bacteria of all kinds may develop, as they require nitrogenous matter for their growth. Numerous cases of typhoid fever, diphtheria, cholera, and similar diseases, have been traced to milk which has been diluted with water containing these germs of disease. Some species cause what are known as ptomaines (poisons) in milk or cheese. A number of instances are on record where persons have been poisoned by eating milk and cheese containing this poison.

"Impurities in the Wurzburg Market; Milk, and the Source of the Bacteria in Milk." L. Schulz (Arch. Hygiene, 14 (1892), pp. 260-271).

The author determined the amount of sediment in a number of samples of milk, and studied the origin of the bacteria in milk. In these latter studies the first and last portions of a milking of a cow and a goat were compared as to the bacteria content. The teats and udder of the animal, and the hands of the milker, were thoroughly washed with water and with corrosive sublimate solution, previous to milking. About 200 c.c. of the milk drawn first, and of the strippings, were each caught in sterilized flasks; the latter were closed with plugs of cotton, immediately placed on ice, and taken to the laboratory for testing by means of plate cultures.

The following results show the average number of germs per 1 c.c. of milk :

Cow's milk ..	First portion	55,566
	Last "	Sterile
Goat's milk ..	First portion	50,836
	Last "	Sterile

In a second series of tests no sublimate solution was used for washing, but water was used freely. The average number of germs per 1 c.c. of milk was :

Cow's milk ..	First portion	97,240
	Last "	500
	Middle "	2,590
Goat's milk ...	First portion	78,718
	Last "	665

The author believes the following conclusions to be warranted: The enormous germ-content of milk is not, as was previously supposed, due entirely to lack of cleanliness, but is partially accounted for by germs working up into the opening in the end of the teat, where, under the favorable temperature, they increase rapidly between the milkings, growing upon traces of milk adhering to the outlet. They are largely washed out in the first portion of milk drawn, which accounts for the higher germ content of this portion. As milking progresses the number of organisms in the milk naturally decreases, until the strippings may be sterile, as was found in the first tests made, though this is not believed to be the rule. (Experiment Station Record, September, 1892.)

Bacteria of Cream. To give an idea of the number of these organisms that would be contained in an ordinary churning, Prof. Conn estimates that in some of the specimens studied by him, there were from 200,000 to 2,000,000 in a single drop of cream the size of a pin head.

On the inside of the bowl of a cream separator there is always found at the end of the separation a considerable amount of slimy material; the more milk that has been run through without cleaning the bowl, the more slime will be present; and he (Prof. Conn) found that this slime contained the greater number of bacteria, the cream next, and the skim-milk next. He found in ripened cream at least fifty different species or varieties of organisms, including bacteria, yeasts, and moulds. "In cream there is a great battle of the forms with each other. The victors will be those which chance to get the best start."

Having, then, so many different agents at work in the cream, it is no wonder that we find great difficulty in having cream ripened evenly at all times. In fact, it is almost impossible to get cream ripened uniformly, even under seemingly uniform conditions. By the use of proper cultures (breeds) taken from good cream and buttermilk it has been found possible to eliminate undesirable qualities in the butter; and in cases where these have been used, improvement in the quality of the butter has been very noticeable. Some manufacturers have already begun to advertise "pure bred acid-producing bacteria." It is possible that a new live stock industry may spring up in the near future, breeding "thoroughbred" bacteria for use in the dairy, which will guarantee uniform butter and cheese.

Already John Boyd, of Chicago, has patented a process of ripening cream by the use of a ferment or starter made from fresh skim-milk, which, he claims, will give very uniform results in butter-making. We have used the process to some extent in the College dairy, and are quite well pleased with it. (For full particulars see College Report, 1891, dairy department.)

The characteristics of ripened cream are:

(1) Sourness due to the formation of lactic acid by the acid class of organisms.

(2) Thickening due to a more or less complete precipitation of the casein caused by the acid.

(3) A characteristic odor due to a mixture of the volatile products of bacteria growth.

(4) An aroma or flavor due to the same cause. I think, however, that food has something to do with the flavor of butter and cheese. In those districts where coarse grasses and ill-smelling weeds abound, the flavor of dairy products is not nearly so good as in those places where a variety of fine-flavored grasses may be found in the pastures. Other cases might be cited where food has a marked influence on the flavor of dairy products.

Bacteria of Butter. Lafar found the number of live germs per grain in samples of fresh creamery butter to range from ten to twenty millions, and about twenty times as many germs were found in samples taken from the surface as in those taken from the inner portions of the material. In packing butter to keep some time, it is necessary to pack solidly and cover with something that will exclude the air which contains these germs. The use of saltpetre, sugar, and borax mixed with salt, forming a plaster with which to cover the tub or crock, is commended. The reason that these act favorably in this connection is that they are antiseptics or germ destroyers.

Cold has also the effect of decreasing the number of germs in butter. A sample kept on ice by Lafar showed a marked decrease in the number during the first week, but after that there was no loss, showing that cold destroyed some species while others are not affected. The addition of ten per cent. of salt was not sufficient to destroy all the germs. Heat kills a great many of them, but some varieties are able to resist a very high temperature. Not only does natural butter contain these germs, but artificial butter also has a great number of them. Other bacteriologists (Heim and Laser) have found that cholera, fever and tuberculosis germs retain their vitality in butter fat long enough to make infection with these diseases through butter possible.

We are thus surrounded by invisible friends and foes. To obtain the help of the former and to combat the latter, it is very necessary that we understand the peculiar circumstances or conditions under which they thrive best; and knowing these we are able, to a certain extent, to get all the good possible out of them, and to check as much evil as possible which is liable to emanate from them.

Temperature and Cleanliness are the two most important things which affect bacteria. They all thrive best at a certain temperature, most of them at from 30° to 40° C., although some do best at a lower (the one causing bitterness in milk or cream) and some at a higher temperature. We know that milk sours more quickly at a temperature of from 90° to 100° F. As we increase or decrease the temperature from this range the milk will keep sweet for a longer time, other things being equal. Thus we know that milk will keep sweet longer if we cool it down to 40° F. than at a higher temperature; while if we raise it to 150° or 160° F., it will also keep for a longer time. Why? Because temperature has a marked effect on these organisms. We also know that among filth contagious diseases revel. Tainted milk and infection are most likely to come from a dairy where uncleanliness prevails.

Your obedient servant,

H. H. DEAN,
Professor of Dairying.

FOURTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION.

The fourteenth annual meeting of the Ontario Agricultural and Experimental Union was held at the Agricultural College, Guelph, on December 22nd and 23rd, 1892, commencing at 10 a.m. on the 22nd.

The President, NELSON MONTEITH, B.S.A., Stratford, Ont., occupied the chair. The minutes of the last meeting were read and approved.

REPORTS OF COMMITTEES.

Agriculture. Mr. C. A. ZAVITZ: I may say, as Secretary, that we have had a very successful year, on the whole. During the year 1892 we have increased our work to a large extent, and have sent out about 6,000 packages of seeds and fertilizers. In 1891 we sent out about 2,500; so you can see that the work during the past year has increased very largely. As we have a long report which comes on to-morrow forenoon, I think it is not necessary to speak at greater length at this time. I may say that the expense of agricultural experiments during the year was about $300.

Horticulture. E. LICK: On behalf of the Horticultural Committee I may say that we have a report to be presented this afternoon; and while it may not be quite so complete as last season's, yet considering the weather this year, I think will be fairly satisfactory. I do not know exactly the expenditure, but it will be somewhere about $35.

Dairying. Prof. DEAN said that the committee on dairying did not do anything definite during the past year.

Live Stock. D. BUCHANAN: I was one of those appointed on this committee; and as you will understand, our work was to undertake experiments in any matter relating to live stock. It is very difficult to carry this on by individuals engaged in farming, as almost any line whatever in which live stock is concerned must be carried on at considerable expense. So the committee has found it impossible at the present stage of the Union to do anything in this work.

Prof. SHAW: I do not want you to go away with the impression that nothing has been done because the matter has gone by default. Such is not the case. The committee that was appointed to consider this matter did consider it, and the conclusion arrived at was that there were so many difficulties in the way of carrying on co-operative experiments in the feeding of live stock it was not advisable to undertake it at the present time. Whether it will ever be done, I am not in a position to say.

Apiculture. R. F. HOLTERMANN : The Apiculture Committee has this year taken up the question of foul brood—the vitality of the germ, etc. ; and I may say that as far as the work of the committee itself is concerned, all that we have been able to do was to secure the services of Mr. J. J. Mackenzie, of the Provincial Board of Health, who is a very thorough man in that line ; and the committee has supplied him with all the neces sary material in that direction. We thought it would be desirable for the Union to have the credit of this work as we had started it, but if the Union had not continued the investigation, then the Government would have taken it up. The latter part of our work was hindered a little on account of the threatened cholera invasion, and Dr. Bryce had to be away, and that made Mr. Mackenzie very busy ; and on that account there was a certain amount of work which we would like to have accomplished last year but we were unable to do so. I may say that the results which have been obtained are very satisfactory.

REPORT OF CORRESPONDING SECRETARY.

Mr. President and Gentlemen : During the past season the Executive met at Toronto, and we decided that the better way would be to hold our meeting at this time of the year. We thought it would give a better chance to prepare the report for the year, and it would not interfere so much with the work of the students at the College. We also thought that at that time we would be able to secure reduced rates independent of the number who would be with us. In regard to the reduced rates we were disappointed, as you all know. As soon as I found that we would not get the holiday rates, I at once wrote to the district secretaries, informing them of this. I also wrote to the President of the College and Mr. Zavitz, asking them to inform those present at the institution, so that they might inform their friends.

In getting up the programme we of course understood that we had plenty of ability amongst the graduates of the institution who could very well take part in the programme, and carry it out satisfactory, but we thought it would be to our own interest to try and get some outside talent—men who are making special efforts to develop special lines. You will be very much pleased to know that we are going to have Prof. Bailey, the Minister of Agriculture, Prof. Shutt, and other prominent men, with us.

We sent out a circular asking the ex-students to co-operate more with us, and also asked them for their membership fee. As a result I have already heard from about twenty-five, and no doubt we will hear from a great many more.

PRESIDENT'S ADDRESS.

Gentlemen : With the experience and lessons of another year we are permitted at this Christmas season to gather at this the fourteenth annual meeting of the Ontario Agricultural and Experimental Union. As an officer of this Association, and fellow-student with you in agriculture, I heartily welcome you to this meeting, and would invite you to join in a full discussion of the various questions arising from the subjects which may be here introduced. We desire our meeting to be of the greatest possible good to the greatest number, and with this in view we would ask you to be concise in your remarks. I shall not occupy your valuable time in explaining the object for which our meeting has been convened. This is already familiar to you. The extension of our Union work during the past year has been especially gratifying. With our Alma Mater as a common centre, the beneficent influence of experiment has radiated, until to-day data will be forthcoming from almost every township in the province. Never was there a time when agriculturists seemed more alive to the necessity of increased knowledge in their business. Is this a time that we should lag? Let us rather redouble our efforts, and show the practical usefulness of the work in which we are engaged. Year by year the sphere of our operations has increased, until within the past year the number of individual experiments carried on throughout Ontario aggregated almost six thousand. The rapid increase in the number of outside experiments is a sure indication of the increasing interest and confidence placed in the value of our work. The results from the extended and successive experiments so carefully conducted should act as finger-boards pointing the farmer to that crop or fertilizer which is most likely to give profitable results in his locality. This might possibly lead to specialties, varied by conditions which I believe to be the ultimate destiny of successful agriculture. To-day we find among farmers a lack of that thoroughness so essential to success, which is largely due to the dresent system of mixed farming. The words of Pope are indeed applicable.

"One science only will one genius fit,
So vast is art, so narrow human wit."

Our Association is but yet in its infancy. We look for still greater and grander results in the years to come, and that this may be accomplished we must be loyal to our Union, and strive for greater excellence through the medium of perseverance and accuracy in our experiments. In the growth of fodder crops our operations might be largely extended, whereby we may wrest from the sun, air and mother earth the greatest amount of energy, to be in turn moulded into beef or other animal products, for which our Province has become deservedly far-famed.

There are forms beneath our farms we know not of. Instead of increasing the number of our acres let us rather increase the productiveness of those we already possess. The opportunity for development in this direction is only limited by our knowledge and industry.

It has been customary with my predecessors in office to make some reference to our College paper, the *O. A. C. Review.* I hope you will pardon me if I digress somewhat from the ordinary line in speaking upon this subject. I have a very friendly feeling for the *Review*, and am pleased to note the ardor with which each successive editorial staff enters upon its duties, and the determination to make its year's publication superior to all previous ones. The present editorial staff is to be commended in its laudable efforts to convey to every ex-student a reflex of modern college life, with its increased attractions. I shall not comment upon the relation which should exist between the *Review* and the Union, except to say that the Union should help the *Review* and the *Review* help the Union. Our interests are largely mutual.

In conclusion, I have to thank you for the honor conferred upon me by electing me to the presidency of this Association during the past year. I have also to thank you for the staff of fellow-officers who have so ably wrought out the design and purpose of our Experimental Union.

QUESTION DRAWER.

Q. Is the Babcock test likely to come into general practice in the private dairies of Ontario?

Mr. W. J. PALMER: In answer to that question I would say that it may be some time before the farmers generally through Ontario will adopt the Babcock test on the farms. I think, however, it will come to that in the end. It is a test that requires a certain amount of care, and some are afraid of handling the sulphuric acid. I think the associates who go out and adopt dairy farming to any extent would certainly find it pay them to get a Babcock tester and use it wisely. I think there is nothing that requires more attention from the dairy farmers of Ontario, especially of eastern Ontario, than the using of some test on the farm to weed out the poor cows.

Mr. John HANNAH: I perhaps can do nothing better than repeat the words of Mr. Palmer regarding the Babcock tester. I do not know that we will see it in general use for some time, but certainly any person who intends to follow dairy farming should use a Babcock tester. They can be had for a very small amount, perhaps $6 or $8, and the expense for acid is the only other outlay, and that is practically next to nothing. However, if one man does not care to go to this expense, let three or four combine and get a tester amongst them and follow out the test week by week. In a very short time they would know exactly what their cows were doing—whether it was profitable to keep them or not. I think the introduction of the Babcock tester is one of the greatest advances that has been made in this century. Any ordinary dairyman who has skill enough to set a can of milk has skill enough to work the Babcock tester.

Mr. S. P. Brown: I purchased a tester last spring, and I find that it is of great value to anyone who is handling milk. I found by using it that in our herd we have two or three cows which it is very necessary to exterminate as soon as possible, and I think it would be one of the best means of advancing the dairy industry that there is. We should extend its use as widely as we can.

Q. Is it a good practice to feed roots to breeding ewes before lambing?

Mr. D. Buchanan: It is not that I have had any practical experience myself, but I attended the meeting of the Sheep Breeders' Association, held in the city here, and there was an article read by Mr. H. Arkell in favor of feeding roots to breeding ewes. The President, Mr. J. C. Snell, was of the opinion that it is not well to feed roots to breeding ewes. Mr. McGillivray had fed roots and found that there were no injurious results from feeding them. The opinion of that meeting was slightly in favor of feeding roots to breeding ewes.

Mr. J. Burns: I have not had very much experience in feeding roots to sheep, from the fact that I do not keep a very large flock of sheep, but I always make a practice of feeding them a few roots—I could not tell how many—but I make no difference as to whether it is lambing time or not, and I find no injurious results from doing so.

Prof. Shuttleworth: Did Mr. Arkell discuss the quantity of roots fed towards lambing time? It seems to me that it would not be advisable to feed the same quantity near the lambing season as earlier in the season. I have heard farmers express that opinion.

Mr. Buchanan: Some think that the roots are the cause of the weakness of the lambs. Mr. Arkell said it was not due to the feeding of roots at all. He might have qualified his statements by saying that he made a difference in the quantity for one or two days before lambing, but not more.

Prof. Shaw: I am not very sure that my own personal experience will be of much value in this matter, but I had some experience which was not very favorable to it some years ago. I grew a very good crop of turnips one year, and we fed roots to the ewes very freely, with the result that when the lambs were dropped we noticed they were unusually large and deficient in vitality; and in consequence a good many of them died, but I am not just prepared to say that that condition of the lambs resulted from the feeding of roots—it is possible that it did not. I may say that other experienced breeders have observed the same thing; but on the other hand, I have met with some feeders, and feeders who have been very successful, who are prepared to say that in their judgment they think there is no danger in feeding roots very freely to breeding ewes, providing they are fed under certain conditions. Those who take that view have been particularly careful in the way in which the roots are fed, that is to say, they have not given them to the ewes early in the morning. When they do it has a tendency to chill the animal, and possibly the difficulty has arisen to some extent in that way. Their practice is to feed about the middle of the forenoon about half the amount given in the day, and again in the middle of the afternoon the other portion; so that the roots are fed when the animals are the least hungry, and they seem to think that this practice is favorable because the roots have a less tendency to chill the ewes. I was astonished at the amounts that some of these men had fed—seven and eight pounds per head per day to breeding ewes, yet they say that the lambs have come in fine form. At present the whole question is not quite cleared up. With the present knowledge that I possess, I would be inclined to advise to feed roots with some caution; but I am not prepared to say that they should not be fed at all.

Q. How much meal should a steer receive daily when being fattened for the block?

Prof. SHAW: If I live long enough, I hope to be able to tell you that between ten and twenty years hence. I may say, however, that we have done something in that line here, but our experiments thus far have not led to any very conclusive results. We have been in the habit of feeding about from ten to twelve pounds per head per day, but the idea seems to prevail latterly that feeding that amount is too much. Of course there are very many conditions on which the amounts of feed to be fed are dependent. The breed probably would have something to do with it, the age of the animal, the way in which it had been fed previously, and the qualities which it possesses would also affect the amount of meal that should be fed. I may say, however, that we are carrying on an experiment that has principally that object in view this winter. Of course we can say nothing as yet as to what the results will be, but we look upon it as a very important line of experiment, and we hope to continue it till some definite results are arrived at, but it will probably take a long time before we get anything of very much value in reference to so wide a question as that.

Q. What are the best modes of fattening swine to supply the market of the present day?

Prof. SHAW: I am sorry to have to say that we have not done more in that line in the past. Those of you who are acquainted with the circumstances will know that we have been somewhat hampered in that respect on account of room. That difficulty is now to be removed, however. I may say that the most of the experiments that we have conducted in regard to feeding swine in the past have related to the feeding of certain mixtures of meal along with roots, in the one case, and ensilage in the other, and sometimes feeding the meal unground, and at other times ground. We find that a mixture of meal, as a general thing, without very much of the other adjuncts gives the best results. In that respect, so far as our experiments have gone, they do not seem to be quite in touch with some experiments that have been conducted in several of the American stations. In some of these experiments they lay considerable stress upon the feeding of green food along with certain proportions of meal. We did not get sufficient encouragement in our test to justify us in giving much attention to that course, but I should say here by way of explanation, lest a wrong idea should be carried away, that no doubt the age of the pigs had considerable to do with the results. We generally commenced when the pigs were perhaps from three to five months old, as the case may be, and we fed a pretty large amount of green food, sometimes ensilage, sometimes turnips and mangels, and sometimes, when in the proper season, green food that was cut and mixed with the meal; and I must say that so far as my personal ideas were concerned in regard to what the results would be that I was somewhat disappointed. The trend of the experiment pointed simply the direction, that the mixture of certain kinds of meal fed pure gave on the whole about the best results. The favorite mixture with us in the past has been this: equal proportions of ground barley, ground peas, and ground oats. Of course, as I have said before, our experience is somewhat limited, but we have experimented enough in that line to feel quite justified in recommending that as a good ration for the Canadian farmers to use in feeding pigs, for these can all be freely grown in this country. We found considerable advantage from grinding the grain. Allowing a reasonable cost for grinding the grain, we found that that cost was not only returned in the extra gain that the animals made, but that there was also a profit in addition.

Q. Can superphosphate be profitably used by the Ontario farmer?

Mr. C. A. ZAVITZ: It might be profitable on some farms, and it might not be profitable on other farms to use superphosphate. There are some crops that it would be useful for. I might say that the work of the Experimental Union in that line, which I consider is now the best authority on the practical application of fertilizers in Canada which we have, is that it will not pay the average farmer to use superphosphate upon grain crops. That has been the experience of the Experimental Union during the last five or six years, during which time there were perhaps 125 experiments carried on by the members of the Union. Do not understand me that in all instances superphosphate will not make a profit upon the outlay. In some instances there have been large profits resulting from the use of superphosphate. Much depends upon the quality of the soil and the manures it has received before. This is the real value of the Union, to determine upon which farms it will give good results and upon which it will not.

Q. What breed of poultry is best for the farmers?

The PRESIDENT: I have had some experience, and would favor the Plymouth Rock.

Mr. HOLTERMANN: I have taken some interest in poultry lately, and am in favor of the Plymouth Rock. Some whom I have written to are of the same opinion also.

Prof. SHAW: Why do you favor them?

Mr. HOLTERMANN: They mature fairly early, commence laying early, are good birds to kill, fairly good to lay, their eggs are of a good size, and the color is such as to please the public generally. I regard them as a general purpose bird.

Mr. GRAHAM: Are they not given to setting two-thirds of the time?

Mr. HOLTERMANN: Hardly two-thirds. The Leghorns have been favorites up to the present time, but I think it is the general opinion that they are no good for killing; and a bird that is only good for laying is not a desirable bird.

Mr. GRAHAM: Would you favor the dark Plymouth Rock?

Mr. HOLTERMANN: Yes; I know very little about the white.

Mr. GRAHAM: If you kill the dark during the time they are moulting, their pin-feathers, which are black, will show, whereas with the white Plymouth Rocks they do not show very much. I might say that I was at a poultry show in Brantford about a week ago, and I was asking a great many about the Plymouth Rocks, and they seemed to think that they wanted to set too much for the average farmer, but what other breed they favored I could not find out. I never tried the Plymouth Rocks but once, and they wanted to set too much for me. They were all right for a time, but would set nearly all summer. I find from experience that there are other breeds which you can get to lay earlier in the winter than the Plymouth Rocks will. I tried the Leghorns. The Langshans gave better success with me than any other. A great many favor the light Brahma for winter laying. The difficulty with the Leghorns is that you require a very warm place for them in winter.

Mr. HOLTERMANN: What appeared to be the general opinion as to the best bird?

Mr. GRAHAM: You could not get that out of them. There were a number of breeders who had bred nearly every variety. Mr. Daniels, of Toronto, I believe, has had every variety of fowl there is, but he did not favor the Plymouth Rocks at all. He was more inclined to favor the Java, and I might say that the majority were in favor of the Light Brahma. They claimed that if you do not feed the Light Brahmas too heavily they will lay the most of all the breeds.

REGISTER FOR EX-STUDENTS.

The following report was read by G. F. Marsh, B.S.A., *Farmers' Advocate*, London, Ont.: The work upon which I am to give a report is the establishment of a register of all the ex-students, giving their occupation and place of residence. This question was brought up at the Union meeting last year, and it was decided that we should start a register, and the Personal Editor of the O. A. C. *Review* should compile the report. We consulted with President Mills, who offered to bear any expense in connection with it. We sent postcards to all students since 1874. Some responded at once, others were longer in answering, and some have moved away and we have not been able to find them. Quite a number however neglected to return the cards, and a great many are to be heard from yet. I only wish that my report was more satisfactory; but when you consider that it is some eighteen years since the College started, you will understand that it would be very difficult to get information regarding them all.

We talk about the sun never setting on the British dominions, but we may say that the sun never sets on the College dominions. I am very glad to say, however, that the students as a body are in Ontario. Of those who came before 1886, there are about two-thirds of them farming, and half of them are farming in Ontario. I think that is a good showing, considering that a great number of them did not come from farms; and of those who came since that time, three-quarters are farming, and two thirds are in Ontario.

I would recommend that the register be printed and distributed. If not, I think it should be printed, and let the students buy it. By that means it would be scattered all over.

Prof. SHAW: I was particularly interested in the report of Mr. Marsh in reference to the gathering of the names of the ex-students for that registry. It is one of the many important things that this Union has undertaken; and I think if the information which has thus been gathered is properly used, it will be found to be one of the most important. I think so for this reason: you all know that the reproach has been brought against this institution from all sides that the College was not educating men to go back upon the farms. We had no data whereby we could answer that charge, but I am glad to say that we have data now.

OUR PUBLIC ROADS.

The following paper was read by Mr. JOHN BURNS, of Kirkton: That the condition of the common road has much to do with the prosperity of both town and country; that it enriches the farmer and raises him socially, commercially and financially; that it widens his influence, contributes to the happiness of his family and brings him in touch with all the improving and civilizing influences of the busier world, there can be no manner of doubt.

We have in this country something like 2,000,000 of horses, above the age of two years, upon our farms, and at a moderate estimate of twenty-five cents as the cost of feed and care of each of these animals we see that the aggregate expense of maintaining them is about $500,000 per day. If by a similarly moderate estimate we say that they are kept in the stable in a condition of enforced idleness by the bad condition of the roads in spring and fall for a period averaging twenty days in each year, we may easily compute that the loss in this respect alone will amount to $10,000,000 per year, a sum sufficient to build, if properly expended, about 3,000 miles of excellent highway.

But of course there are so many conditions to be considered that it is impossible by any mathematical formula to compute the loss entailed upon any community by the continued toleration of these bad roads in their present condition. But it is certain that with the burden of extra help and extra draft animals, lost time, wear and tear of wagons and harness, the drawing of light loads and the depreciated value of farm lands, we are pursuing a short-sighted policy in permitting the present system to continue. Besides the actual loss, which a moment's reflection will serve to show, we are gaining nothing and saving nothing in that great department of agricultural industry to which the condition of our roads is of such marked importance. By dwellers in cities the actual condition of these country roads during the wet season is scarcely known. While with farmers, to whom all roads are bad roads and who have never seen or known of a highway better than that which they have used from boyhood, these bad roads are an accepted fixture which long habit and use have impressed upon them as a natural and neccessary adjunct of farm life.

But aside from the social and political features of this question and the direct bearing which it has upon the personal income, expense and economy of the farmer, a bad road increases the first cost of produce—an increase which tends to enhance the price paid by every consumer, and this consideration, if no other, brings the road question home to everybody. During the period this fall when our roads were in their worst condition, the people of St. Mary's were paying fully thirty per cent. more than the market value for their wood and hay; and this increase of price represents nothing to the farmer, who was practically shut out of the local market on account of the muddy roads. It simply represents an added profit of about thirty per cent. to the middleman or speculator, who following the unbending rule of supply and demand, trades upon the helplessness of the consumer in a market where he is unhampered by competition.

How long should this costly and paralyzing condition be permitted to continue? Measured by every rule of economy, public and private, we are paying a heavy premium for keeping our roads in their present condition, and in labor and money we are spending more to carry on a system of shiftless maintenance than would be sufficient to keep in proper repair double the length of high-class roads under the methods pursued by England and other European states. In our struggle for road reform we are following in the footsteps and repeating the history of European nations, where in the beginning the same objections were urged, and the same obstacles interposed which we meet with at the present time.

Macaulay makes graphic reference to the difficulties of travel upon English country roads at a time when the English farmers indulged in the same periodical diversion of working out their road taxes that is provided for in our oldfashioned Ontario Statutes which we still keep in force for the maintenance of our own highways.

He states: Not so are the English roads of to-day. By experiment and by the better light of experience, the English people and their neighbors all over the European continent have learned that true economy in the construction and repair of the common roads, as in the construction and repair of the great railroads, consists in the scientific making and the systematic maintenance of these roads according to fixed rules and under the direction of an intelligent head.

In the perfection of this enlightened system it is probable that France leads the world. The government maintains a large body of trained engineers in its special department of roads and bridges to whom is entrusted the practical work of constructing and repairing the common roads. No part of the road system of France escapes attention, and every road is subdivided into sections varying in length according to its importance, each section being placed in charge of a man who is held responsible for the constant excellence of its condition. Referring to the economic worth of these roads to the French government, Mr. Francis B. Loomis commercial agent at St. Etienne, made a report to the United States Department of State within the last year.

Our conditions differing in some respects from those of the European nations I deem it wise to deal with the matter more from a local standpoint than from a general. And having said sufficient to convince anyone of the necessity of putting our roads in a state of greater efficiency, I will try and point out how I think it can possibly be done without increasing the cost very materially, and in order to do this it will be necessary for me to give you an illustration from which I can submit figures and draw comparisons. And to do this I will take the township of Blanshard, in which I live, as a typical one, convinced that what is here said in regard to this township will be applicable with slight variations from local circumstances to most of the townships of the Province. Generally speaking this township presents few difficulties in the way of road-making, it being traversed from north to south by the Thames, which has several small creeks running into it. This gives ample opportunity for drainage. Entirely within the limits of this township we have the town of St. Marys, which is the grain market for the surrounding neighbor hood, which causes much heavy traffic over its roads, rendering it necessary to keep in good repair its main entrances. All the main roads of the township lead in the direction of the town. The side roads are little used and consequently need little attention The main roads are those on which nearly all the expense occurs, and it is of these I will speak principally. All the roads of this township, with the exception of seventeen miles of company road that was built under the turnpike and toll-gate system, have been built and maintained by what is known as the statute labor system, a proçeeding well known to you all, and which it would be superfluous for me to describe here. Although possessing some good features, this system is not the most suitable for the construction and maintenance of good roads and should give place to a better.

Perhaps it will be necessary for me here to make some reference to the way in which our roads have been constructed. Most of you have had some experience in building corduroy and grading. A width of about twenty feet was left in the middle of the road allowance, the earth on each side was loosened with a plow to the depth of six to nine inches and conveyed to the centre by scraper and shovel to a depth of from eight to twelve inches, and about eight feet wide. In places where the ground was high, no grading was done at all, the longitudinal slope being depended on to keep the surface dry. The traffic soon compressed the clay and pressed it down so that in the majority of cases it was only from two to five inches above the original level of the land; and where no grading was done, the track became a depression, passable only in dry weather. On the other hand the narrow roadway was raised where the ground was low and wet to a height of fifteen to twenty inches, making a dangerous place for teams turning off when meeting. This is what was known as the clay, or more commonly and appropriately, as the mud road, for many years in use. On this, as a roadbed, pit-gravel was hauled and spread loosely to a depth of from eight to twelve inches, according to the fancy of the man doing the work. When the formation of the roadbed interfered with the natural course of the surface water, culverts were put in. These were usually built of logs with a plank covering but sometimes stone sides were built up without mortar, and a plank covering put on that. The defects of this condition of things are obvious. The superintendence of the work is placed in the hands of parties who have no training or experience in the best methods of work, who have given the matter no attention or consideration, and who are consequently unskilled and incompetent to make the best use of the time and money spent. No good road of any kind can be made and kept without a proper system of drainage, and this fundamental fact is almost entirely neglected by path-masters. In many places no side drains exist at all, and where they do exist they are always too shallow. In the wet weather of spring and fall, (the seasons when traffic is greatest) the roadbed becomes saturated and softened and unable to support the covering, and heavy wagons cut through the gravel and bring up the clay, mixing it with the covering, permanently ruining the road where it occurs and rendering reconstruction necessary the following summer. Too great a depth of gravel is put on at one time, and it is a long time before it is possible to go over it with a heavy load. In this condition the traffic seeks the side of the road when possible, cutting it and bringing the clay on the gravel. The gravel is taken from the nearest pit with no regard to its quality, and always contains too much clay or large stones to make a good road. The large stones are the worst as they cause ruts on either side from the concussion of the wheel as it drops over them. Wooden culverts are a constant source of danger, being generally in a state of ill-repair. The foundations as a rule are not put deep enough, and the water soon undermines them allowing the walls to fall in, in which condition they are usually allowed to remain until some one complains, or the township becomes liable for an accident. Moreover they are not economical, decaying as they do so rapidly from the alternate wetting and drying to which they are subjected. The cost in this township for repairs to culverts alone, for the year 1889 amounted to almost $360, and this, without any road commissioners' salary, which if added would amount to almost another $100. This of course does not include a dollar spent for new ones.

To effect an improvement in these roads, thorough drainage is a prime necessity. This can be provided by an open drain on each side of the road, with slopes of one to one, and a width of one foot in the bottom. Culverts should be made to last as long as possible, and for this reason they should be built of stone where stone can be got so conveniently as it can be here. It will always be found to repay the extra cost of construction by its solidity, permanency and consequent safety. The floor should be made of concrete to provide a bed that the water will not wash out, and render the cleaning out easier. The walls should be built on a solid foundation got by digging down to the solid clay, and should always go below the flooring, the mortar used should be made of cement, as it best resists the action of water. A culvert properly built will never need repairing, will be always perfectly safe and of no expense save for cleaning out once or twice a year.

In order that the road covering should be maintained so that extensive repairs will never be needed, minute repairs should be made to the surface systematically in small patches, as soon as ruts and depressions appear. The road should be constantly undergoing repairs. To have this done the road should be divided into lengths, on each of which an intelligent laborer should be placed, who thoroughly understands his business, to attend constantly to the condition of the road, and for which he should be held accountable. He should keep the ditches clean and in good order, and fill in the ruts as soon as they appear. To enable him to do this, gravel should be deposited in suitable places on the side of the road, one heap in each quarter of a mile. He should be furnished with a shovel, a wheelbarrow, a pickaxe, and a rammer. The new material should be added little by little, from time to time, in depressions and deficient places, and it should be broken fine in comparison with that used in the original construction. This patching should be done so constantly that it will never be necessary to add more than one to two inches in thickness at a time. It is one of the greatest mistakes in road making that can be committed, to lay on thick coats of material. A cubic yard nicely prepared and broken to a rod will be quite enough for a coat, and if accurately noticed, will be found to last as long as double the quantity put on unprepared, and in thick layers.

In speaking of keeping up the roads by constant patching Gilmore says: "This system of maintenance for roads of moderate traffic, seems open to the objection of being unnecessarily expensive, but observation and experience have fully demonstrated that such is not the case, and that the 'stitch in time' policy applies here with peculiar and significant force. It is not only cheaper to maintain such a highway in good condition for a given traffic adapted to it than to pay the extra expense of conducting the same traffic on a bad road, but it is also vastly cheaper to keep the road in excellent condition than it is to restore it to that state after a period of injurious neglect, during which it has become filled with deep ruts and thickly covered with dust and mud."

An eminent French engineer, who gave the matter an exhaustive and practical study, came to the conclusion that in proportion as the intervals between the periods of repairs were shortened upon roads of small traffic two important and valuable results followed: first, that the annual expense was *lessened*, and second, the roads were always in better condition; and finally that the roads were never so good nor the expense of maintenance so small as when the system of unremitting and minute attention was in operation. The experience of these men I think would furnish sufficient argument in favor of putting our roads in a state of efficiency such as has been described. A thing which is manifestly impossible under our present system of administration.

The statute labor system was devised to meet the requirements of early settlements when a simultaneous opening of all the roads in a township was the thing most desirable. Its chief advantages were that under its working each ratepayer was permitted to do his share of the road building in his own immediate neighborhood, and that he was able to pay his road tax in labour rather than in money; but these considerations (however important at first) have long since lost all their force. The portions of the road in which all are most interested now are those in the neighborhood of the town which are used in common by all. And the second consideration has come to be looked upon as a doubtful privilege as time is quite as valuable to the farmer on his property as on the road. Owing to the laxity of path masters the time spent on the road is flagrantly misapplied. The day required is eight hours long, and any pretence of work is accepted. The impression is prevalent that in road work the time is to be put in with as little exertion as possible. The real amount of gravel hauled is never so great as reported on account of the smallness of wagon boxes and the desire of teamsters to save their horses. Anyone who has observed statute labor will agree with me that over one-third the time is wasted through the trickery of workmen and the carelessness or ignorance of directors. As a proof of this statement I will give you one example: The township council pays thirty-five cents per cord for gravel, and counts five loads to the cord. Now by actual measurements, I find the average gravel box used is eight feet long, three feet one inch wide and ten inches deep, which if filled five times would hold 79 per cent. of a cord, showing a loss of 21 per cent. of a cord on every cord paid for or a total loss of 21 per cent. of the money paid out, which in the last year of which I have any account would be 21 per cent. of $524 or a total of $110, and besides this the boxes were hardly ever filled.

I will now briefly suggest what I think would be an improvement. It seems to me that first of all it is absolutely necessary that we should have a thoroughly competent and responsible man as engineer or overseer, who would know how, when and where the work could be done to the best advantage, and that he should have the power, with the approval of the council, to purchase the necessary tools, keep the time of the workmen and be responsible for all the work left in his charge. He might also have the power to hire farmers and their teams to work on the roads who were willing to work according to the regulations which he might adopt. Another method which I think would give good results would be to abolish farmers' labor and do the work entirely by contract. I will give you a statement of the expenditure on the Blanshard roads for the year 1889, as taken from the auditor's report, together with a statement showing how I think a better result at a smaller cost is possible under a proper system of management. (The standard wages in each case being fixed by the council).

PRESENT SYSTEM.

2,757 days statute labor	$2,757 00
Contracts for gravelling	805 00
" " grading	238 00
Repairing culverts	358 00
Contracts for ditching	95 00
Other work on roads	6 00
Total	$4,259 00

CONTRACT SYSTEM.

Seven men for eight months, at $208	$1,456 00
Eight teams and drivers, five months at $260	2,080 00
Superintendence	800 00
Total cost	$4,136 00
Balance	$123 00

There you see gentlemen, with the time and money now spent on the roads of this small township, we could maintain a force of fifteen men and eight teams for a little over six months of the year and still leave a balance on hand to the credit of the new system.

But I very much fear it will be a difficult matter to accomplish much in the direction of a general adoption of this system unless legislation can be secured to assist in perfecting it, and I would suggest that the Provincial Government by legislative enactment, do at once two or three things in the direction of furthering this movement:

Procure and disseminate information by establishing a bureau where the facts relating to the expense, mechanical construction, care, durability, use and extent of the different kinds of roads shall be known and ascertained.

Then I would have some kind of government supervision, presided over by a competent engineer or by engineers appointed by the government, in aid of road making, and repairing upon scientific and economic principles, and I think it would also be to the public advantage, if the state should own or control and maintain some through highways connecting the principal towns. They could in this way give a profitable example, and a strong incentive to the different municipalities to construct better contributory roads as feeders to the main ones. And it appears to me also that this would be a good investment for some of the rusty millions of surplus which is periodically reported as being in the hands of the Provincial Treasurer, and I trust that some influential body of our citizens may suggest it to the Premier so that he may have ample time to take it into his consideration.

Prof. SHAW: In reference to the paper that was given us by Mr. Burns, I am very much pleased with the principal portion of what he said, and do not know that I would be disposed to take exception to any part of it. The paper was evidently very thoughtful, and a great many ideas in it were new to me, but the great difficulty in connection with the road system seems to be, not so much to find fault with the method that is in vogue at present, but to devise a better one; and I was pleased to notice that Mr. Burns, if we may so speak, took the bull by the horns, in his paper, and ventured the suggestion of a better system. Whether that system would be the best or not, of course I am not prepared to say, with the little thought that I have given it. I was impressed with this statement, the advisability of putting on but a moderate quantity of gravel at once and having it put on oftener, and having any depressions in the road filled up at once. I believe there would be very great economy, indeed, not only in constructing roads in that way, but in keeping them in a good state of repair. Mr. Burns recommended that ditches should be made of a considerable depth. I do not know just how deep you would recommend them to be made, but I am not inclined to favor ditches that are very deep. They require of course to be deeper in some soils than in others. We should be satisfied with a moderate depth of ditch—just enough to give the road a proper inclination. One evil in connection with roads is a tendency to have them too narrow—to heap all the gravel within a narrow space, perhaps 8 or 10 feet, and have an elevation so that only one conveyance can go along the road at once. Mr. Burns took exception to putting too many and too coarse stones. This really tends to harm roads that would otherwise be good; and I am very pleased to think that we have been trying to remedy that so far as our roads in the neighborhood of this Farm are concerned. It is our practice to go out in the spring of the year and two men take each side of the road with iron rakes, and draw the stones that are loosened into the centre, and a fifth man comes along with a cart and draws the stones away. The consequence is that there are scarcely any stones left to inconvenience a person. Four young men will, as a rule go over five-eights of a mile in half a day; and when we think of the advantages in comparison with the small amount of work taken to do it, it is evidently the proper thing to do

Mr. HUNTER: I agree as far as I have heard in that paper with the method of constructing roads, but I am convinced that we cannot keep our roads in anything like a fair state of repair until we have a complete reformation in the rigs used, and the method that I would suggest is that the tires be broadened in proportion to the load that the rig is to carry. If you are going to drive to market with a load of from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons with tires $1\frac{1}{2}$ inches wide, how can we keep the roads in repair? If loads like that had to be drawn on rigs with tires 4 inches wide, you can see that the effect on the road would be quite different. If the length of the axletree were altered so that instead of one wheel following the other it would run outside, you would get double the space of road for the load to occupy. Suppose the tires were 4 inches wide, and the axletrees made as suggested, we would have a space of 16 inches wide for the load to be pressing on, instead of three or four the other way.

Mr. LICK: We have used piping for culverts for the last nine years with success. We imported them from Ohio, and they have given unbounded satisfaction. We are now using sewer pipe—import some and get some from Hamilton. We have them as large as two feet in diameter, and they cost $1.75 a foot, and they grade down to about 12 inches. We thought that they would be damaged by frost, but we have had no evidence whatever that they are injured in any way by exposure. They require to be put in where there is considerable earth over them, that the wheels may not injure them.

Mr. HUNTER: Have you had any trouble in their choking with earth?

Mr. LICK: Not when the ditches are properly looked after.

S. P. BROWN: With reference to the width of the farm waggon wheels, I understood not a great while ago that there was an Act passed in 1885, requiring that all waggons, like farm waggons, etc., should have tires not less than 4 inches, and that Act was passed with a view to give five years for the use of the old waggons, and the Act really was to go into force in 1890, and since that I have never heard anything of it.

Hon. J. DRYDEN: That bill has been introduced in our Legislature two or three times, but has never gone through. The Legislature would rather leave it to the municipalities to decide themselves. The Act that you suggest has not been passed.

Mr. BURNS: I think it is a very great mistake to leave the matter with the municipalities themselves. One municipality might adopt that law and another might not, and it would not be convenient for a person who had a wide tire waggon when he got out into a township that used narrow tires; and unless the law can become a provincial law I do not think it would be of any assistance to the farmers at all. It has been proposed by some that farm waggons should be taxed, and in proportion to the width of the tire used. If a man used a six inch tire, tax him $1 a year; two inch tire, $6; and so on, for the use of it.

Hon. J. DRYDEN: I am greatly interested in this subject, and I would like to congratulate the writer of this excellent paper, for it contains a good deal which, when it is printed, will be of value in the discussion which is sure to take place on this road question. It is not a very easy question to settle, and I believe my friend here is the first person that I have met who, after finding fault with the present system, is prepared to suggest one that he thinks better. Many of the newspapers in discussing this subject say, "Take away the statute labor; it is of no use," but they leave you there and do not seem to know how to suggest anything as a remedy. It is not easy to do that. Mr. Burns does not like leaving this matter with the municipalities. He may be right, but all will see that if we are going to pass a general law we must have the support of the people, and members of the Legislature dare not go against the feelings of those who send them there. When they think that their constituents do not agree with a proposition of that kind, they prefer to leave the matter with the people themselves. That is safe enough if the people are educated to know the proper steps to take in the matter. I am free to endorse what Mr. Burns has said, that the present system is very faulty; but I do not agree with those who say all statute labor is done in an improper manner. I know sections where men have put in their full time, and were willing to put in a day or two extra to complete the job. The system of statute labor is not so very bad in theory; it is only so when you come to work it out in practice. Labor is entirely misdirected in a great many cases; men take the work in charge who never studied road making or thought about it, and put in their time with the rest without taking any further interest in it. Now, suppose we are going to change the whole system of road-making and do away with the statute labor, I point out to Mr. Burns that in a large majority of the municipalities it would be impossible to get any other labor than those who do the work now. You will find that when you come to put the new system in practice you will have to come back to the same labor that you are using now. Instead of having twenty-five path-masters in a municipality, you might have one, two or three, according to the size of the municipality, men who have a salary, who would be expected to have some qualifications for the work —who would know how to repair or construct a new road, or put in a culvert, etc. If these men attempted to do their duty, with the same labor that we now have, they would, no doubt, accomplish a great deal more than is accomplished at present. I am very glad that you discussed this road question, because I am here to listen, and ready to catch at any idea that is good. We cannot, however, always do what we want to do—we cannot go beyond public opinion. So that those who have advanced information of this kind must be prepared to educate the people to some extent in order to have it carried out. I was very much pleased with that part of the paper which made mention that you cannot have a good road without thorough and proper drainage. I believe that is the foundation principle of road-making. I can take you in my constituency to a road that goes down the side of a hill, that is very boggy and springy. It would have been utterly impossible to have made a road there in the ordinary way. At the outset a drain was constructed right down the centre of the road-bed. I think it is a stone drain. That piece of road, constructed some 40 years ago, and on the worst portion of 20 miles in length of road, is the driest piece, I suppose, in the whole lot; it is always in order and dry. I have seen this plan tried elsewhere, and I believe one of the difficulties is the neglect of that principle. I have spoken to Prof. Shaw about the roads here, and have said I thought it would have been better if before they had started them they had put a tile drain in the bottom, or one on each side of the road. Another thing I want to endorse is what Mr Burns stated, that the correct idea was not to pile such a large amount of gravel on the road at once.

It does not make the road any better to put on large stones. Even if they are no larger than your fist, when one of these wide tires—or a narrow one either, comes over one of them you know that it jolts down and makes a hole in the road. My friend did not suggest that the tires should be a greater width. That is all right, because you cannot run wide tires on these mud roads. I have on my farm 4 in. tire waggons, but I cannot get my men to take them off eight or ten miles on the road with a load; they say it kills their horses. They will take the narrow-tired waggon in preference every time. If you had a perfectly smooth road and you could keep it in repair, then the wide tires are all right, according to the French system, with the hind wheels running wider than those in front. Such tires greatly assist in keeping the road smooth.

I want to say one word about the cost of the system suggested. Let me point out to you that when you do away with the statute labor and commence to work your roads on any other system you are going to add very materially to the cost of it. My friend suggests that the Government have charge of some of these roads. My experience is that it generally costs considerably more to have it done in that way. You have got to employ some person to see that the contract is done properly. He suggests that we use some of the "rusty millions" in this Province. I want to point out that we have no "rusty" millions in this Province, it is all in good use. It is all laid away just the same way that one of you who has made a fortune puts his money away. We have got lots of uses for our money, and must use it to the best advantage. My friend suggests that the Government should give information. That is something I am preparing to do. I have in my office a paper that we are going to put out in the form of a departmental bulletin, giving all the information we can get on this matter. We are going to publish it by the thousands, and send it all over the country. That is the first step, so far as I know, the Government of Ontario has taken. I think it is due the farmers and others that they should know all there is to know on this subject. You will find, however, that it will be quite a while before much will be accomplished, but this education work must be persistently followed. We have got to add line upon line and precept upon precept, and by-and-by we will see the day that all over the country we will have better roads, and the people will be able to enjoy them, and thus add greatly to their happiness.

CHEMISTRY OF FARM-YARD MANURE.

FRANK T. SHUTT, M.A., Chief Chemist, of the Dominion Experimental Farms, Ottawa, then delivered the following address: There are few subjects, I suppose, of greater importance to the farmer than the one I am to address you upon to-day, and I think you will agree with me that its discussion, both from the standpoints of theory and practice, at such a meeting as this, composed of thinking and practical agriculturists, should be attended with profit to all. I say this word "discussion" advisedly, because from my experience I have found that the greatest good results not from a lecture alone (no matter how good it may be, nor how well the subject may be presented), but by a judicious and well directed discussion following a brief introduction setting forth the more salient points of the subject. I have laid some stress upon the importance of the subject; in a few words I should like to make good my claim.

In the first place I think that a consideration of the subject, "Farm-yard Manure," leads to a practical realization of the fact that plants feed—that like animals they require food for growth and development. I find in speaking to many farmers, who have been in the profession of agriculture all their lives, that they have never thoroughly realized this fact, and I am the more sure of this because they have not worked up to it. A man cannot be said to properly believe and realize anything until he works up to it.

It is a very wide and embracing subject. It leads us to consider the nature or character of plant food, the condition or availability of the food requisite for plant nutrition, and also the amounts of the different fertilizing elements required by different crops. It also includes the subject of soil exhaustion, as well as of soil fertility, subjects regarding which we as yet know very little of a definite character. It plays a prominent part in the choice of crops, and is intimately related to success in general farming, dairying, stock-raising, and fruit-growing.

I take it that, other things being equal, we shall find that the wealth of the farmer is proportionate to his crop. His crop is proportionate to the fertility of the soil, and the fertility of the soil depends upon the economical using of his barn-yard manure—that is, obtaining the greatest return at the least cost. A right understanding and correct practice in this matter, therefore, is of paramount importance. We must agree, at the outset, upon what barn-yard manure is. Commonly, I think it is understood to include the mixed excrements of the horse and the cow, in addition to the bedding used.

The value of barn-yard manure depends primarily upon the percentage of nitrogen, phosphoric acid and potash which it contains, and therefore the chief value of any particular sample of barn-yard manure is in direct proportion to the amounts of these elements that it possesses. Secondly, its value is dependent upon the presence of other and secondary elements, such as lime and magnesia. Thirdly, it is valuable for its organic matter, which in decomposing in the soil sets free much carbonic acid. This renders soluble locked-up food of a mineral character, of which all soils contain a more or less liberal amount. Organic matter (apart from its nitrogen) is not direct plant food, but by virtue of its products of decomposition and their beneficial action in the soil, it has a high value, and one which we must not overlook, as I fear we have been too apt to do of late years. Moreover, organic matter is the natural food of the microscopic organisms that convert organic nitrogen into nitrates, which are the nitrogen compounds available for plant nourishment. The important part that these organisms play in rendering soils fertile has of late years been a matter of careful research by the most eminent agricultural chemists in the world. The intelligent and studious farmer is appropriating the knowledge thus gained and applying it for his own profit. We never find a virgin soil that is fertile but what it is rich in organic matter. Recent scientific research tells us why this is, and also how to imitate or bring about those conditions most suitable to luxuriant plant growth.

These, then, are the three chief qualities that make farm-yard manure valuable, and they are all deduced from a chemical study of the subject. There are other values, but of them I cannot speak to-day. For instance, there are the mechanical uses of barn-yard manure—how it brings about an amelioration or improved condition of tilth, how it allows air to freely permeate a soil, how it in a great measure prevents evaporation of soil moisture, how it renders a soil absorbent, and assists in maintaining a proper degree of temperature.

I intend to-day to consider only the *composition* of farm-yard manure, and the causes which affect its value as a direct supplier of plant food. The composition of farm-yard manure in the fresh state is dependant upon—

1. The proportion of horse to cow manure.
2. The proportion of the litter to the excrements.
3. The quantity and the quality of the food fed, and more particularly the latter.
4. The age and function of the animal producing the manure.
5. The care with which the liquid portion of the manure is maintained.

As all these factors affect the composition of manure, we can readily understand the great differences in value that exist between different samples of barn-yard manure.

Before discussing in detail these factors or conditions, I would ask your careful consideration of the following table, as throughout my lecture I shall constantly refer to it :

AVERAGE COMPOSITION OF MIXED EXCREMENTS.

Animal.	Nitrogen.		Phosphoric Acid.		Potash.	
	Per cent.	Per ton.	Per cent.	Per ton.	Per cent.	Per ton.
		lb.		lb.		lb.
Horse	.6	12.0	.3	6.0	.5	10.0
Cow	.4	8.0	.1	2.0	.8	16.0
Sheep	.9	18.0	.5	10.0	1.0	20.0
Pig	.5	10.0	.1	2.0	.5	10.0

1st. *The proportion of horse to cow manure.* In the foregoing table we have stated the amounts of the chief fertilizing constituents of the ordinary manures in their order of value—nitrogen as the most costly, and potash the cheapest. It will be observed that both in nitrogen and phosphoric acid horse manure is richer than that from cows. Therefore, the more horse manure the more valuable the mixed or farm-yard manure. Taking the above figures as representing fair averages, and assigning the following values : nitrogen, 17 c. per lb. ; phosphoric acid, 7 c. per lb. ; and potash, $5\frac{1}{2}$ c. per lb., one ton of horse manure (the mixed excrements) would be worth $3.01, and the same quantity of cow manure, $2.38. For the purpose of reference I have added the composition of sheep and pig manure. Sheep manure is an exceedingly valuable one, being rich in all fertilizing elements. Its worth on the above basis would be $4.86 per ton. Although the figures representing the composition of pig manure are the results of averaging many analyses, there is a wide divergence between different samples, principally caused by the nature of the feed. I would now draw your attention to the fact that cow manure is very rich in potash, and in this way its addition supplements in plant food that from the horse. Together they form a complete manure, and one in which the fermentation is more easy to control than when the manure consists of either one by itself.

2nd. *The proportion of litter to the excrements.* Litter is used for two purposes : first, as a bedding material to keep the animal warm, and secondly as an absorbent to retain the liquid manure. In so far as litters possess nitrogen, phosphoric acid and potash they enrich the manure ; according to their efficiency as absorbents they serve to preserve the valuable and liquid portion of the excrements. I have prepared the subjoined table of the more common bedding substances, keeping this double object in view.

BEDDING MATERIALS. AVERAGES PER TON.

Material.	Nitrogen.	Phos. Acid.	Potash.	Absorbed.
	lb.	lb.	lb.	per cent.
Wheat Straw	9.6	4.4	12.6	230
Oat "	11.2	5.6	32.6	210
Pea "	20.8	7.0	19.8	280
Leaves (autumn)	20 0	5.0	4.0	160
Sawdust	20.0	1.0	2.0	420
Muck (air-dried)	28.0	5.6	6.4	400

Wheat straw is the most common of all litters. Its absorbent qualities are high, 100 lb. being capable of absorbing 230 lb. of water (see last column of above table), but as it does not rot readily its fertilizing constituents are not of immediate value in the soil.

Oat straw is more valuable by reason of increased quantities of nitrogen and potash, but on account of its feeding value it is seldom used as litter.

Pea straw would yield a manure richer in nitrogen than either of the former, as it contains a large amount of this element.

The tubular structure of the straws enhance their absorptive qaulities, and to this end their value is increased by cutting the bedding.

I can only speak but doubtfully as to the advantage or value of dried leaves for bedding. They have not high absorptive powers. The general impression is that when other material is obtainable it will not pay to collect them. The analyses show, however, that as they fall they possess a considerable amount of plant food.

Sawdust is a fairly rich material and a good absorbent. Without previous fermentationin the manure pile, however, it will remain undecomposed in the soil for many years, and its constituents are consequently unavailable.

With regard to muck, I can speak very highly. It is not only an excellent litter, but also a valuable manure when properly treated. For some years past we have analysed samples of muck from various parts of the Dominion, and the result has been that in certain districts the use of this muck has been extensively practised. We find in muck a material rich in nitrogen. In the matter of nitrogen the percentage in muck might have been placed much higher than recorded above. The analysis of some forty or fifty samples last year gave an average of 33 pounds per ton, and some samples yielded as much as 40 pounds per ton. The nitrogen becomes easily available when rightly composted. Muck in an eminent degree serves to hold fertilizing material in the liquid portion of the manure, which might otherwise be lost; and the fermentation of that liquid manure in the muck brings about the solution of the elements of fertility in the muck itself. This is a material which can often be obtained at the cost of simply drawing it. The latter should be done in the winter, and the muck allowed to dry. After having become thoroughly air-dried it can be used for the purpose of bedding or composting. Good results will be obtained by spreading a thick layer of the dry muck in the barnyard. This will prevent the liquid portions from leaking away. It is also an excellent absorbent in the pig-pen, and any other place where waste of manure is likely to occur.

3rd. *The quantity and the quality of the food fed.* Only in small quantities are the nitrogen, the phosphoric acid, and the potash in the food of the animal retained in the system. You will understand, then, that the elements of plant food in a fodder are to a very large extent excreted. Consequently, the more nitrogen, phosphoric acid and potash the food contains the more the manure will contain. Since the percentages retained do not vary within very wide limits, the fact is patent that the richer the food the richer the manure. From this you will readily infer that a food which is low in albuminoids gives a manure that is poor in nitrogen, and thus it is that cows wintered on straw alone cannot produce a rich manure.

The *quantity* of the food affects the quantity of the manure rather than its quality. Indeed, some hold that the effect of quantity in no way alters or modifies the value of the resultant manure—that the only result from an ample supply of food is that a larger quantity of manure is produced. I myself am not of this opinion. I think that when the quantity fed is in insufficient amounts, there will be a tendency for the animal to absorb and retain a larger percentage of nitrogen from the food than when it is supplied liberally. But this point I do not press. It is one on which there is considerable divergence of opinion.

Let us remember in this connection then, that, save for the small quantity required by the animal, the fertilizing elements are excreted, and that consequently poor feed means poor manure—the richer the food the more valuable the manure.

4th. *The age and the function of the animal.* I have just said that the amounts of the fertilizing elements retained in the animal system are very small, but these amounts are dependent upon the age and function of the animal. If the animal is young and growing, the muscle, blood and bone must be made in large quantities from the food; and consequently these demands upon the food leave the less to go into the manure. We can very well see from this that in the case of a young, growing animal the food is exhausted to a very great extent of its fertilizing constituents. In the case of wool-bearing animals and in that of cows giving milk, we have a like condition of affairs; that is to say, they take the nitrogen for their wool and milk from the food consumed, and the more they retain the less there is eliminated. Therefore, the animal which will produce the most valuable manure, other things being equal, is the adult animal which is not producing flesh, nor wool, nor milk, since in merely maintaining life the fertilizing elements, nitrogen, phosphoric acid and potash may be said to be almost entirely excreted.

5th. *The care with which the liquid portion of the manure is maintained.* This is not the least important factor because it is placed last; indeed it is one of the most important of those which regulate the value of the manure. The comparative value of the liquid to the solid portion of the manure must be recognized by the farmers if economy in manure production is to be observed. In the first place, as we have already seen, liquid manure is much more valuable than the solid. It seems very necessary to emphasize this point, because the common neglect throughout this country gives evidence that there is a failure to practise up to the belief. For the purpose of impressing you the more forcibly with the great importance of the point I am now making, I would direct your attention to the following chart. It states the pounds per ton of nitrogen, phosphoric acid and potash in the solid and liquid portions of the manure of the horse and cow, and at the same time shows you the relative value of each.

SOLID AND LIQUID EXCREMENTS.

Manure.	Nitrogen.	Phos. acid.	Potash.	Value.
	lb. per ton.	lb. per ton.	lb. per ton.	$ c.
Horse { Liquid	30.4	....	18.5	6 20
Horse { Solid	11.2	7.0	2.0	2 50
Cow { Liquid	21.0	....	27.2	5 07
Cow { Solid	8.7	2.4	.8	1 69
Samples of drainage water from manure piles;				
A	1.02	.208	5.32	48
B	2.28	.076	3.96	60
C	3.20	.200	9.80	1 10

The foregoing chart, however, does not show you all the true worth of liquid manure contrasted with the solid portion. Plant food, unless it is soluble, is not available to a growing crop. The plant food in the liquid portion of the manure is very much more readily available for plant nutrition than it is in the solid portion; consequently we must assign it a greater value than here represented, where the same values have been used alike throughout for the calculation. How necessary is it then that we should preserve with care all the liquid manure produced on the farm.

On this account I thought it well to have the analysis of certain drainages from manure piles placed on this chart, so that I could draw your attention to their composition, and hence to their value. A. B. C. are three different samples.

The chief conditions which regulate the composition of the drainage from a manure pile are the extent of exposure, the amount of rainfall and the degree to which fermentation has progressed. As the conditions are variable, so is the composition. Consequently, here, even in three samples, we see that the value fluctuates between 48 cents and $1.10. We might have drainage waters from manure piles worth less and some worth more than these quoted. The amount of fertilizing elements that are constantly going to waste on the farm is thus brought before you in an emphatic way, and I trust I have shown you the necessity for preserving it in some way. Liquid manures not only contain their elements of plant food in a highly soluble condition, but they form a very favorable medium for the growth and development of those microscopic plants, bacteria, which are the agents, with the assistance of the oxygen of the air, in converting the nitrogen of inert organic matter into nitrates, the form in which plants can utilize it.

We have, then, three reasons why the liquid portion of the manure is the most valuable: Firstly, the large number of pounds of plant food per ton; secondly, the very soluble condition in which this exists; thirdly, because it forms a favorable means for the growth of the nitrifying agents. Lastly, this drainage being of an alkaline nature, acts as a solvent upon other material in the manure, especially nitrogenous substances, bringing them into a soluble condition.

Experiments with Manure at C. E. F., 1892.

I wish to speak now with regard to some experiments that I have carried on at Ottawa this past year. A great deal has yet to be done in investigating manure in Canada. We hear all sorts of opinions from various men, and we have as yet very little scientific data on the subject. We want more careful observation as to the results obtained by different methods of preservation of manure, and to make a beginning in this good work at the Experimental Farm I made the following experiments this year. They were conducted with the view of ascertaining what loss, if any, resulted from spreading well rotted manure upon the field—say 3 or 4 days or longer before plowing it in. For economy of labor it is often found advantageous to do this. Two samples of manure were taken—the one well rotted and past active fermentation, so that it had again come to the temperature of the atmosphere—the other in a high state of fermentation, very hot, but only partially rotted. These manures were then carefully analysed, and the results are to be found in the annexed table under the heading "before exposure."

——	Nitrogen.		Phos. acid.		Potash.		Total Value.
	Per ton.	Value.	Per ton.	Value.	Per ton.	Value.	
	lb.	$ c.	lb.	$ c.	lb.	$ c.	$ c.
Well rotted, before exposure......	10.3	1 75	8.5	0 60	15.9	0 87	3 22
" " after "	10.1	1 72	8.5	0 60	15.9	0 87	3 19
Partially rotted, before exposure..	9.8	1 67	6.0	0 42	13.6	0 75	2 84
" " after " ..	9.3	1 58	6.0	0 42	13.6	0 75	2 75

Samples of each of these manures were then spread in thin layers on glass plates and exposed to the rays of the sun daily for a month. At the expiration of this time the manures were again analysed. The results are tabulated as "after exposure." Any real loss that would occur on the field after spreading would similarly take place on the glass plates, since fertilizing material washed out by the rain would be retained by the soil. We have then, to see if there has been any loss of nitrogen by volatilization of the ammonia. The chart shows us that very little is lost under such circumstances—that in the case of the well rotted and cold manure there is only a difference of 3 cents per ton in value between the unexposed and exposed, while the manure spread while hot lost 9 cents in value per ton. The losses, then, are very small, even under the most favorable circumstances for the volatilization of ammonia. The manure upon exposure in thin layers dries up quickly and further fermentation stops.

In speaking of the loss of ammonia from manure, I would say a word or two regarding the escape of this valuable constituent in stable and manure heaps. If the litter is in insufficient quantities and no absorbent used, a strong smell of ammonia is to be observed in the stable. This ammonia, or rather carbonate of ammonia, is developed by the fermentation of the urine or liquid portion of the manure, and being readily volatile, easily escapes into the atmosphere. Plenty of bedding (if straw, preferably cut into one or two inch lengths) and the use of an absorbent, such as gypsum or dry muck, are therefore advised. Gypsum serves to fix the ammonia by converting it into a form which is not volatile.

Where cow manure predominates in the manure pile, I do not think there is much loss from this cause, but in the case of horse manure it may be very different. In such it often occurs that, owing to the light and easily fermentable character, there is a considerable loss of ammonia. Hence the great economy in thorougly mixing the two in the pile

Cow manure is slow to decompose, but its fermentation is aided by that from the horse; horse manure would often fire-fang and lose in value were it not for the presence of the colder and more moist cow dung.

Principles of Economic Fermentation.

The object in rotting manure is to render its fertilizing elements available for plant food. Green or fresh manure is almost valueless to plants—fermentation, either in the heap or in the soil, must first take place before its elements can be used as nourishment by vegetation.

Fermentation or rotting is brought about by the aid of microscopic plants, known as bacteria. They feed on the organic matter of the manure, converting it into other forms, liquid and gaseous. They require, as well, air, moisture and warmth for their development. Mention should be made, however, that there are some bacteria of fermentation which do not require air. These live and grow in the bottom of the heap, and produce different compounds to those that live near the top of the pile. They develop no heat. Where the manure has access to the air and other conditions are favorable, the bacteria or microscopic plants burn up, by the assistance of the oxygen of the air, much of the organic matter to carbonic acid, and a considerable amount of heat is generated in the process. Again, it is one of these organisms that converts the nitrogen, present as urea (in urine), into a salt of ammonium, making it fit for plant use. The ammonia so formed, if fermentation is not checked or an absorbent used, may be to a large extent lost. The alkaline solution of ammonia serves a useful purpose in dissolving nitrogenous material in both litter and dung, and thus prepares them for plant food.

We must therefore induce fermentation, but, at the same time, we must keep it under control. We have seen that liquid manure is much more valuable than solid, and also that fermentation cannot proceed without moisture. It will be good economy, then, to keep the liquid and solid portions of the manure together, thereby saving fertilizing material and the cost of labor incident upon preserving them separately. The pile should be trodden down and kept moist, though not soaked. The degree of fermentation to which manure should be allowed to proceed before application must depend upon the character of the soil and the nature of the crop. The best rotted manure should go, in my opinion, upon the lightest land, applying it frequently so that as far as is practicable the fertility of the manure may be largely used at once by the growing crop. With soils of this character, that leach easily, it is better to manure for the crop than to try to permanently fertilize the soil. To increase the amount of humus in such soils and improve their tilth, muck will be found cheaper to use than manure; or a better plan still would be to plow under a crop of peas or clover.

Plants, such as the cereals, that have a short growing period, should be supplied with well-rotted manure. They can only take their food for a few weeks, and consequently they should have it in a readily available form—such as is found in well-rotted dung.

The manure that is least fermented on the farm should be put on the heaviest land and used to furnish food for the long-lived crops—more especially roots. A clay soil is retentive of the fertilizing constituents, and does not lose its plant food to the extent that sandy soils do when exposed to rain. Nitrification goes on during the summer months, and thus continually supplies from the manure soluble food. Again, a manure that is not thoroughly fermented will improve the tilth of a heavy soil, opening it to the action of the atmosphere—whereas well-rotted manure has not this beneficial action to the same extent.

Taking everything into consideration I think the most serviceable manure is one partially rotted, one in which fermentation has begun before it is applied to the field. It is more concentrated than fresh manure, and is rich in nitrifying organisms. Further, it is more easy to spread. Manure must ferment before it can be used by plants, therefore, in the majority of cases, it is good economy to start this fermentation so that the plants are supplied with soluble food in the early stages of growth. When fresh manure is used some time must elapse before the fermentation sets in and there is any appreciable amount of plant food, no matter how favorable the conditions are. Thus it results that in the early summer months there is a scarcity of food. This is just the time when the cereals make the most rapid growth and require an abundant store to draw from. With other crops, as I have pointed out, it is different. When the growing season extends into September there must be, if the weather has been at all favorable, much material of the manure converted into assimilable forms by the agency of bacteria that can be used by the longer growing plants.

I must now draw my address to a conclusion. I have but touched upon the salient points of my subject—details I have not been able to enter into. I have endeavored to impress upon you the relative values of different manures, and the value of the liquid portions compared with the solid. I have stated the essentials for fermentation and given it as my opinion that the liquid and solid parts should be preserved together. Also that the manure pile should be kept *moist*—preferably with its own drainage liquid—and tolerably *compact*. Under such circumstances but little loss can ensue. I have further shown that fermentation is requisite (either in the pile or in the ground) before the plant food of manure is available. If you wish to apply the manure fresh, put in on the heavier soils, but on light soils and for the shorter-lived crops the partially rotted manure will give more immediate results. In the rotted condition it is more concentrated than when fresh, and less labor is required to handle it. It contains and gives to the soil the organisms of nitrification, without which the nitrogen of humus would be of no value to plants. And, lastly, rotted manure can be more evenly applied to the soil than before it has undergone fermentation.

Prof. Shuttleworth: I wish to say that the address which we have just listened to on the composition of farm-yard manure is, in my opinion, a most excellent one, and I like it the more because it is the result of original work. I think there is no data on this subject which is late and reliable; and this fact has so impressed me this winter that I have decided to pursue the examination of farm-yard manure as we have seen to-day it has been done. It is very hard to get the practical farmer to take an interest in this subject, but the time is coming, I believe, when the farmers tilling the soil will be as well acquainted with the composition of manures as those who at the present time are teaching agricultural chemistry, and until that time comes the farm-yard manure will not be well made and well preserved. The mixing of the liquid manure with the solid is an important factor in the making of manure. I think it would be well to cut the litter before using it, because it is an important thing to have the liquid manure absorbed by the litter, and in this way there would be more complete absorption. When liquid manure is left too exposed to the air there is great loss of nitrogen.

The opinion that I have been led to form in regard to the degree of fermentation which manure should undergo is this, that on heavy soil we should apply unrotted manure, but in other cases it is best to have it rotted. There is great trouble on the farm in getting the manure rotted. We know that where manure is tramped by the animals it does not undergo much fermentation; so I would feel strongly of the opinion to have the litter cut, and have the barn yard of such a form that there is no loss by draining, and during the winter season draw the main manure into the field and pile it in squares where it will undergo that partial fermentation.

Prof. James: I am hardly in a position to discuss the paper as I have heard but a portion of it. But I am afraid that one part was not touched upon at all, and perhaps this part presents as much difficulty in connection with agriculture as anything that has been touched upon. Perhaps it might be called the æsthetic part of it. I think we would do a great deal to bind the farmer's son to the farm if something could be suggested in the handling of this material that would make the work a little more agreeable.

President Mills: I do not like to allow the opportunity to pass without saying that I have been personally pleased with this address by Prof. Shutt. It is comprehensive and very clear, and while it is scientific, I think Prof. Shutt succeeded in drawing a practical lesson which even the commonest farmers can understand. I do not know the way in which the quantity of food effects the value of manure, unless it be when an animal is overfed and has more than it can digest that the nutritious elements, that is the nitrogen, phosphoric acid and potash will pass out unappropriated ; or is it that when an animal has not a sufficient amount of food that this loss occurs? In regard to the exposure of manure, I do not know myself as to how great the loss is from exposure of, liquid manure. I presume, however, it is great.

Prof. SHUTT: I may say that President Mills has just stated the two reasons or causes that I should have gone into with regard to the quantity of food affecting the quality of the manure, but I felt that time would not permit. I know that I stand somewhat alone in my opinion upon this matter. In the case of scarcity of food with a certain ration, the percentage of nitrogen, phosphoric acid and potash retained by the animal are, I believe, greater than when the animal is liberally fed. Nevertheless it is true that to a great extent the percentages taken by the animal from the food are regulated chiefly by the function of the animal. On the other hand, we find that when there is an excess of food, not only does that excess pass through the animal but the elements produced by the action of the digestive fluids are not assimilated in due proportion, and thus some digested food is not taken into the blood but passes out in the excrement, consequently the quality of the manure in that way is affected by the quantity of the food. In regard to the other question of the loss, by exposure in the manure heap, of ammonia or nitrogen, the experiment referred to does not give you any explanation. We all understand, however, that there is a great loss when the manure is very loose and not sufficiently moist. I think, with Prof. Shaw, it is very useful to cut the litter. The factors which regulate the value per ton are : the extent of fermentation, the exposure, and the amount of rainfall, other things being equal.

Mr. HUTT: I spread the manure on the fields in winter ; does any loss occur from this?

Mr. MACKENZIE: In connection with that question, allow me to add a little more. Do the scientists here know of data sufficient to give the amount of loss when manure is spread in the winter?

Prof. SHUTT: It is probable that the loss is very small, if anything, when the fields are not flooded in the spring, because directly the manure is carried out it is frozen and no fermentation takes place. When that manure is thawed it is plowed into the ground and there fermentation goes on and the elements of fertility retained. I do not think therefore that there is any loss except in the case where the fields are flooded in the spring. Of course, then the amount of loss is exactly proportionate to the amount of water, containing drainage from the manure, that is carried off the surface of the field.

REPORT OF APICULTURE COMMITTEE.

The following report was read by Mr. R. F. HOLTERMANN, of Brantford : It will only be necessary for me to say a very few words, as Mr, Mackenzie has really got the report of the work which has been done. I would simply say that there is no question at present which is engaging the attention of the bee-keepers more than the foul brood disease. As you know we have an inspector, Mr. McEvoy, who is present with us, and he is doing that work at the same time. We should have liked to have made some tests in regard to the disease which we were not able to complete this year, but we hope to carry them on during the next year. I may say also that the Apiculture Committee feels very much indebted to Mr. Mackenzie for the work he has undertaken. The Committee has supplied him with all the material, and this was the only expense of the year. I am sure there is no one present who does not value scientific work.

THE FOUL BROOD BACILLUS (*B. Alvei*); ITS VITALITY AND DEVELOPMENT.

Mr. J. J. MACKENZIE, B.A., Bacteriologist of the Provincial Board of Health of Ontario, read the following paper: Gentlemen,—At the request of your secretary, Mr. Holtermann, I undertook for your Union some investigations on the subject of foul brood, the results of which I purpose giving you in this paper. Although it is almost a year now, since I undertook this work under the auspices of the Agricultural and Experimental Union it is by no means exhausted, and there are many points which require to be further elucidated, which I have not had time as yet to touch on, owing to the fact, that investigations on foul brood had to be carried on simultaneously with my regular laboratory work. These points I hope to work at next summer, and reserve the privilege of reporting again to your Union on the results of further investigation.

The subject of foul brood is an old one to apiarists and an intensely interesting one to Canadian bee-keepers, but in reading over the bee journals one cannot help being struck with the great want of unanimity amongst bee men as to the disease, how it should be treated, how it is spread and on many other points. Some would have us believe that the disease arises *de novo* whenever unsanitary conditions prevail; others claim that there is a specific infection and where the disease arises it must have originated from previously existing disease; some claim that the honey is the only method of transmittal, others that it is not; and so on, on every point there seems to be plenty of arguments *pro* and *con*.

I have attempted in my work to take hold of some of these controverted points from a bacteriological standpoint in order to aid in coming to some definite conclusion. Some of these points I should consider settled from the results of previous investigation, but as many bee men do not seem prepared to accept this, my work will have value as confirming what has already been done.

Before an association which includes many practical bee-keepers it would be superfluous to enter upon a minute account of the clinical features of the disease. Most of you know them better than I do. I certainly would not be prepared to "spot" foul brood in an apiary, although I certainly think I can under the microscope. The infectious character of the disease has been generally accepted for many years, but not until Cheshire and Watson Cheyne worked it out scientifically was it definitely proved. They isolated a bacillus (*bacillus alvei*), which they found in the diseased brood, and which they cultivated on nutrient media for many generations finally reinfecting perfectly healthy brood from these pure cultures. This evidence to a bacteriologist is absolutely conclusive that *bacillus alvei* is the specific cause of foul brood. Consequently when I began my investigations on some samples of diseased brood which were sent me through Mr. Holtermann, I looked at once for *bacillus alvei*; microscopically and by means of bacteriological methods I had no difficulty in isolating a bacillus which corresponds in all points to *bacillus alvei*. It is a bacillus, similar to that of Cheshire's in size, produces spores which are somewhat thicker, giving the bacillus a clubbed appearance. On agar jelly it grows rapidly so as to cover the whole surface. In gelatine its growth is very peculiar, shooting out from the infected point in all directions. On potatoes it produces a yellow growth. All these characters show conclusively that it is identical with *bacillus alvei*. There seems no doubt, therefore, that the foul brood which we have in Ontario is the same disease and produced by the same bacillus as in other places.

Many prominent bee-keepers both here and in the States, however, maintain that wherever unsanitary conditions are allowed to prevail, wherever chilled brood is allowed to putrify or decapitated drones are left to decay in the hive, foul brood may arise *de novo*. This is not a new theory either in bee-keeping, or in medicine, but unfortunately it is a theory which is not supported by the results of investigation. Diphtheria naturally will develop more readily if unsanitary conditions are present, but it certainly will not develop if the *bacillus diphtheriæ* is absent. The same is true of other diseases and consequently when we come to consider such a decidedly infectious disease as foul brood and learn the facts about it which such men as Cheshire have told us we naturally come to the same conclusion. If I were to maintain that a Carniolan queen might lay an egg which would develop into a humble bee, bee men would be inclined to think that not only my bee knowledge but also my scientific knowledge was at fault; but yet in all the bee journals I find many prominent bee-keepers maintaining that an ordinary microbe which produces putrefaction may become metamorphosed into the specific cause of foul brood. It is easy enough, however, to combat such an opinion upon *a priori* grounds; but not quite so easy to offer convincing proof.

In order to do this I thought it worth while to try some experiments. With this end in view I obtained some comb containing chilled brood and endeavored to isolate *bacillus alvei* from it, but without success.

There were plenty of other bacteria, but none which presented the well-marked morphological characters peculiar to *bacillus alvei.* Again I had sent to the laboratory a piece of perfectly healthy comb. I killed the brood by chilling; then I infected some of the cells from a pure culture of *bacillus alvei.* I allowed all the killed brood to putrify in a moist chamber for two weeks, at the end of which time I obtained *bacllus alvei* again from the cells which had been artifically infected but could find no traces of it in the other cells. I left this comb in a moist chamber for several months and again examined but with the same results; in the cells in which *bacillus alvei* had been placed it was still to be found, in the others it was not present.

It seems to me that an experiment such as the above conclusively shows that there is a distinct difference between foul brood and ordinary putrefaction.

In considering the subject of the vitality of *bacillus alvei* the first question which naturally arises is its power to resist heat. We know that bacilli which produce spores, and those which do not stand in entirely different positions in this regard. The sporeless bacillus is destroyed at a much lower temperature than one which contains spores. Consequently in considering the question of the vitality of *bacillus alvei* which produces spores very quickly and easily, we may confine our attention entirely to the vitality of the spore.

This is of special interest, as the question has been repeatedly raised whether it is dangerous to use comb foundation made from foul broody wax. Does the temperature to which the wax is raised in the manufacture of comb foundation sufficiently destroy the vitality of the spore? Can the spore germinate and infect the brood when once enclosed in the wax?

These questions have been raised by many careful thinkers among bee men and certainly deserve attention. The second point ought to be considered first since if surrounding a spore with a film of wax prevents its germination we need pay no further attention to the question of heat. The crucial test of this would naturally be, supply a healthy colony with comb foundation known to contain the spores and observe the result. This I had hoped to try with the assistance of your secretary, but other work came up which interfered with the carrying out of this experiment and consequently it had to be postponed until next year. However, I was able to perform one experiment which throws some light on the subject. Mr. Holtermann, the secretary of your Union, sent me several pounds of very fine wax, such as is used for the manufacture of comb foundation. I cultivated the *bacillus alvei* upon agar jelly until I had a large quantity of the bacilli containing spores; this was carefully scraped off the jelly and dried first in the air and then over sulphuric acid. The resulting greyish mass was pulverized with a sterilized pestle and mortar, and finally mixed thoroughly with the melted wax kept at a temperature sufficiently low to prevent the immediate destruction of the spores by heat. By this means an enormous number of spores were introduced into the wax. After stirring the wax for some time in order to insure a proper mixing it was allowed to cool. This as you all know takes some time, when dealing with a considerable quantity. During the cooling I was careful not to disturb the wax.

After it had solidified I set out to discover if I could again obtain my bacillus from the infected wax. If it could germinate in the nutrient media it certainly would in the bees, and that point was to a certain extent settled. Now I obtained the following results:

From the upper layers of the infected wax I was unable to obtain cultures of the bacillus alvei, either by melting the wax in the nutrient jellies or by allowing particles of the unmelted wax to fall on the surface of these jellies.

From the under layers, however, the results were different; particles of wax placed on nutrient agar in an oven kept at 98°F. became surrounded in 24 hours with a luxuriant growth of bacillus alvei. When the wax was melted into the agar or into beef tea I also obtained the bacillus, consequently it looks as if the mere fact of enveloping the spores with a film of wax was not sufficient to prevent germination. I confess I cannot understand how a spore could germinate when surrounded with a film of wax. Spores in germinating require moisture, and if a spore is completely imbedded in wax it cannot obtain sufficient moisture, to germinate; I would rather believe, therefore, that in this particular experiment the spores had not each an envelope of wax, but that many of them were partially free from the wax. Now if this was the case in my experiment where I endeavored to make the incorporation of the spores in the wax as thorough as possible, I certainly think it may frequently be the case when foul broody wax is used and no particular precautions taken. That even when spores are thoroughly surrounded by wax they may not be freed occasionally by the workers is a point which requires further elucidation and upon which I intend to try some experiments next year.

In looking through the bee journals, however, I find it everywhere maintained by foundation makers that they never knew of a case of foul brood originating from foul broody wax; and I have yet to discover a well authenticated case where this has occurred. What explanation can we offer of this widespread opinion?

I explained to you above that I was unable to cultivate bacillus alvei from the upper layer of the infected wax. Your secretary also sent me a small specimen of wax which he stated he knew to be from foul broody comb. This I examined repeatedly for foul brood but was able to obtain it only once. I think we must look to the physical conditions for an explanation of the freedom from infection through comb foundation. The difference in the specific gravity of the bacteria and of melted wax is so great that throughout the process of manufacture the bacteria tend to fall to the bottom. The first refining of the wax must of course remove the greater quantity and the vast majority of the remainder will settle to the bottom during the process of foundation manufacture. But that the simple process of mixing the infected material with the melted wax is not sufficient to prevent germination I think is shown by the results quoted above where simple fragments of infected wax when placed on agar jelly gave rise to a culture of bacillus alvei.

This question I hope to touch on again after I have had an opportunity of supplying healthy bees with foundation made from infected wax.

The other question is whether the temperature to which wax is raised during foundation making is sufficiently high to destroy the spores of foul brood. In order to decide this question there are several points to be noted. The first is the character of the heat. We know that moist heat will destroy bacteria and their spores much more quickly than dry heat, and Mr. Corneil of Lindsay has raised this point several times, claiming that the heat to which the bacteria are exposed in melted wax is not moist heat but dry heat, consequently we must heat to a high temperature and for a long time in order to destroy the spores. The point is undoubtedly well taken, and can only be settled by direct experiment. In order to determine the temperature at which the spores are destroyed in melted wax, I used a method that was first described by Koch. Sterilized silk threads were saturated with a beef tea culture of bacillus alvei in which there were large numbers of spores. These threads were then allowed to dry and in the dry state were preserved. These dried threads were introduced into the melted wax and allowed to remain in it for a definite time at a fixed temperature. At the end of that time the thread was introduced into the melted agar or into beef tea heated to the melting point of wax, and thoroughly shaken so as to separate the wax as much as possible from the threads; then the culture medium was rapidly cooled and the tubes placed in the ordinary cultivating oven kept at 98°F. If I obtained a growth of bacilli I concluded that the threads had not been sufficiently heated in the wax, if I did not, I concluded that they had been sufficiently heated. The following are my results:

At 212° F. (100° C.)	For one-quarter of an hour: growth.
	For one-half an hour: growth.
	For one hour: growth.
	For one hour and a half: growth.
	For two hour: growth.
	For two hours and a half: no growth.
At 194° F. (90° C.)	For one-half hour: growth.
	For one hour: growth.
	For two hour: growth.
	For three hours: no growth.
	For four hours: no growth.

On the other hand a temperature of 122° F. (50° C.) did not destroy the spores in twenty-four hours.

I have repeated these experiments several times with the same results so that I would conclude that to destroy the foul brood in wax it is necessary to heat to a temperature of at least 194° F. for at least three hours. Now the question arises, does this take place during the process of manufacture of comb foundation? In order to get as much data as possible on the subject I wrote to Mr. Larrabee, of Michigan Agricultural College, as he had kindly offered me any assistance in his power. He applied to two prominent foundation makers for information. From their replies it is apparent that for a short time at any rate during the refining and purifying of the wax it reaches a temperature quite at or near 212° F. During sheeting, however, it apparently does not reach a temperature much above the melting point, say 175° F. They both seemed to agree that steam heat for too long a time injures the quality of the wax.

In the *American Bee Journal*, 1891, p. 470, we find some statements on the subject in a reply by two prominent foundation makers, to an article by Mr. Corneil upon the dangers of infected comb foundation. One of them, Mr. Dadant, states that in refining it is heated for some time at 212° F., and is kept liquid for twenty-four hours. The other, Mr. M. H. Hunt, states that it is kept at the boiling point for six or seven hours. If these are the actual temperatures reached during foundation making I am inclined to think there is little danger from foul brood in that direction.

I thought it possible that the whole question could be settled by introducing a certain amount of some disinfectant, say beta naphthol, into the melted wax, but my results have not been satisfactory. Apparently even the introduction of one per cent. beta naphthol into wax did not hasten materially the destruction of the spores. I was able to demonstrate the presence of living spores in wax containing one per cent. beta naphthol, and heated for two hours to 194° F.

From all these facts, and taking into consideration also the physical fact of the settling of the bacilli to the bottom, I should think that with reasonable care in the preparation of comb foundation the dangers of infection from this source would be slight. But that the spores may germinate after being mixed with the wax, I think I have shown.

Why the spores of the bacillus alvei are killed so quickly in the melted wax I am not able to explain, but it may be due to the fact that the wax itself when heated to such a temperature has an antiseptic value. That the spores resist other antiseptics as strongly as do the spores of anthrax, I have proved by testing.

Cheshire and others recommend a solution of two per cent. carbolic acid for disinfecting the hive after removing infected comb, but on actual experiment with the infected silk threads I found that two per cent. carbolic acid did not kill the spores in six days. These results are similar to those obtained by Koch for the spores of anthrax, and show that two per cent. carbolic acid cannot be relied on to destroy the spores. However, the question of the value of antiseptics I will take up more in detail later on in this paper.

I would like to say a word or two now on the methods of treating the disease. There are practically two methods; first, the starvation method; second, the method by medicated syrup. Mr. McEvoy's method of treatment, it seems to me, is practically a modification of the starvation method. The first method is widely used both here and in the United States; whilst in England and Europe generally the second method is adhered to.

Considering the vitality of the spores of foul brood, it would seem at first sight useless to try any process which did not recognize as its foundation the destruction of the germ. I find, however, that many prominent bee-keepers who have had practical experience with the method of starvation, or Mr. McEvoy's method, accept it as successful. I have not had an opportunity to examine colonies which have been cured in this manner, and so cannot say that the bacilli have disappeared; I hope next summer to test this question more fully. We may, however, examine into the rationale of the method. In conversation with Mr. Corneil, of Lindsay, he made a suggestion which may be quite familiar to you all, but which seems to me the only explanation. That suggestion was that either starvation or comb building carried the infected nurses past the period at which they act as nurses, and give them a chance to rid their intestines of the germ. If this is combined with a removal to absolutely clean hives, with new foundation, it may succeed, but I must say that absolute cleanliness in this respect must be insisted on. As I said above, I have not had any opportunity of investigating the results of these methods practically, and so cannot speak with certainty.

The fact of the presence of the bacilli in the workers, and in the queen, bears, to a certain extent, upon this question. Cheshire and others make the statement that the bacilli are found in the intestine of the workers and in the ovary of the queens. My own experience confirms this. I have found them repeatedly in the workers, and in five queens from infected hives I succeeded in obtaining the bacillus from the ovaries of three. That they are not always present in the ovaries of the queens from diseased colonies is certain; their presence there is apparently accidental. For instance, in the case of one of last year's queens in a hive rather badly diseased, I was unable to find the bacillus, whilst in a six-weeks' queen from a hive in which there were only a few diseased cells, I succeeded in finding it.

Cheshire's statement that he found a bacillus in an egg of an infected queen seems to me to require confirmation. I have not been able to find the eggs infected myself, but it is a question which would require very long and careful investigation before one could be able to deny or confirm such a statement.

In the second method of treatment by medication I do not think that an absolute destruction of the spores takes place, any more than in the starvation method. As I have shown above, two per cent. carbolic acid was not sufficiently strong to destroy the spores, consequently it is not likely that 0.2 per cent, (one part in 500) would be strong enough. I tried 0.2 per cent., but found it quite unsuccessful. Its action then must have another explanation. To test this I made up a sterilized beef broth containing 1 per 500 of carbolic acid, and in it placed my infected silk threads. I found that there was no indication of growth. These threads were then taken out and placed in ordinary sterilized beef broth, and I obtained a luxuriant growth, *i.e.*, the 0.2 per cent. carbolic acid in the culture fluid, although it did not destroy the spores, prevented their germination. That, then, is the explanation of the value of carbolated syrup in the treatment of foul brood, it prevents the germination of the spores. The bee journals contain numerous examples of cases where carbolated syrup produced an improvement, but as soon as it was stopped there was a relapse. It is evident that here again, as in the starvation process, there must be combined an extremely thorough cleaning up, so that the best possible results may be obtained from the treatment. Medicated syrup does not destroy the spores, it simply prevents their development, and gives the bees a chance to rid themselves of the infection, and in that respect I certainly think resembles the starvation process. Its advantage over that is that it can be carried on for a longer time.

In the course of these experiments I tried another substance which has been much used since Lortet's work on the subject, viz, beta naphthol. I do not think, myself, from recent work on this substance, that beta naphthol should be ranked very high as an antiseptic, mainly on account of its insolubility in water. I found, however, that a bee broth containing 1 per 1,000 beta naphthol would not allow spores of *bacillus alvei* to germinate, and consequently had an equal value with 1 per 500 of carbolic acid. It has an advantage over carbolic acid on account of the disagreeable taste of the latter, and I think would be more acceptable to the bees.

Salicylic acid in syrup has apparently the same effect, but I would not recommend the addition of borax, as Behring has shown that borax lowers considerably the antiseptic value of salicylic acid.

I tested also formic acid in the same way, but my results so far have not been satisfactory, owing to the uncertain strength of my sample of formic acid. I prefer to reserve a report upon it and other substances which I wish to try, until later.

Mercuric chloride I have not tested, as I do not think it wise to use it around the hive. The idea of using a one per 1,000 solution to spray the diseased combs, as suggested sometimes, is, I think, absurd, and would be a rather serious operation for any living brood.

You will see that I consider all these methods of treatment do not in themselves necessarily presuppose the destruction of the spores, but depend upon the fact that for a longer or shorter period the spores are prevented from germinating, and in this period they are eliminated from the infected bees. Whether the vitality of the bees themselves has an effect upon the elimination or destruction of the spores is a point which would be extremely interesting, but one on which at present we have no definite information. From the results of bacteriological work on other diseases we know that the animal body is engaged in a constant warfare with the disease germs which may be introduced, and this also may be the case in foul brood. Much more extended investigations, however, would be necessary to prove this. It is much safer for apiarists to accept the possibility of a recurrence of the disease after a course of treatment, owing to the lodgment somewhere of some of the spores of *bacillus alvei*, and by care and cleanliness remove this possibility. To do this, the hives and frames in which a foul broody colony has lived must be sterilized, and this may be done in various ways. For the sterilization of material by disinfectants there was a tendency formerly amongst bacteriologists to run to such disinfectants as corrosive sublimate, carbolic acid, etc., but later work has shown that there are a number of common chemicals which will act just as well, or perhaps better. Corrosive sublimate has lost much of its reputation as a disinfectant within the last few years, and carbolic has been shown to be not nearly so powerful as at first supposed.

For cleaning hives and frames which are suspected to contain the spores of foul brood, a hot 10 per cent. solution of soft soap is perhaps as effectual as any that can be recommended. A good strong solution of washing soda, when hot, is also very active, destroying the spores in a few minutes. Both these are certainly better than 5 per cent. carbolic for disinfecting the hives and frames, as their cleansing properties are so much better than it, and Behring has shown that 5 per cent. carbolic requires at least three hours at blood heat to destroy the spores of anthrax. In case the soap or the washing soda is used, however, it must be used as hot as possible. Of course anything which is of no value should be burnt.

I trust that in this paper I have thrown a little light upon some of the facts in connection with the disease of foul brood, but as I stated in the beginning, I reserve the privilege of submitting to you at a future meeting the results of next summer's work.

Before closing I desire to express my thanks to your able secretary, Mr. Holtermann, for the assistance which he has given me, and also to Mr. Corneil, of Lindsay, for advice and for the use of volumes of all the principal bee journals, which he has supplied me with; also to Mr. Larrabee, of Michigan Agricultural College, in connection with the subject of comb foundation.

WM. McEVOY: I am very thankful for that paper that Mr. Mackenzie read. I am pleased to think that we agree in so many things, and in time I think we will be agreed in all. In the first place, in going into the disease, I like to give the cause, cure and preventive. Where brood after brood has rotted in the same cell, and where the queen lays in that cell and the young bee is fed in this corrupt cell, in time it will become diseased. If there was not so much dead brood there would not be so much foul brood. I know that a lot of uncared for brood does produce foul brood.

Next, to prevent it. I will take a foul brood hive and I will remove the disease. Now, you might say that is impossible, but I can cure it. First use the starters and then the foundation. The foul brood may break out again, but afterwards, when there is little or no honey coming in, when the foundation is small put them on the starters again. All the difference depends on the honey flow, how bad it was diseased, and the make of the foundation. Put them on the starters for four days, and when that is drawn out, drive the bees off, remove the starters, and give foundation. By the time this work is done the disease has gone. When you have a part of your bees diseased you should go in the evening, about sundown, to the diseased hives and remove the combs, shake the bees in their hives and give them starters. If you do this during the day, they will mix and start the disease in others. This disease can be cured in the honey season by the use of the honey extractor. The great difficulty is in getting the men to carry out instructions. Where a man has only a few hives and they are diseased, if he is busy at anything else he is not very particular, and the ones from the strong hives go and spead the disease to the others. Is the comb so costly or the foundation so dear that you must take old rotten combs and spray them? Spraying is not a success and never will be to the public. I know some places where they have tried it, and they could not have had a worse outbreak than when they tried it. That is my experience. I have examined eggs many a time, and there is more foul brood deaths at the age of 7, 8 and 9 days than at any other age. Now, if these were diseased, why did not they die in 2 or 3 days; But they run on 8 or 9 days.

Mr. GEMMELL: Some claim foul brood cannot be cured in the honey. I have had some experience, and I have proven in every case that where you once get rid of the infected honey from the colony, whether or not you bale the hive, you can get rid of the disease. The first season that I had it, I baled all my hives. I had it in some cases in the second season, and I did not bale them, and got rid just as well. In regard to the queen being diseased, I may say that if the disease is in the egg, what is the use of trying to cure the bee?

Mr. MACKENZIE: My opinion in regard to the infection of the ovary in the queen is that it is purely accidental. My method is as follows: I sterilize the whole upper surface of the bee, and I cut down through the top part and remove all the other organs except the ovaries and then sterilize the surface of the ovaries and put a hot needle into the centre and allow it to stay there until it is cold, and discovered in three out of five cases there had been foul brood spores on the inside. My explanation is that they can move, and have simply worked their way up here accidentally.

Mr. GEMMELL: Do you think it is possible for the germs to be wafted from one hive to the other?

Mr. MACKENZIE: Of course we know that in an infected cell you will find a good deal of the infected material down at the bottom of the cells, and as long as it is there I do not believe it would be wafted. Of course that is not an absolute opinion.

FACTORS NECESSARY TO THE ADVANCEMENT OF THE DAIRY INDUSTRY IN ONTARIO.

Following is an address delivered by Mr. JOHN HANNAH of Seaforth: After having heard so many very scientific addresses, I do not know but it would be quite a relief to have something off-hand for a little while. I may say that I had felt like apologising for not having my remarks in the form of a paper, knowing the advantage of that in a good many ways.

I am expected to give a few remarks to-day on dairying in Ontario. The dairy industry has been taking a good deal of prominence lately in Ontario, and I believe there is a goodly reason; in fact, there would be no difficulty at all in proving to this audience that it is one of the most important branches of Canadian farming to-day. We find that grain raising, although we can perhaps get about as good returns to the acre as a few years ago, through a depression of prices is getting quite unprofitable. We find also that our live stock industry is being attacked. When we find these sources of our income curtailed we have got to look in another direction, and that direction, I think, is dairying, in one form or the other. We have at the present time three great sources of income from dairying as practised by the farmers of Ontario, cheese factories, creameries and private dairies. I will take them in the inverse order in which I have named them.

Private dairying, which largely takes the form of butter-making, I am happy to say, is receiving considerable attention, and through the enterprise of our Minister of Agriculture, we have now two travelling dairies in operation giving practical instruction as to the care of cream, making, printing and handling of butter, etc., and at the same time, capable men, such as Mr. Palmer and Mr. Linfield, are in charge of these dairies, giving the best information as to the selection, care, feeding of dairy cows, handling of milk, etc. In a great many parts of Ontario I have no doubt this will do a great amount of good. No matter how well a cow is fed, if the manufacturing of the butter is not properly done the dairy interest will suffer, but if the churning and handling of the butter is done uniformly it means a uniform product, and a uniform product means a uniform price, and the travelling dairies are doing considerable to bring this about.

The next point I would touch on is the cheese factories. I think that it was almost understood or claimed by the cheesemen that cheese-making in Ontario was at its highest point of excellence, but that there was room for improvement in butter-making. We had our name established in the Old Country for sending in the greatest quantity of an excellent quality of cheese that was received from any country. We had, too, the cheese factory proprietors and managers giving the returns that the individual farmers had been making from their cows and from their farms, showing that they were doing very well and were satisfied; but since that time a little spirit of unrest has dropped in among these cheesemen. They find that they cannot run the factory more than about seven months of the year; and we find that if we want to use a cow to the best advantage, we have got to keep her milking for more than seven months in the year. They should milk at least ten months, and if they turned the three months' milk into butter they were of course at the disadvantage of not having any good market for it. Of course the travelling dairy has been to a certain extent overcoming this difficulty, but that necessitates a good deal of expense and a good deal of labor at a time when the cheese factories were not running. The man that has gone into keeping many cows with the help that he usually has and milking from 15 to 30 cows and keeping them up every day—Sunday and Saturday—for six or seven months wants a comparative time of leisure if he can get it, and he will not get it if he keeps on the production of dairy butter for three months more. Now, if they can dispose of this milk for the other five or six months it would be a great advantage, and I think I may safely say that Prof. Robertson has the credit of first advocating, if it is a credit, the running of creameries in connection with the cheese factories, and in this way be able to make butter through the whole winter season and cheese during the rest of the year. I would throw out an idea to the cheesemen of how to run these winter dairies in connection with cheese factories. The idea has come from the other side, that is, having skimming stations and a central factory for making butter. We find that in any good cheese-making district there are cheese factories about every four miles. Take one central factory in a radius of from 8 to 10 miles and fit it up for butter-making, and then put in separators in the other factories within this radius, have the milk delivered at these factories, separated, and the cream brought to the central factory to be manufactured into butter. The advantage which I think we would find in this system is the economy in manufacturing. You know that the larger the quantity in a single factory the more cheaply and economically it can be manufactured, besides the benefit of having a larger quantity to sell. There is also further economy in the matter of machinery when you club the cheese factories together in this way. A separator can be put in at a very little expense over the cost of the separator. If you had to fit up each of these factories for a creamery there would have to be a large amount expended in purchasing churns, butter-workers, etc., and another expense would be the paying of more butter-makers. Suppose you were in a district where you could get seven or eight factories to club together in the way indicated, all you would require would be one first-class butter-maker in the central factory. There is no difficulty in any cheese-maker learning to run a separator, and I think you could engage the cheese-makers at the stations for the remaining five months of the year to run these separators. He could run the separator in the forenoon, three times a week, or oftener if the quantity of the milk were sufficient, and deliver the cream in the afternoon at the central factory, and in that way reduce the expense to the least possible amount. This system has been adopted on the other side of the line quite extensively.

I would like to speak about the marketing of cheese. The old country is a good market, and you can go to your board meetings at London, Ingersoll, Woodstock, etc., and you will get all it is worth on that market, but there is a market for a considerable quantity of Canadian cheese which I think is undeveloped, and that is the home market. I think there are very few who have any hesitation in saying that the cheese consumed at home is not first-class. Now, I think in Canada you would find we are prepared to pay a good price for a good article, and if we do not get the best article we do not want it at all; and this is one reason why our home trade in cheese is not larger than it has been, and I fancy that by making a nice cheese for our home market we will increase this trade to a great extent.

Now as to the creamery industry. This industry is comparatively in its infancy. We have had creameries running more or less for about 9 or 10 years, and even yet we have not very many in the Province of Ontario. One reason for that, no doubt, is that the cheese factories were established some 15 or 20 years earlier and have proved quite successful, and where they have been established there has been no object in changing by introducing the creamery. Some sections have creameries, however, and they have taken to the creameries simply because they can keep their skim-milk at home on the farm to feed their stock, and at the same time they are getting a fair price for the cream; and even though they should not show the same returns as from a cheese factory, still they have been satisfied to go on, and as far as I know from the present season's manufacture there has been a very marked increase in the quantity of butter from the creameries. I do not think this has been at the expense of the cheese factories, for I find there has been a very large increase also in the production of cheese. The creameries in Western Ontario have been nearly all, so far, conducted on the cream-gathering process. It has some serious defects, and I fear that we are not going to be on the right track until we get that changed for the separator system. My reasons for that are that in the cream-gathering system the creamery managers are too much at the mercy of the farmers; and where you have to depend on so many they do not take sufficient care in attending to the cream properly, and we sometimes get cream in condition that is not favorable to making the best quality of butter. Another advantage in the separator system is that you are able to make a complete separation of the cream from the milk, and thereby the returns can be made to the farmers for the whole of the butter, while with the gathered cream system you have from 15 to 25 per cent. left in the milk. With regard to the skimming stations there is the great advantage of having the whole of the cream taken out of the milk; there is also the advantage, when you have the skimming stations placed close together, of not having very far to haul the cream to the factory, and the skim-milk can be returned in fairly good condition to feed to the hogs or calves. With these advantages I do not see why our creamery industry should not be supported, as in many sections where they want to raise the young stock it could be followed with advantage. I think it will be adopted to a considerable extent when known. One of the great difficulties, however, is the expense; the separators are very costly, but there is no doubt that in a very short time the price will be reduced. I believe it has been reduced fairly well during the past year. I think that with this system we will be able to induce a larger number to go into the creamery system, and we will be able through that means to get an increased export supply of butter, for which there is a fairly good demand at all times in the Old Country as well as in our own western countries. British Columbia has been getting quite a lot of our butter for the last few years. Exports from Montreal to England during the past season have doubled as against last year, and we still have room there for any amount of butter. The market there is a very profitable one if you put in the right quality. There is one factor with regard to the advancement of the dairy industry in Ontario which I think is the most difficult to get, that is to get the farmers to understand that it is going to be profitable to go into dairying. One difficulty is that they have not realized the possibilities of the profit in the way of milk production. They are satisfied to milk for seven or eight months in the year, and after that they allow their supply to dwindle down until it is next to nothing, and through that means they do not get anything like what they should get from a cow. The only way that we are ever going to get these men into line and to make dairymen worthy of the name is to keep on educating them and to get them to interest themselves. I think a good work could be done by the Babcock test. I was doing a little work myself with a Babcock test this season, and we paid according to that test, which I hold is the proper way. I got a private one for going around among patrons and tested their cows for them, and it had the effect of opening their eyes to the folly of keeping some of the cows that they were keeping. We all know that there is no profit in keeping a poor cow.

Prof. DEAN: I would offer a few thoughts along the line that Mr. Hannah has spoken. There is a mistaken idea in the country that private dairies are antagonistic to creameries,—that if you go around teaching men how to make private butter, you will ruin the creameries. The facts are, that there are more creameries being established this year and the next year than have been established during the last 10 or 12 years in this province. Under the heading "Items" from Belleville, I read the following: "Since the travelling dairy has been in this section the results are that two or three cheese factories are putting in apparatus for making butter." The private dairy is the forerunner of the creamery. You cannot change from grain-growing to dairying in a day or two—you cannot get the cows; so people must go into the private dairying before creameries can be established to any great extent. Mr Hannah also spoke about changing cheese factories into creameries during the winter. There have been a great many of these established during the last season—I think there were only two or three last year, but now about 20 or 30. He also referred to the fact that we might develop a home market for our cheese. It is a lamentable fact that if you go into the best hotels in the province of Ontario you cannot get cheese fit to eat. What is the reason for that? If a cheese maker makes a poor lot of cheese, he keeps that back when he sells to the buyer for the English market; and consequently our store-keepers get this poor cheese. If we say that we will not eat this poor cheese, the maker will be compelled to dispose of it in some other way. I think that the gathered cream system is going out of date, because from tests made in all parts of the Province, we find that farmers are losing from one-half to a pound of butter in every hundred pounds of milk. Can we afford to feed 23 cent butter to calves and pigs? I think there is more money in taking that out of the milk. We have found that unless the room in which the cream is set is cooled down to 45 degrees we do not get a clean skimming; and I think, taking it all the year round, that those who use the creamery cans loose from 20 per cent. to 25 per cent. of their butter. There are, however, certain advantages in the cream-gathering system: one is less cost in hauling to the factory. A drawback to the cream-gathering system is that they have all the work but churning the cream to do on the farm; and it really does not make much less work than when they manufacture the butter at home.

If it were not for the fact that the creamery men were able to get a better price for their butter, I do not think they would run at all. I am satisfied that in the next two years we shall see the separator plan coming into almost universal use. There are certain factors necessary to the advancement of this dairy industry. In the first place, we must get at the men who are managing the cows and supplying the cream. If we cannot get the people to come to these meetings, then we will have to go to the people, and instead of having these large meetings we will have to divide up and have dairy association meetings in every county. We want more local associations and get at the men who are producing the milk on the farm. I am also satisfied that we need to get a better class of cows. It is said that the average cow gives but 3,000 pounds of milk per year. If that is a fact, it means that the average cow does not pay for her keep and the trouble and expense of looking after her. The standard I take is 6,000 pounds of milk, or 250 pounds of butter, and that is a standard which should be put up in every dairy stable in this country. How are we to get this standard? The only way to do it is for every man to put a pair of scales in his stable and have a tester on the farm or at the cheese factory. We weigh the milk from each cow every night and morning, at the end of the week we record these weights in a book kept for the purpose, and twice a week we take a sample from each cow and test it. Until the dairymen of this country adopt some such method as this, we will not see much improvement in our dairy industry. First, then, get at the men; secondly, get a better lot of cows; and the only way to got them is to find out which are the best and breed them to pure bred sires, and in this way we will see a great improvement in our dairy industry in the next five years.

ADDRESS BY MR. MULOCK, M.P.

Mr. W. Mulock M.P., Vice-Chancellor of Toronto University, was then introduced and spoke as follows: I came here to-day on the invitation of the Secretary of this Union both for the pleasure of meeting men engaged in this industry and also to see the work done here by this College under the able management of your President, Mr. Mills. I can hardly claim to be a practical farmer, and think it a mistake to expect to find too many qualities in one man. For example, I saw an advertisement in a paper by an Australian ranchman who advertised for a university graduate to take charge of his children, but added in the postscript that he must be able to milk goats. (Laughter). That branch has not yet found a place on the curriculum of the University. Speaking of dairying, my experience has been that in order to successfully carry on dairying, we should soil in summer as well as in winter. Therefore, it appears to me that in connection with this institution it would do well to give instruction as to the best system of soiling. I have practiced it for six years, and my experience with a herd of between 20 and 30 cattle has been that I never had my cattle flourish so well and fed so cheaply and with so satisfactory results. If I can do nothing more, I can give that little bit of experience in my limited way as a farmer, and ask that the traveling dairies give attention to this subject if it is thought worthy of attention.

I am a supporter of the Ontario Government, and I am rejoiced to see that they are doing what they are for the Agricultural industry; and I am not a fault-finder as a rule, but as a taxpayer I venture to criticise to some extent the unnecessary degree of economy in my judgment that I see manifested in connection with certain of the works of this institution. I believe the farming industry is of sufficient importance in Ontario to be entitled to a larger support, and it is unwise to stint this Farm and College in any respect, and if I were to go over this whole scheme accurately, I think I could point out where public money could be used to advantage in equipping the different departments here to the desired extent. It is my pleasure to encounter throughout the Province many of the graduates of this College, and I find them taking prominent positions where they live. There are several in my riding taking much interest in the great field of agriculture, aiding in the advance of the science and becoming the means of disseminating amongst their neighbors much valuable information. Such work is of incalculable advantage to the country, and the Legislature cannot too fully appreciate the importance, therefore, of affording every facility in this institution for the youth of this country becoming educated in scientific farming. Of course it is gratifying to know that the institution is being well filled with students and that more are demanding admission than the facilities can accommodate; and I would say to the management and to our able President, Mr. Mills, that this result is more complimentary to them, is testimony of the good work they are doing for the Province; and I think it is the duty of the Government to see that the doors of this institution are not closed to any worthy student who knocks for admission. Mr. President, you call upon me without notice, and perhaps I, therefore, speak more unguardedly than I would otherwise have done. I am speaking in the presence of a Minister of the Crown, and I trust that he will not altogether censure me for making these assertions. I know that his heart is in the work, he is a practical farmer, and I rejoice to know that he has been the means of doing great good to the province. With him has originated, if I am correctly informed, the idea of carrying out this progromme of instructing the farmers in dairying; and if he never lives to do anything more in his public life than that he will have deserved well of his country. The dairying interest is a great and growing interest, and the people throughout the country are in a fever on the subject. All over the country there is a thirst for information how to successfully carry on the dairy industry, and that cry is brought forth to a great extent through the Minister of Agriculture and his endeavoring to supply that want. Therefore, I say the name of John Dryden will ever be remembered with gratitude by the people of Ontario for the part he has taken in furthering the dairy interests of this Province.

I am glad to be here to-day and to compare what I have seen during my wanderings this afternoon with the condition of affairs a few years ago. It is a progressive age, and without finding fault with anything in the past, I think I can compliment the management of his Institution upon the progress that has been made. It is gratifying to know that it is manned by live, energetic men who are also to be found ready whenever required to go out to deliver lectures and otherwise disseminate such information as they may have among the farmers of this fair Province. I have met several of the professors of this institution outside of their engagements here, and I have had a feeling of sympathy and pity for them at the amount of work exacted from them by that severe task-master, the general public; and again meeting them here and finding them always at work, I say that the Ontario Agricultural College deserves well of the people, and demands at the hands of the Government the most liberal treatment that the circumstances of the people warrant.

ANNUAL SUPPER.

After the close of the afternoon session, President Mills invited all the ex-students and other visitors present, to join the College officers and students in the dining hall, to partake of the matron's hospitality. After supper was served, various toasts were proposed and fittingly responded to by members of the Union and by visitors, among whom the following may be mentioned: Hon. John Dryden, M.P.P., Wm. Mulock, M.P., Messrs. C. C. James, F. T. Shutt, and J. J. Mackenzie. A very enjoyable evening was thus spent.

SECOND DAY.

The first business taken up after roll call on the second day, was the report of the Nominating Committee.

Moved by E. Lick, seconded by S. P. Brown, that Article IV be amended to read as follows: "The officers of this Association shall consist of an honorary president, president, vice-president, treasurer, secretary, editor, two auditors, one corresponding secretary for each county, and such committees on experiments as may be found desirable, who shall hold office for one year, or until successors are elected." Carried.

Moved by E. Lick, seconded by R. F. Holtermann, that Article VII become Article VIII, and that Article VII read: "The treasurer shall pay out all money held by him only on order of the President." Carried.

After some discussion as to the best method of inviting farmers generally to the Annual Meeting, President Mills offered to instruct the heads of the different deputations attending the Farmers' Institutes, to give a general invitation to those present at each of their meetings to attend said meeting.

OFFICERS FOR 1893.

Honorary President	Prof. A. E. Shuttleworth, B.A.Sc., O. A. College, Guelph.
President	A. G. McKenzie, Fairview, Ontario.
Vice-President	A. R. Yuill, Carleton Place, Ontario.
Treasurer	H. L. Hutt, B.S.A., Southend, Ontario.
Secretary	R. F. Holtermann, Brantford, Ontario.
Editor	C A. Zavitz, B.S.A., O.A.C., Guelph.

AUDITORS:

Jas. Atkinson and C. M. Macfie.

DISTRICT OR COUNTY SECRETARIES.

Name.	County.	Post Office.
W. A. Mattice	Stormont	Cornwall.
W. L. Carlyle	Dundas	Chesterville.
G. G. Shirreff	Russell	Clarence.
E. G. McCallum	Glengarry and Prescott	Martintown.
J. C. H. Sparrow	Carleton	Antrim.
P. McLaren	Lanark	McGarry.
W. Lindsay	Renfrew	Loch Winnoch.
J. C. Stagg	Leeds and Grenville	Brockville.
B. C. Brown	Frontenac	Kingston.
D. Aylsworth	Lennox and Addington	Bath.
D. H. Leaven	Hastings	Belleville.
W. M. Newman	Prince Edward	Gilbert's Mills.
Wm. Wiancko	Muskoka	Sparrow Lake.
Wm. Morrison	Haliburton	Minden.
F. J. Davidson	Peterborough	Peterboro'.
W. Carlaw	Northumberland	Warkworth.
J. L. Fair	Durham	South Monaghan.
T. H. Tinny	Victoria	Oakwood.
S. P. Brown	Ontario	Whitby.
R. A. Thompson	Simcoe	Thornton.
G. A. Brodie	York	Bethesda.
J. A. B. Sleightholm	Peel	Humber.
W. Ewing	Dufferin	Mulmur.
E. P. White	Grey	Clarksburg.
A. R. Vannater	Wellington	Ballinafad.
H. Black	Halton	Scotch Block.
H. L. Beckett	Wentworth	Hamilton.
J. Harcourt	Lincoln	St. Anns.
A. M. Soule	Welland	Southend.
D. Z. Gibson	Haldimand	Willow Grove.
Allen Shantz	Waterloo	Waterloo.
G. C. Emigh	Oxford	Holbrook.
G. N. Hunter	Brant	St. George.
B. E. Kitchen	Norfolk	Waterford.
Jno. Buchanan	Huron	Hensall.
N. Monteith	Perth	Stratford.
J. B. Muir	Bruce	North Bruce.
E. M. Husband	Middlesex	Cairngorm.
C. R. Stevenson	Elgin	Fingal.
N. J. Clinton	Essex	Windsor.
B. Robinson	Kent	Wheatley.
A. E. Wark	Lambton	Wanstead.

Delegate to Central Farmers' Institute, C. A. Zavitz.

COMMITTEES ON EXPERIMENTS.

Agriculture.—President Mills, Prof. Shaw, Prof. Shuttleworth, C. A. Zavitz, H. Story, A. M. Soule, G. Y. Payne, R. Shaw, Jas. Atkinson, R. Harcourt.

Horticulture—E. Lick, N. Monteith and H. L. Hutt.

Dairying.—Prof. Dean, S. P. Brown and W. J. Palmer.

Apiculture.—R. F. Holtermann, E. M. Husband and N. Monteith.

Economic Entomology.—Prof. J. H. Panton, H. L. Hutt and Jas. Atkinson.

TREASURER'S REPORT.

—	Dr.	Cr.
	$ c.	$ c.
To amount on hand	162 54	
" Membership fees	15 00	
" Government Grant	400 00	
By expenses of speakers (at meetings)		74 80
" grains, fertilizers, printed forms, expressage, etc. (for experiments in agriculture)		301 99
" potatoes, printing, posting, etc. (horticultural experiments)		36 19
" foul brood, printing, posting, etc. (apiculture experiments)		23 00
" Secretary's salary, ($15 for 1891)		40 00
" travelling expenses of officers		9 20
" reporting meeting, editing report, printing circulars and programme, postage, etc.		90 05
" balance on hand		2 31
Total	577 54	577 54

We, the undersigned, auditors of the Ontario Agricultural and Experimental Union, beg leave to say that we have examined the accounts of the Treasurer for the past year, and have found them to be correct.

Signed { J. ATKINSON,
H. STORY.

O. A. College, Guelph, December 22nd, 1892.

REPORT OF THE HORTICULTURAL COMMITTEE.

PRESENTED BY ELMER LICK, OSHAWA, ONTARIO.

The committee, after consultation, thought best to continue the experiment with new and promising varieties of potatoes. It was also decided to drop Puritan, Crown Jewel and Thorburn, of the previous year, and substitute Harbinger, Toronto Queen and Burpee's Extra Early. The following circular was sent out in April :

OSHAWA, April , 1892.

Dear Sir,—It has been decided by the Horticultural Committee of the Ontario Agricultural and Experimental Union, to carry on the following experiments with potatoes : Testing new varieties with a view of arriving at correct conclusions as to the earliness, productiveness and quality. Five pounds of each will be sent to each experimenter, free of all charges. Each variety must be cut to 99 pieces and planted uniformly on six rods of row.

Each experimenter is also asked to select his own best yielding variety and treat in a similar manner. The rows are to be adjoining and the soil as uniform as possible. Send the weight of entire crop. In digging be careful to weigh accurately, and forward results on blank form before November 10th, to

ELMER LICK.

N.B.—Those who carried on experiments last year are expected to take five pounds of their own growth of each variety as well as the three new ones and report results. In cutting potatoes to 99 pieces cut larger ones first ; endeavour to secure as uniform size of pieces as possible. If you wish to undertake experiment, send postal card as soon as you receive this, stating post office and express office.

Owing to the very unfavorable season, a considerable number of experimenters failed to secure reliable results. The large rainfall in June, followed by dry weather and rust, or blight in many cases, deterred the experimenters from keeping record of the different varieties. Notwithstanding this, we are pleased to report that we have twelve complete and satisfactory reports (with the exception of Empire State in W. H. Foster's report). This, however, has been calculated in with the average results, as it did not alter the relative positions of the varieties. The following table shows the average weight of each variety per plot and estimated yield per acre.

At the bottom of the table the results of three experimenters whose reports were not satisfactory to themselves, and therefore not worthy of a place in average, are given.

Experimenters.	Empire State.		Summit.		Rural No. 2.		Toronto Queen.		Burpee's Extra Early.		Harbinger.		Distance of rows.	Soil.	Date of planting.
	Total weight.	Small.	Total weight.	Small.	Total weight.	Small.	Total weight.	Small.	Total weight.	Small.	Total weight.	Small.			
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	in.		
Samuel Rankin	110	....	92	....	61	....	56	....	50	....	43	....	36	Clay.	May 30.
H. L. Hutt	49	12	51	11	55	8	35	18	32	15	30	15	30	Loam.	June 7.
Walter S. Clapp	115	17	98	18	97	8	68	32	66	33	69	30	42	Sandy Loam.	June 2.
James Watson	105	$6\frac{1}{4}$	76	$5\frac{3}{4}$	$100\frac{1}{2}$	$3\frac{3}{4}$	$10\frac{1}{2}$	$8\frac{1}{2}$	$75\frac{3}{4}$	$11\frac{3}{4}$	$41\frac{1}{2}$	$2\frac{1}{4}$	36	Clay.	May 27.
W. H. Foster	30	15	79	13	65	6	86	14	52	11	99	20	44	Sandy Loam.	May 28.
N. Monteith	150	36	132	30	72	18	90	30	90	33	63	18	30	Clay Loam.	May 30.
Ben. Shirreff.........	183	21	115	15	120	12	64	5	$122\frac{1}{2}$	$35\frac{1}{2}$	40	25	34	Light clay Loam.	May 10.
S. H. Rittenhouse.....	165	5	131	12	139	2	116	9	103	18	70	10	36	Sandy.	May 30.
Geo. G. Shirreff	77	15	$93\frac{1}{2}$	$16\frac{1}{2}$	$64\frac{1}{2}$	20	89	9	114	22	56	18	34	Gravelly Loam.	May 25.
D. K. Erb.........	60	27	75	26	59	9	54	24	76	11	38	25	26	Loam.	May 28
G. F. Blaney	80	....	76	....	54	....	111	....	118	5	111	27	36	Loam.	April 26.
Thos. Steadman	85	9	109	12	137	2	87	10	89	9	57	11	34	Loamy clay.	May 21.
Average yield of one row 6 rods long ...	$100\frac{3}{4}$	13.6	93.9	13.2	84.7	7.6	77.2	13.3	82.4	17.0	59.7	16.8			
Yield per acre........	253.6 bu.		236.3 bu.		213.3 bu.		194.3 bu.		208.3 bu.		150.0 bu.				
Wm. Bailie	100	20	45	20	89	18	50	16	45	15	70	16			
E. B. Edwards.......	40	....	40	....	30	....	15	....	36	....	17				
Jas. Forsyth	....	....	....	....	....	....	141	19	102	17	62	18			

The next table shows the yield per plot of the other varieties grown by the experimenters in pursuance of request to grow best yielder, and also those varieties sent out last year.

Experimenter.	Varieties.	Total Weight.	Small.	Experimenter.	Varieties.	Total weight.	Small.
		lb.	lb.			lb.	lb.
Samuel Rankin.	Clark's Seedling	125	....	Geo. G. Shirreff	Puritan	103	$7\frac{1}{2}$
H. L. Hutt.....	Late Hebron ..	62	11		Crown Jewel .	$86\frac{1}{2}$	15
Walter S. Clapp.	Rural Blush ..	$104\frac{1}{2}$	....		Thorburn.....	88	$11\frac{1}{2}$
	Puritan	78	25	D. K. Erb	Dakota Red..	80	4
James Watson..	Everett's Seedling	$104\frac{1}{4}$	$5\frac{1}{4}$		White Elephant	74	8
N. Monteith ...	White Elephant	140	35		White Star...	79	5
B. Shirreff......	Late Hebron .	110	8		Late Rose	70	8
	Bell	112	5	G. F. Blaney, jr.	Puritan	73	2
S. H. Rittenhouse	Farmer's Favorite ...	137	4		Crown Jewel .	76	....
	Ideal	132	2		Thorburn	85	....
	White Star...	103	3	Thos. Steadman.	Early Puritan	89	9
	Rural Blush..	146	4		Crown Jewel .	91	10
					Thorburn	79	9

Showing average period of growth and reported mealiness and quality of each variety.

—	Empire State.	Summit	Rural No. 2.	Queen.	Burpee's Extra Early.	Harbinger.
Average number days from planting to maturity...	109	102	107	95	87	102
Mealiness .. Good	7	7	5	7	8	4
Mealiness .. Medium	3	3	5	3	2	4
Mealiness .. Bad	..	..	..	..	..	2
Quality .... Good	7	6	7	7	8	3
Quality .... Medium	2	3	2	2	1	5
Quality .... Bad	..	..	.	..	..	1

Remarks of Experimenters.

Samuel Rankin, Fairview, Perth Co.: They are all good eating potatoes. We have the Daisy; it is best in quality but not as good a yielder. This was not a good year with us, being too wet for clay. You will notice that Clark's Seedling is the best yielder. It is a new variety but a fine potato and good table quality also.

H. L. Hutt, Southend, Welland Co.: Of the early varieties Burpee's Extra Early is one of the most promising, while in late varieties Rural No. 2 is my favorite, being uniform large potatoes of good quality.

Walter S. Clapp, Rose Hall, Prince Edward Co.: I think it is unfair to the early varieties, and with the six kinds I should make but little difference for table use; but all I would want of Rural No. 2 and Rural Blush would be for feeding purposes. Potatoes are a very poor crop here this season.

James Watson, Sonya, Durham Co.: The yield of Harbinger was small on account of bad seed, only one-half growing. Empire State was the best yielder, but tubers very rough and subject to rot, one-half being useless. Rural New Yorker is an all-round good potato, very smooth and free from rot. The other three varieties very good. Everitt's Seedling is the best of the seven varieties.

W. H. Foster, Leamington, Essex Co.: Too much rain in the fore part of the season and too dry at the time of setting. No rotten ones. Empire State inclined to be rather rough in shape.

Nelson Monteith, Stratford, Perth Co.: The season was very unfavorable for a good report, the extreme wet weather during June almost destroyed the potato crop in this locality. The tops upon most varieties kept green until the middle of September, when a blight appeared to affect them, and consequently rot tended to decrease the yield. Rural No. 2, Harbinger, and White Elephant were most affected by the rot. Empire State, Summit and White Elephant were smooth and free from scab.

Benjamin Shirreff, Allenford, Bruce Co.: The blight affected all these potatoes early in August else I believe the results would have been much greater, especially in the late varieties. I do not think they ripened; they were killed with blight. They were all completely dead by Sept. 1st.

S. H. Rittenhouse, Jordan Station, Lincoln Co.: According to test plot the Empire State are ahead of all the others; their size the only point against them. Farmer's Favorite are my main cropper; they resemble White Star. Cannot say much in favor of Rural No. 2. I also tried them in the field.

G. G. Shirreff, Clarence, Russell Co.: Burpee's is first over all with a large percentage of small ones, while Puritan is best of varieties sent last year with the lowest percentage of small. Harbinger takes lowest place of the nine with the largest percentage of small, and Rural No. 2 holds that place among those destributed in '91 with the 2nd highest percentage of small. None of the varieties show any appearance of rotting up to the present, nor were any showing signs of ripening when the rust came on them and all perished together. Were well manured with farmyard manure and had also an application of wood ashes, superphosphate, sulphate of ammonia. Killed with rust in the 1st week of August.

D. K. Erb, Sebringville, Perth Co.: Some of the new varieties had a great many potatoes in the hill, but there were so many small ones. This perhaps may be partly owing to the very wet weather previous to July 1st, succeeded by a very dry spell, which rendered the soil very hard.

G. F. Blaney, Jr., Oshawa, Ontario Co.: The whole of the above varieties turned out good, with the exception of the Summit, which rotted very much. The season was very wet for potatoes.

Thos. Steadman, Wyoming, Lambton Co.: This has not been a favorable season. My crop was away above the average. Harbinger and Queen are good quality. All the late kinds had a few of the biggest potatoes rotten, and the season was not favorable for early kinds.

Conclusions.

1. It is a very difficult matter to arrive at definite results owing to the season. Yet in view of last year's results (see Agricultural College Report, 1891, pp. 224-226) we see that the two varieties which were ahead last year again stand first, only the order is changed, Empire State occupying first place and Summit second. Empire State yield, 1892, 253.6 bush. per acre, and in 1891, 290 bush. per acre. Summit, in '92 236.3 bush., and in '91 329.2. In view of these results, it certainly should indicate that these two varieties are ones most likely to succeed in Ontario.

2. Rural No. 2 has not fulfilled expectations of one year ago, probably a result that should be attributed to the blight. It stands third in yield.

3. Of the three new varieties, Burpee's Extra Early has shown itself to be an excellent early variety, fourth in yield, earliest of the six varieties, and best in mealiness and quality.

Prof. PANTON: Did the blight affect both your early and late potatoes in the same way?

Mr. LICK: Our potatoes died in very much the same way. Up to the time our barley was ready to be taken to the barn we had very excellent weather, but at that time it became very wet, and it was during that time the blight struck the potatoes, and when we dug them there were quite a good many starting to rot, but since they have been taken up there is not much sign of rotting.

Prof. PANTON: We discovered an interesting thing in connection with potato rot. In the examination of some potatoes found rotting at the College this fall, I observed the cause was largely due to the fungus *Fusisporium colani*, a parasitic plant which is more likely to attack the potato late in the season; while the common potato blight (*Phytophthora infestans*) appears early. The blight which struck Mr. Lick's field was likely caused by an attack from some species of bacteria.

Mr. LICK: Do you consider that the eyes from the seedy end of a potato are better than from the main body of it?

Mr. HUTT; I would not say that they are better. They might, however, be better in this way: the seedy end of a potato will make a little earlier and more vigorous start in the spring.

Mr. LICK: We have experimented along that line, and found as a result of planting the seedy ends that we get a less quantity of potatoes and a greater percentage of small ones.

Mr. ZAVITZ: We have been experimenting with potatoes here to a considerable extent. In 1890 we had 35 varieties, and the Empire State came to the head of the list, and in 1891 the same variety came to the top of the list again. For three years the Empire State has been at the head of the list and the Summit second. It is very gratifying to see how experiments here correspond with the experiments over the Province. I may say that we have been carrying on experiments this year in regard to planting potatoes in different ways. We put in large whole potatoes every foot, one every two feet and one every three feet; medium whole potatoes every two feet and every one foot; small whole potatoes every foot; medium potatoes, cut in half; medium potatoes, two eyes in a piece; medium potatoes, one eye in a piece, and the seed ends from medium potatoes, and the results show that the smallest yields were obtained from the seed ends. All things considered, we got the best yields from medium whole potatoes put in 2 feet apart, but that is the experience of one year only.

REPORT OF EXPERIMENTS IN AGRICULTURE.

PRESENTED BY C. A. ZAVITZ, B.S.A., AGRICULTURAL COLLEGE, GUELPH.

Co-operative experiments in agriculture have been conducted during the past year by seven hundred and fifty-four ex-students of the College and other farmers throughout Ontario. The number of plots used for this work was upwards of five thousand, and the Committee was unable to supply all the applicants for seeds and fertilizers owing to the great demand. The number of experimenters is increasing about 50 per cent. each year, and much interest is being manifested in the work. Although the season was somewhat unfavorable owing to the excessive wet weather, still the Committee has reason to feel much encouraged by the good number of successfully conducted experiments, the reports of which have been received. With but one exception reports of successful and interesting experiments came from every county in Ontario during the past year.

About fifteen hundred copies of the following circular letter were sent out in the spring of 1892.

Dear Sir,—The members of the Ontario Agricultural and Experimental Union, along with other interested farmers over Ontario, are carrying out a system of co-operative experiments in agriculture. This work was started, upon the present plan, in the spring of 1886, with twelve experimenters, who were willing to receive the grains and fertilizers, carry out the necessary instructions, and report the results at the close of the season. For the first two or three years the experiments were confined almost entirely to the ex-students of the Agricultural College, but as many other farmers expressed a desire to join in the work the invitation was extended to them also, and material was sent free to those who applied, on the condition that they would be careful to follow the few necessary instructions and report results of their work after harvest. The number of both the experimenters and the experiments have steadily increased since the commencement, insomuch that during the past season upwards of two thousand five hundred plots over Ontario were used for these tests.

The members of the Committee on agricultural experiments are pleased to state that for 1892 they are again preparing to introduce into every township of Ontario material for experiments, with fertilizers, fodder crops and promising varieties of roots and grains. Upwards of six hundred varieties of roots and grains were tested at the Experiment Station, Guelph, during the past year, consisting of nearly all the Ontario varieties and about three hundred new varieties imported during the past five years from different parts of Europe, Asia, Africa, New Zealand and the United States. Some of these varieties are certainly very promising and are now in sufficient quantities for a limited distribution.

The experiments chosen for 1892, are as follows:

No.	Name of Experiments.	Plots for each.	Size and shape of each plot.
1	Testing nitrate of soda, superphoshate, muriate of potash, mixture, and no manure with oats	2	2 rods x 2 rods.
2	Comparing the advantage of nitrate of soda over no fertilizer with rape	2	2 " x 1 "
3	Ascertaining the relative value of three varieties of millet	2	2 " x 1 "
4	Growing lucerne as a crop for fodder	1	4 " x 4 "
5	Testing six promising varieties of fodder-corn	6	1 " x 1 "
6	Testing five promising varieties of turnips	5	1 " x 1 "
7	Testing five promising varieties of mangels	5	1 " x 1 "
8	Testing five promising varieties of carrots	5	1 " x 1 "
9	Testing six promising varieties of spring wheat	6	1 " x 1 "
10	Testing six promising varieties of barley	6	1 " x 1 "
11	Testing six promising varieties of oats	6	1 " x 1 "

Prosperous farmers need not find much difficulty in conducting any of these experiments successfully, but care will certainly need to be exercised in every instance, and where this is done the Committee feels assured that the experimenters will be far more than repaid for time and labor expended. Each experimenter will glean information from his own work and also have the benefit of the reports of similar experiments from other parts of Ontario. The results of carefully conducted experiments are presented at the Annual Meeting of the Association, held at the Agricultural College, Guelph, and are afterwards printed in its Annual Report. Each experimenter is invited to the meeting and has forwarded to his address a copy of the Union Report.

A sheet of instructions for the work, and blank forms on which to report results of the tests will be furnished to each experimenter at the time the fertilizers or seeds are forwarded. All material is sent entirely free of charge to each farmer who wishes to join in the work. The produce of the plots, of course, becomes the property of those who conduct the experiments.

Each person is allowed to choose any one of the eleven experiments mentioned above, for which the material will be furnished until our limited supply becomes exhausted, hence those who apply first will be the surest of the desired outfit.

Those desiring to conduct an experiment during 1892, will kindly apply to the Secretary of the Committee as soon as possible, that the material may reach them in good time for seeding. The nearest express office to those applying for No. 1 experiment should be mentioned.

The demand for the experimental material was beyond our expectation, and we were kept busy in filling the many orders. Great care was exercised in sending out none but seed of good quality, nearly all of which had been grown upon the experimental plots at this Station. It is a satisfaction to be able to state that although upwards of 5,000 packages of seeds and fertilizers were distributed over Ontario for these co-operative tests, we have not yet had a single complaint regarding the quality of the seed sent or the manner in which it was packed. We believe in sending material of high quality, even though the quantity may of necessity be small in some instances.

Each experimenter was furnished with the essential instructions for carrying out the various tests, and also with blank forms on which to report the results of his work at the end of the season. These along with the following letter were sent to the experimenters at the same time the material was forwarded:

AGRICULTURAL COLLEGE, GUELPH, March 30th, 1892.

DEAR SIR,—Your reply to our letter regarding the co-operative experiments for Ontario during 1892 has been received. We wish to inform you that we are forwarding to your address the material for the experiment or experiments which you chose from the list in the letter we sent to you. If you have asked for No. 1 experiment, the material is addressed to your nearest express office; but if your application calls for any of the other experiments, the material is forwarded to you by post. This sheet gives the "Instructions" for conducting, and the "Blank Forms" on which to report the results of the different experiments with fertilizers, fodder crops, roots and grains. Should you desire any further information regarding your experimental work, kindly write us to that effect.

For each experiment, soil of a uniform character should be chosen, and the plots should be so located that there would be no danger of trespassing by poultry, etc. The preparation of the soil should be similar to that for the same crops in the larger fields.

We hope the material which we have forwarded will reach you safely, and that you will have good success with your experimental work.

I—TESTING FOUR DIFFERENT FERTILIZERS, AGAINST NO FERTILIZER, WITH OATS.

1. Upon uniform land, which has received no manure for at least four years, mark off five plots of one fortieth of an acre each, leaving a clean path, three feet wide, between the plots. Two rods square is the size recommended.
2. Treat all plots alike as regards cultivation of ground, etc., and sow the packages of Bavarian Oats upon the five plots, as indicated by the labels on the bags. Aim at seeding one inch deep, and cover the seed by going crosswise over the plots with a light harrow, or by using a hand rake.
3. Apply the fertilizers upon their respective plots, as indicated by the labels on the bags.
4. When the plants are three or four inches high, cut off all those outside of the plot limits.
5. Your safest method of harvesting would probably be to cut the crops with a cradle after the oats have become sufficiently ripened, and then, when properly dried, thresh with a flail.

Individual results of seven experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Weight of oats per plot. Mixture.	Nitrate of soda.	Muriate of potash.	Superphosphate.	No fertilizer.
					lb.	lb.	lb.	lb.	lb.
Geo. Carlaw	Nort'mb'land	Clay loam.	Winter wheat	15 loads in 1888 ..	58	54	50	47	52
A. W. Peart. ...	Halton	Black "	Mangels	No manure, cropped 30 years	54½	54½	54½	60	58
Herbert Elford ...	Huron	Sandy "	Winter wheat	None	35	34	31	32	28½
John A. Smithson.	Peterborough	Clay "	Barley	f. y. m. '88	37½	43½	33	30	30½
Thomas Wheatley	Grey	Clay "	Hay	15 years ago.....	42	40	38	34	36
Elmer Lick	Ontario	Clay "	Hay	15 years ago.....	39½	33¼	26¾	24¼	15
Henry Coben	Peterborough	Sandy "	Peas	18 years without	49	26	28	25	20

Average results of seven experiments.

Fertilizer.	Average of seven co-operative tests. Mixture.	Nitrate of soda.	Experiment Station list. Muriate of potash.	Superphosphate.
	tons.	bush.	tons.	bush.
Mixture	1.44	53.0	2.5	68.3
Nitrate of soda	1.39	47.9	2.6	70.3
Muriate of potash	1.26	43.9	2.0	67.4
Superphosphate (mineral)	1.15	42.4	2.1	68.2
No fertilizer	1.17	40.3	1.9	61.5

The "mixed fertilizer" was made up of nitrate of soda, muriate of potash and superphosphate, in the proportion of 1, 1 and 2, respectively by weight. The muriate of potash and the superphosphate were applied at the time of seeding, and the nitrate of soda when the plants were about two inches high. The following table shows the amount applied and the cost per acre of each fertilizer:

Fertilizer.	Quantity applied per acre.	Cost per acre.
	lb.	$ c.
Mixture	213	4 35
Nitrate of soda	160	4 40
Muriate of potash	160	4 48
Superphosphate	320	4 16

Under the term "cost per acre" neither the freight charges nor the expense of applying the fertilizers is included. The material for this experiment was all obtained in Ontario.

Conclusions.

1. The average results obtained by seven experimenters over Ontario in 1892 show that the fertilizers increased the oat crop as follows: Mixture—grain, 12.7 bushel; straw, .27 ton. Nitrate of soda—grain, 7.6 bushel; straw, .22 ton. Muriate of potash—grain, 3.6 bushel; straw, .09 ton. Superphosphate—grain, .9 bushel; straw, .02 ton.

2. The mixed or "complete" fertilizer gave an average increase yield of 31.5 per cent.; the nitrate of soda 18.8 per cent., the muriate of potash 8.9 per cent. and the superphosphate 5.2 per cent. of oats, over no fertilizer.

3. The grain crop was more than doubled upon some soils by the use of the fertilizers, while upon others it was influenced to a very limited extent.

4. Some soils may be more benefited by one kind of fertilizer, and other soils by another class of fertilizers, as for example, upon one farm the mixed fertilizer increased the yield of grain 23 per cent., and the nitrate of soda 43 per cent., and upon another farm the increased yield of grain for the mixed fertilizer was practically the same as in the first instance, while that from the nitrate of soda was but 19 per cent.

5. In five experiments out of seven, the mixed fertilizer gave the highest yield of grain per acre.

6. The greatest average length of straw was obtained from the application of muriate of potash, the second greatest length from superphosphate, and the shortest length of straw from no fertilizer.

7. The average crop which had received the mixed fertilizer was the first to mature, that which had received superphosphate was second, and the unfertilized crop was the latest in reaching maturity.

8. In the test at the Experimental Station, the fertilizers showed an average increase over no fertilizers of 11.5 per cent. of grain, and 21.1 per cent. of straw.

9. The average yield per acre from the co-operative tests was 45.5 bushel of oats and 1.28 tons of straw, and the yield per acre from the Station test was 67.1 bushels of oats and 2.22 tons of straw.

II—APPLICATION OF SODIUM NITRATE TO RAPE.

1. From a section of ordinary land, to which no manure has been applied for at least four years, measure out two uniform plots, each one rod wide by two rods long, and leave a path three feet wide between each two plots.
2. Prepare the soil for rape in much the same manner as you would that for a root crop.
3. In each plot make eight drills, two rods long, and leave twenty-five inches between every two consecutive rows.
4. During the last week in June sow the two packages of rape seed upon their respective plots.
5. When the young plants are about two inches high sow the package of sodium nitrate upon plot No. I., after which stir the soil in each plot.
6. Cultivate the land in the same manner as you would that having a root crop.
7. About the end of October cut the rape and immediately weigh the crop from each plot.

The experiment by Geo. Wright, Wellington Co., is the only one recorded. The soil was a clay loam, cropped in 1891 with fall wheat, followed by rape in the spring of 1892. Farm-yard manure was applied in 1890.

YIELD OF GREEN RAPE (DWARF ESSEX).

	Per plot.	Per acre.
Nitrate of soda	500 lb.	20 tons.
No ertilizer	450 "	18 "

Nitrate of soda was applied at the rate of 80 lb. per acre. The cost of this fertilizer per acre, not including freight charges or expense of applying, was $2.20. Both the rape seed and the fertilizer used were obtained in Ontario.

In most instances a wrong kind of rape seed was furnished by the seedsmen, which greatly interfered with the value of this experiment. The variety used produced seed the same summer as sown. The Dwarf Essex rape, which is the variety recommended for fodder purposes, should not produce seed until the second year.

CONCLUSIONS.

1. A handsome yield per acre of green fodder can be obtained from a good crop of the Dwarf Essex rape.

2. While the application of nitrate of soda produced an increase in yield of rape, this increase was made at a cost of $1.10 per ton for the fertilizer used.

3. A variety of rape which produces its seed the first season after sowing is not as valuable for fodder purposes as one which does not produce seed until the second summer.

III—TESTING THREE VARIETIES OF MILLET.

1. Measure off three uniform plots, each two rods long by one rod wide, leaving a path of two feet between each two consecutive plots.
2. Prepare the land similar to that for a corn crop.
3. Sow broadcast the three packages of millet seed upon their respective plots during the first week in June. Aim at seeding one inch deep.
4. Cut the crop as soon as all the heads are in appearance.
5. Weigh the produce from each plot immediately on cutting.

Individual results of three experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of green millet per plot.		
					Salzer's Dakota.	Golden Wonder.	Common
					lb.	lb.	lb.
John Baker	Huron	Black loam	New land	Never man'red	250	234	165
E. Morden	Welland	do	Cabbage	1891 f. y. m	248	148	170
Ed. Butterworth	Victoria	Clay loam	Potatoes	do	112	56	56

Average results of three experiments.

Varieties.	Average of 3 co-operative tests.		Experiment Station test.	
	Height.	Yield of green crop per acre.	Height.	Yield of green crop per acre.
	in.	tons.	in.	tons.
Salzer's Dakota	54.0	8.1	42	12.7
Golden Wonder	31.3	5.8	33	11.1
Common Millet	33 3	5.2	31	7.4

The millet seed was sown at the rate of 40 lb. per acre. The Salzer's Dakota variety was obtained from Wisconsin, the Golden Wonder from Nebraska, and the common millet from Ontario

Conclusions.

1. In all the reports of millet during 1892 the Salzer's Dakota variety was not surpassed in yield per acre of green fodder by any other millet in any of the tests made.

2. The Salzer's Dakota millet gave an increase yield of green fodder per acre of 55.8 per cent. over the common millet in the co-operative experiments, and an increase of 71.6 per cent. in the Station test.

3. The average height of Salzer's Dakota millet in the four experiments of table was 51 inches, of the Golden Wonder 31.7 inches, and that of the common millet 32.7 inches.

IV—THE GROWING OF LUCERNE.

1. Select a one-tenth acre plot, conveniently situated to the stables, and in such a position that it may remain unbroken for a number of years.
2. Cultivate the ground thoroughly, making a fine seed bed.
3. Sow the 1.8 lb. of lucerne in the same way you would seed with red clover.
4. If there is a heavy crop of lucerne in the autumn, cut high; if the crop is light, leave uncut.

Individual results of twelve experiments.

Experimenter.	County.	Nature of surface soil.	Nature of sub-soil.	Character of drainage.	Remarks.
William Lyman ..	Lambton ...	Clay loam....	Clay	Tile drain	Lucerne 12 in. to 14 in. high, nearly blossomed, looks well, even on ground, and I am well satisfied with it.
A. Warnica.......	Simcoe	Clay loam ...	Clay	Middling.....	I have ¼ of an acre, and have cut it four times this season; it makes excellent summer feed for stock.
Wm. Chantler....	Simcoe	Clay loam....	Clay	Natural	Requires cleaner ground than I had; when 12 in. to 15 in. it was cut with weeds, and eaten by horses and cattle with avidity.
J. I. Graham.....	Grey	Clay loam....	Clay	Natural	I was surprised how quickly it commenced to grow after being cut.
Thos. Armstrong..	Muskoka...	Light gravel..	....	....	Grew 2 ft. 6 in. high, not cut.
Ed. Butterworth..	Victoria	Clay loam....	Gravelly....	....	I believe it will form a good substitute for red clover, and will yield more per acre.
A. Wiancko	Muskoka...	Loam	Clay	Good	My land does not seem to be fit for it.
Geo. E. Merkley..	Dundas	Sandy loam...	Clay loam..	Open ditch....	Has appearance of sweet clover.
E. G. McCallum..	Glengarry ..	Clay	Clay	Natural	Seeded with barley; considerable lucerne was in blossom when barley was cut; looked very well.
Peter Werry......	Durham....	Light loam...	Clay	Rolling land..	On June the 24th the plants were from 6 in. to 10 in. high.
John Stub........	Lanark.....	Clay loam....	Clay	Tile.....	Grew with a heavy crop of wheat, but lucerne did not make heavy growth.
W. J. Fletcher ...	Oxford	Sandy........	Sandy to gravelly.	Good natural..	Lucerne produces light crop first year; my neighbor sowed lucerne 5 years ago, and gets immense crops.

Average results of twelve experiments.

Crop.	Number of days required to germinate.			Height of plant in autumn.		
	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.
				in.	in.	in.
Lucerne	4	23	9.2	6	36	14.2

Lucerne seed was sown broadcast at the rate of 18 lb. per acre. In some instances a grain crop was grown with the lucerne, but in several cases no grain crop was used. The seed was bought from an Ontario seedsman.

Conclusions.

1. The remarks of the experimenters are quite encouraging regarding the growth of lucerne during the first summer after seeding.

2. Marked variations are noticeable in the behavior of lucerne upon the various farms in Ontario.

3. A large crop of lucerne cannot be expected during the first season after sowing.

V—TESTING SIX PROMISING VARIETIES OF CORN.

1. Measure off six plots, each one rod square.
2. Mark out each plot into five rows both ways, allowing in every case 3 feet 4 inches between each two consecutive rows.
3. Plant each variety of corn upon its respective plot. Drop six kernels at each of the places where the lines touch, and thus make twenty-five hills of each variety.
4. When the corn is about four inches high, thin out to four plants per hill.
5. Cultivate all the plots alike and take necessary notes during the summer for the report.
6. Cut each variety before frost, and at the time when its stage of growth corresponds to the roasting condition of field corn, or when the ears are in the glazed state.

Individual results of twenty experiments.

Experimenter.	County.	Date of seeding.	Nature of soil.	Cropping of 1891.	Weight of whole crop per plot.					
					Mammoth Southern Sweet.	Thoroughbred White Flint.	True Leaming.	Mammoth Cuban.	Wisconsin Earliest White Dent.	Compton's Early.
					lb.	lb.	lb.	lb.	lb.	lb.
Sleightholm Bros..	Peel	May 30.....	H'v'y cl'y lo'm	Meadow	$162\frac{1}{2}$	$164\frac{1}{2}$	122	97	137	110
Nelson Monteith..	Perth	June 10.....	Clay loam	Winter wheat.	250	225	150	225	200	125
J. W. Henry.....	Simcoe	May 18.....	Light loam....	Oats..........	285	220	225	230	172	160
W. A. Scott......	Parry Sound..	" 30.....	Sandy loam...	Potatoes......	200	200	185	175	200	150
Alexander Ritchie	Frontenac	June 1	Clay	Oats	164	131	117	126	117	60
W. G. Robertson..	Dundas.	May 19.....	do	Pasture.......	330	306	265	222	256	156
Phineas Hutchins.	Grenville.....	" 21....	Sandy loam ..	....	317	327	298	289	217	229
R. W. Hermon...	Prince Edw'rd	June 7......	Clay loam	Beans	360	292	220	239	167	125
Thos. B. Scott....	Middlesex	" 1......	do ...	Oats	188	232	188	232	208	96
Edmund Barrick..	Welland	May 18.....	Clay & humus.	Potatoes	280	300	260	160	188	100
William Merkley.	Dundas.	" 14.....	Gravelly loam.	do	142	175	248	120	217	152
Alex. Thom......	do	" 16.....	Sandy loam ..	do	280	283	240	265	223	144
G. W. Douglas...	Lambton......	" 31.....	Clay loam....	Millet.........	195	210	160	140	140	120
D. E. Bloomfield..	Brant	" 28.....	Sandy loam...	Meadow......	193	234	187	$138\frac{3}{4}$	139	128
Geo. E. Merkley..	Dundas.......	June 2......	do ...	Fodder corn..	250	258	222	220	182	171
H. S. McConnell..	Elgin.........	May 31......	do ...	Potatoes......	288	255	300	268	240	260
Walter Hartman..	Grey..........	" 30.....	Clay loam....	Alsike clover..	277	$302\frac{1}{2}$	262	$250\frac{1}{2}$	231	$192\frac{1}{2}$
Alfred Brown	Prince Edw'rd	" 28.....	Dark clay	Rape	302	193	$293\frac{4}{5}$	$237\frac{4}{5}$	$256\frac{3}{5}$	$153\frac{1}{5}$
Wm. Blake.......	Huron........	" 28.....	H'v'y cl'y lo'm	Oats..........	163	127	192	172	260	155
John Andrews....	do	" 31.....	Clay loam....	....	197	209	185	210	176	166

Average results of twenty experiments.

Varieties.	Average of 20 co-operative tests.		Experiment Station tests.	
	Weight of green ears per acre.	Total weight per acre.	Weight of green ears per acre.	Total weight per acre.
	tons.	tons.	tons.	tons.
Mammoth Southern Sweet	4.2	19.3	2.4	22.6
Thoroughbred White Flint	5.6	18.6	2.6	19.8
True Leaming	6.1	17.3	3.9	19.8
Mammoth Cuban	5.5	16.1	4.3	19.1
Wisconsin Earliest White Dent	5.8	15.7	4.7	17.8
Compton's Early	4.5	11.8	3.3	13.1

The Mammoth Southern Sweet, Thoroughbred White Flint and Compton's Early varieties of corn were purchased in Ontario; the True Leaming in Pennsylvania, the Mammoth Cuban in Nebraska, and the Wisconsin Earliest White Dent in Wisconsin. These varieties were chosen from among 76 kinds grown at the Station.

CONCLUSIONS.

1. No one variety of fodder corn is equally suitable for all parts of Ontario.
2. In yield per acre of green fodder the varieties occupy the same relative position in the average results of both the co-operative tests and the Station tests.
3. The greatest average of green ears was produced by the True Leaming in the co-operative tests, and by the Mammoth Cuban in the Station tests.
4. The Compton's Early and the Wisconsin Earliest White Dent were the first to reach maturity.

VI—TESTING FIVE PROMISING VARIETIES OF TURNIPS.

1. Five plots, each containing 272¼ square feet, are required for the experiment with turnips, or mangels or carrots.
2. Every two consecutive drills for the roots should be twenty-five inches apart.
3. Make all plots alike and arrange each plot according to one of the following plans: (*a*) Eight drills, 16 feet 4 inches long; or (*b*) four drills, 32 feet 8 inches long; or (*c*) two drills, 65 feet 4 inches long.
4. Sow the different varieties upon their respective plots.
5. Thin young plants in the rows to the following distances apart: Mangels and turnips, ten inches; carrots, four inches.
6. Be careful of the plants when cultivating and hoeing the ground.

Individual results of 13 experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of turnips per plot.				
					Red Globe Norfolk.	Hartley's Bronze Top.	Carter's Elephant.	Fettercairn Green Top.	Royal Norfolk.
				stable manure.	lb.	lb.	lb.	lb.	lb.
Alex. Morton	Huron	Clay loam	Oats	1892	572	436	500	480	324
W. Fotherington	Huron	Clay loam	Oats	1892	431	333	305	308	284
Allan Shantz	Waterloo	Garden loam	Winter wheat	1892	384	308	265	283	253
A. Wiancko	Muskoka	Clay	Roots	1892	245	420	415	386	409
W. J. McKnaughton	Glengarry	Black loam	Potatoes	1892	380	275	367	346	260
W. H. Caton	Welland	Clay loam	Potatoes	1892	215	62	84	75	105
W. J. Quinn	Muskoka	Loam	Potatoes	1892	143	169	93	167	172
W. H. Phillips	Hastings	Clay loam	Clover	1892	140	160	165	175	172
Benjamin Story	Prince Edward	Sandy loam	Turnips	1889-90	221	351	299	182	237
Enos Remner	Ontario	Clay soil	Clover	1891	361	320	310	300	280
Thos. Fagan	Simcoe	Good loam	Oats	1892	736	416	336	408	368
John Rumford	Huron	Clay loam	Native grass	....	285	290	300	250	350
E. Morden	Welland	Soft sandy	Corn	1892	300	280	286	242	200

Average results of 13 experiments.

Varieties.	Average of 13 co-operative tests. Yield per acre.	Experiment Station test. Yield per acre.
	bush.	bush.
Red Globe Norfolk	905.2	774.7
Hartley's Bronze Top	783.6	698.3
Carter's Elephant	764.1	578.7
Fettercairn Green Top	738.9	578.7
Royal Norfolk Purple Top	699.7	600.7

The Red Globe Norfolk is a white-fleshed fall variety, and the other four are Swede turnips. Seed of each of these kinds was obtained from Ontario, with the exception of that of the Carter's Elephant, which was imported from England.

Conclusions.

1. The fall turnips gave a greater yield per acre than any of the Swede varieties, in the average results of the co-operative experiments and in the test at the Experiment Station.

2. The Carter's Elephant Purple Top Swede, which gave the highest average yield over Ontario in 1891, stands third in point of yield for 1892.

3. The average yield, from five varieties of turnips, grown in thirteen different parts of Ontario, was 738 bushels per acre.

VII—Testing Five Promising Varieties of Mangels.

Instructions.—Same as those given for turnips.

Individual results of 10 experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of mangels per plot.				
					Our Selected Mammoth Long Red.	Carter's Champion Yellow Intermediate.	White Sugar Beet.	Carter's Warden Orange Globe.	Red Globe.
					lb.	lb.	lb.	lb.	lb.
E. Worthington	Leeds	Gravelly l'm	Roots	1881 f. y. m.	625	612	442	445	451
A. Wiancko	Muskoka	Clay	Roots	1892	480	415	405	355	476
G. S. Hull	Middlesex	Clay loam	Potatoes	f. y. m.	1095	907	539	391	378
John Rendall	Grey	Sandy loam.	Potatoes	1892 f. y. m.	318	489	350	358	279
James Cruickshank.	Kent	Sandy	Potatoes	1892 f. y. m.	388	327	249	209	206
W. A. Graham	Lambton	Clay loam	Peas and oats.	1891 f. y. m.	572	156	364	260	182
R. H. Smithrim	Middlesex	Clay loam	Mangels	1892 f. y. m.	232	225	152	167	223
W. Fotherington	Huron	Clay loam	Oats	1892	222	200	166	246	172
Geo. H. Ferguson	Grey	Clay loam	Potatoes	1892	285	270	275	245	260
Simpson Rennie	York	Clay loam	Peas, barley and oats	1892 night soil	487	478	432	370	372

Average results of 10 experiments.

Varieties.	Average of 10 co-operative tests. Yield per acre.	Experiment Station test. Yield per acre.
	bush.	bush.
Our Selected Mammoth Long Red......	1069.6	906.
Carter's Champion Yellow Intermediate	939.9	998.0
Vilmorin's Improved White Sugar Beet	828.9	542.7
Carter's Warden Orange Globe.........	786.3	697.0
Red Globe..........................	776.6	581.0

The seed for this experiment was all purchased in Ontario. The variety of Sugar Beet is one used for the purpose of stock feeding.

Conclusions.

1. The Steele Bros.' Mammoth Long Red mangel gave the highest yield of roots per plot in eight of the co-operative experiments, out of the ten conducted in Ontario.

2. The Sugar Beet occupied an intermediate position between the Long varieties and the Globe varieties of mangels.

3. The Sugar Beet gave an excellent average yield over Ontario during 1892.

VIII—TESTING FIVE PROMISING VARIETIES OF CARROTS.

Instructions—Same as those given for Turnips.

Individual results of 15 Experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of carrots per plot. Improved Short White.	Large White Vosges.	Large Belgian.	Carter's Orange.	Mitchell's Perfected.
					lb.	lb.	lb.	lb.	lb.
Simpson Rennie........	York	Clay loam....	Barley	1891, night soil	509	460	397	345	326
G. S. Hull	Middlesex..	"	Wheat	1892, f. y. m..	434	434	411	359	369
R. H. Smithrim........	" ..	"	Mangels ...	1892, " ..	239	174	179	175	189
Robert Currie..........	Lambton ..	"	Potatoes ...	1891-2, " ..	350	215	280	330	355
John D. Scott..........	Durham....	Sandy loam ..	Garden.....	1892, " ..	177	199	186	173	177
Wm. E. Armstrong	Muskoka ..	Heavy loam ..	Turnips	1891, " ..	128	182	120	390	112
John Dalton...........	Simcoe.....	Rich clay loam	Onions	1891, ..	372	343	314	202	267
Robert King	Kent	Sandy soil....	Roots	Salt..........	214	210	216	217	214
Thomas Watson	Haldimand .	Sandy loam ..	Raspberries.	None..........	271	192	256	203	200
Geo. E. Merkley	Dundas	" ..	Fodder corn	1892, f. y. m..	248	284	228	204	208
John Randall	Grey	" ..	Potatoes ...	1892, " ..	285	308	221	142	227
A. Wiancko	Muskoka ..	Hard clay....	Roots	1892, " ..	155	105	121	97	110
Wm. McGarry	Lanark	Gravelly loam	Peas	1891, " ..	270	540	290	270	240
R. J. Moon............	Simcoe.....	Sandy loam ..	Potatoes ...	1891..........	437	351	365	338	248
T. H. Carroll..........	Wellington .	....	....	....	194	115	131	95	120

Abbreviation—f. y. m., farm yard manure.

Average results of 15 Experiments.

Varieties.	Average of 15 co-operative tests—yield per acre.	Experiment Station test—yield per acre.
	(bush.)	(bush.)
Improved Short White....	761.4	1265.0
Large White Vosges....	731.0	1130.0
Large Belgian....	660.4	1073.3
Carter's Orange....	629.2	840.0
Mitchell's Perfected....	597.9	840.0

The seed of all the varieties of carrots was obtained in Canada.

CONCLUSIONS.

1. The Improved Short White carrot took the lead in point of yield in 50 per cent. of the co-operative experiments during 1892.

2. The average weight per root of the Improved Short White in the co-operative tests was .93 lb., and in the Station test it was .98 lb.

3. The two varieties of carrots which were the easiest to remove from the ground at the time of harvesting were the Improved Short White and the Large White Vosges.

4. The white varieties of carrots all gave larger yields than the yellow-fleshed kinds.

5. The comparative yields of the different varieties were substantially the same in both the co-operative and the Station tests.

IX—TESTING SIX PROMISING VARIETIES OF SPRING WHEAT.

(1) Select a portion of uniform soil and mark off six plots, each one rod square. Allow a path two feet wide between each two consecutive plots.

(2) Drive stakes at the four corners of each plot.

(3) Sow the different varieties upon their respective plots. It is an advantage to run a strong cord around each plot and sow inside the line.

(4) After the grain is up three or four inches, again run the cord around the plots and cut off any plants that happen to be outside the line.

Average results of 35 experiments.

Varieties.	Average of 35 co-operative tests.		Experiment Station test.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	Tons.	Bushels.	Tons.	Bushels.
Red Fern....	1.8	19.6	2.2	27.8
Manitoulin....	1.6	19.0	1.3	26.8
Herison Bearded....	1.7	18.3	2.0	24.0
Pringle's Champion....	1.7	18.3	2.1	23.7
Rio Grande....	1.7	18.2	1.8	20.5
Holben's Improved....	1.6	17.8	2.0	22.6

The seed of the Herison Bearded variety was originally imported by the Ontario Experiment Station from France in 1888, that of the Pringle's Champion and Holben'

Improved from Germany in the same year, and that of the Red Fern, Manitoulin and Rio Grande was obtained in Ontario.

Individual results of 35 experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of spring wheat per plot (lb.)					
					Red Fern.	Manitoulin.	Herison Bearded.	Pringle's Champion.	Rio Grande.	Holben's Improved.
George Bennett..	Simcoe.....	Sandy loam.....	Potatoes......	1892, .ashes.	8	7	6	6	5	6
Thos. B. Moon..	Simcoe.....	Clay loam......	Pasture	....	8	6	5½	5¼	7	7
M. G. Easton....	Renfrew....	Sandy loam.....	Potatoes......	New land...	9	9	8½	8½	8½	8
Thomas Fagan...	Simcoe.....	Good loam......	Hay..........	'87, f. y. m..	5½	5	4¼	4	6	6
W. Hartman....	Grey.	Clay loam......	Peas..........	No manure.	5¾	5¾	6¼	4½	6	5¾
Jas. W. Young..	Wentworth.	Black loam.....	Beans.........	....	5	3	2½	3	3	2¼
Wesley Stevens .	York.	Heavy clay.....	Barley......	'90, f. y. m..	7	5	6½	6¾	7¼	7
J. J. Campbell..	Glengarry .	Clay and gravel.	Corn.........	'91, f. y. m..	9	14	8	7	4	6
G. E. Petepiece..	Carleton....	Heavy clay marl	Potatoes......	'91, f. y. m..	6½	9	3	6	4½	6½
D.McNaughton..	Bruce	Clay loam.....	Winter wheat	'87, B're f'low	6¼	6¼	8	6½	7½	7
James Holmes...	Grey.......	Clay loam......	Roots	'91, f. y. m..	9	7	7	8	7½	7
David Rogers....	Frontenac..	Light clay loam.	Potatoes,......	'91, f. y. m..	12	8	14	10	10	12
Thos. Graham...	Ontario.....	Clay loam......	Potatoes......	'91	10	8	11	11	12	9
E.G. McCallum..	Glengarry.	Clay...........	Corn fodder..	'82, f. y. m..	10	8	9	9½	9¼	8¾
James Collison...	Dundas.....	Gravelly loam.	Wheat	'91, f. y. m..	40	37	40	39	45	35
L. V. Burnham..	Lambton....	Sandy loam.....	Corn.........	'92, f. y. m..	10½	11	13½	14	11	10
W. A. Jemison..	Simcoe.. ...	Clay loam......	Winter wheat	'85..........	5½	7¼	5½	5	4	5½
P. S. McGarry ..	Lanark.....	Clay loam......	Oats..........	Never mn'd	3¾	3¾	2½	3¼	3	3½
J. A. Swan......	....	....	....	....	4	4 3/16	2½	3 3/16	3 11/16	3 1/16
Samuel Brown...	Parry Sound	Sandy loam.....	Oats..........	Never......	1½	3½	3	2½	3	4
Jos. Martineau ..	Prescott....	Clay loam	Barley........	'90, f. y. m..	4	4½	4¾	4¾	4	4½
O. A. Lawrence..	Halton......	Heavy clay.....	Peas..........	....	2⅞	3 5/16	3¾	2½	3½	3¼
Jos. M. Rogers..	Grey........	Clay loam......	Roots....	'92, t. y. m..	2 11/32	6⅛	7 3/16	4½	6⅝	6¼
James Capstick..	Victoria	Clay loam......	Turnips	'82, f. y. m..	5	4⅛	1 11/16	3½	4	3 3/16
D.P. L. Campbell	Glengarry ..	Loam	Corn.........	'91...	4¾	5½	9	8	4½	8
Wm.McDonald..	Algoma	Clay loam......	Oats	'91, f. y. m..	4	3½	2½	3	3½	3½
Jno. Henderson..	Hastings....	Clay loam......	Oats..........	Past're 20 yrs	5	8	6	5	5½	5½
W. McKenzie....	Perth	Clay loam......	Mangels	'91	4	3	6	3	5	3
Jno. McAsh	Huron......	Limestone clay.	Potatoes......	'91	4¾	4¾	3¼	3¼	3	4¾
W. T. Gale......	Nipissing...	Black clay......	Peas..........	....	6	6	3¼	10	5	2¼
A. A. Moody....	Wellington..	Clay. loam	Carrots.... ..	....	6	5	3½	3	2	4
James Wilkinson	Dufferin....	Clay loam......	Wheat'.......	'90, f. y. m..	8	6	6	6	7	6
Angus Ross......	Ontario.....	Heavy clay.....	Roots....	f. y. m..	6½	5½	5½	6	4½	4½
James Johnston.	Muskoka...	Clay loam... ..	Peas.........	'90, f. y. m..	10	9½	6	7½	7	8½
James Johnston.	Dufferin....	Clay loam.....	Wheat	'91, f. y. m..	8	7	6	6	8	6

Conclusions.

1 The variety of spring wheat which came first in point of yield of grain in the greatest number of experiments was the Red Fern, and the variety which came second was the Herison Bearded.

2 The Red Fern gave the largest average yield of both grain and straw in the co-operative experiments and also in the Station test.

3 The first varieties to reach maturity were the Herison Bearded and the Pringle's Champion, and the last to reach maturity were the Holben's Improved and Rio Grande.

4 The longest straw was produced by the Rio Grande, and the shortest by the Herison Bearded.

5 The strongest straw was produced by the Manitoulin and the Holben's Improved, and the weakest straw by the Herison Bearded and Rio Grande.

6 With but one exception the comparative yields of grain of the different varieties were the same in both the co-operative tests and the Station experiment.

X—TESTING SIX PROMISING VARIETIES OF BARLEY.

Instructions.—Same as those given for Spring Wheat.

Individual results of 5 experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of barley per plot (lb)					
					Mandscheuri.	Oderbrucker.	Common Six-rowed.	Hallett's Pedigree.	Improved Cheyne.	French Chevalier.
Hugh Caldwell..	Peterboro'..	Light loam.....	Buckwheat...	'91, f. y. m.	11	10	8	8	7	7
W. H. Metcalf..	Brant	Sandy soil.	Potatoes......	'91..........	15	10	10	12	12	11½
E. G. McCallum.	Glengarry ..	Clay	Corn	....	13	14¾	12	9¾	9¾	10¾
Robert Banden..	Elgin.......	Black loam.....	Potatoes......	Never......	12	5	6	4	4	2
Wm. Wilkinson.	Dufferin....	Clay loam.....	Wheat.	'89, f. y. m.	10	9	10	8	8	8

Average results of 5 experiments.

Varieties.	Average of 5 co-operative tests.		Experiment Station test.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	Tons.	Bushels.	Tons.	Bushels.
Mandscheuri..............	1.7	40.7	1.6	53.3
Oderbrucker..............	1.2	32.5	1.3	42.2
Common Six-rowed.........	1.3	30.7	1.2	42.8
Hallett's Pedigree..........	1.2	27.8	1.6	39.8
Improved Cheyne..........	1.3	27.2	2.1	50.3
French Chevalier..........	1.3	26.2	2.0	51.7

With the exception of the Common Ontario Six-rowed, these varieties were all imported by the Ontario Experiment Station in the spring of 1889. The Mandscheuri came from Russia; the Oderbrucker and Hallett's Pedigree from Germany; the Improved Cheyne from England, and the Chevalier from France.

Conclusions.

1 The Mandscheuri variety of barley gave an average yield of 10 bushels per acre more than the Common Ontario Six-rowed in the co-operative tests, and 11.5 bushels per acre more in the experiment at the Station.

2 The Mandscheuri variety of barley gave the greatest yield per plot in nearly every instance.

3 The three six-rowed varieties gave greater yields of grain per acre than the three two-rowed varieties in the co-operative tests.

4 The six-rowed varieties of barley all reached maturity at an earlier date than the two-rowed varieties.

5 The longest straw was produced by the Mandscheuri, and the shortest straw by the Chevalier.

6 The strongest straw was produced by the Mandscheuri, and the weakest by the Oderbrucker.

XI.—TESTING SIX PROMISING VARIETIES OF OATS.

Instructions same as those given for Spring Wheat.

Individual results of one hundred and twenty-five experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yields of oats per plot (lb.) Siberian.	Bavarian.	Joanette	Oder-brucker.	Poland White.	White Tartarian.
W. G. Wilson	Grey	Gravel loam	Peas	Never	14	14½	12¾	13½	12¾	13½
Thos. Teasdale	Norfolk	Sandy loam.	Sod	'91, h. m.	16	15½	14	14½	15	13
Rymal Young	Wentworth	Black loam.	Beans	....	10	12	10	10	12	9½
Wilby Scott	Simcoe.	Clay	Wntr. wheat	s. m.	11	10	9	9	10	9
G. M. Freeman	York	Clay loam	Beans	'91, s. m.	15 11/16	16	11⅓	14	13 13/16	12½
Valentine Foerster	Huron	Clay loam	Corn	'89, s. m.	12¼	14	13¼	12½	13¼	13
E. G. McCallum	Glengarry	Clay	Corn.	....	14¾	15½	12	15¼	12¾	13¼
R. H. Smithrim	Middlesex	Clay loam	Wntr. wheat	'92, s. m.	11½	11	8	14	12½	10½
Edgar M. Husband	Middlesex	....	....	....	5¾	4	3	5	5¼	6
John Anderson	Huron	Clay loam	Oats	'91, s. m.	11	9½	14	9	7	10
J. H. Esplen	Bruce	Clay loam	Corn.	'91, s. m.	14	14	13	14	13	12
Thos. E. Hays	Huron	Clay loam	Peas	....	13	14½	15	15½	14	13½
David Gilmour	Grey.	Clay loam	Potatoes.	....	12	6⅝	12½	6	8	10 3/16
Joseph G. Decker	Elgin	Clay loam	Turnips	'90, s. m.	13¼	12	14½	12	14½	9
John Jackson	Lincoln	Clay loam	Mangels	'90, s. m.	9½	9½	8	9½	8½	11
Erland Lee	Wentworth	Clay loam	Oats	....	8	11	7	9½	9¼	11½
David Crich	Monck	Sandy loam.	Pasture	....	5¼	4¼	10	8	8¼	6¼
Thos. Yegge	York	Clay loam	Turnips	'91, s. m.	15	16	13	15	15	15
David Madden	Bruce	Clay loam	Peas	'84, s. m.	18½	14½	21½	16½	21	17
G. S. Hull	Middlesex	Sandy loam.	Wheat.	....	25	24	27	28½	22	24
James Henderson	Hastings	Clay loam	Potatoes	'91, s. m.	15½	16	17	16	17	18
Philip Corbett	Grey.	Sandy loam.	Potatoes	'91, s. m.	15	17	12	11	11	16½
Henry Warren	Middlesex	Clay loam	Hay	Never	11½	10	10	11	11	9½
George Millar	Haldimand.	Black loam.	Potatoes	'92, s. m.	11½	11¾	11	11½	11½	10½
John Henry	Algoma	Red clay	Peas	Never	14	13	11	18	8	12
D. Larmour	Dundas	Black loam.	Oats.	'90, s. m.	10	10	11	9	9	8
J. H. Garbutt	Peterboro'	Clay loam	Oats.	'91, s. m.	9	9	10	12½	9	7½
Samuel Murphy	Elgin	Sandy loam.	Rye	'90, s. m.	8½	12½	11	10½	8¾	11
J. K. Campbell	Grey.	Sandy loam.	Peas	'92, s. m.	4	4	4½	3½	6½	4½
Patrick McAlpin	Hastings.	Clay loam	Oats	Pasture	5	3 9/16	3⅝	3 1/16	3 1/16	3½
J. H. Montgomery	Essex	Heavy clay.	Potatoes	None	1¼	2⅜	2⅞	2½	1½	2 3/16
C. R. Stevenson	Elgin	Clay loam	Pasture	Never	3¾	4¾	3½	4⅛	4	3½
Wm. Thurston	Victoria	Sandy	Buckwheat	Never	6⅛	6 9/16	8 11/16	5 3/16	6¼	7¾
Robert Gardiner, Jr	Huron	Clay loam	Hay	....	9½	10	8	9	9	10
Thos. N. Hipwell	Simcoe.	Clay loam	Wntr. wheat	'92	12	15	14	10	13	13
Chas. Silverthorn	York	Clay loam	Hay.	'92, s. m.	15	14½	13	12	13	12½
John McBride	Dufferin	Sandy loam.	Spring wh't	'87, s. m.	20	20	18	19	17	21
Angus L. Brie	Simcoe	Clay loam	Bare fallow.	'91	19	7½	13	10	12	15
J. H. McCorkindale	Grey	Sandy loam.	Barley.	'90	16	12	13½	14	11½	9½
Neil S. Murray	Oxford.	Clay loam	Turnips	'91	11	15	8½	11	16	13
Wm. Ferguson	St. Joseph I'd.	Light	Sod	None	9	10	7	11	10	12
Alex. S. McDiarmid	Elgin	Clay loam	Wheat	'90, s. m.	9	10½	10½	8½	10½	8
Wm. Frishette	Norfolk	Clay loam	Wheat	'91, s. m.	7	8	9¾	7½	8	5¼
James Tesky	Addington	Aluv. clay.	Oats, 12 yrs.	Never	3½	3½	½	3¾	6	3
T. C. Stark	....	Clay	Spring wh't	3 yrs. s. f.	7½	5	10	3¼	5	6
F. W. Lowin	Nipissing	Light gravel	Potatoes.	Never	7	9	7	5	6	7
Alex. McInnis	Essex	Sandy loam.	Corn	'88, s. m.	6	5	7¼	7	7	5½
A. D. Gillis	Kent	Loam	Oats.	'89.	7½	9	5½	8	8	9
W. A. Johnston	Dufferin	Clay loam	Potatoes	'91	12	10	13	11	12	11
Jas. W. Fisher	Norfolk	Sandy loam.	Garden	'92, hen m	14	19	14½	10⅓	13	14
John Dalgarno	Grey.	Clay loam	Oats	Never	19	17	16	17	16	20
Malcolm Cameron	Grey.	Clay loam	Potatoes	'91, s. m.	26	13½	19	10	15	14½
James Smith	Grey.	Gravel loam	Turnips	'91, s. m.	20	23	17	15	24	20
Martin Emigh	Oxford	Clay loam	Corn	'91, s. m.	20	18½	25	16	17½	12
J. N. Kernighan	Huron	Sandy loam.	Pasture	Never	12½	10	13½	14½	14	19¼
Robert Russel	Bruce	Clay loam	Fallow	Never	10	9½	4½	4	13½	11½
Michael McQuade	Huron	Clay	Oats	Never	12	12	13	12	12	14
Alex. Mitchel	Wentworth	Clay	Potatoes	'91.	14	19	13	11	14	14
Gordon Young	Huron	....	Clover	'92, s. m.	11	13	12	13	10	10
James Alexander	Halton.	Black loam.	Wheat	Never	10	9½	7½	7	6	8
Donald Fleming	Grey.	Sandy loam.	Potatoes	'91, s. m.	15½	14½	9½	12½	10¾	11¼

Contraction: s. m.—stable manure.

Individual results of one hundred and twenty-five experiments.—*Continued.*

Experimenters.	County.	Nature of soil.	Cropping of 1891.	How and when last manured.	Yield of oats per plot. (lb.) Siberian.	Bavarian.	Joannette	Oder-brucker.	Poland White.	White Tartarian.
V. Emanuel	Middlesex	Gravel loam	Oats	'89, s. m.	15	13½	13	15½	12	13
N. C. Brown	Elgin	Sandy loam.	Corn	'91, s. m.	13	11	12	12½	10	11½
Alfred Smith	Brant	Sandy loam.	Mangels	Ashes	13	14	13½	14	14½	16
A. T. Brown	Huron	Rich c. loam	Wntr. wheat	....	13½	12¼	12½	12½	12¾	8½
John Hall	Grey	Black loam.	Peas	Never	16¼	16	15⅝	14½	16½	15½
David Noble	Bruce	Clay loam	Turnips	'91, s. m.	16½	14	13	15½	13	15
Dawson Kennedy	Peterboro'	Clay loam	Wheat	....	15	15½	14¾	16	17	10½
D. Hurley	Peterboro'	Loam	Barley	'90	12	13	9	5	5½	6
John Hunter	Lambton	Clay	Wntr. wheat	....	14	13	13	14	15	12½
T. C. Stark	Frontenac	Black muck.	Mangels	'90, s. m.	7	10	14	13	11	9
Francis McDonald	Bruce	Clay loam	Peas	'86	12½	11	13½	11¼	13	14
Wm. J. Roger	Perth	Clay loam	Potatoes	'91, h. m.	13	12	11	11½	12½	11
John D. McKay	Kent	Clay loam	Oats	Never	11	11	9	10	10	11
John Watson	Ontario	Loam	Wheat	'88, f.y.m.	12	11½	13½	10½	12	10
Wesley Buskin	Grey	Light clay	Wheat	'88, f.y.m.	11	12	11	8	11	10
James Young	Algoma	Clay loam	One crop	'91, f.y.m.	9½	9	6	8	8½	6½
Alex. S. Weir	Muskoka	Light loam.	Mangels	'92, f.y.m.	8	5	9	9	6	9
J. G. McKay	Bruce	Clay loam	Spring wh't	'89, f.y.m.	8¾	10¼	10	8½	8½	7¼
Alfred Ray	Muskoka	Light c. loam	Oats	'90, f.y.m.	7	6½	5½	11	6½	11
Chas. Bard	Muskoka	Clay loam	Flax	'89	7⅛	7⅞	6½	7 1/32	5 7/32	6 1/16
Nicholas DeHart	Simcoe	Light clay	Potatoes	'91	6¾	8 9/16	6½	8⅞	7½	6⅜
David Kiernan	Dufferin	Clay loam	Barley	'90	10	7½	9	12½	12	11
John Harcourt	Lincoln	Black loam.	Pasture, 8 y's	....	10	10 9/16	10 15/16	5 3/16	9	8⅝
Wm. Howe	Bruce	Clay loam	Barley	'84, f.y.m.	8 7/16	9 1/16	7½	7⅛	8⅛	7¾
Amos Picard	Perth	Clay loam	Hay	'88, f.y.m.	7	8	7½	9½	7	8
James Bell	Lanark	Clay	Oats	Never	7	5½	5½	7½	6½	8
M. Munroe	Glengarry	B. loam	Oats	....	9	8	7	8	9	10
Bernard Kelly	Simcoe	Clay	Peas	'90	15½	17	16	16¼	18	17½
Conrad R. Gies	Waterloo	Clay loam.	Wntr. wheat	'90, f.y.m.	16	12⅞	17	16¾	14½	13¾
John Brydone	Perth	Clay loam	Roots	'91, f.y.m.	17	25	18	22	18½	16½
John H. Westwick	Parry Sound	Sandy loam.	Carrots	'92, Guano	19	10	9¾	14	16	12½
John Richardson	Dufferin	....	....	....	17	15	17½	16	16½	14
Duncan Graham	Perth	Clay loam	Peas	'88	25½	20½	20½	28½	27	23½
R. E. Main	Grey	Clay loam	Wheat	New land	29	23½	19½	22	17	22
Thos. Graham	Ontario	Clay loam	Potatoes	'91	32	23½	19	29	25	39
Richard Stutt	....	Clay loam	Turnips	None	37	36	37	35	40	33
James H. Newlove	Peel	Clay loam	Wntr. wheat	'90, f.y.m.	19¾	23	21½	22½	19¼	21
J. W. Springsted	Wentworth	Heavy clay.	Oats	'85, fallow	12	10	10½	10½	7½	8½
Samuel Brown	Parry Sound	Sandy loam.	Oats	None	7½	6	5	5	7	7
Arthur Ribble	Elgin	Clay	Potatoes	'92, f.y.m.	5	6	5	6	4¾	5½
Benj. Mannen	Brant	Clay	Meadow	'88, f.y.m.	8	5	10	11	6	5
Edward Butterworth	Victoria	Clay loam	Potatoes	f.y.m	7	5	7	8	6	8
Edward Prout, Jr	Durham	Sandy loam.	Turnips	'91, f.y.m.	3	3¾	5	3½	8	3½
B. W. Harrington	Hastings	Gravel loam	Weeds	New land	2 5/16	4¼	3⅛	6¼	2⅛	4¼
Elmer Lick	Oshawa	Clay loam	Hay	....	8¾	9	9¾	10½	8	8¾
Thos. Fagan	Simcoe	Light loam.	Wheat	'86, f.y.m.	12½	12	9¾	14	10	10½
Wm. Rowand	Bruce	Clay loam	Spring wh't	'91, f.y.m.	12 7/16	12½	10 9/16	8¾	12¼	16¼
Jas. Murison	Elgin	Blk. s. loam	Potatoes	'91, f.y.m.	15½	15½	12½	11½	12½	10
Jno. McKowen	Parry Sound	Clay loam	Oats	'92.	10	14	12	9	10½	8
Alf. Brown	Prince Edward	Sandy loam.	Sweet Peas.	'90, f.y.m.	15¾	23¼	8⅞	9 7/16	9	13½
Alex. Morton	Huron	Sandy loam.	Roots	'91, f.y.m.	12	13	13	15	13	13
Robert Bandeen	Elgin	Black loam.	Mangels	Never	11	11	11	8	12	9
Michael King	Dundas	Light c. loam	Oats	'92, f.y.m	9	9	11½	9½	8	8½
Robt. Currie	Lambton	Clay loam	Barley	'90, f.y.m.	11	12	12	8	12½	10
Joseph Smith	Simcoe	Clay	....	'90, fallow	9½	10	9¼	7	9¼	10½
James Haylon	Oxford	Rich clay	Oats	'91, f.y.m.	9	6	8½	6½	4	5
W. J. Sproul	Dufferin	Clay	Pasture	'88, f.y.m.	11	10½	15½	14	9	12
Richard Delbridge	Huron	Clay	Turnips	'91, f.y.m.	12	10	15	13½	12	15½
Hugh Davidson	Algoma	Sandy loam.	New land	None	16½	18	10	10	10	10
Chas. A. Young	Algoma	Clay loam	Oats	Never	14	18	9	10¼	16¾	16¼
Edward W. Young	Bruce	Clay loam	Peas	'91, f.y.m.	17	16	16	13½	11½	14½
Robert Anglin	Frontenac	Clay loam	Peas	Sod	9½	11	8½	8½	8	11½
H. Brown	Huron	Clay loam	Roots	'91, f.y.m.	17	15	19½	16	13	12
Geo. W. Maxwell	Peel	Sandy loam.	Peas	'88, f.y.m.	38	34	41	35	30	25

Average results of 125 experiments.

Varieties.	Average of 125 co-operative tests.		Experiment Station test.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	tons.	bush.	tons.	bush.
Siberian	1.7	58.84	2.6	75.6
Bavarian	1.9	57.34	2.9	70.8
Joanette	1.7	55.31	2.8	76.5
Oderbrucker	1.8	54.76	2.8	82.4
Poland White	1.9	54.50	2.4	68.8
White Tartarian	2.0	54.21	2.6	61.0

The Siberian and the White Tartarian were imported from Russia, the Bavarian and Oderbrucker from Germany, and the Joannette and Poland White from France. With the exception of the Bavarian, the varieties were all imported by the Ontario Experiment Station in the spring of 1889. The Bavarian was brought into New York State some years ago, and from there into Western Ontario.

Conclusions.

1. In the average of 125 experiments there was only a difference of 4.63 bush. of grain per acre between the lowest and the highest yielders.

2. The Joanette, which comes third in the co-operative experiments, stands second in the Station test for 1892.

3. The longest straw was produced by the White Tartarian, and the shortest straw by the Joanette and the Oderbrucker.

XII—TESTING PROMISING VARIETIES OF WINTER WHEAT.

1. Select a portion of uniform soil and mark off five plots, each one rod square. Allow a path three feet wide between each two consecutive plots.
2. Drive stakes at the four corners of each plot.
3. Sow the different varieties upon their respective plots. It is an advantage to run a strong cord around each plot and sow inside the line.
4. After the grain is up three or four inches, again run the cord around each plot and cut off any plants that happen to be outside the line.

Average results of 39 Experiments.

Varieties.	Number of experiments.	Average of 59 co-operative tests. Grain per acre.	Experiment Station test. Grain per acre.
		bush.	bush.
Canadian Velvet Chaff	26	26.2	45.3
American Bronze		28.5	52.5
Canadian Velvet Chaff	33	27.0	45.3
Jones' Winter Fyfe		30.9	47.1

Thirty-seven varieties of winter wheat were sent out in the autumn of 1891. These were divided into ten different sets. The Canadian Velvet Chaff was included in all these, the American Bronze in one half, and the Jones' Winter Fyfe in the other half of the sets. The three varieties which were used extensively in the tests show results which are interesting and valuable.

Individual results of 39 Experiments.

Experimenter.	County.	Nature of soil.	Cropping of 1891	Yield of winter wheat per plot, (lb).	
				American Bronze.	Canadian Velvet Chaff.
Joseph Bell	Simcoe	Clay loam		12	$11\frac{1}{2}$
Robert Warwick	Huron	"	Peas	14	10
Jno. F. Brown	York	"	Alsike clover	10	8
Richard Warren	Lanark	"	Peas	7	$7\frac{1}{2}$
Thomas Ruddell	Wellington	"	"	9	$8\frac{1}{2}$
R. V. Phillips	York	"	Potatoes	$9\frac{5}{16}$	$7\frac{3}{4}$
John Milroy	York	"	Peas	11	9
Charles Krooter	Huron	"	Barley	14	13
H. A. Walker	Durham	Clay	Bare fallow	18	22
Wm. Inkster	Bruce	Strong clay	Peas	19	$22\frac{1}{2}$
E. G. Hacker	Elgin	Clay loam	Oats	$11\frac{5}{8}$	$7\frac{1}{8}$
Wm. McDonald	Simcoe	"	Pasture	11	12
Thomas Chalmers	Wellington	Light loam	Bare fallow	$9\frac{1}{2}$	11
Frank Shuh	Waterloo	Sandy loam		$7\frac{7}{8}$	6
Thomas Smith	Simcoe	"	Hay	4	$3\frac{1}{2}$
Wm. Purdon, jr.	Lanark	Clay	Never cropped	7	3
W. F. Davidson	Peel	"	Barley	$7\frac{1}{2}$	$3\frac{1}{2}$
Wm. McGregor	Halton	Sandy soil	Oats	8	8
Elisha Barber	Norfolk	Clay loam	Potatoes	$9\frac{1}{32}$	$4\frac{7}{8}$
B. Henderson	Bruce	Clay	Oats	8	7
George Baird, sr.	Huron	Clay loam	Bare fallow	8	$8\frac{1}{4}$
Donald Jack	Perth	Clay	"	8	9
Jno. Atton	Bruce	Clay loam	Pasture	7	9
W. O. Jones	Huron	Clay	Oats	8	9
Jno. Phillips	Huron	Sandy clay	Bare fallow	18	16
T. A. Walker	Wentworth	Sandy soil	"	22	18
				Jones' Winter Fyfe.	
Ernest Morgan	Middlesex	Clay loam	Oats	15	13
Robert Cussins	Ontario	Clay	Barley	16	14
Mark Crawforth	Ontario	Strong clay	"	15	13
Thomas Dryden	Bruce	Clay loam	Pasture	12	11
Jacob Travis	York	"	Peas	$12\frac{1}{3}$	$11\frac{3}{8}$
Wm. Cumberland	Simcoe	"	Bare fallow	12	$10\frac{1}{2}$
Albert W. Bishop	Oxford	"	Corn	$9\frac{5}{16}$	$10\frac{5}{16}$
Robert Wilson	Bruce	Sandy soil	Oats	$6\frac{1}{4}$	$4\frac{3}{8}$
W. H. Caton	Welland	Clay loam	Bare fallow	$3\frac{1}{4}$	$4\frac{7}{16}$
Jas. Stitt	Norfolk	Sandy loam	Potatoes	$6\frac{5}{8}$	$6\frac{1}{2}$
John Riddle	Northum'land	Clay	Meadow	$5\frac{1}{2}$	7
G. S. McTaggart	Hastings	Sandy loam	Hay	8	6
John Bent			Peas	11	8
Joseph Tuck	Welllington	Loam	"	11	10
Wm. Beatson	York	Clay loam	Oats	$8\frac{1}{2}$	$8\frac{1}{2}$
Aaron Keffer		Sandy loam	..	9	$8\frac{1}{2}$
Robert Camplin	Grey	Clay loam	Winter wheat	$12\frac{1}{16}$	12
Henry McKinney	Wellington	Gravel	Potatoes	$15\frac{1}{2}$	$19\frac{1}{2}$
Thos. L. Leslie	Peel	Black loam	Oats	15	$15\frac{1}{2}$
David Carstairs	Northum'land	Clay loam	Bare fallow	14	13
Jacob Longhead	Grey	"	Peas	$25\frac{1}{2}$	17
Orlando Reid	Oxford	"	Wheat	14	12
Hugh Lamont	Huron	Sandy loam	Peas	$10\frac{1}{2}$	8
John Turnbull	Perth	Clay loam	Corn	8	7
Richard Reynolds	York	Rich clay loam	Bare fallow	8	10
Wm. Mowbray	Lambton	Good clay	Bare fallow	$10\frac{1}{2}$	10
A. J. Turner	Bruce	Clay loam	Pasture	$12\frac{1}{2}$	$9\frac{1}{4}$
N. Drummond	Simcoe	Black clay loam	Potatoes	8	5
Benj. Sheriff	Bruce	Clay loam	Peas	11	9
David Gorman	Lambton	"	Oats	12	3
Benj. Parker	Lambton	"	Oats	14	10
Matthew Crawford	Ontario	Clay	Barley	15	13
Purdom Wilson	Peel	"	Mixed grain	16	15

Conclusions.

1. Both the American Bronze and the Jones' Winter Fyfe gave higher yields per acre than the Canadian Velvet Chaff in the co-operative tests, and also upon the experimental plots at the Station.

2. The American Bronze gave a greater yield of grain than the Canadian Velvet Chaff in sixteen out of twenty-six co-operative experiments.

3. The Jones' Winter Fyfe gave a greater yield of grain than the Canadian Velvet Chaff in twenty-six out of thirty-three co-operative experiments.

4. The Early Red Clawson, Lancaster, Red Velvet Chaff, Hybrid Mediterranean, Garfield and Golden Cross made the best average yields among the other varieties tested.

A somewhat lengthy discussion took place regarding the relative merits of the different kinds of fertilizers, corn, roots and grain, also regarding the great value of the experimental work of the Union to the farmers of Ontario.

RECENT PROGRESS IN AMERICAN HORTICULTURE.

The following paper was read by Prof. L. H. Bailey, Professor of Horticulture, Cornell University Experiment Station:

You have asked me to say something about recent progress in horticulture. I am at a loss to know how you want the subject treated. The subject is a large one and can be approached in many ways. It is by no means admitted that there is any recent progress. There is a large class of our horticultural public which disparages these modern times as in no way so good as those of several or many years ago. These men are mostly gardeners who were apprenticed in their youth. There is another class which decries the introduction of new varieties of plants, thinking these novelties to be unreliable and deceitful. There are others who are content with the older things and who have never had occasion to ask if there has been any progress in recent years. Others have looked for progress, but have not found it. A professor of horticulture told me a few days ago that nothing new nor interesting seems to be transpiring in the horticultural world. Some people even deny outright that any progress is making at the present time. On the other hand, there are some, perhaps the minority, who contend that they see great advancement. Perhaps these are mostly young men. Then there are the catalogues with their fascinating impossibilities, pregnant with the glory that is to come. Between all these diversities, where is the young man to stand who loves plants and sunshine and is yet ambitious? Is there any progress in horticulture? If not, it is dead, uninspiring. We cannot live on the past, good as it is; we must draw our inspiration from the future. This subject is of vital personal interest to me; it must be so to you.

I cannot forego the satisfaction of saying at the outset, that some of this supposed stagnation must be due to blindness on the part of the observer. The apprenticed gardener underwent in his youth the stupendous misfortune of having learned the art and science of horticulture. The apprentice system, in itself, does not often educate a man; that is, it does not make him a student. It teaches him to base the whole art upon rule, personal experience and "authority;" it is apt to make him a narrow man, and he may not readily assimilate novel methods. Those who have looked for progress and have not found it, may have looked in the wrong place. It is possible that they do not understand very clearly just what progress is. Those who are simply indifferent exert little influence upon our inquiry and may be omitted. Those who see progress upon all sides may be over-sanguine. Perhaps they project something of their own passion into their statements, and the catalogues, being for the most part editorial rather than horticultural productions, may be liberally discounted as evidence. It is apparent, therefore, that we must make independent inquiry if we are to answer our own question. Several considerations incline me to believe that progress is not only making, but that it is making very rapidly. And I may say here that I care little for any facts or illustrations of progress merely as facts. There must be some law, some tendency, some profound movement underlying it all, and this we must discover. I shall not attempt, therefore, to indicate how great the progress has been in any definite time, but endeavor to ascertain if there is progression which gains impetus with the years.

1. *There is a progressive variation in plants.* Horticulture is the science of cultivation of plants. The plant is the beginning and the end. For the plant we till the soil, build greenhouses, and transact the business of the garden. All progress, therefore, rests upon the possibility of securing better varieties, those possessing greater intrinsic merit in themselves or better adaptations to certain purposes or regions. In other words, all progress rests upon the fact that evolution is still operative, that garden plants, like wild animals and plants, are more or less constantly undergoing modification. American horticulture may be said to have begun with the opening of the century. It was in 1806 that Bernard McMahon wrote his *American Gardener's Calendar.* This work contains a catalogue of 3,700 "species and varieties of the most valuable and curious plants hitherto discovered." Among the cultivated varieties of fruits and vegetables, the present reader will see few familiar names. He will observe among the fruits, however, some American types, showing that even at that date American pomology had begun to diverge from the English and French which gave it birth. This is especially true of the apples, for of the 59 kinds in the catalogue about 66 per cent. are of American origin. Several nurseries were established in the next thirty years and fresh importations of European varieties were made, so that when Downing, in 1845 described the 190 apples known to be growing in this country, American varieties had fallen to 52 per cent. In 1872, however, when almost 2,000 varieties were described in Downing's second edition, the American kinds had risen to 65 or more per cent, or to about the proportion which they occupied at the opening of the century. At the present time, the per cent. of varieties of American origin is much higher, and if we omit from our calculations the obsolete varieties, we find that over 80 per cent. of the apples actually cultvated in the older apple regions at the present time are of American origin. The percentage of native varieties, in other words, has risen from nothing to 80 per cent. since the apple settlement of the country, and at least once during this time the native productions have recovered from an overwhelming onslaught of foreigners. Except in the cold north and north-west where the apple industry is now experiencing an immigration not unlike that which befell the older states early in the century; few people would think of importing varieties of apples with the expectation that they would prove to be a commercial success in America. Other plants have shown most astounding development. In 1889, 39 varieties of chrysanthemums were introduced in North America; in 1890, 57 varieties; and in 1891, 121 varieties. The chrysanthemum is now the princess of flowers, yet in 1806 McMahon barely mentioned it, and there were no named varieties. All this is evidence of the greatest and most substantial progress, and much of it is recent; and there is every reason to believe that this rapid adaptation of plants to new conditions is still in progress in all cultivated species. In fact, the initial and conspicuous stage of such adaptation is just now taking place in the Russian apples in America, in which the American seedlings are even now gaining a greater prominence than some of their parents. Both the parent stock and the seedling brood are radical and progressive departures of recent date. The same modification to suit American environments is seen in every plant which has been cultivated here for a score or more of years. The mulberries are striking examples, for our fruit-bearing varieties are not only different from those of Europe, whence they came, bnt many of them belong to a species which in Europe is not esteemed for fruit.

The European varieties of almonds are now being superseded in California by native seedlings which are said to be much better adapted to our Pacific climate than their recent progenitors. These facts of rapid adaption are everywhere so patent upon reflection that I need not consider them further at this time. They are indisputable evidence that there is permanent contemporaneous progress, and upon them alone I am willing to rest my whole argument.

There is another feature of this contemporaneous variation which must be considered at this point,—the great increase in numbers of varieties. This increase is in part simply an accumulation of the varities of many years, so that our manuals are apt to contain descriptions of more varieties than are actually cultivated at the time. But much of this increase is an actual multiplication of varieties. That is, there are more varieties of all plants in cultivation now than at any previous time. McMahon mentions six beets as grown at his time; in 1889, there were 42 kinds. Then there were 14 cabbages; now there are over 100. Then there were 16 lettuces against 120 now. He mentions 59 apples; now there are about 2,500 described in this country. He mentions 40 pears, against 1,000 now. There were over 450 species of plants native to the United States mentioned by McMahon; now there are over 2,000 in cultivation. These figures are average examples of the marvellous increase in varieties during the century. I may be met here with the technical objection that McMahon did not make a complete catalogue of the plants of his time. This may be true, but it was meant to be practically complete, and it is much the fullest of any early list. Gardening occupied such a limited area a century ago that it could not have been a burdensome task to collect very nearly all the varieties in existence; and any ommissions are undoubtedly much over-balanced by the shortcomings of the contemporaneous figures which I have given you. It is certainly true that during the nineteenth century varieties of all the leading species of cultivated plants have multiplied in this country from 200 to 1,000 per cent. This variation still continues, and the sum of novelties of any year probably exceeds that of the preceding year. Every generation sees, for the the most part, a new type of plants.

But I suppose that these statements, as to the increase of varieties, will be accepted without further proof. The question which you all desire to ask me is whether all this increase represents progress. Many poor varieties have been introduced, beyond a doubt, but I am convinced that the general tendency is decidedly progressive. You may cite to me the fact that we have not improved upon the Rode Island Greening and Fall Pippin apples, the Montmorenci cherry, the Green Gage plum, and other varieties which were in cultivation at the opening of the century, as proof of a contrary conviction; but I shall answer that we now have a score of apples as good as the Greening, although we may have none better. This habit of saying we have not improved upon certain old plants is really a fallacy, for the reference is always made to quality of fruit alone; and furthermore the test of progress is not the supplanting of a good variety, but the orgination of varieties which shall met new demands. The more numerous and diverse the varieties of any plant, the more successful will be its cultivation over a wide area, because the greatest number of different conditions—as soils, climates, the uses—will be satisfactorily met. If we had at present only the apples which were grown in McMahon's time, apple culture in the prairie States, in our bleak North-west and even in some of the apple sections of Ontario, would be impossible. We are constantly extending the borders of the cultivation of all fruits by means of these new varieties. The horticultural settlement of our great west and of the cold north is one of the wonders of the time. We should not ask ourselves of a new variety if it is better in all respects than other varieties, but if it will fill some specific need more satisfactorily. If a variety does better than all other varieties, in one locality alone, for one specific purpose, it is not a failure, and it represents progress. Every peculiar or isolated region tends to develop a horticulture of its own, but this is possible only with a corresponding initial variation in plants.

No doubt many of our discarded varieties failed to find the place or conditions in which they would have succeeded. We should not look upon adverse reports upon the novelties as necessarily denunciatory; they may only indicate that in some places or for some purposes the variety in question is unsatisfactory.

I must also call your attention to the fact that while the areas of cultivation have greatly widened in recent years because of the evolution of adapted varieties, the economic uses of the plants have increased in like ratio. We now have varieties of fruits which are specially adapted to the making of dried fruit, to canning, to enduring long journeys, and the like; and flowers which meet specific demands in decoration or other uses. The period of maturation of varieties has extended greatly in both directions, so that fruits and flowers are now in season much longer than formerly. The gist of the whole matter is simply this, that our horticultural limits and products have greatly broadened in very recent times by reason of great increase in number and diversity of varieties; and this leads us to expect that still other wants will be met in like manner, and that the uttermost habitable parts of the country will develop a special horticulture.

2. *There is a constant augmentation in new specific types of plants, both from our native flora and by importations from without.* I suppose that there is no parallel to the marvellous evolution of native fruits in America. Within a century we have procured the grapes, cranberries, the most popular gooseberries, some of the mulberries, the raspberries and blackberries, the pecans and some of the chestnuts from our wild species. Perhaps the strawberries can be traced to the same source. There are many men still living who remember when there was no commercial cultivation of these fruits. Here is progress enough for one century; yet an overwhelming host of new types is coming upon us. I sometimes think that the improved native plants are coming forward so rapidly that we do not properly appreciate them. Witness the perplexing horde of native plums, the varieties even now reaching nearly 200, which are destined to occupy a much larger area of North America than the European plum now occupies. New species of grapes are now coming into cultivation. The dewberries, juneberry, Crandall currant type, buffalo berry, wild apples, and more than a score of lesser worthies, are now spreading into our gardens. Many of these things will be among the staples a hundred years to come. One hundred and eighty-five species of native plants, some for fruit but mostly for ornament, wese introduced into commerce last year; and the number of plants native to North America north of Mexico, which have come into cultivation is 2,416. Under the stimulus of new conditions some of the species will vary into hundreds, perhaps thousands of new forms, and our horticulture will become the richest in the world. It is a privilege to live when great movements are conceived and new agencies first lend themselves to the dominion of man.

Many species have come to us from many parts of the world throughout the century, but the immigration still continues and perhaps is greater now than at any previous time. It is well-nigh impossible to chronicle the new types of ornamental plants which have come to America during the last two decades. Consider the overwhelming introduction of species of orchids, alone. Even the wholly new types of fruits are many. Over twenty-five species of edible plants have come to America comparatively recently from Japan alone, and some of these species are already very important. Two of them, the Japanese persimmons and the Japanese plums, are most signal additions, probably exceeding in value any other introductions of species not heretofore in the country, made during the last quarter century. During the years, 1880, 1890 and 1891, some 380 species of plants not in commercial cultivation here were introduced in North America, partly from abroad and partly from our own flora. In the year 1891 alone, 219 distinct species were introduced.

Valuable as these new types are in themselves, all experience teaches that we are to expect better things from their cultivated and variable progeny. We can, therefore, scarcely conceive what riches the future will bring.

3. *There is great progress in methods of caring for plants.* The manner of cultivating and caring for plants has changed much during recent years. It is doubtful if all this change represents actual progress in methods, but it indicates inquiry and growth, and it must eventually bring us to the ideal treatment of plants. Some of the change is simply a see-saw from one method to another according as our knowledge seems to point more strongly in one direction than another. In one decade we may think lime to be an indispensible fertilizer, and in the next it may be discarded; yet we may eventually find that both positions are untenable. Yet there has been a decided uplift in methods of simple tillage and preparation of land and the science of fertilizing the soil; and moreover, the application of this knowledge is widespread where it was once local or rare; and the application of machinery and mechanical devices to almost every horticultural labor cannot have escaped the attention of the most careless observer.

Among specific horticultural industries, the recent evolution of the glass house has been remarkable. In 1806, the greenhouse was still a place in which to keep plants green, and McMahon felt obliged to disapprove of living rooms over it to keep the roof from freezing, because they are "not only an additional and unecessary expense, but they give the building a heavy appearance." The first American greenhouse, with a wooden roof and heavy sides, was built in 1764. Glass houses increased in numbers very slowly until the middle of this century, and they can only now be said to be popular. Twenty years ago a glass house was a luxury or an enterprise suited only to large concerns, and the management of it was to most intelligent people an impenetrable mystery. At the present time, even the humblest gardener, if he is thrifty, can afford a greenhouse. In fact, the glass house is rapidly coming to be an indispensible adjunct to nearly all kinds of progressive gardening. The secret of this increasing popularity of the glass house is the simplicity of construction of the modern building. Large glass, low straight roofs, light frames, simple foundations, small wrought-iron pipes, portable automatic heaters—these are the innovations which have given the greenhouse a greater popularity and practicability in America than anywhere else in the world. Yet many of these features would have been heresies when Leuchars wrote his excellent book in 1850.

The simplification and popularization of the glass house has simplified the management of plants in them. Even laymen are now taking to greenhouse plant-growing and many of them achieve most gratifying results. The first days of the commercial forcing of plants are still within the memory of many in this audience; and it is only within the present decade that great attention has been given to this country in the forcing of tomatoes, cucumbers, carnations, and many other plants. The business is yet in its infancy. The greenhouse has also exerted a marked influence upon the plants which are grown in them. There has now appeared a list of varieties of various plants which are especially adapted to the purposes of forcing; and this phenomenon is probably the most important and cogent known proof of contemporaneous evolution.

If one were asked off-hand what is the most conspicious recent advancement in horticulture, he would undoubtedly cite the advent of the sprays for destroying insects and fungi. These are not only eminently effective, but they were perfected at a time when dismay had overtaken very many of our horticulturists, and they have inspired new hope everywhere, and have stimulated the planting of fruit and ornamentals. I fancy that the future historian will find that the advent of the spray in the latter part of this century marked an important epoch in agricultural pursuits. Yet this epoch is not disconnected from the era before it. It is but a natural outcome or consequence of the rapid increase of insect and fungus enemies, which increase, in turn, is induced by the many disturbing influences of cultivation itself. When we devise effective means of ckecking the incursions of our foes, therefore, we are only keeping pace with the initial progress fostered by the origination of new varieties and the quickening commercial life of our time. Yet the area of spraying is none the less a mark of great achievment, and we have not yet seen the good of which it will ultimately prove to be capable. But a greater achievement than this must be made before we shall have reached the ideal and inevitable method of combatting external pests: We must learn to so control natural agencies that one will counteract another. Nature keeps all her forces and agencies in comparative equilibrium by putting one against another in the remorseless struggle for existence. The introduction of insect parasites and predaceans, entomogenous fungi, colonization of insectivorous birds, and the use of strategy in cultivation and in the selection of immune species and varieties, and the planning of rotations and companionships of plants, will eventually be so skillfully managed that most of our enemies will be kept under measurable control. A short rotation is now known to be the best means of combatting wire-worms and several other pests. The first great success in this direction in America is the introduction of the Australian vedalia, or lady-bug, to devour the most pestiferous of the orange tree scales on the Pacific coast. This experiment is pregnant of greater and more abiding results than all the achievements of the sprays. But in your generation and mine, men must shoulder their squirt guns as our ancestors shouldered their muskets, and see only the promise of the time when they shall be beaten into pruning hooks, and plowshares and there shall come the place of a silent warfare.

4. *There is great progress in the methods of handling and preserving horticultural products.* I need not tell the older men in this audience that there has been progress in methods of handling fruits. When they were boys, apples and even peaches were taken to market loose in a wagon-box. We have all seen the development of the special package industry, beginning first with rough bushel baskets or rude crates, then a better made and smaller package which was to be returned to the consigner, and finally the trim and

tasty gift packages of the present day. I am sorry to say that some regions have not yet reached this latter stage of development, but their failure to do so only makes the contrast stronger of those who have reached it. Quick transportation and methods of refrigeration have tied the ends of the earth together. Apples in quantity are carried 14,000 miles from Tasmania to England, and in 1890 they reached the San Francisco markets to compete with the fruits of the Pacific coast. From a small beginning in 1845, the exportation of American apples to England and Scotland began to assume commercial importance from 1875 to 1880, until nearly a million and a half barrels have been exported in a single season. It is said that the first bananas were brought to the United States in 1804, and the first full cargo in 1830. Now from eight to ten million bunches arrive annually. The Canary Islands are now shipping tomatoes to London, and the United States will soon be doing the same. Watermelons will follow. California now unloads her green produce in the same market. Even pears are exported from America to Belgium, disputing the old saw that it is unwise to carry coals to Newcastle. The world is our market. This result may have been achieved with some detriment to home markets and transportation, which have been in some measure overlooked and neglected; but this evil must correct itself in the long run.

Perhaps we owe to a Frenchman the first distinct exposition, some eighty years ago, of the process of preserving perishable articles in hermetically sealed cans; but the process first gained prominence in the United States, and it became known as canning. In 1825, James Monroe signed patents to Thomas Kensett and Ezra Daggett to cover an improvement in the art of preserving, although Kensett appears to have practiced his method somewhat extensively as early as 1819. Isaac Winslow, of Maine, is supposed to have been the pioneer in canning sweet corn, in 1842. About 1847 the canning industry began to attract general attention, and in that year the tomato was first canned. The exodus to California in 1849 stimulated the industry by creating a demand for unperishable eatables in compact compass. North America now leads the world in the extent, variety and excellence of its canned products, and much of the material is the products of orchards and gardens. In 1891, the sweet corn pack of the United States and Canada was 2,799,453 24-can cases, and the tomato pack was 3,405,365 cases. Over 20,000 canning factories give employment, it is said, to about one million persons during the canning season. The rise of the evaporated fruit industry is not less remarkable in its way than that of the canning industry.

There are other marvels of progress in methods of caring for horticultural products, but these examples sufficiently illustrate my position. I am aware that all these things are features of commerce and manufacture rather than of horticulture, but they are responsible for much of the phenomenal extension of horticultural interests in recent years. They have also exerted a powerful influence upon the plants which we cultivate, and varieties have appeared which are particularly adapted to long carriage and to canning and evaporating. The vegetable kingdom is everywhere responsive to the needs of man.

5. *There is a corresponding evolution in the horticulturist.* The rapidity with which education and general intelligence have spread in recent years is patent to everyone. The rural classes have risen with the rest, but among the agricultural pursuits horticulture has probably shown the greatest advance in this respect. The horticulturist grows a great variety of products, many of which are perishable, and all of which demand expedition, neatness and care in marketing. And these many and various crops bring in a multitude of perplexities which not only demand a ready knowledge for their control, but which are important educators in themselves. The horticulturist lives nearer the markets and the villages than the general farmer; as a rule, and he is more in touch with the world. Downing rejoiced in 1852 that there were "at least a dozen societies in different parts of the union devoted to the improvement of gardening, and to the dissemination of information on the subject." Since that time a dozen national horticultural societies, of various kinds, have come into prosperous existence, and there are over fifty societies representing states, provinces or important geographical districts, while the number of minor societies runs into the hundreds. Over fifty states, territories and provinces have established agricultural schools and experiment stations, all supported by

popular sentiment. The derision of "book farming" is well nigh forgotten. Subjects which a few years ago were thought to be "theoretical" and irrelevant, are now matters of common conversation. In short, a new type of man is coming on the farms. This uplift in the common understanding of the science of cultivation, and of the methods of crossing and of skillful selection, is exerting a powerful accelerating influence upon the variation of cultivated plants. But the most important and abiding evolution is that of the man himself; and I expect that the rising intellectual status will ultimately lead people to the farm rather than away from it. We are just now living in a time of conspicious artificialism; but the farm must be tilled and it must be inviting. When agriculture cannot pay, something is wrong with the times.

These, then, are the chief lines of progress in horticulture, and they are still operative and capable of indefinite growth. The achievement of a generation has been phenomenal. The prospect is inspiring to both the cultivator and the student.

Prof. James: We have frequently seen the statement that the process of canning is much older than is generally supposed, and that the hint came from some of the old cities—that it was suggested from some discoveries from Pompeii. Is that so? I think it would be exceedingly interesting if Prof. Bailey would give us some information as to what he has been contributing in his own work to this horticultural development. Our schools take up the development of almost everything else except that of agriculture, and it is very refreshing indeed when our attention is turned to this line.

Prof. Bailey: In regard to the canning industry, the statement has been made that the canned products which were found in the old cities have been the starting point of the evolution of canning in recent years. This was gone over pretty carefully by a writer some three or four years ago, and he concludes that it is not true, from the fact that the cans of the Romans were not unearthed, or at least not generally known, until after the initial progress of canning had taken place in France. In 1810 the French Government found some method of preserving vegetables. So far as we know this was the starting point of our modern develepment. But it is essentially an American institution. In regard to the historical development of agriculture, I may say that I am not discouraged because the agricultural schools have a comparatively small attendance. In our institution, of about 1,700 students, we have at present only 50 or 60 in agriculture. It seems certainly a very small proportion; but of course there are certain valid reasons why we have so few. We must remember the fact that the evolution of education everywhere shows that whenever anything new has been set on foot it has gained progress exceedingly slowly during its youth. If you were to look up the history of mechanical education, you would find that that had this same difficulty in the first—that there was this long period of incubation during which there was very little progress. The incubation was not so long as in agriculture however. In the first place, the farmer, of all other people, has been the one who has been conservative; and I think the conservatism of the farmers of the United States, at least, is the one salvation of our nation. They are the ones who move slowly, who take new ideas not upon trust but on experience; and when they do grasp them they grasp them with fervor. When the farmer does wake up to the fact that agricultural education is essential then he will have it at almost any sacrifice. For myself, I am not discouraged that we have so few students; I am rather encouraged to think that we have any at all. When we consider the fact that a large part of the educational development of our country has not been in the direction of the farming community, but in the direction of the professions and manufacture, it seems to me that it is a wonder that we have even so many in the Agricultural Colleges as we have. It is not so much a matter of love for the farm which draws the young men to the College as it is the uncertainty as to whether they can make money off the farm. Just so soon as we show them that money can be made, so soon do we expect our farmers' sons to go to College. In New York State we have a different class of young man than in some States. In Michigan, the farmers' boys who came were nearly all those who expected to earn a farm when they got through the institution. In New York State, where we have a good deal of inherited wealth, we have some who are not to be the actual farmers themselves, but who are to be the owners and managers of land. Some of them do not come with the idea that they shall be made into farmers, but with the expectation that they shall be educated.

Mr. Hutt: What are you doing in the line of experimenting?

Prof. Bailey: The experiment stations of the United States are endowed by an annual appropriation of $15,000 from Washington; it was a part of the provision by law that this $15,000 should go to every State that desired to have it; and where there were in existence two agricultural colleges in the one State, or an agricultural college and an experiment station, the Legislature decides to which of these the grant shall go. In New York this annual grant goes to Cornell. This national grant we think is a great advantage, because we are not dependent upon the votes of the people of the State in which we live for support. Thus we can lay out such experiments as we wish, as the influence of electric light upon plant growth, which, perhaps, for a series of ten or a dozen years may not give any distinct results, but which may be profitable in the end. The Agricultural College was founded with Cornell University in the sixties. Thus we have the two organizations at the present time—the Agricultural College as part of Cornell University, and we have connected with this the Agricultural Experiment Station. Now, since the Agricultural Experiment Station came, we have reorganised our College of Agriculture, so that it is composed of two parts, College and Experiment Station. Therefore we are bound by the very terms of our existence to do both teaching and experimenting. In some States these two features are kept entirely separate, and different men employed in each department, but in our institution the same men carry on both. I have an assistant to do the teaching for me, and an Experiment Station foreman to carry on the experiments; and this is the way with all the departments. The College of Agriculture, while it is a distinct institution, is also a part of the University at large, and some of the instruction is given by the general University. It is required that all the agricultural students have political economy and mathematics, and some of the University professors instruct agricultural students in these branches. Some of my teaching has to do with the evolution of plants, and some of the students come over to me from the University proper for specific instruction in those things relating to natural history. The experiment station itself came late in the life of the University. Our land is very rolling and very varied in character of soil. We have no place on the whole 25 acres devoted to horticulture as large as 50x60 feet which is continuous in slope or soil.

As our long vacation comes in the summer time, and when the teachers are away, and as we have a considerable glass space and student help, we carry on various kinds of experiments during the winter season. This matter of cultivation of vegetables under glass is after all an important matter. This experiment with the electric light is the largest that has ever been carried on. We find that it commercially pays to grow lettuce by electric light. We find that some plants will grow and some will not under its influence. Lettuce will grow very rapidly, while a radish plant in the same position will not grow so rapidly. Some parts of the electric light are more useful to some plants than to others. We have one electric light which is surrounded by a globe which has different colored glass on different sides, and this is put in the centre of a room and the plants are grown around it, and we are trying to find out what part of the electric light exerts the greatest benefit upon plants. Under the orange light the plants are growing very well, but under the blue light they are not doing well.

Prof. Panton: I am sure we have all listened with interest to what Prof. Bailey has said, and the practical part is probably along the line in which Prof. Bailey is distinguishing himself more than in any other. What have you done along the line of hybridizing—along what lines have you been the most successful?

Prof. Bailey: I might say first that I have seen conservatories in all parts of the world, but I never saw one that pleased me as much as that at this Station. The character of those begonias and other flowers captivated me this morning. In regard to hybridizing, you understand of course that I am yet too young to say anything about it. All that we think we learn one year is sometimes unlearned the next year. In 1886 I began some experiments with squashes. I succeeded in getting a most remarkable squash—a good deal larger and better in every way than the ones from which it came ; but if I were to tell you how many kinds I got from the seeds of this the next year it would surprise you. I planted every individual seed of that squash, which made a whole field of nearly two acres, and every blessed plant was different—I counted 110 distinct kinds from the seed of the one squash and several intermediate kinds which I could not group. Nearly all my endeavors during the past two or three years have tended more to the evolution of myself than the plants with which I have worked. We have, however, made some distinct progress ; and I suppose if there is any one thing in which we have obtained more striking results than in any other it is the hybridizing of corn. The plant which we know as Indian corn is supposed to be the only plant of its genus, and as hybridization refers properly to crossing between two distinct species of plants, therefore there can be no such thing as hybridizing in corn. In 1888 a man in Mexico found a new type of corn which he thought was the aboriginal form of Indian corn. This plant was sent to Harvard, and two or three seeds of it were sent to me. The seeds which I had did not grow, and the people at Harvard had little better success. Two or three of the seeds, however, were saved over, and it was grown again at Harvard and at Cornell. The plant was studied by the late Sereno Watson, who called it *Zea Canina*, or dog-tooth corn. The important feature of this species is that the ears branch—a single central stock from this will grow various arms, one above the other, which may be five or six in number, and each arm will produce four or five ears. Of course, these ears are very small, not larger than the ordinary pop-corn. We had difficulty in maturing ours. Last year my attempts to hybridize this corn with sweet corn produced one kernel of corn ; this we called the $100 kernel of corn ! We got fourteen kernels in hybridizing with another corn which comes from Japan. This Japanese corn has a very peculiar appearance, the leaves being striped with white. We got a cross between this wild corn and the Japanese corn. This has given us remarkable results. Our corn this year averaged from 20 to 35 ears for every seed. The fact that these long arms have been shortened so that they hang in clusters, like a brace of fish, is very important. One of our plants produced 35 different ears from one seed, and we have matured about 20 ears from one seed. If this were given to the world, people would send to us for kernels of the corn, and perhaps next year there would not be any such thing. You get a certain thing this year that appears to be very remarkable, and the next year it may revert or disappear. We are to plant a large area of this corn next year, and we shall attempt to pick out those stocks which have held their characteristics most steadily, and upon some of these plants we shall practice cross-pollenization. We also have carried on experiments between cabbages, and kales, and cauliflowers, etc.. We now have one house in which we have these crosses between cauliflowers and cabbages growing. So far as I know, a cross between a cabbage and a turnip would not take. Cauliflowers form a thick head, a thickened flower cluster, and the cabbage is the solid lapping in of leaves. The crosses are neither cabbages nor cauliflowers, but the peculiar thing is that they all wish at first to be cabbages, but they break early into flower. The probability is that the results will be nothing valuable so far as cabbages and cauliflowers are concerned. We have succeeded in getting some most remarkable turnip crosses. I may say that the real value of crossing lies not so much in the novelties which we get as in the fact that it infuses fresh vigor into the progeny. In every case the best plants which we have come from crosses. For instance, we have taken two lots of geraniums, and the seedlings which came from these varieties are better than from either parent.

A Member : What success have you had with cucumbers ?

Prof. Bailey : The cucumbers which we grow are the long English varieties. Our ordinary field cucumbers will not grow very well under glass during the winter. The peculiar point is that they will sometimes grow without any seeds or pollen. By withholding pollen from them you can frequently grow them nearly solid and entirely seedless. In the greenhouse, however, we find that some plants refuse to bear fruit unless the pollen is applied to some extent. You know that the influence of pollen upon a fruit is two-fold ; first, it fertilises the ovules or seeds and causes the fruit to grow larger ;

and secondly, it stimulates the development of the fruit or pericarp. In the house we have to pollenate our plants artificially, because there are no insects or winds to do it.

Prof. JAMES: What line do you think would be the most profitable for the young men to carry out on their farms in connection with this Union in horticultural lines?

Prof. BAILEY: I should imagine that in your series of investigations a profitable one would be to go into a good co-operative test of varieties ot different fruits. In your case you have your experimenters spread over the province. I must say that I have been astonished at the work done by this Union.

Prof. MILLS: What is your opinion in regard to the effect of the change of temperature during the twenty-four hours in our greenhouses? Say the temperature is 65° in the day and 40° to 45° at night, are the plants injured by that change, or should they be kept about the same temperature all the time?

Prof. BAILEY: That depends entirely upon the character of the plants. There are no plants that ought to have the same temperature during the day and night. In tomatoes and cucumbers, which require a warm temperature, we find that such change is a decided advantage. In the day time we keep the temperature not lower than 70°, and at night not below 60°. I prefer some change. I suppose that in ordinary conservatories a difference of 20° would not make much difference.

Prof. MILLS: How do you apply bottom heat?

Prof. BAILEY: By running the pipes or returns back underneath the benches. For some plants, as lettuce and radishes, I prefer no bottom heat, but tomatoes and cucumbers demand it.

Mr. WELD: Can you raise tomatoes with profit in winter?

Prof. BAILEY: Yes, but it is more profitable to grow something between them. It depends entirely of course upon the market. If we can sell them for 40c. per lb. during the winter it is profitable in New York, but if you cannot it is not.

WHAT CAN BE DONE TO IMPROVE THE SOCIAL OONDITION OF THE FARMING COMMUNITY.

By D. BUCHANAN, B.S.A., TORONTO.

There are at present many barriers in the way which retard progress in the development of the social side of the agriculturist's character, and the lack of opportunity for this development has greatly hindered the progress of agriculture by causing many of the best sons of the farm to seek some other way of earning a livelihood which affords an opportunity for social development. The first barrier to be removed in clearing the way for social advancement amongst agriculturists is hard times. It is useless to talk of social training for people who require to work fifteen hours a day to make ends meet. When agriculturists become prosperous they are then in a position to make social advancement. The condition of the markets and the way in which they are regulated materially affects the farmer's prosperity. Another important factor in bringing about prosperity is the universal adoption of the more modern and advanced methods of farming. The farmer in Eastern Canada should as a rule market his produce in the form of meat, cheese, butter eggs etc.; he must part with it a finished product as far as possible and at seasons when the market is best; he must have a thorough knowledge of all branches of work which he undertakes so that he may not lose in one department what he makes in another; he must be a shrewd business man, and requires to keep abreast of the times. The facilities which will aid him in becoming thoroughly master of his business are numerous. There are first our agricultural colleges, and it to be regretted that any young man will start out to make farming his life work without, if at all possible, having taken a course at a first-class agricultural institution. Again, there are our agricultural journals, the usefulness of which is far from being fully appreciated; there are our agricultural exhibitions, our experimental stations, our farmers' institutes, and many other sources through which the farmer may obtain information which will enable him to become master of his profession.

After all this, however, there is still something wanting. Supposing that the farmer is possessed of all the qualifications mentioned above he is yet in the same position as was Adam before Eve was created—he wants a helpmate—not a housekeeper, not a female labor-performing machine, but a helpmate. Owing to their present condition the female portion of the agricultural community requires attention. While there is a percentage of thoroughly intelligent young women, that is, intelligent along the lines which it is appropriate that farmers' daughters should be, to be found on the farm, the rank and file of farmers' daughters might be divided into two classses. First, those who, on account of the monotonous drudgery and secludedness of farm life, have taken to some other line of of work, and, second, those who monotonously plod away on the farm doing work that was never calculated for women's hands and with no scientific knowledge of the work they are performing. The work of the female agriculturist then must be made less laborious, and she must become more intelligent in and more thoroughly mistress of the branches of work which properly come under her supervision, before we have that degree of prosperity amongst agriculturists that is desirable. The idea of young ladies attending dairy schools in this country is talked of by some with a degree of ridicule, yet in Great Britain young ladies are attending dairy institutions, becoming thoroughly mistresses of dairying, and filling positions as instructresses in such institutions. The women might superintend the dairy, but should not be asked to turn the churn crank; they may attend the poultry, but should not be required to clean the poultry house; they should be thorough all-round horticulturists, but using the spade is no job for them. I believe that before many years regular courses of instruction for ladies will be established at our agricultural colleges, which will be greatly appreciated by the fair sex. I am also of the opinion that before five years there will be more ladies than gentlemen taking the special dairy course. When farmers, male and female, have become more prosperous, which implies that they have become intelligent, then considerable progress has been made in their social development.

We must remember, however, in considering this question that social training which is not subservient to intellectual training is usually of little value. In endeavoring to advance socially then let us as a community base our training upon intellectual development. It is impossible under any circumstances for farmers to mix with each other to the same extent that town people may; yet it is possible for them to mingle much more than they at present do, and doubtless to a sufficient extent to give the social bump at least a normal development. Nevertheless the farmer must be a lover of books; he requires to become intimate with science, and by reading he may associate with the leading spirits of this and former ages. An intelligent agriculturist will commune with nature and enjoy her company. We see then the paramount importance of intellectual development in considering the question of social training. Considerations of a different nature which affect this question are the improvement of our public highways and the beautifying of our homes. Why should so many farm houses stand bleak and desolate in the centre of the farms, and why should they not be surrounded by beautifying trees and shrubs? No people have natural advantages for being supplied with tennis courts, etc., as have the agriculturists, and no people are more deserving of the same. The last particular worthy of mention, which is probably one of the most directly effectual, is the universal establishment and active use of mechanics' institutes, farmers' clubs, debating societies, reading circles, etc.

These propositions may appear to some as though they would be difficult to carry out, in fact all the reforms mentioned above look as though they would require many years to work themselves out and bring about with other things the needed social reform, yet we all feel that the agricultural world is at present becoming on fire, and that we are entering upon an era when the progress made in agriculture will far surpass the record of any former period, so that the next quarter of a century may see changes that as yet have never even been thought of.

POULTRY AS A BRANCH OF CANADIAN FARMING.

By Geo. Nicol, Cataraqui, Ont.

The practice of breeding domestic fowls must have been commenced at a very early date, and wherever the art of farming has been introduced do we in some way find associated with it the breeding of various kinds of poultry. Yet it seems by far the greater majority of farmers keep fowls chiefly because of the satisfaction they afford by furnishing supplies of excellent food for home consumption. Comparatively few have studied poultry and raising as a special branch of husbandry. It has now become quite evident that we, the farmers of Ontario, have not fully availed ourselves of the benefits which might be derived from this important branch of agricultural industry.

The annual poultry product of France is estimated at $60,000,000, some $12,000,000 worth of which is exported to England.

The United States poultry products exceed in value the entire cotton, corn, wheat, or hay crops, and is estimated at $300,000,000 annually. Yet, notwithstanding the high tariff, that country imports from Canada a large quantity of poultry and eggs as can be learned from reliable statistics.

In some of our markets at the present time good beef is being sold by the carcass as low as four cents per pound, while poultry of almost all kinds sells readily at from eight to ten cents per pound.

Stale eggs are not, and cannot be worth much at any market, but I know of some farmers who have no difficulty in contracting for supply of fresh eggs at 30 cents per doz.

Two million dozen eggs were imported from Canada last year into the British markets; we have not heard the results, which must have depended very much on the temperature of storage. But one thing we do know is, the market for good fresh eggs is practically unlimited. Thus it will ever be. The profits of the poultry business will depend very much on management. Eggs and slaughtered fowls can be kept in cold storage for almost any length of time, but if kept in a temperature much above the freezing point they soon become unfit for human food.

In regard to the value of different breeds of fowls, there is much difference of opinion. It has not yet been, nor perhaps never will be decided which of all the various breeds is the most profitable under all circumstances. There seems to be a prevailing desire for a general purpose fowl, and with that object in view the Plymouth Rock, Wyandotte, Langshan, and other breeds have been produced by crossing the heavy weight flesh producing with the laying or non sitting breeds.

As a fancier, although discountenancing cock-fighting, I would prefer the Game on account of their noble contour, graceful habits and the excellent quality of their flesh and eggs. If the production of eggs were my leading object, I would prefer the Leghorns, the Spanish, or the Hamburgs, because they lay a greater number of eggs than any of the Asiatic breeds.

Where the raising of chickens for market is the chief object, it is not by any means an established fact that the largest kinds are the most profitable, because about in proportion to their size is the amount of food consumed by them. Brahma and Cochin chickens, the chief bulk of which consists of neck and legs, are not worth as much in any market as plump birds of moderate dimensions.

Aside from direct profits which may be derived from the sale of poultry productions, the use of fowls on the farm, especially in the orchard, now that insects injurious to fruit culture have increased to such an alarming extent, is of great importance.

We have now in Canada thousands of distinct species of insects injurious to agriculture, and when we consider that each fowl will during the season daily consume thousands of these insects we may be able to form some idea of the amount of good they do, although perhaps not perceptible to the unobserving.

During some months of the year, the food of turkeys when allowed a large range is chiefly insects, and on them they grow faster and thrive better than when fed on grain in limited space; hence on many farms turkeys are profitable stock.

In large cities everywhere the increased demand for geese and ducks, has caused a considerable advance in price. All farms are not very well adapted for raising this class of fowls, but wherever there is a constant supply of water they can be raised with advantage, and the supply is not likely to exceed the demands.

Taking many things into consideration I think it is very doubtful whether at the present time any other branch of business connected with the farm is more satisfactory than the production of poultry and eggs.

A committee composed of Messrs. Lick and Zavitz was appointed to wait upon the Minister of Agriculture to urge the claims of the Association with a view of obtaining an increased grant, and also better facilities for carrying forward the experimental work of the Union.

As some changes have been made in the Constitution since its last publication several of the members spoke of the importance of having it again printed in the report of the Association.

Mr. Zavitz moved a vote of thanks to the gentlemen who were so kind in taking part in the different sessions of the meeting, making special mention of Prof. Bailey, Mr. Shutt, Mr. J. J. MacKenzie, Mr. John Burns and Mr. John Hannah. President Mills said he took much pleasure in seconding the motion made by Mr. Zavitz.

CONSTITUTION AND BY-LAWS OF THE EXPERIMENTAL UNION.

CONSTITUTION.

ARTICLE I—*Name.*

This organization shall be known as "The Ontario Agricultural and Experimental Union."

ARTICLE II—*Object.*

The object of this Association shall be to form a bond of union amongst the officers and students, past and present, of the Ontario Agricultural College and Experimental Farm; to promote their intercourse with the view of mutual information; to discuss subjects bearing on the wide field of agriculture, with its allied sciences and arts; to conduct experiments in this field in union as far as possible, or by individual efforts; to secure the co-operation of the agriculturists of the province in this work; and to meet at least once annually to hear papers and addresses delivered by competent parties, and to report upon the labors of the past year.

ARTICLE III—*Membership.*

All officers and students of whatever time shall be entitled to become members of the Union on payment of the annual fee, 50 cents, and these shall be entitled to vote, hold office and discuss any question before the Association. The honorable the Commissioner or Minister of Agriculture for the Province of Ontario, the presidents for the time being of the various agricultural societies and farmers' institutes of Ontario, and such parties as the Association deem it advisable to appoint, shall be honorary members of the Union.

ARTICLE IV—*Officers.*

The officers of this Association shall consist of an Honorary President, President, Vice-President, Treasurer, Secretary, Editor, two Auditors, one Corresponding Secretary for each county, and such Committees on experiments as may be found desirable who shall hold office for one year, or until their successors are elected.

ARTICLE V—*Meetings.*

The Union shall meet annually at the Ontario Agricultural College for one or more days, at the call of the President and Secretary.

ARTICLE VI—*Vacancies in Office.*

Vacancies in office by death, resignation or otherwise shall be filled by the Executive Council until the next annual meeting.

ARTICLE VII—*Payments.*

The Treasurer shall pay out money held by him only on order of the President.

ARTICLE VIII—*Amendments.*

This constitution may be amended at any annual meeting by a two-thirds vote of all the members in attendance.

BY-LAWS.

Article 1. The officers of this Association shall be elected by a majority ballot, or, if so decided by a two-thirds majority of those present, the officers may be elected by a show of hands.

Article 2. It shall be the duty of the President to open all meetings of the Association, and preserve order; to call for all reports of officers and standing committees; to put to vote all motions regularly seconded; to decide upon all questions of order, according to the Constitution and By-Laws of the Association and in accordance with parliamentary usage; to provide for the counting of votes at elections; at expiration of his term of office, to deliver an address before the Association; and to appoint Committees unless otherwise decided by a special resolution.

Article 3. It shall be the duty of the Vice-President in the absence of the President, or in the absence of both, it shall be the duty of the Chairman elected by the Association, to perform the duties of the President.

Article 4. The Treasurer shall receive the annual dues, and keep account of all receipts and disbursements.

Article 5. The Secretary shall conduct all correspondence in regard to membership, general meetings, and all the business of the Executive Council, for which purpose he shall be *ex-officio* a member of that Council; he shall also keep the minutes of the general meetings of the Union, and read the same and call the names of the members of the Association at the opening of each annual meeting.

Article 6. The Editor shall receive, revise and attend to the publication of such addresses, articles or papers as may be authorized for publication in the transactions of the Union.

Article 7. It shall be the duty of the Auditors to audit all accounts before the general annual meeting.

Article 8. It shall be the duty of the Corresponding Secretary of each county to make out a list of names and post office addresses of all agriculturists in his county whom he thinks might either assist the Union in experimental work or attend the annual meeting of the Association, and forward it to the Secretary; to write personally to any whose interest he may secure in that way, and to write letters each year at least a month previous to the annual meeting, to a few of the leading papers in his county, setting forth the objects of the Union, and the date and place of the annual meeting.

Article 9. It shall be the duty of every member *throughout the year* to advance the interests of the Union as far as may lie in his power; to report the result of at least one experiment if at all possible, and to invite any agriculturist that he may come in contact with who would be at all likely to attend the annual meeting or assist in experimental work.

Article 10. The Association shall be governed, as far as possible, by the following order of business:

Call to order.
Reading the minutes of the last annual meeting.
Calling the roll of officers and members.
Reception of new members.
Collection of annual dues.
Secretary's report.
Treasurer's report.
Report of standing committees.
President's address.
Miscellaneous business.
Discussion of topics.
Election of officers.
Installation of officers.
Adjournment.

Article 11. The Executive Council shall consist of the Honorary President, President, Vice-President, Treasurer, Secretary and Editor. Its duties shall be to prepare a programme for annual meetings; invite and arrange with parties for the reading of papers; pass the annual report before printing, and transact such other work as has been indicated for it in this Constitution, or which may be hereafter authorized by the general meetings.

Article 12. In all other matters such as motions, etc., at the general annual meeting, the Union shall be governed by Todd's Parliamentary Usage.

Article 13. These By-Laws may be amended by a two-thirds majority of all the members present at the annual general meeting.

The Experimental Committees.

It shall be the duty of each Experimental Committee to decide upon its own course of experiments for each year; to purchase and distribute the material to be used by experimenters, and to receive and compile the reports, and submit them to the annual meeting.

LIST OF MEMBERS, 1893.

Name.	Post Office Address.	Province or Country.
Atkinson, James	Seaforth	Ontario.
Aylesworth, David	Bath	“
Armstrong, Christian	Montgomery	Alabama, U. S.
Bell, L. G	Qu'Appelle Station	Northwest.
Brown, W. J	Aylmer	Ontario.
Brown, Robert	Dalbeate	Scotland.
Ballantyne, W	Stratford	Ontario.
Burns, J. H	Kirkton	“
Beckett, H. L	Hamilton	“
Brooks, C	Brantford	“
Buchanan, D	Hensall	“
Brodie, C. E	Bethesda	“
Brown, S. P	Whitby	“
Burns, J. A. S	Broughty Ferry	Scotland.
Bayne, Percy R. C	Beaver Creek	British Columbia.
Bayne, Stanley R. S	“	“
Curzon, A	127 Victoria Street, London	England.
Carrick, C. S	Kincardine	Ontario.
Caldecot, F	Toronto	“
Clunn, W. P	Penarth	South Wales.
Curzon, S	127 Victoria Street, London	England.
Crealy, J. E	Strathroy	Ontario.
Cooper, W. W	Kippen	“
Cowan, J. H	Galt	“
Conn, Jos	Heathcote	“
Cook, J. H	Gordonville	“
Christian, H. H	Solina	“
Carlaw, G	Warkworth	“
Campbell, J. A	Simcoe	“
Dean, F	Harley	“
Dyer, Wm	Brooklin	“
Dunkin, T. L	Norwich	“
Eaton, L. W	Dartmouth	Nova Scotia.
Elmes, W. A	Princeton	Ontario.
Elmes, J. H	“	“
Elliot, W	Galt	“
Emigh, Clarence	Holbrook	“
Elton, W	North York	Northwest.
Elliott, R. R	Ottawa	Ontario.
Ferguson, J. J	Smith's Falls	“
Findlay, J. H	Barrie	“
Graessar, F. B	Argold Hall, Llangollen	Wales.
Grant, P	Beecher	Ontario.
Graham, W. R	Belleville	“
Grindly, A. Wolverton	Massawippi	Quebec.
Garbutt, R. A	Peterborough	Ontario.
Gilliland, H. C	St. Catharines	“
Hunter, H. E	Pembroke	“
Harcourt, R	St. Anns	“
Harvey, T. B	Charing Cross	“
Husband, E. M	Cairngorm	“
High, A. M	Beamsville	“
Hutt, H. L	South End	“
Henderson, R. H	Rockton	“
Hurley, T. J	Belleville	“
Harvey, W. H	Exeter	“
Hay, L	Poland	Russia.
Hamilton, C. A	Rugby	England.
Henson, Jas. R	Tullamore	Ontario.
Holtermann, R. F	Brantford	“
Harkness, A. D	Irena	“

LIST OF MEMBERS, 1893.—*Concluded.*

Name.	Post Office Address.	Province or Country.
Harcourt, Geo	Charlottetown	Prince Edward Island.
James, D. A	Nilestown	Ontario.
Jardine, J. E. A	Prince Albert	Northwest.
King, R. E	DeCewsville	Ontario.
Kennedy, P. B	Sarnia	"
Kidd, D. F	Cookstown	"
Kennedy, W. A	Apple Hill	"
Lehmann, R. A	Orillia	"
Lailey, F. T	414 Markham Street, Toronto	"
Logie, A. W	Grantley	"
Lindsay, A. J	Loch Winnoch	"
McCallum, W	Ontario Agricultural College, Guelph	"
McCrimmon, W. D	Glenroy	"
McKenzie, R. V	Lucknow	"
McLean, R. R	Muskoka	"
McNaughton, K	Walkerton	"
McMordie, R	Kippen	"
McKenzie, W. G	Fairview	"
McKay, W. E	Prince Albert	Northwest.
McFie, C. M	Appin	Ontario.
McLean, Malcolm	Ridgetown	"
McKay, T. G	Underwood	"
McLaren, P. S	McGarry	"
Mitchell, H. L	Brampton	"
Monteith, N	Stratford	"
Morgan, R. N	Kerwood	"
Milson, W. G	Goring	"
Maude, Fred. S. A	Leesburg	Florida, United States.
Mattice, W. A	Moulinette	Ontario.
Nelles, N	Grimsby	"
Newman, W. M	Gilbert's Mills	"
Nelson, Jas. A	Lyn	"
Nichol, Geo	Cataraqui	"
Payne, G. Y	Peterborough	"
Pettit, F. E	Burgesville	"
Perry, Eldon	Ottawa	"
Rowe, F	East Dulwich, London	England.
Rathwell, W	Ferguson's Falls, Toronto	Ontario.
Ross, J. G	Barrie	"
Robertson, T. A	Kingston	"
Robertson, Jno	Hatley	Quebec.
Raynor, T	Rosehill	Ontario.
Shaw, R. S	Ontario Agricultural College, Guelph	"
Soule, A. M	Niagara Falls South	"
Shuttleworth, Prof. A. E	Ontario Agricultural College, Guelph	"
Simpson, A. E	Hamilton	Prince Edward Island.
Silverthorn, Chas	Summerville	Ontario.
Shantz, A	Waterloo	"
Story, H	Picton	"
Sutherland, A. D	Fort William	"
Travis, C. H	Holt	"
Templar, Wm	Jerseyville	"
Willans, T. B		Northwest.
Wooley, D. M	Simcoe	Ontario.
Wheatley, Jno	Blackwell	"
Watson, H	Brampton	"
Walker, F	Norwich	"
Wood, R. S	Surrey	England.
Werry, W. J	Tyrone	Ontario.
Webster, F. E	Creemore	"
Watson, Jno. H	Brampton	"
Yarwood, Ed. B	Picton	"
Zavitz, C. A	Ontario Agricultural College, Guelph	"

APPENDIX I.

GRADUATES, ASSOCIATES AND COLLEGE ROLL.

1. Bachelors of the Science of Agriculture, Degree of B.S.A.

University of Toronto.

1890—Brodie, G. A.
1891—Buchanan, D.

1892—Carlyle, W. L.
1891—Cowan, J. H.
1888—Craig, J. A.
1888—Creelman, G. C.

1890—Dean, H. H.

1888—Fee, J. J.
1891—Field, H.

1892—Gibson, D. Z.
1889—Harcourt, G.
1892—Harrison, F. C.
1891—Hewgill, E. A., (*ob.*)
1891—Hutt, H. L.
1889—Hutton, J. R.
1892—Hutchinson, J. W.

1889—Lehmann, A.
1891—Linfield, F. B.

1892—Marsh, G. F.
1890—McCallum, W.
1890—Monteith, S. N.
1889—Morgan, J. H. A.
1892—Morgan, R. N.

1892—Newcomen, W. F.

1891—Palmer, W. J.
1888—Paterson, B. E.

1889—Raynor, T.

1890—Shantz, A.
1891—Sharman, H. B.
1891—Sleightholm, J. A. B.
1889—Soule, R. M., (*ob.*)

1891—Whitley, C. F.

1888—Zavitz, C. A.

2. Associates.

The total number of Associates up to the present time is 240, as follows :

1888—Austin, A. M.
1880—Anderson, J.
1880—Ash, W. E.
1892—Aylesworth, D.

1881—Ballantyne, W. W.
1879—Bannard, E. L.
1888—Bayne, S. R. S.
1892—†Beckett, H. L.
1892—Bell, L. G.
1888—Birdsall, W. G.
1888—Bishop, W. R.
1889—*Brodie G. A.
1890—Brown, H. H.
1892—Brown, B. C.
1890—Buchanan, D.
1888—Budd, W.
1885—‡Butler, G. C.
1884—Black, P. C.
1882—Blanchard, E. L.
1886—Broome, A. H.
1886—‡Brown, C. R.
1888—Brown, S. P.
1892—Burns, J. A. S.

1886—Calvert, S.
1890—Campbell, C. S.
1877—Campbell, J. A.
1880—Campbell, D. P. L.
1892—Carlaw, W.
1891—Carlyle, W. L.
1884—*Carpenter, P. A., (*ob.*)
1888—Carpenter, W. S.
1892—Carpenter, F. C. S.
1886—Cobb, C.
1880—Chapman, R. K.
1882—Charlton, G. H.
1882—Chase, O.
1879—Clark, J.
1879—Clinton, N. J.
1880—Clutton, A. H.
1890—Cowan, J. H.
1890—‡Cowan, R. E.
1887—Craig, J. A.
1892—Crealy, J. E.
1887—Creelman, G. C.
1878—Crompton, E.

1878—Davis, C. J.
1880—Dawes, M. A.
1882—Dawson, J. J.
1892—*Day, G. E.
1888—†Dean, H. H.
1882—Dennis, J.
1889—Derbyshire, J. A.
1881—Dickenson, C. S.
1890—Dolsen, W. J.
1887—Donald, G. C.
1887—Donaldson, F. N.
1877—Douglas, J. D.
1877—Dunlop, S.
1892—Dyer, W. D.

1892—Eaton, L. W.
1890—Elliott, R.
1888—Elton, C. W.
1888—Elton, R. F.
1882—Elworthy, R. H.
1887—Ewing, W.

1878—Farlinger, W. K.
1886—Fee, J. J.
1890—Field, H.
1881—File, J.
1882—Fotheringham, J.
1883—‡Fotheringham, W.
1879—Fyfe, A.

1883—Garland, C. S.
1889—Gelling, J. A.
1892—Gies, N.
1891—*Gibson, D. Z.
1887—Gilbert, W. J., (*ob.*)
1879—Gillespie, G. H.
1892—Graham, W. R.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindlay, A. W.

1890—Hadwen, G. H.
1891—Haight, W. L.
1882—Hallesy, F.
1892—Harcourt, R.
1888—*Harcourt, G.
1890—†Harcourt, J.
1887—Harkness, A. D.
1891—Harrison, F. C.
1888—Harrison, R. E.
1887—Hart, J. A.

* Gold Medalist. † First Silver Medalist. ‡ Second Silver Medalist.

ASSOCIATES.—*Continued.*

1887—Hart, J. W.
1892—Harvey, W. H.
1888—Heacock, F. W.
1890—Hewgill, E. A., (*ob.*)
1890—Holliday, W. B.
1886—Holtby, R. M.
1880—Holtermann, R. F.
1892—Honsberger, J. D.
1882—Horne, W. H.
1888—Horrocks, T. J.
1887—Howes, J. S.
1882—Howitt, W.
1892—Hurley, T. J.
1890—*Hutt, H. L.
1888—Hutton, J. R.

1886—Idington, P. S.

1886—Jeffrey, J. S.
1883—Jeffs, H. B.
1879—Jopling, W.

1888—Knowlton, S. M.

1882—Landsborough, J.
1887—Leavens, D. H.
1884—‡Lehmann, A.
1887—‡Lick, E.
1877—Lindsay, A. J.
1889—‡Linfield, F. B.
1887—Livesey, E. M.
1880—Lomas, J. W.
1878—Logan, T.

1880—Macaulay, H.
1890—Macfarlane, T. W. R.
1885—Macpherson, A.
1886—*Madge, R. W.
1882—Mahoney, E. C.
1884—Major, C. H.
1889—Marsack, F.
1889—Marsack, H. A.
1891—Marsh, G. F.
1877—Mason, T. H.
1890—McKergow, J. G.
1877—Myer, G. W.
1887—Morgan, J. H. A.
1881—Motherwell, W. R.
1885—†Muir, J. B.
1887—McCallum, E. G.
1889—McCallum, W.
1889—McEvoy, T. A.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.

1891—McKenzie, A. G.
1889—McLaren, P. S.
1883—McPherson, D.
1890—Monk, W. D.
1889—Monteith, S. N.
1891—*Morgan, R. N.
1890—Mulholland, F.

1878—Naismith, D. M.
1891—Newcomen, W. F.
1879—Nicol, A., (*ob.*)
1882—Nicol, G.
1882—Notman, C. R.

1877—O'Beirne, A. C.
1887—Orsman, C. P.
1886—Owen, W. H.

1888—Palmer, W. J.
1887—Paterson, B. E.
1883—Perry, D. E.
1891—Perry, E. C.
1881—§Phin, R. J.
1881—Phin, W. E.
1881—Pope, H.
1886—Power, R. M.
1884—Powys, P. C.

1882—‡Ramsay, R. A.
1879—Randall, J. R.
1885—*Raynor, T.
1885—Reid, P.
1889—Randall, W.
1889—Rennie, E. A.
1883—*Robertson, W.
1879—Robertson, J.
1881—Robins, W. P.
1879—Robinson, C. B.
1892—Roper-Curzon, S.
1881—Ross, J. G.
1892—Ruthven, W. A.

1884—Saxton, E. A.
1888—Serson, W. E.
1892—*Shaw, R. S.
1888—Sinclair, J. J.
1882—Silverthorne, N.
1888—Soule, R. M., (*ob.*)
1877—Skyes, W. J.
1883—Schwartz, J. A.
1887—†Scrugham, J. G.
1886—Shantz, A.
1887—Sharman, H. B.
1877—Shaw, G. H.

1882—†Shuttleworth, A. E.
1892—Silverthorn, C.
1884—†Slater, H., (*ob.*)
1887—*Sleightholm, F. J.
1890—Sleightholm, J. A. B.
1885—Smith, E. P.
1892—‡Soule, A. M.
1891—Sparrow, J. C. H.
1891—Spencer, W. A.
1884—Steers, O.
1888—Stevenson, C. R.
1878—Stewart, W.
1892—Story, H.
1882—Stover, W. J.
1886—†Sturge, E.
1888—Sweet, H. R.

1891—Thompson, R. A.
1889—‡Tinney, T. H.
1892—Tolton, J. E.
1879—Toole, L.
1883—Torrance, W. J.
1884—Tucker, H. V.
1885—Thompson, W. D.

1888—Valance, R., (*ob.*)

1879—Warnica, A. W.
1884—Wark, A. E.
1878—Warren, J. B.
1890—Webster, F. E.
1880—§Webster, J. L.
1879—Wells, C.
1890—Wells, E.
1882—Wettlaufer, F.
1891—White, E. F.
1892—Wiancho, A. T.
1891—†Wilkin, F. A.
1879—Wilkinson, J. P.
1888—Willans, T. B.
1888—Willans, N.
1879—Willis, J.
1883—Willis, W. B., (*ob.*)
1888—Wilmot, A. B.
1890—Wilson, F. G.
1882—White, C. D.
1879—White, G. P.
1890—Whitley, C. F.
1890—Wood, W. D.
1884—Wroughton, T. A.

1892—Yuill, A. R.

1886—Zavitz, C. A.

* Gold Medalist. † First Silver Medalist. ‡ Second Silver Medalist.
§ Winner of the Governor-General's Medal—the only medal given that year.

3. College Roll for 1892.

Third Year Students.

Name.	P. O. Address.	County, etc.
†Aylesworth, D	Bath	Lennox, Ont.
†Beckett, H. L	Hamilton	Wentworth, Ont.
†Bell, L. G	Qu'Appelle	North-West Territory.
†Burns, J. A. S	Halifax	Nova Scotia.
*Carlyle, W. L.	Chesterville	Dundas, Ont.
†Carpenter, F. C. S	Rat Portage	Rainy River District, Ont.
†Crealy, J. E	Strathroy	Middlesex, Ont.
†Day, G. E	Guelph	Wellington, Ont.
†Dyer, W. D	Columbus	Ontario, Ont.
†Eaton, L. W	Dartmouth	Nova Scotia.
*Gibson, D. Z	Willow Grove	Haldimand, Ont.
†Graham, W. R	Belleville	Hastings, Ont.
Haight, W. L	Wellington	Prince Edward, Ont.
†Harcourt, R	St. Anne's	Lincoln, Ont.
*Harrison, F. C	Ronda	Spain.
*Hutchinson, J. W	Randolph	Wisconsin, U.S.A.
*Marsh, G. F	Thornbury	Grey, Ont.
*Morgan, R. N	Kerwood	Middlesex, Ont.
*Newcomen, W. F	Epping	Essex, England.
Roper-Curzon, A	Kingston	England.
†Roper-Curzon, S	Kingston	England.
†Shaw, R. S	Guelph	Wellington, Ont.
†Soule, A. McNairn	Southend	Welland, Ont.
Sparrow, J. C. H	Antrim	Carleton, Ont.
†Story, H	Picton	Prince Edward, Ont.

Second Year Students.

Name.	P. O. Address.	County, etc.
Atkinson, James	Seaforth	Huron, Ont.
Brooks, W. C	Brantford	Brant, Ont.
Brown, B. C	Kingston	Frontenac, Ont.
Brown, W. J	Dunboyne	Elgin, Ont.
Burns, J. H	Kirkton	Perth, Ont.
Carlaw, W	Warkworth	Northumberland, Ont.
Conn, J	Heathcote	Grey, Ont.
Cooper, W. W	Kippen	Huron, Ont.
Dean, F	Harley	Brant, Ont.
Elmes, W. A	Princeton	Brant, Ont.
Ferguson, J. J	Smith's Falls	Leeds, Ont.
Findlay, J. H	Barrie	Simcoe, Ont.
Freeman, G. M	Boxgrove	York, Ont.
Gies, N	St. Jacob's	Waterloo, Ont.
Hamilton, C. A. W	Alcester	Warwickshire, England.
Harvey, T. B	Charing Cross	Kent, Ont.
Harvey, W. H	Exeter	Huron, Ont.
Hay, L	Ruda Guzowska	Poland.

* Obtained the degree of B.S.A. in June. † Received an Associate Diploma in June.

Second Year Students.—Concluded.

Name.	P. O. Address.	County, etc.
Honsberger, J. D	Jordan Station	Lincoln, Ont.
Hunter, H. A	Orangeville	Dufferin, Ont.
Hurley, T. J	Belleville	Hastings, Ont.
Husband, E. M	Cairngorm	Middlesex, Ont.
Kennedy, P. B	Sarnia	Lambton, Ont.
Kent, A. L	Toronto	York, Ont.
Lehmann, R. A	Orillia	Simcoe, Ont.
Moody, A. A	Guelph	Wellington, Ont.
McCallum, Wm	Guelph	Wellington, Ont.
McCrimmon, W. D	Glen Roy	Glengarry, Ont.
McKenzie, W. G	Fairview	Oxford, Ont.
Maclean, R. R	Stanley House	Parry Sound District, Ont.
McMordie, R	Kippen	Huron, Ont.
McNaughton, K	Walkerton	Bruce, Ont.
Phin, A. E	Hespeler	Waterloo, Ont.
Ruthven, W. A	West Essa	Simcoe, Ont.
Spencer, J. B	Brooklin	Ontario, Ont.
Stewart, J	Snake River	Renfrew, Ont.
Tolton, J. E	Walkerton	Bruce, Ont.
Walker, F	Norwich	Oxford, Ont.
Wiancko, A. T	Sparrow Lake	Muskoka, Ont.
Yuill, A. R	Carleton Place	Lanark, Ont.

First Year Students.

Ainley, W	Barrie	Simcoe, Ont.
Atkinson, John	Seaforth	Huron, Ont.
Aveline, R	Wrington	Somerset, England.
Baird, W. H	Weir	Wentworth, Ont.
Barr, D. M	Douglas	Renfrew, Ont.
Bealy, H. B	Ratcliffe Close	England.
Black, Hugh	Scotch Block	Halton, Ont.
Brent, A. H	Tyrone	Durham, Ont.
Brown, Robert	Hermitage	Dalbeattie, Scotland.
Buchanan, John	Hensall	Huron, Ont.
Burdett, A. H	Hallatrow	North Bristol, England.
Butler, E	Dereham Centre	Oxford, Ont.
Caldecott, F	Toronto	York, Ont.
Carrick, C	Kincardine	Huron, Ont.
Christian, A. H	Danforth	York, Ont.
Clunn, W. P	Penarth	South Wales.
Connor, George	Chiselhurst	Huron, Ont.
Cook, J. H	Gordonville	Wellington, Ont.
Counsell, W. N	Hamilton	Wentworth, Ont.
DeHart, H. F. R	Whitby	Ontario, Ont.
Day, A. H	Guelph	Wellington, Ont.
Doherty, W. M	Eglinton	York, Ont.
Elford, F. C	Holmesville	Huron, Ont.
Elliott, Wm	Galt	Waterloo, Ont.
Elmes, J. H	Princeton	Brant, Ont.
Emigh, C. G	Holbrook	Oxford, Ont.
Farrer, J. W	Parry Sound	Parry Sound, Ont.
Ferraby, E. L	Cottingham	Yorkshire, England.
Fee, F. W	Toronto	York, Ont.
Fitzgerald, J. P	Mt. St. Louis	Simcoe, Ont.

First Year Students.—Concluded.

Name.	P. O. Address.	County, etc,
Garbutt, R. A	Peterborough	Peterborough, Ont.
Gilleland, H. C	St. Catharines	Lincoln, Ont.
Graesser, F. A	Llangollen	North Wales.
Grantham, H. V	Mohawk	Brant, Ont.
Gray, F. W	Delhi	India.
Hallett, F. T	Weymouth	Dorset, England.
High, A	Beamsville	Lincoln, Ont.
Henderson, R	Rockton	Wentworth, Ont.
Heward, A. D	Toronto	York, Ont.
Holmes, C. U	Selkirk	Haldimand, Ont.
Hunter, H. E	Pembroke	Renfrew, Ont.
Jackson, T. M	Victoria	British Columbia.
James, D. A	Nilestown	Middlesex, Ont.
Jardine, J. E. A	Prince Albert	Northwest Territory.
Kennedy, W. A	Apple Hill	Glengarry, Ont.
Kerr, W. C	Pembroke	Renfrew, Ont.
Kidd, D. F	Cookstown	Simcoe, Ont.
King, W. A	Decewsville	Haldimand, Ont.
Kirk, Hugh	Kirkton	Huron, Ont.
Lailey, F. T	Toronto	York, Ont.
Logie, A	Grantley	Dundas, Ont.
Mey, W. B	Leipsic	Germany.
Miller, R. C	Burlington	Halton, Ont.
Millson, A	Solina	Durham, Ont.
Mitchell, S	Brampton	Peel, Ont.
McCullough, H. A	Nantye	Simcoe, Ont.
McDonald, F. J	Tracadie	Prince Edward Island.
McDonald, W. A	Tracadie	Prince Edward Island.
McDonald, N	Russell	Russell, Ont.
McDonald, R	Alexandria	Glengarry, Ont.
Macfie, C. M	Appin	Middlesex, Ont.
McKay, W. E	Prince Albert	Northwest Territory.
McKenzie, R. V	Lucknow	Bruce, Ont.
Nelles, N. C. S	Grimsby	Lincoln, Ont.
Newman, W. M	Gilbert's Mills	Prince Edward, Ont.
Payne, G. Y	Peterborough	Peterborough, Ont.
Pettit, F. E	Burgessville	Oxford, Ont.
Phin, George	Hespeler	Waterloo, Ont.
Rathwell, W	Ferguson's Falls	Lanark, Ont.
Reinke, C. E	Ancaster	Wentworth, Ont.
Rice, T. L	Toronto	York, Ont.
Robertson, G. A	Kingston	Frontenac, Ont.
Robertson, Wm	Meaford	Grey, Ont.
Ross, T. E	Barrie	Simcoe, Ont.
Rowe, G. F	East Dulwich	London, England.
Shorey, S. C	Harrowsmith	Addington, Ont.
Simpson, A. E	Hamilton	Prince Edward Island.
Smyth, F. L	Tormore	York, Ont.
Thompson, W. J	Edgar	Simcoe, Ont.
Thompson, J. A	Thornton	Simcoe, Ont.
Travies, C. H	Holt	York, Ont.
Vannater, P. O	Ballinafard	Wellington, Ont.
Vipond, J. M	Donegal	Perth, Ont.
Wait, J. W	St. George	Brant, Ont.
Watson, H	Brampton	Peel, Ont.
Webster, C. L	Lutherville	Leeds, Ont.
Werry, M. J	Tyrone	Durham, Ont.
Westover, M	Frelighsburg	Province Quebec.
Wheatley, J	Blackwell	Lambton, Ont.
Widdifield, J. W	Siloam	Ontario, Ont.
Wilson, E. E	Brampton	Peel, Ont.
Wilson, G. H	Toronto	York, Ont.
Wood, R. S	Toronto	York, Ont.
Woolley, D	Walton-on-Thames	Surrey, England.
	Simcoe	Norfolk, Ont.

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APPENDIX II.

SYLLABUS OF LECTURES.

Lectures began as usual on the 1st October, 1891, and continued with the omission of the Christmas vacation, until the 30th June, 1892, which latter date was the end of the scholastic year 1891-92.

The following syllabus of lectures will convey some idea of the class-room work done by the several Professors in the nine months just mentioned:

FIRST YEAR.

Fall Term.—1st October to 22nd December.

AGRICULTURE.

Introductory.—Ancient and modern agriculture; agricultural literature; different systems of farming; history of agriculture.

Soils.—Their formation and composition, physical and chemical properties, etc.; examination and classification of soils; cultivation of soils, including various tillage operations—plowing, harrowing, cultivating, rolling, etc.

Land Drainage.—Method of laying out drains; various kinds of drains and their construction; different modes of draining.

Rotation of Crops.—Importance and necessity of rotation; principles underlying it; rotations suitable to different kinds of soil; examination and criticism of different systems of rotation.

Cattle.—Pointing out and naming the different parts of the animal; characteristic points and peculiarities of the principal beef and dairy breeds of cattle; practical handling of beef and dairy animals.

NATURAL SCIENCE.

Chemical Physics.—Matter; accessory and essential properties of matter; attraction; various kinds of attraction—cohesion, adhesion, capillary, electrical and chemical; specific gravity; weights and measures; heat, measurement of heat, thermometers, specific and latent heat; sources, natures and laws of light.

Inorganic Chemistry.—Scope of subject; elementary and compound substances; chemical affinity; symbols; nomenclature; combining proportions by weight and by volume; atomic theory; atomicity and basicity; oxygen and hydrogen; water—its nature, functions, decomposition and impurities; nitrogen; the atmosphere—its composition, uses and impurities; ammonia—its sources and uses; nitric acid and its connection with plants.

Human Physiology and Hygiene.—Description of the different tissues of the body; alimentary system; circulatory system; nervous system; importance of ventilation and the influence of food on the body; remarks on the proper care of the body and attention to its surroundings in order to keep it in a continual state of health.

Zoology.—Distinction between animate and inanimate objects; distinction between plants and animals; basis of classification of animals; leading character of each sub-kingdom, with special reference to classes of animals connected with agriculture.

VETERINARY SCIENCE.

Anatomy and Physiology of the horse, ox, sheep and pig; osseous system, muscular system, syndesmology, plantar system and odontology.

ENGLISH.

Composition.—Review of Grammar, with exercises on capital letters and punctuation.
Literature.— Selections from Tennyson.

MATHEMATICS.

Arithmetic.—Review of subject, with special reference to farm accounts. Interest, discount, stocks, and partnership.
Mental Arithmetic.—Calculations in simple rules.
Book-keeping.—Subject commenced.

Winter Term.—22nd January to 16th April.

AGRICULTURE.

Manures.—Composition, management, and application of farmyard manure; artificial fertilizers—their composition, uses, and modes a application; mechanical and chemical effects of manures on various kinds of soil and crops; the amounts to apply, etc.; green manures.

Crops for Soiling.—The advantages of soiling; the principal soiling crops; feeding of green crops to live stock.

The Weeds of the Farm.—The most troublesome weeds described, and different modes of eradicating them.

Sheep.—Characteristic points of medium and long wool breeds, and practical handling of same.

NATURAL SCIENCE.

Inorganic Chemistry (Continued).—Carbon; combustion; carbonic acid and its relation to the animal and vegetable kingdom; sulphur and its compounds; manufacture and uses of sulphuric acid; phosphorus; phosphoric acid and its importance in agriculture; chlorine—its bleaching properties; bromine; iodine; silicon; potassium; calcium; magnesium; iron, etc.

Organic Chemistry.—Constitutions of organic compounds; alcohols; aldehydes, acids and their derivatives; formic, acetic, oxalic, tartaric, citric, lactic, malic, uric, and tannic acids. Constitution of oils and fats—saponification; sugars, starch, cellulose; albuminoids, or flesh formers, and their allies; essential oils; alkaloids—morphine and quinine; classification of organic compounds.

Zoology (Continued).—Sub-kingdoms further described; detailed account of some injurious parasites, such as "liver-fluke," "tape-worm," "trichina," etc.; insects—their influence on plant life; corals and mollusks as agents in the formation of soil; vertebrates, with special reference to those of importance in the economy of the farm.

Lectures illustrated by specimens and diagrams.

Veterinary Science.

Veterinary Anatomy.—Anatomy and physiology of the horse, ox, sheep and pig—digestive system, circulatory system, respiratory system, urinary system, nervous system, sensitive system, generative system, tegumental system.

English.

Composition.—Exercises continued; letter writing, etc.
English Classics.—Critical study of selections from Tennyson.

Mathematics and Book-keeping.

Arithmetic.—Equation of payments; percentage; profit and loss; stocks; partnership; exchange.
Book-keeping.—Business forms and correspondence; general farm accounts; dairy, field, and garden accounts.

Spring Term.—17th April to 30th June.

Agriculture.

Preparation of Soil.—Modes of preparation for different crops, and various kinds of soil.
Seeds and Sowing.—Testing the qality of seed; changing seed; quantity per acre; and methods of sowing.
The Crops of the Farm.—Their growth and management—hay, rye, wheat, barley, oats, peas, buckwheat, potatoes, turnips, mangels, sugar beets, rape, etc.
Pastures.—Growth and management of pastures; temporory and permanent pastures.
Feeding of Live Stock.—General outline of the principles of feeding different kinds of stock.

Natural Science.

Geology.—Connection between geology and agriculture; classification of rocks—their origin and mode of formation, changes which they have undergone after decomposition; fossils—their origin and importance; geological periods and characteristics of each.

Geology of Canada, with special reference to the nature and economic value of the rock deposits; glacial period and its influence on the formation of soil.

Lectures illustrated by numerous specimens and designs.

Botany.—Full description of seed, roots, stem, leaves, and flower. Plants brought into the lecture-room and analyzed before the class, so as to render students familiar with the different organs and their use in the plant economy.

Lectures illustrated by excellent diagrams.

Veterinary Science.

Materia Medica.—The preparation, doses, action, and use of about one hundred of the principal medicines used in veterinary practice.

English

English Grammar and Composition.—Authorized Grammar.
English Classics.—Critical study of selections from Wordsworth.

MATHEMATICS.

Mensuration.—Mensuration of surfaces—the square, rectangle, triangle, trapezoid, regular polygon, circle. Special application to the measurement of lumber. Mensuration of solids; special application to the measurement of timber, earth, etc.

Fall Term—1st October to 22nd December.

AGRICULTURE.

Cattle.—Origin and history of the leading breeds of cattle in America; beef breeds—their leading characteristics and principal points: dairy breeds—their leading characteristics and principal points; practical handling and judging of cattle.

NATURAL SCIENCE.

Agricultural Chemistry.—Connection between chemistry and agriculture; the various compounds which enter into the compositions of the bodies of animals; the chemical changes which food undergoes during digestion; chemical changes which occur during the decomposition of the bodies of animals at death; the functions of animals and plants contrasted; food of plants, and whence derived; origin and nature of soils; classification of soils; causes of unproductiveness in soil and how detected; preservation, improvement and renovation of soils; manures classified; the chemical action of manures on different soils; commercial valuation of fertilizers.

Horticulture.—Ontario as a fruit-growing country; the natural divisions into which it may be divided for growing fruit; detailed account of the operations, layering, grafting, budding pruning, etc.; laying out and cultivation of an orchard; list of fruits best suited for general purposes, with best methods for their cultivation; remarks on gardening as a source of profit; plants best adapted to bedding and potting.

Lectures illustrated by practical work in the garden, and specimens in the class-room.

VETERINARY SCIENCE.

Pathology.—Osseous System.—Natuse, causes, symptoms and treatment of diseases of bone, as splint, spavin, ringbone, etc.

Muscular System.—Nature, causes, and treatment of flesh-wounds, etc.

Syndesmology.—Nature, causes, symptoms and treatment of curb, bog-spavin and other diseases of the joints.

Plantar System.—Nature, causes, symptoms and treatment of corns, sand-crack, founder and other diseases of the feet.

Odontology.—Diseases of the teeth, and treatment of the same.

ENGLISH.

English Classics.—Critical study of Shakespeare's "Julius Cæsar."

MATHEMATICS.

Dynamics.—Motion, forces producing motion, momentum; work, the simple machines, etc.

Winter Term—22nd January to 16th April.

Agriculture.

Sheep.—Origin and history of the leading breeds of sheep in Britain and America; coarse, medium and fine wooled sheep—their leading characteristics and principal points; practical handling and judging of sheep.

Swine.—Origin and history of the leading breeds of swine in Britain and America; large and small breeds of swine—their leading characteristics and principal points; practical handling and judging of swine.

Natural Science.

Agricultural Chemistry.—Continuation of the subject from preceding term, as follows: Composition of plants in relation to the soils upon which they grow; rotation of crops; the classification of fodders according to their chemical composition and a general treatment of the science of cattle feeding; relation of feeding to manure; chemistry of the dairy.

Entomology.—Importance of the subject to agriculturists; beneficial and injurious insects—their habits and the best means of checking the ravages of the latter.

Lectures illustrated by specimens.

Meteorology.—Relation of meteorology to agriculture; composition and movements of the atmosphere; description of the barometer; different kinds of thermometers; pluviameter and anemometer, and how to read them; temperature, its influence on agriculture; the elements which are to be considered in the discussion of climate; the principles considered in forecasting the weather.

Lectures illustrated by instruments referred to.

Veterinary Science.

Digestive System.—Nature, causes, symptoms and treatment of spasmodic and flatulent colic, inflammation of the bowels, acute indigestion, tympanitis in cattle, impaction of the rumen, and many other common diseases.

Circulating System.—Description of the diseases of the heart and blood.

Respiratory System.—Nature, causes, symptoms, and treatment of catarrh, nasal-gleet, roaring, bronchitis, pleurisy, and inflammation of the lungs, etc.

Urinary System.—Nature, causes, symptoms and treatment of inflammation of the kidneys, etc.

Nervous System.—Nature, causes, symptoms, and treatment of lock-jaw, string-halt, etc.

Sensitive System.—Nature, causes, symptoms, and treatment of the diseases of the eye and ear.

Generative System.—Nature, causes, symptoms, and treatment of abortion, milk fever, etc.

Tegumental System.—Nature, causes, symptoms, and treament of scratches, sallenders, mallenders, parasites, and other diseases of the skin.

English Literature and Political Economy.

English Classics.—The critical study of Shakespeare's "Hamlet."

Political Economy.—Utilty; production of wealth—land, labor, capital; division of labor; distribution of wealth; wages; trades unions; co-operation; money; credit credit cycles; functions of government; taxation, etc.

MATHEMATICS.

Statics.—Theory of equilibrium ; composition and resolution of forces ; parallelogram of forces ; moments ; centre of gravity, etc.

Hydrostatics.—Transmission of pressure ; the hydraulic press ; specific gravity ; density ; pumps, siphons, etc.

Book-keeping.—Review of previous work.

Spring Term—17th April to 30th June.

AGRICULTURE.

Breeding.—Outline of the general principles of breeding.

Feeding.—Feeding standards ; feeding for growth, meat, milk, quality of milk, etc.

Care and management of cattle, sheep and swine ; care at different periods of growth, at different seasons, and under varying conditions.

NATURAL SCIENCE.

Determinations of soils and fertilizers by physical properties.

Analytical Chemistry.—Chemical manipulation, preparation of common gases and reagents ; operations and analysis—solution, filtration, precipitation, evaporation, distillation, sublimation, ignition and the use of the blow-pipe ; testing of substances by reagents ; impurities in water ; adulterations in foods and artificial manures ; injurious substancss in soils.

Systematic and Economic Botany.—Classification of plants and characters of the most important orders.

This course is illustrated by a large collection of plants in the college herbarium, and also by analysis of several plants collected in the fields and woods of the farm.

Green-house Plants.—Special study of all plants grown in our green-houses, and the shrubs, etc., on the lawn.

VETERINARY SCIENCE.

Materia Medica.—The preparation, actions, uses, and doses of medicines—continued from the spring term of the first year. Lectures on special subjects, such as pleuro-pneumonia, the rinderpest, tuberculosis, etc.

Veterinary Obstetrics.—Description of fœtal coverings. Pneumonia in connection with puberty, œsirom, gestation, sterility, abortion, normal and abnormal parturition. Diseases incidental to pregnant and parturient animals.

ENGLISH.

English Classics.—The critical study of Milton's "L'Allegro" and "Il Penseroso."

MATHEMATICS.

Surveying and Levelling.—Fields surveyed with chain and cross-staff ; measurements of heights.

Road-making.—Determination of proper slopes ; shape of road bed ; drainage of roads ; friction on different roads ; various road coverings ; the maintenance of roads ; cost, etc.

THIRD YEAR.

Fixed Work.

Chemistry.—The work in this department comes under four heads, each of which forms the basis of a separate examination:

General Chemistry, Organic and Inorganic.—Roscoe's "Lessons in Elementary Chemistry" (1886 edition), with a course of lectures. Most stress laid on those elements and compounds which have an agricultural bearing; laws and theories of chemistry discussed.

Agricultural Chemistry.—"Chemistry of the Farm" (Warington), and "Agriculture in some of its Relations with Chemistry" (Storer), with lectures, Vol. I, Chapters, 1, 2, 3, 4, 7, 8, 9, 10, 11 and 12; Vol. II, Chapters, 5, 6, 7, 8, 9, 10, 15, 17, 18 and 19.

Animal Chemistry and Cattle Feeding.—"Manual of Cattle Feeding" (Armsby), with lectures.

Analytical Chemistry.—Qualitative and Quantitative Analysis of soils, fertilizers, agricultural products, etc.

Natural History.—Four Examinations, as follows:

Zoology.—Differences between plants and animals; parasitic animals, especially those injurious to farm animals; animals which have assisted in the formation of soil; insectivorous birds, etc.

Economic Entomology.—Classification of insects; characters of orders into which insects are divided; 75 insects injurious to vegetation, and the best means of destroying them; insecticides—their uses and modes of application.

Structural and Physiological Botany.—Cells and tissues of plants; reproduction, assimilation, absorption, and metabolism of plants; processess of fertilization and hybridization; plants in relation to soil; classification of plants and study of the most important orders; analysis of plants; examination of specimens in herbarium, and illustrations by magic lantern.

Economic Botany.—Special reference to injurious fungi and weeds.

Microscopy.—Manipulation of microscope; methods of mounting specimens; drawing and measuring objects under microscope; microscopic study of the structure of plants and other objects. Hillhouse pp. 1-35, and appendix IV.

Drawing.—Freehand and mechanical drawing, especially the drawing and construction of farm houses, barns, stables, etc.,—ground plans, elevations, sections, and construction.

English.—(1) Grammar (High School Grammar). (2) Composition and Rhetoric (Bain). (3) Outlines of English Literature (Lectures with Spalding and Craik. (4) Themes. (5) Critical reading of the following selections:

Shakespeare—Richard II.

Bacon—Essays: Of Studies, Great Place, Boldness, Goodness and Goodness of Nature, Youth and Age, Discourse, Friendship.

Milton—Lycidas and Paradise Lost, Bk 1.

Pope—Essay on Criticism.

Addison—Spectator, Nos. 23, 26, 47, 93, 115, 162, 225, 381, 387, 483, 583, 598.

Wordsworth—The Solitary Reaper; Intimations of Immortality; Resolution and Independence.

Macaulay—Essay on Lord Bacon.

DeQuincey—William Wordsworth.

Tennyson—Locksley Hall; In Memoriam, i--xxvii.

Note—**In order to pass this department, it is necessary, above everything else, that the candidate know how to spell correctly and be able to write good English.**

Options.

Three of the the following subjects must also be taken, in addition to the fixed work prescribed above.

1. *Agriculture.*—(1) Principles and practice of general agriculture ; "Agriculture in some of its relations with Chemistry" (Storer), Vol. I., Chapters 5, 6, 13, 14, 15, 16, 18, and Vol. II., Chapters 1, 2, 3, 4, 11, 12, 13, 14, 16, 20, 21, 22 ; (2) Characteristic points of the most valuable breeds of horses, cattle, sheep, and pigs ; "History of Polled Aberdeen or Angus Cattle" (Macdonald and Sinclair), Chapters I—V ; "History of Hereford Cattle" (Macdonald and Sinclair), Chapters I and X ; (3) Construction and arrangment of farm buildings with a view of cheapness, economy of space, and convenience.

2. *Darying.*—(1) "Dairy Farming" (Sheldon), Chapters 1-6, 11-15, 19, 33, 34 ; (2) "American Dairying" (Arnold) ; (3) "Scientific Dairy Practice" (Lynch) ; (4) Milch Cows" (Flint) ; (5) "Dairyman's Manual" (Stewart) ; (6) "Reports of Dairy Associations of Ontario," 1887, pp. 21-63, 66-68, 99-107, 125-146, 156-174, 177-205, 213-249 ; 1888, pp. 7-11, 15-17, 21-24, 51-59, 114-128, 143-156, also subsequent reports to date ; (6) "Analysis of Foods" (Blyth), pp. 194-218, 228-246, 251-280, 283-293, 305-313.

3. *Geology.*—A general review of the subjects ; special reference to the various systems and formations found in Canada, particularly the Geology of Ontario, New Brunswick, Nova Scotia, Manitoba and the Northwest; economic products in Canadian rocks ; chief agents in the disintegration of rocks ; a thorough study of the origin and formation of soil.

4. *Algebra.*—Through quadratic equations.

5. *Euclid.*—Books I and II, with simple deductions.

6. *Latin.*—Principia Latina, part I, I—XXXIII, with a view to learn the pronunciation of scientific terms, and those Latin roots from which a large number of English words are derived.

Books of Reference in Botany, etc.—Entomology (Comstock) ; Injurious Insects (Saunders) ; Bound Reports Entomological Society ; Structural Botany (Gray), Physiological (Vines) ; Systematic (Gray's Manual and Spotton, part II.) ; Injurious Fungi (Smith) ; Weeds (Stock Journal '88) ; Practical Botany (Hillhouse) ; Microscope (Phin) ; Microscope and Botany (Behrens).

APPENDIX III.

I.—PAPERS SET AT EASTER EXAMINATIONS, 1892.

FIRST YEAR.

Agriculture.

I. How may undue fermentation in farmyard manure be checked? Are moderate and frequent dressings preferable to heavy dressing at long intervals? If so, give the reasons.

II. Why are bones valuable as a fertilizer? In which forms are they chiefly used as manures? What effect has grinding upon their action?

III. State some general principles that govern the wise application of fertilizers.

IV. Show how a judicious rotation of crops is economical of manure; how it improves the texture of the soil. State a rotation suitable for sandy loams.

V. How does soiling affect the quality of the manure? the health and condition of the animals? What value do you place upon lucerne as a soiling crop?

VI. Where should wheat be placed in the rotation? State the preparation of soil required.

VII. State the amount of seed required in sowing rye. Wherein consists the value of the straw? How may it be separated from wheat?

VIII. State the leading facts relating to the introduction of the turnip into Britain. What were the effects upon the agriculture of that country?

IX. Describe the cultivation required in growing rape, including the preparation of the soil before sowing?

X. State the principal uses of the common red clover (*Trefolium pratense*) and the amount of seed required per acre. Give notes bearing on the growth of common yellow clover (*Medicago lupulina*)?

Inorganic Chemistry.

I. What is meant by chemical action? "The numerous cases of chemical action may be divided into three classes"; name them, and give examples.

II. Name the products formed in the following: Sulphur burned in oxygen; phosphorus burned in the air; hydrogen burned in the air, and also in chlorine.

III. A large quantity of hydrogen gas is required. Sketch apparatus, and describe the method of preparation you would adopt. What weight of pure zinc (At. Wt. 56) will be required to make three litres of hydrogen collected under the normal conditions of temperature and pressure?

IV. Name the substances represented by the following formulas:—H^2O^2, $HClO$, $H_4P_2O_7$, P_2O_5, $As_2\,O_3$, $AlK\,(SO_4)_2$, Hg^2Cl^2, and H_2SO_3.

V. Explain the action of hydroxides of calcium, potassium or sodium on salts of ammonia.

VI. Define an acid, a base, an acid salt, a non-metal, and a dibasic acid.

VII. Show, by chemical equations, the action of sulphuric acid on calcium phosphate in the preparation of mono-calcic, di-calcic, and tri-calcic phosphates.

VIII. Write formulas for the following: Soda, Chili saltpetre, Glauber's salt, sal-ammoniac, gypsum, bleaching-powder, superphosphate of lime, and kaolin.

Organic Chemistry.

I. Define the terms hydrocarbon and carbohydrate. Give a classification of the carbohydrates.

II. Represent graphically the relation between the members of the marsh gas series.

III. Give the formulas for ethane, ethyl alcohol, ethyl-methyl ether, acetic aldehyde, and acetic acid.

IV. Write the graphic formulas for the hydroxyl derivatives of butane and isobutane.

V. Give the characteristic groups of the following: Primary alcohol, aldehydes, monobasic acids, and ketones.

VI. Define an etheral salt, giving the names and formulas of three contained in animal fat.

VII. Distinguish between secondary and tertiary alcohols.

VIII. Name the acids of the ethereal salts of butter.

Zoology.

I. Compare the circulatory apparatus of an insect with that of a bird.

II. Name three classes of animals that have exerted an influence upon the composition of soil and the sub-kingdoms to which they belong.

III. From what sources are the following obtained: Spermaceti, pearls, amber, sponges, and ivory?

IV. Describe fully the life history of trichina spiralis, with special reference to its occurrence and influence upon man.

V. Give four marked differences between animals and plants.

VI. Give a list of injurious birds, and state in what way they may be termed such.

VII. To what orders and sub-kingdoms do the following belong: dolphin, hydra, egret, salmon, amœba, sheep, swan, liverfluke, sea-mat, snail?

VIII. Explain the terms, parasite, hybernate, mimicry, metamorphosis and symbiosis, giving the name of sub-kingdoms containing animals which illustrate them.

IX. Identify the specimens before you.

Veterinary Anatomy.

I. State the functions of voluntary muscles, and explain how they are made up.

II. Give the functions of the abdominal muscles and diaphragm.

III. Where is the mucous membrane found?

IV. What are glands?

V. In what respect do the teeth of herbivora, carnivora, and omnivora differ in form?

VI. How is the process of chylification affected, and what becomes of the chyle?

VII. Name the respiratory organs, and describe the trochea, bronchi, and bronchial tubes.

VIII. Describe a malpighian body of the kidneys, and the course the urine pursues from its point of secretion to its point of excretion.

IX. Describe the uterus.

X. Describe the course of the semen from its point of secretion to its reservoir.

English Grammar and Composition.

I. Explain and illustrate what is meant by the terms *Nominative case, Objective case, Possessive case.*

II. Quote rules and exceptions, with an example of each, for the formation of the plural of nouns and pronouns in English.

III. Analyse the following passage :

" But if the compound consists of a noun, followed by an adjective word or phrase, the noun part alone takes the plural."

IV. Correct the following sentences where necessary, giving the reason for each change you make :

(1) Will I bring your glasses ?
(2) They have laid here since morning.
(3) We merely refer to the order of the words.
(4) Please hand me them books.
(5) Can I have it after you are done with it ?
(6) A brave prudent honorable man was chosen.
(7) Don't buy any more of those sort of pencils.
(8) Six month's interest was due on the note.

V. Quote the rules for the use of the semi-colon and the dash.

(*a*) Punctuate the following sentences :

(1) Henry F Bond junior LLD
(2) This is the question whether it is expedient to purchase temporal pleasure at the expense of eternal happiness.
(3) This is the question Is it expedient to purchase temporal pleasure at the expense of eternal happiness.
(4) Mirth shd. be the embroidery of conversation not the web and wit the ornament of the mind not the furniture.

VI. Write a short friendship letter, paying strict attention to the matter, the form, and the punctuation.

Literature.—" Selections from Tennyson."

I. "The poem ' Ulysses' affords a study of a character modified or developed by the force of peculiar circumstances."

Enlarge on the above statement. What ' circumstances ' are referred to ? Who was Ulysses ?

II. Explain the phrases :

(*a*) " ....sitting well in order smite "
" The sounding furrows :.................. "
(*b*) " One equal temper of heroic hearts "
(*c*) " Lies the warrior, my forefather, with his feet upon the hound"
" Crossed ! "
(*d*) " ....since our dying race began,"
" Ever, ever and forever was the leading light of man."
(*e*) " ..... for man can half control his doom."

III. What is " Poetic license ?" Describe any examples in these poems.

IV. Quote not less than eight consecutive lines from " The Revenge."

Briefly describe the character assigned to Sir Richard Grenville in this poem. Support your description by quotations, if you can.

V. Write explanatory notes on " The Holy Grail." Why is Sir Galahad called "' just and faithful knight of God ? "

VI. Explain :

(*a*) ....Freedom slowly broadens down,
From precedent to precedent."
(*b*) " When single thought is civil crime."
Where did Tennyson obtain the material for the poems ?
" You ask me why " and " Of old sat Freedom ? "

VII. Quote a stanza (four lines) from "The May Queen."

VIII. Narrate briefly (in correct English) the story of Emmie, from "In the Children's Hospital."

State any objections you think may be urged against the beauty of this poem.

Arithmetic.

I. Find the profit or loss from feeding 10 steers for one month (30 days) from the following date:

Daily ration: ensilage 40 lb., worth $3.50 a ton; cut hat 10 lb., $10.50 a ton; meal 10 lb,, composed of peas 4 lb., 40c. a bushel; barley 2 lb., 50c. a bushel; oats 2 lb., 38c. a bushel; bran 2 lb., $12 a ton.

Daily increase in weight $1\frac{3}{4}$ lb. (sells for $5.87 a lb.;) manure, 90 lb. a day, worth $1.50 per ton.

II. A mow of hay contains $2\frac{1}{2}$ tons. Out of this, 7 horses are fed 12 pounds each daily for 3 weeks. Find the quantity left and its value at $12 a ton.

III. Add $\frac{1}{2}$, $\frac{5}{8}$, $2\frac{3}{4}$, and $3\frac{}{10}$; divide the sum by $3\frac{1}{2}$, and subtract the quotient from 7.

IV. Multiply 340.07 by 71,001; add 11.1 to the product; and divide the sum by 1.1.

V. Find the simple interest on $545.50 for 1 year 6 months at 6 per cent. per annum.

VI. A sends B wheat which he sells for $1,000 on a commission of 2 per cent. B invests the proceeds in goods for A, after deducting his commission for buying at 3 per cent. Find the value of goods bought.

VII. $860 GUELPH, April 11th, 1892.

Three months after date, I promise to pay J. Smith or order, the sum of eighteen hundred and sixty dollars, value received.

R. JONES.

(*a*) If this note is discounted at the Bank of Commerce May 2nd at 7 per cent, find the discount.

(*b*) If the note bears interest at the rate of 10 per cent per annum, find the discount; also find, to two decimal places, the rate per cent. of interest the banker receives for his money.

SECOND YEAR.

Agriculture.

I. Wherein consists the value of a standard scale of points? In the standard for Guernsey cattle, how many points of the scale of 100 relate to the milking qualities? Under what general headings are the remaining points included.

II. State the theories that have been advanced in reference to the origin of our domesticated varieties of sheep. What evidence have we that the improvement received much attention in ancient times?

III. What is meant by *softness* in wool. Mention some influences which affect this property of wool. State the principal defects in wool, and in a general way the means to be used to remedy these.

IV. Give the leading characteristics of the American Merino.

V. Compare the head of the Southdown, Dorset, Hampshire Down, and Oxford Down breeds with that of the Shropshire.

VI. Compare the fleece of the Cotswold, the Lincoln, and the Romney Marsh breeds with that of the Leicester.

VII. Draw a comparison between the Black Faced Highland, Welsh Mountain, and Cheviot breeds, in respect to hardihood, adaptability, mutton producing qualities, and quantity and quality of fleece.

VIII. State the principal points of difference in physical conformation and color between the Duroc-Jerseys, the Improved Yorkshires, and the Chester Whites when compared with the Berkshires.

IX. Give a synopsis of the facts relating to the origin of the Middle Yorkshires. State the leading characteristics of the small Yorkshires.

X. Give in brief and yet in somewhat minute detail what relates to the origin of the Poland China breed of swine.

Practical Cattle.

Time allowed to each student, 12 minutes.

I. Compare the Shorthorn cow "Authoress 16,204," with the Sussex cow "Columbine 7th (4,731")" for purposes of beef production.

II. Compare the grade cows Melinda and Matilda for purposes of milk production.

III. Give your opinion of the suitability of the store calf Baalam for purposes of beef production.

Practical Sheep.

Time allowed to each student, 12 minutes.

I. Compare the grade wethers Borderer and Bannerman for mutton purposes; for wool production.

II. Give your opinion of the ewe, E.N. 982, as a representative of the breed as a mutton sheep.

III. Give your opinion of the Oxford Down ram Hero of O.A.C. (850 O.E.F.) as a representative of the breed.

Agricultural Chemistry.

I. Discuss exhaustion of roots and stems of cereal crops during seed formation.

II. Show by chemical equations why alkaline substances, as lime, should not be mixed with ammonium salts, nitrate of soda with damp superphosphate, nor carbonate of lime with superphosphate.

III. State the characteristics in the composition and growth of leguminous crops.

IV. Give the chemical composition of albumnoids, keratin, stearin, and carbohydrates. From what sources are keratin, gelatinoids and animal fat derived.

V. Define protein, nutrient, and animal nutrition.

VI. It is stated that oats contain 12.9 per cent. nitrogenous substance. What are the basis of calculation? What nitrogenous substance does it represent?

VII. Distinguish between heat co-efficient and digestion co-efficient. Give the heat co-efficients of cellulose, starch, fat, and albumin.

VIII. Give the composition of cow's milk. Determine its albuminoid ratio.

IX. Discuss the several fattening periods, with special reference to the statement "after considerable fat has been deposited in the animal, gradually increase the quantity of protein in the food."

Entomology.

I. Give notes on the use of Paris Green as an insecticide, referring to its composition, amount used, method, and time of application.

II. Draw diagrams illustrating typical forms of the hawk moths, saw-flies, and borers, and name the plants affected by them.

III. Give two emulsions, describing how they are made and applied, and name the insects which are destroyed by them.

IV. What plants are usually attacked by the following insects: curculio, army-worm, tussock moth, thrip, cut-worm, chinch bug, canker-worm, rose bug, flea beetle, and Hessian fly.

V. For what insects is carbon disulphide a remedy, and how is it applied? What precautions require to be observed in its use?

VI. By whom and what are the latest results regarding remedies for *Agriotes mancus*?

VII. Give the life history of *Aphis mali* and name other insects of the same order that are injurious.

VIII. Compare London purple and Paris green as insecticides, referring to composition, costs, and results.

IX. Name three injurious insects from each of the following orders: Diptera, hymenoptera, and coleoptera.

Diseases of Domestic Animals.

I. Explain the errors usually committed in shoeing horses.

II. Give the nature, causes, and symptoms of side-bones.

III. What are the differential symptoms of thrush and canker.

IV. Give the nature, symptoms, and treatment of melanotic tumors.

V. Explain the four chief points to be attended to in the treatment of wounds, and name the diseases liable to follow wounds.

VI. Explain the causes of digestive disorders.

VII. Give the symptoms of impaction of the rumen and bloating of cattle.

VIII. Give the treatment of spasmodic and flatulent colic.

IX. Explain the differential symptoms of acute indigestion and enteritis.

X. Give the symptoms and treatment of congestion of the lungs.

Practical Horse.

I. Explain the defects met with in the action of horses.

II. Describe the desirable formation of the middle piece of the horse, and the defects of formation met with in that part.

III. What are the uses of the thermometer? State how to use it, and give the normal temperature of the horses, ox, and sheep.

IV. Explain the advantages and disadvantages of the different methods of administering medicines to animals.

V. Explain how respiration is affected, and the objects of that function.

English Literature—Shakespeare's "Hamlet."

I. Give a general outline of the plot of this play.

II. Why is the monologue used so extensively in this play? Quote a few lines from each of Hamlet's soliloquies in the first four acts,

III. Give a general outline of Hamlet's character, quoting where you can in illustration of your statements, and contrast him with the other young men in the play.

IV. Point out, quoting where you can, where and how in the play the poet satirizes each of the following: Play-actors, affectation in language, court sycophancy, national intemperance, military glory.

V. Trace out and characterize the elements of humor in the play.

VI. In what act, by whom, and under what circumstances, was each of the following often quoted expressions used in the play:

(*a*) "But break my heart for I must hold my tongue."
(*b*) "Something is rotten in the State of Denmark."
(*c*) "Brevity is the soul of wit."
(*d*) "Though this is madness yet there is method in it."
(*e*) "The glass of fashion and the mould of form."
(*f*) "Lay not that flattering unction to thy soul."
(*g*) "There's a divinity that shapes our ends
"Rough-hew them how we will."

VII. Explain and name the speaker of each of the following: "Take each man's censure," "Tickle in the sere," "A vice of kings," "Worse than the mutines in the bilboes." "This quarry cries on havoc."

Political Economy.

N. B.—Candidates are requested not to attempt more than seven questions.

I. What is the problem which Political Economy proposes to solve?

II. What are the forces which lead to the division of labor; and what harmful results have followed its introduction?

III. How does the introduction of labor-saving machinery affect the wage-earner?

IV. What is the fundamental cause of any rent being paid for land, and what is the standard whereby to judge how much rent per annum a particular farm will bring.

V. What rules should be observed in devising a system of national taxation?

VI. Discuss the relative advantages of different kinds of paper currency.

VII. "Wages are increased by increasing the produce of labor." Examine this proposition.

VIII. Estimate the value of co-operation as a means for improving the position of working-men.

IX. "The value of a commodity is in proportion to the amount of labor bestowed on its production." Criticise this doctrine.

II. PAPERS SET AT MIDSUMMER EXAMINATIONS, 1892.

FIRST YEAR.

Agriculture.

I. Give the classification of corn as to varieties, and also its suitability to various soils.

II. Mention the conditions that should govern the planting of corn (1) as to distance (2) as to mode, and (3) as to the amount of seed required.

III. Give your views (1) as to the value of wilting corn after it is cut, (2) of spreading and tramping it in the silo, and (3) of its value as a food factor in making beef.

IV. Describe the common mode of building the wall of a silo from the foundation upwards.

V. Give the leading characteristics of millet.

VI. Would you recommend growing meadow foxtail (*Alopecurus pratensis*), tall oat grass (*Avena elatior*), and meadow fescue (*Festuca pratensis*)? If so, under what conditions?

VII. Name the grasses and clovers suitable to sow in a permanent pasture and the quantities that may be used.

VIII. Describe in detail the mode of destroying the Canada Thistle (*Cnicus arvensis*) by means of growing rye in conjunction with rape.

IX. Give the most effective mode of destroying couch grass (*Triticum repens*).

X. Give a description of Pigeon weed (*Lithospermum arvense*), and name the crops which it more commonly infests.

Dairying.

I. "Farmers must lessen the cost of production." How may this be done in the dairy?

II. Give the requisites of a good dairy cow.

III. How would you proceed to establish a good dairy herd?

IV. State how you would manage a heifer intended for a dairy cow from the time she is dropped until four years old.

V. Explain the secretion or milk, giving an outline of the theories that have been put forth in explanation of the process.

VI. What does ripening cream consist of? Is it necessary for churning?

VII. When and how would you salt butter? How much salt would you add?

VIII. Give a synopsis of "making the butter" in the pamphlet "Good Butter. How to make it".

IX. What are the main features of the Cheddar system of cheesemaking?

X. Give a scale of points for judging Cheddar cheese.

Botany.

I. Describe a seed, and state what conditions are necessary for its germination.

II. Compare the orders Rosaceæ and Leguminosæ, and name three plants in each.

III. Name the different kinds of irregular corrollas, and give examples of each.

IV. How would you proceed to analyze a plant and then identify it?

V. Give notes upon the leaf, and distinguish between an exogenous and endogenous plant.

VI. Draw a diagram illustrating the different forms of roots.

VII. Give examples illustrating how plants store up material for their future use.

VIII. Explain the terms: tetradynamous, syngenesious, perigynous, monadelphous, apetalous, and give examples illustrating each.

Geology.

I. What rocks in Canada give information regarding the composition of the soil in Ontario?

II. Account for the formation of coal, and name the systems in which it is found.

III. Compare the economic products of the Devonian and Triassic systems as regards original. State where these rocks are represented.

IV. Draw diagrams illustrating the terms conformable, fault, cleavage, and denudation.

V. Give the characteristics of the Cretaceous system, and state where it is found.

VI. Name the systems represented in the Province of Ontario.

VII. What forces influence the disintegration of rocks? Give the composition of apatite, gypsum, limestone, dolomite, and granite.

Materia Medica.

I. How do the majority of medicines establish their actions?

II. Define the following terms, and give examples viz., caustic, stomachic, purgative, diaphoretic, diuretic, restorative, sedative, and anæsthetic.

III. Name the different ways in which medicines are given to animals.

IV. Give the capacity of the different domestic utensils, viz., tumblers, tea cups, wine glasses, table-spoons, desert-spoons, amd tea-spoons.

V. Give the properties, actions, and uses of Epsom salts.

VI. Give the uses of tbe products of flax seed in veterinary patients.

VII. Give a prescription for a tonic for the horse, containing both a mineral and vegetable substance.

VIII. Give the dose of aconite, aloes, Epsom salts, croton oil, and raw linseed oil.

IX. Give the source, properties, actions, and uses of iodine.

X. What are the actions and uses of carbolic acid.

Elementary English Grammar.

I. Make such corrections as you think necessary in the following sentences, giving reasons:

(*a*) He was an independent small farmer.
(*b*) There is a farmer's club in our village.
(*c*) I had not idea but what she'd be here.
(*d*) Let you and I go, Tom and him can stay at home.
(*e*) They have laid here since morning.
(*f*) At what hotel are you stopping?
(*g*) Each of the boys have their books.
(*h*) Give every word and syllable their proper sound.
(*i*) You shouldn't have undertook the business.
(*j*) Those hats didn't ought to be laying there.
(*k*) Raising the window and looking out, busy crowds were seen in the street.
(*l*) Hoping to hear from you, believe me, yours truly.
(*m*) I was present when he done it.
(*n*) That flower is very beautiful and smells so sweetly.

II. Write out a list of auxiliary verbs in English and divide them into two classes.

1. Those which are always used as auxiliaries.
2. Those which are used sometimes as auxiliaries and at other times as principal verbs.

(*a*) State briefly the auxiliary uses of *have* and *be*.

III. Quote rules for the comparison of English adjectives.

IV. Give examples of the different forms of *infinitives* and *participles* found in English; and state how the forms in *ing* can be distinguished from one another.

V. Give the present subjunctive of the verb *to be*.

VI. Explain and illustrate what is meant when we say that "*the verb agrees with its subject in person and number*"; and state what further changes in our language are necessary before we can dispense with this rule.

Literature.—Selections from Wordsworth.

I. Indicate briefly the traits of character of the "Happy Warrior."

II. (*a*) Paraphrase the Ode to Duty.
(*b*) Quote the Ode to Duty.

III. What is the main purpose, or the central thought of each of the following poems, (express this first in your own words, and then, where you can do so, in the poet's words):

(a) We are Seven, (b) The Fountain, (c) The Two April Mornings, (d) Expostulation and Reply, (e) The Tables Turned.

IV. Narrate the story of Laedameia.

V. Carefully explain (referring to the context) the meaning of the following:

(a) . . . her bondage prove
The fetters of a dream, opposed to love.

(b) "Ill," said he,
"The end of man's existence I discerned," etc.

(c) but lofty thought,
In act embodied, my deliverance wrought.

(d) Earth destroys
Those raptures duly, Erebus disdains;
Calm treasures there abide, majestic pains.

(e) And many love me, but by none
Am I enough loved.

(f) We wear a face of joy because
We have been glad of yore.

VI. In the poem "The Fountain," compare the two readings:
"At this he grasped his hands," etc. and
" . . . . my hand," etc.

State which you prefer; and show how the slight verbal change makes a considerable change in the character of the old man.

VII. Describe the construction of the sonnet. Give the thought or substance of the sonnet:
"A Poet! he hath put his heart to school."

Mensuration.

I. A field is 210 yds. long and 120 yds. wide.
(a) Find the number of acres.
(b) Find the area of a circular field with the same perimeter.

II. The diameter of a cistern is 14 ft. Find (a) the circumference, (b) the number of gallons when the water is 8 ft. deep.

III. A barn is 120 ft. long and 80 wide. If the water from the roof is drained into cistern of question II, find to what depth one inch rainfall will fill the cistern.

IV. A log 5 ft. in diameter is 30 ft. long. Find the cubic feet in the largest squared stick that can be hewn from it.

V. The diameter of the bottom of a pail is 7 inches; the diameter of the top 14 inches; the depth 1 foot; how often can it be filled from a vessel in the form of a frustum of a pyramid on a square base; the edge of base 6 ft., the edge of top 3 ft., and height 5 ft?

VI. Explain by means of examples how to find the height of an object which cannot be climbed, and the breadth of a stream that cannot be crossed, (a) using carpenters' tools etc., (b) using only measuring line and rods.

Book-keeping.

I. Briefly describe the best system of book-keeping that will give the information, regarding his business that the average Ontario farmer requires.

II. Write the form of a promissory note, of a receipt for wages, of a receipt for rent of an accepted draft.

III. Make out an inventory of implements on a farm of 150 acres.

IV. Make out and close an annual account with cows.

V. How would you enter the following in the ledger:

Mention the name of the account, the side and the amount.

(a) Jan. 10, '91. You buy a cow for $225, giving your note, due six months hence, bearing interest at 8 per cent.
(b) July 12, '91. You pay for the note.
(c) April 5, '91. You sell a horse for $150 cash and a note for $100 due six months hence.
(d) July 10, '91. You get the note discounted at the Bank of Commerce at 7 per cent.
(e) You underdrain Field No. 1, paying for tile and labor $300 cash; value of labor for which no money is paid is $100.
(f) You sow twenty bushels of fall wheat in Field No. 2, for which you pay $1.10 a bushel.
(g) You put 50 loads manure on Field No. 3, worth $1 a load.

SECOND YEAR.

Live Stock and Arboriculture.

I. In breeding, what is meant by the terms "prepotency" and "selection?" What value should be put upon the former, and what are the leading principles which govern the latter?

II. Give the distinctions between a cross-bred, a grade, a high grade and a scrub. Which of these classes of animals, in your opinion, may be most profitably bred by the average Canadian farmer under existing conditions, and give the reasons?

III. Mention the general individual properties to be sought in a dam of the beefing types of cattle, the dairy types, and in the dam of the combined mutton and wool producing sheep.

IV. Mention the rations suitable for calves of the beefing and the dairy breeds, giving prominence to the points of difference.

V. State the winter rations which you consider suitable for store cattle to be finished on the grass the following season, and for beef cattle to be shipped from the stall, giving prominence to the points of difference.

VI. State the leading indications of nerve power, good digestion, and superior milk secretion in a dairy cow, and the special milk indications in a dairy bull.

VII. Give the desirable characteristics as to form in sheep and lambs for fattening.

VIII. Give the chief of the reasons for and against the wholesale removal of forests.

IX. Give the definition for coniferous trees; state some important particulars regarding their growth. Which varieties do you consider the most suitable for windbreaks?

X. In reforesting, where should a regular order be observed, and where is it not necessary? What are the respective advantages of planting in rectangles, in squares, and in the quincunx order? How would you mark out a field for planting in triangles?

Dairying.

I. Review briefly "Scientific Dairy Practice."

II. What are the chief causes of imperfect milk?

III. State the advantages and disadvantages of the centrifuge; give the points of merit in a cream separator.

IV. How would you keep a record of a herd of dairy cows? Is it important to do so?

V. Give the classification of the bacteria of milk according to L. Adametz; state the effects (chemical and physical) produced on milk by each class.

VI. Give a list of utensils required in a cheese factory of 500 to 700 cows capacity.

VII. Explain the theory of cheese-making.

VIII. Determine volumetrically the per cent. of water, fat, solids not fat, and total solids in the sample of milk before you.

IX. Score the samples of butter placed before you.

X. There was delivered at a cheese factory 312,259 lb. milk, from which was made 30,312 lb. cheese. Value of the cheese $2,609.54; cost of manufacturing $363.85.

Of this milk A sent	4,804 lb., testing	3	per cent. fat.
B "	200,000	"	$3\frac{1}{2}$	"
C "	107,455	"	4	"

Find the amounts of money which A, B and C are entitled to receive

1. On the the present plan of distributing proceeds at the factory.
2. On the proposed plan according to the fat contents of the milk.

Practical Chemistry.

I. Determine the metal or metals present in the solution given.

II. The precipitated chlorides of Group 1 are washed first with cold and afterwards with warm water. Why?

III. A residue of mercurous and silver chlorides is washed with warm ammonia water; give chemical equations showing its effect upon each chloride.

IV. Name the sulphides of the metals of G. II, S.-G. A, that are soluble in dilute boiling nitric acid.

V. State a method for determining bismuth and cadmium in a nitric acid solution containing in addition lead and copper.

Economic and Systematic Botany.

I. Give an outline of the development of a typical form among the fungi and draw diagrams illustrating the life history of the common rust upon wheat.

II. Give brief notes upon Chlorophyll, Inulin, Lenticels, and "Root pressure."

III. How are cells formed, and name some of the modifications they undergo, giving examples in each case.

IV. Name poisonous plants in the following orders: Leguminosæ, Solanaceæ and Umbelliferæ, and give the characters of the Borraginaceæ with examples of weeds found in it.

V. Compare the orders Labiatæ and Scropulariaceæ, giving examples of weeds from the latter.

VI. Give reasons for believing chess is not deteriorated wheat, and distinguish couch grass from rye grass, and bladder campion from white cockle.

VII. To what orders do the following belong: Chickweed, sow-thistle, artichoke, buckwheat, plum, milkweed, clematis and sorrel.

VIII. In what orders do we find plants of value in the manufacture of cloth, varnish, oil, and for fruit.

IX. Identify the specimens before you, stating where those under the microscopes can be obtained.

Practical Horticulture.

I. Draw a diagram indicating an arrangement of the most common orders among flowering plants for instructive purposes.

II. Compare the following shrubs: Caragana, Spiræa, Weigela, Deutzia, and Forsythia.

III. Arrange the following plants in a rectangular bed: Geranium, cerastium, dahlia, iresine, coleus, and distinguish between carpet and ribbon bedding.

IV. Give the position of the first four trees in an orchard where the trees are planted after the hexagonal form, 35 feet apart.

V. Outline the management of a strawberry bed for three years, and state the varieties you would suggest to plant.

VI. Describe the weather and state of vegetation during the first week in June.

Breeds of Horses and Veterinary Obstetrics.

I. Give the strong and weak points of Clydes and Shires respectively.

II. Give the characteristics of the "Suffolk Punch."

III. What qualities has the Cleveland Bay that renders him suitable to produce carriage horses? State what stamp of mare to mate him with in order to get the best results for carriage purposes in Canada.

IV. Why is it advisable to infuse more thoroughbred blood into our light horses in this province? Give opinion as to the stamp of mare suitable to breed to a thoroughbred.

V. Describe the arrangement of the placenta in cows and mares.

VI. Name the four acts by which generation is accomplished, and the organs by which they are effected.

VII. State the causes of sterility, and give the average number of fruitful animals amongst mares, cows and ewes.

VIII. Give the average period of gestation in the mare, cow, ewe, sow and bitch.

IX. Explain how to perform amputation of the fore extremity, and evisceration of the fœtus.

X. Explain how to effect delivery in the following cases: Transverse presentation, one foreleg completely retained, extreme downward deviation of the head towards the abdomen.

English Literature.—Milton's L'Allegro and Il Penseroso.

I. Discuss the poet's selection and treatment of each of the following subjects in the two poems respectively, with quotations: The time of say, time of life, music, the stage, birds, morning scenes.

II. Show the relative importance respectively placed in the two poems on each o the following subjects. Quote where you can, and show the suitability to the prevailing sentiment in each poem:

> Day and night, sunshine and gloom, companionship and solitude, the senses and the intellect.

III. Quote and explain the allusions in the poem to each of the following: Cynosure, Hermes, Orpheus, Vesta, Chaucer, Jonson, Plato, Shakespeare.

IV. Explain the following lines occurring in the poem :

The mountain nymph, sweet Liberty.
In weeds of peace high triumphs hold.
And every shepherd tells his tale.
Lap me in soft Lydian airs.
How little you bestead.
Over thy decent shoulders drawn.
But let my due feet never fail
To walk the studious cloister's pale ;
And love the high embowed roof,
With antique pillars massy proof.

V. Point out the poetical and rhetorical peculiarities in each of the following lines :

The frolic wind that breathes the spring.
Till the dappled dawn doth rise.
Where the nibbling flocks do stray.
The laboring clouds do often rest.
Hard by a cottage chimney smokes,
From betwixt two aged oaks.
Then lies him down the lubber fiend.
With wanton head and giddy cunning.
Forget thyself to marble.

Road-making and Levelling.

I. Distinguish *true* and *apparent* level, and find the difference for a distance of (a) 4 miles, (b) $\frac{1}{4}$ mile.

II. Briefly explain the method of determining the levels for an underdrain. Illustrate by a line and table of measurements.

III. If a force of 80 pounds is necessary to draw a load of one ton on the level, find the force necessary on this road to draw a load of $1\frac{3}{4}$ tons up a slope of 1 in 20.

IV. Give detailed instructions for the construction of gravel roads.

V. Would it be well to abolish statute labor? Discuss concisely.

VI. Write an essay on the advantages of good country roads.

Mechanical Department.

I. The length of base of a right angle triangle is 16 ft., the perpendicular is $10\frac{2}{3}$ ft. Give the most extreme ratio of inches on blade and tongue of the steel square that will determine the bevel cuts of either end of the third side, and the number of applications required to produce the length.

II. Describe the condition of the teeth of a ripping saw when it is at its best for medium hard wood, and give the important points that distinguish between a rip and cross-cutting saw. State also the reasons for the difference.

III. What is meant by jointing the teeth of a saw? and describe the manner in which it is done.

IV. There are three bench planes used more frequently in joiner work than any other; give the names, the grinding angle of the basil, and the condition of the cutting edge of each plane respectively.

V. Explain the difference between planing up a piece of stuff and trying up a piece of stuff.

APPENDIX IV.

CLASS LISTS—EASTER EXAMINATIONS, 1892.

FIRST YEAR.

AGRICULTURE.

CLASS I.

1 Ferguson, J. J.
2 Atkinson, Jas.
3 McCallum, Wm.
4 Walker, F.
5 Cornell, J. G.
6 Spencer, J. B.

CLASS II.

1 McKenzie, W. G.
2 Holmes, C. U.
3 Widdifield, J. W.
4 Robertson, Wm.
5 Hunter, H. E.
6 { McNaughton, K.
  { Stewart, J.
8 Dean, F.
9 Burns, J. H.
10 { Phin, A. E.
  { Elmes, W. A.

CLASS III.

1 Lehmann, R. A.
2 McDonald, F. J.
3 Kennedy, P. B.
4 Hamilton, C. A.
5 { Phin, G.
  { Emigh.
7 McCrimmon.
8 Kirk, H.
9 Baird, W. H.
10 Brooks, W. A.
11 McMordie, R.
12 Vanatter, P. O.
13 Kerr, W. C.
14 Farrer, J. W.
15 { Grey, F. W.
  { Findlay, J. H.
17 Burdett, A. H.
18 Hay, L.
19 Ainley, W.

Ferraby, E. L.
Woolley, D.
Wilson, G. H.
Jackson, T. M.

INORGANIC CHEMISTRY.

CLASS I.

1 Atkinson.
2 Ferguson.

CLASS II.

1 McCallum.
2 McKenzie, W. G.
3 { Hay.
  { Kennedy.

CLASS III.

1 { Dean.
  { Spencer.
3 McLean.
4 Walker.
5 Widdifield.
6 { Elmes.
  { Lehmann.
8 { Burns, J. H.
  { McNaughton.
10 Stewart.
11 { Brooks.
  { McMordie.
13 { Phin, A. E.
  { Vanatter.
15 { Holmes.
  { Robertson.

Cornell.
Phin, G.
Kirk.
Ferraby.
Farrer.
Findlay.
McCrimmon.
Hamilton.
Jackson.
Baird.
Hunter.
Burdett.
Woolley.
Wilson.
Emigh.
Ainley.
Grey.
Kerr.

ORGANIC CHEMISTRY.

CLASS I.

1 Ferguson.
2 Atkinson.
3 McKenzie, W. G.
4 { McCallum.
  { Spencer.

CLASS II.

1 Kennedy.
2 { Walker.
  { Widdifield.

CLASS III.

1 Dean.
2 { Stewart.
  { Phin, A. E.
4 McMordie.
5 Hay.
6 Holmes.
7 Elmes.
8 McNaughton.
9 { Burns, J. H.
  { McCrimmon.
11 Lehmann.
12 { Kirk.
  { Hamilton.

Cornell.
Brooks.
Farrer.
Findlay.
Emigh.
Ferraby.
Baird.
Hunter.
Robertson (ægrotat).
Jackson.
Woolley.
Wilson.
Grey.
Phin, G.
Kerr.
Burdett.
Ainley.

ZOOLOGY.

CLASS I.

1 Ferguson.
2 Atkinson.
3 Walker.
4 { Cornell.
  { McCallum.
6 Widdifield.

CLASS II.

1 Hay.
2 Dean.
3 Spencer.
4 Burns.
5 Kennedy.

CLASS III.

1 Ferraby.
2 McKenzie.
3 { Stewart.
  { McMordie.
5 Farrer.
6 McNaughton.
7 Brooks.
8 Lehmann.
9 Phin, A. E.
10 { Elmes.
  { Hamilton.
12 Hunter.
13 Holmes.
14 McCrimmon.
15 Baird.
16 Phin, G.
17 Burdett.
18 Findlay.
19 Kirk.
20 Vanatter.

Emigh.
Robertson.
Wilson.
Jackson.
Grey.
Kerr.
Woolley.
Ainley.

NOTE.—Names unnumbered (below the line) are those of students who failed to pass in the subjects The minimum for first-class (honors) is 75 per cent.; for second-class (honors) 60 per cent.; for third-class (pass) 33 per cent.

CLASS LIST (EASTER EXAMINATIONS).—*Continued.*

FIRST YEAR.

VETERINARY ANATOMY.

CLASS I.

1 Atkinson.
2 Ferguson.

CLASS II.

1 Widdifield.
2 McCallum.
3 McNaughton.

CLASS III.

1 Stewart.
2 Kennedy.
3 Spencer.
4 McMordie.
5 Burns, J. H.
6 Walker.
7 Hay.
8 Hamilton.
9 Phin, A. E.
10 McCrimmon.
Robertson.
Cornell.
13 Elmes.
Holmes.
Dean.
16 McKenzie, W. G.
Grey.
16 Kirk.
Kerr.
Brooks.
Emigh.
Farrer.

Vanatter.
Hunter.
Ferraby.
Baird.
Phin, G.
Lehmann.
Burdett.
Findlay.
Ainley.
Wilson.
Woolley.
Jackson.

GRAMMAR.

CLASS I.

1 Ferguson.
2 Kennedy.
3 McCallum.
Hay.

CLASS II.

1 Widdifield.
2 Walker.
3 Spencer.
4 Atkinson.
5 McCrimmon.
6 Burns, J. H.
7 Kirk.

CLASS III.

1 McKenzie, W. G.
2 Phin, A. E.
3 Hamilton.
4 Elmes.
5 Holmes.
McMordie.
7 Dean.
8 Farrer.
9 McNaughton.
10 Robertson.
11 Hunter.
Grey.
13 Burdett.
14 Brooks.
Lehmann.
16 Cornell.
Emigh.
18 Stewart.

Kerr.
Findlay.
Baird.
Ferraby.
Jackson.
Phin, G.
Wilson.
Woolley.
Ainley.

ENGLISH LITERATURE.

CLASS I.

1 Ferguson.
2 Burns, J. H.
Walker.
4 McCallum.
5 Atkinson.
6 Hamilton.

CLASS II.

1 Widdifield.
2 Spencer.
3 Cornell.
4 Dean.

CLASS III.

1 McKenzie, W. G.
2 Hay.
3 McCrimmon.
4 Ferraby.
5 Farrer.
6 Hunter.
7 Elmes.
Holmes.
9 Burdett.
Kennedy.
11 McNaughton.
12 Robertson.
13 Kirk.
McMordie.
15 Lehmann.
16 Emigh.
Grey.
18 Phin, A. E.
19 Stewart.

Brooks.
Baird.
Phin, G.
Findlay.
Wilson.
Ainley.
Jackson.
Kerr.
Woolley.

ARITHMETIC.

CLASS I.

1 Walker.
2 Ferguson.
3 Widdifield.
4 McKenzie.
Lehmann.
6 Phin, A. E.
7 Atkinson.

CLASS II.

1 Spencer.
Stewart.
3 Kirk.
4 Emigh.
5 McCallum.
6 McCrimmon.
7 Kennedy.
Findlay.
9 Hamilton.
Holmes.
Brooks.

CLASS III.

1 Burns, J. H.
2 Hay.
3 McNaughton.
4 Ferraby.
5 Elmes.
6 Kerr.
7 McMordie.
Phin, T.
9 Cornell.
10 Hunter.
11 Robertson.
Dean.
13 Vanatter.
Grey.
15 Burdett.

Jackson.
Baird.
Farrer.
Ainley.
Woolley.
Wilson.

GENERAL PROFICIENCY.

1 Ferguson.
2 Atkinson.
3 McCallum.
4 Walker.
5 Widdifield.
6 Spencer.
7 McKenzie, W. G.
8 Kennedy.
9 Burns, J. H.
10 Hay.
11 Dean.
12 Stewart.
13 Phin, A. E.
14 McNaughton.
15 Holmes.
16 McMordie.
17 Elmes.

CLASS LISTS (EASTER EXAMINATIONS).—*Continued.*

SECOND YEAR.

AGRICULTURE.	PRACTICAL CATTLE.	PRACTICAL SHEEP.	AGRICULTURAL CHEMISTRY.	ENTOMOLOGY.
CLASS I.	CLASS I.	CLASS I.	CLASS I.	CLASS I.
1 Shaw, R. S. 2 Soule, A. McNairn 3 Harcourt, R. 4 Curzon, S. R. 5 Crealy, J. E. 6 Wiancko, A. T.	1 Soule. 2 { Shaw. Yuill.	1 Day. 2 Ruthven. 3 { Harcourt. Shaw. 5 Dyer. 6 Tolton. 7 Beckett.	1 Crealy. 2 Day. 3 Dyer. 4 Harcourt. 5 { Beckett. Shaw.	1 Curzon, S. 2 Beckett. 3 Soule. 4 Shaw. 5 Dyer. 6 Day. 7 Crealey. 8 Carpenter. 9 Hurley. 10 Harcourt. 11 Brown.
CLASS II.	CLASS II.	CLASS II.	CLASS II.	CLASS II.
1 Dyer, W. D. 2 Beckett, H. L. 3 Story, H. 4 Day, G. E. 5 { Gies, N. Hurley, T. J. 7 Honsberger, J. D. 8 Silverthorn, C. 9 { Graham, W. R. Tolton, J. E. 11 { Carlaw, W. Aylsworth, D.	1 Ruthven. 2 Bell. 3 Harcourt. 4 Honsberger. 5 { Carpenter. Day. 7 Aylsworth. 8 { Dyer. Graham. 10 Gies.	1 { Soule. Yuill. 3 Story. 4 { Aylsworth. Graham. 6 Wiancko.	1 Burns. 2 Wiancko. 3 Harvey. 4 { Gies. Eaton. 6 Curzon, S.	1 Eaton. 2 Ruthven. 3 Honsberger. 4 Wiancko. 5 Story.
CLASS III.	CLASS III.	CLASS III.	CLASS III.	CLASS III.
1 Brown, B. C. 2 Harvey, W. H. 3 Yuill, A. R. 4 Eaton, L. W. 5 Ruthven, W. A. 6 Burns, J. A. S. 7 Carpenter, F.C.S. 8 Curzon, A. R.	1 { Crealy. Harvey. 3 Beckett. 4 { Tolton. Wiancko. 6 Curzon, A. 7 Hurley. 8 Brown. 9 McDonald. 10 { Eaton. Silverthorn. 12 { Carlaw. Story. 14 Curzon, S. 15 Burns, J. A. S.	1 Crealy. 2 Hurley. 3 Curzon, S. 4 Curzon, A. 5 Eaton. 6 Honsberger. 7 Gies. 8 Harvey. 9 Carlaw. 10 McDonald, F. J. 11 Silverthorn. 12 Brown. 13 Carpenter.	1 Honsberger. 2 { Hurley. Graham. 4 Silverthorn. 5 Carpenter. 6 Brown. 7 Tolton. 8 { Story. Soule. 10 Ruthven. 11 Yuill. 12 Carlaw. 13 Aylsworth. 14 Curzon, A.	1 Harvey. 2 Burns, J. A. S. 3 Graham. 4 Silverthorn. 5 Carlaw. 6 Yuill. 7 { Tolton. Gies. 9 Aylsworth. 11 Curzon, A.
	—— Bealey, H. B.	—— Burns, J. A. S.		

CLASS LISTS (EASTER EXAMINATIONS).—*Concluded.*

SECOND YEAR.

DISEASES OF DOMESTIC ANIMALS.

CLASS I.

1 Day.
2 Shaw.
3 Beckett.
4 Soule.
5 Wiancko.

CLASS II.

1 Curzon, S.
2 Crealy.
3 Gies.
4 Dyer.
5 Silverthorn.

CLASS III.

1 Harcourt.
2 Honsberger.
3 Hurley.
4 Carlaw.
5 Aylsworth.
6 Eaton.
7 Harvey.
8 Story.
9 Ruthven.
10 Tolton.
11 Carpenter.
12 Brown.
13 Yuill.
14 Graham.

Curzon, A.
Burns.

PRACTICAL HORSE.

CLASS I.

1 Day.
2 Beckett.
3 Shaw.
4 Hurley.
5 Silverthorn.

CLASS II.

1 Ruthven.
2 Brown.
3 Harcourt.
4 Yuill.
5 Wiancko.
6 Aylsworth.
7 Story.
8 Soule.
9 Eaton.
10 Graham.
11 Carlaw.

CLASS III.

1 Tolton.
2 Honsberger.
3 Gies.
4 Crealy.
5 Dyer.
6 Harvey.
7 Curzon, S.
8 Curzon, A.
9 Carpenter.
10 Burns.

LITERATURE.

CLASS I.

1 Day.
2 Soule.
3 Shaw.
4 Curzon, S.
5 { Honsberger.
  { Eaton.

CLASS II.

1 { Beckett.
  { Carpenter.
  { Burns, J. A. S.
4 { Harcourt.
  { Harvey.
6 Story.

CLASS III.

1 Dyer.
2 Silverthorn.
3 Wiancko.
4 Crealy.
5 Hurley.
6 { Aylsworth.
  { Gies.
  { Carlaw.
9 Brown.
10 Tolton.
11 { Moody.
   { Ruthven.
13 Yuill.

Graham.
Curzon, A.

POLITICAL ECONOMY.

CLASS I.

1 Day.
2 Shaw.
3 Soule.

CLASS II.

1 Curzon, S.
2 { Dyer.
  { Crealy.
4 Burns, J. A. S.
5 { Beckett.
  { Harcourt.

CLASS III.

1 Gies.
2 Harvey.
3 Carlaw.
4 Eaton.
5 { Wiancko.
  { Silverthorn.
7 Aylsworth.
8 { Honsberger.
  { Ruthven.
10 Yuill.
11 Brown.
12 Story.
13 Tolton.
14 Carpenter.
15 Moody.
16 Hurley.

Curzon, A.
Graham.

PROFICIENCY.

1 Shaw.
2 Day.
3 Beckett.
4 Soule.
5 Harcourt.
6 Dyer.
7 Crealy.
8 Curzon, S.
9 Wiancko.
10 Honsberger.
11 Gies.
12 Eaton.
13 Harvey.
14 Hurley.
15 Silverthorn.
16 Story.
17 Ruthven.
18 Carpenter.
19 Aylesworth.
20 Brown.
21 Yuill.
22 Carlaw.
23 Tolton.

CLASS LISTS.

Midsummer Examinations, 1892.

FIRST YEAR.

Agriculture.

Class I.

1 Atkinson.
2 Ferguson.
3 McCallum.
4 Walker.
5 Robertson.
6 { Stewart.
Widdifield.
8 Spencer.
9 McKenzie.
10 Dean.

Class II.

1 Findlay.
2 McNaughton.
3 { Holmes.
McCrimmon.
5 McMordie.
6 { Beard.
Hunter.
Kennedy.

Class III.

1 { Hamilton.
Phin, A. E.
3 Lehmann.
4 Elms.
5 Burns.
6 Kiely.
7 { Elford.
Brooks.
Phin, G.
10 Maclean.
11 Emigh.
12 Ainley.
13 Farrer.
14 { Kerr.
Kerraby.
Woolley.
17 Kirk.
18 Hay.
19 Burdett.
20 { Jackson.
Wilson.
22 Grey.

Dairying.

Class I.

1 Ferguson.
2 Atkinson.
3 Spencer.

Class II.

1 McKenzie.
2 Robertson.
3 Dean.
4 Widdifield.
5 Kennedy.
6 { McCallum.
Holmes.
8 Walker.
9 McMordie.
10 McCrimmon.

Class III.

1 Elmes.
2 McNaughton.
3 Kirk.
4 Hay.
5 Phin, A.
6 Hamilton.
7 { Maclean.
Stewart.
9 { Lehmann.
Ferraby.
11 { Hunter, H. E.
Brooks.
13 Burdett.
14 Findlay.
15 Baird.
16 Elford.
17 Burns.
18 Emigh.
19 Wilson.
20 { Kerr.
Woolley.
22 { Ainley.
Phin, G.
Farrer.
Grey.
DeHart.

Jackson.
Hallett.

Materia Medica.

Class I.

1 Ferguson.
2 Atkinson.
3 Widdifield.
4 Maclean.

Class II.

1 Spencer.
2 McKenzie.
3 McCallum.
4 Walker.

Class III.

1 Kennedy.
2 Holmes.
3 { Lehmann.
McMordie.
5 Dean.
6 Hunter.
7 Burns.
8 McCrimmon.
9 Stewart.
10 Robertson.
11 Hamilton.
12 { Kirk.
McNaughton.
14 Hay.
15 { Findlay.
Brooks.
17 Baird.
18 { Farrer.
Phin, A. E.
20 Gray.
21 Elmes.

Ferraby.
Kerr.
Elford.
Phin, G.
Burdett.
Emigh.
Wilson.
Jackson.
Ainley.
Woolley.
Hallett.
Kiely.

Botany.

Class I.

1 Ferguson.
2 Atkinson.
3 McCallum.
4 Walker.
5 Widdifield.
6 Spencer.
7 McKenzie.

Class II.

1 Maclean.
2 { Hay.
Kennedy.
4 Phin, A.
5 Burns, J. H.
6 Dean.
7 Stewart.
8 Holmes.

Class III.

1 McCrimmon.
2 Farrer.
3 McMordie.
4 Lehmann.
5 Elmes.
6 Hunter, H. E.
7 McNaughton.
8 Ferraby.
9 Robertson.
10 Findlay.
11 Hamilton.
12 { Kirk.
Phin, G.
14 Brooks.
15 Elford.
16 Baird.

Emigh.
Grey.
Jackson.
Burdett.
Wilson.
Woolley.
Kiely.
Ainley.
Kerr.

Geology.

Class I.

1 Ferguson.
2 Atkinson.
3 Widdifield.
4 McCallum.

Class II.

1 Kennedy.
2 McKenzie.
3 Maclean.
4 Walker.
5 Spencer.
6 Dean.

Class III.

1 Phin, A.
2 McMordie.
3 Lehmann.
4 Stewart.
5 Holmes.
6 Farrer.
7 Robertson.
8 McCrimmon.
9 Elmes.
10 Hay.
11 McNaughton.
12 Burns.
13 Emigh.
14 { Kirk.
Elford.
16 Ferraby.
17 Brooks.
18 Findlay.

Class Lists (Midsummer Examinations).—*Continued.*

FIRST YEAR.

Literature.

Class I.

1 Ferguson.
2 Atkinson.
3 McKenzie.
4 Widdifield.
5 McCallum.
6 Walker.
7 Spencer.

Class II.

1 { Burns.
Dean.
3 Kennedy.
4 Robertson.
5 Ferraby.
6 Hay.

Class III.

1 { Elmes.
McCrimmon.
Lehmann.
4 { McNaughton.
Holmes.
6 Maclean.
7 { Hunter.
McMordie.
9 Kirk.
10 Phin, A. E.
11 Stewart.
12 Hamilton.
13 Findlay.
14 { Emigh.
Elford.
16 Brooks.
17 Phin, G.
18 Baird.
19 Farrer.
20 { Kerr.
Burdett.

Kiely.
Woolley.
Wilson.
Grey.

Grammar and Composition.

Class I.

1 McCallum.

Class II.

1 Ferguson.
2 { Widdifield.
Hay.

Class III.

1 Hamilton.
2 McKenzie.
3 Spencer.
4 Atkinson.
5 Walker.
6 Kennedy.
7 McMordie.
8 McCrimmon.
9 Grey.
10 { Maclean.
Phin, A. E.
12 Elford.
13 { Elmes.
Lehmann.
15 { Burdett.
Burns.
Holmes.
Dean.
Robertson.
McNaughton.
Stewart.
Findlay,

Emigh.
Kirk.
Farrer.
Phin, G.
{ Hunter.
Brooks.
Kerr.
Jackson.
Hallett.
Baird.
Woolley.
Kiely.
Wilson.
Ainley.

Mensuration.

Class I.

1 Atkinson.
2 Ferguson.
3 Phin, A. E.
4 Lehmann.
5 McKenzie.

Class II.

1 McCallum.
2 Walker.
3 Spencer.
4 { Hay.
Widdifield.

Class III.

1 { Kirk.
Emigh.
3 Elmes.
4 Hamilton.
5 McCrimmon.
6 Holmes.
7 McMordie.
8 Robertson.
9 Findlay.
10 McNaughton.
11 Maclean.
12 { Dean.
Grey.
14 { Stewart.
Burns.
Brooks.
Kennedy.
Elford.
Hunter.
Kerr.
Phin, G.

Hallett.
Baird.
Farrer.
Kiely.
Ferraby.
Woolley.

Book-keeping.

Class I.

1 Atkinson.
2 { Ferguson.
Walker.
3 Spencer.

Class II.

1 { McCallum.
Holmes.
3 McKenzie.
4 McCrimmon.
5 { Burns.
Widdifield.
Lehmann.
8 { Hay.
Phin.

Class III.

1 { Dean.
Elmes.
3 Findlay.
4 Kirk.
5 { Kennedy.
Robertson.
7 Brooks.
8 Stewart.
9 McMordie.
10 { McNaughton.
Hunter.
12 Hamilton.
13 { Ferraby.
Emigh.
Phin, G.
16 { Elford.
Kerr.

Farrer.
Maclean.
Burdett.
Baird.
Jackson.
Kiely.
Woolley.
Hallett.
Ainley.

General Proficiency.

1 Ferguson.
2 Atkinson.
3 McCallum.
4 McKenzie.
5 Walker.
6 Widdifield
7 Spencer.
8 Kennedy.
9 Dean.
10 Phin, A. E.
11 Holmes.
12 Lehmann.
13 McCrimmon.
14 { Hay.
Robertson.
16 McMordie.
17 Stewart.
18 Burns.
19 Elmes.
20 McNaughton.
21 Kirk.
22 Findlay.

Class Lists (Midsummer Examinations)—*Continued.*

SECOND YEAR.

Live Stock and Forestry.

Class I.

1 Shaw.
2 Soule.
3 Wiancko.
4 Day.
5 Yuill.
6 { Dyer.
  Hurley.

Class II.

1 Beckett.
2 Silverthorn.
3 { Bell.
  Gies.
  Graham.
  Harcourt.
  Honsberger.
  Story.
9 Harvey.
10 Ruthven.
11 { Aylsworth.
  Carlaw.
13 Eaton.
14 { Tolton.
  Crealy.

Class III.

1 Curzon, S.
2 Burns.
3 Moody.
4 Brown.
5 Carpenter.
6 Curzon, A.

Dairying.

Class I.

1 Day.
2 Shaw.
3 Dyer.
4 Beckett.
5 Harcourt.

Class II.

1 Eaton.
2 Soule.
3 Gies.
4 Harvey.
5 Hurley.

Class III.

1 Carlaw.
2 { Wiancko.
  Honsberger.
4 Tolton.
5 Crealy.
6 Aylsworth.
7 Yuill.
8 { Bell.
  Burns.
10 Ruthven.
11 Graham.
12 Silverthorn.
13 Moody.
14 Story.
15 Brown.
16 Carpenter.
17 Curzon, S.
18 Curzon, A.

De Hart.

Analytical Chemistry.

Class I.

1 Day.
2 Dyer.
3 Gies.
4 { Crealy.
  Bell.
  Beckett.
7 { Graham.
  Wiancko.
9 { Yuill.
  Ruthven.

Class II.

1 { Tolton.
  Burns.
3 Aylsworth.
4 Shaw.
5 Carpenter.
6 Harvey.

Class III.

1 Curzon, S.
2 Curzon, A.
3 Honsberger.
4 Eaton.
5 { Carlaw.
  Harcourt.
  Soule.
8 Hurley.
9 Story.
10 Moody.
11 Silverthorn.
12 Brown.

Botany.

Class I.

1 Bell.
2 Shaw.
3 Day.
4 Dyer.

Class II.

1 Soule.
2 Curzon, S.
3 Harcourt.

Class III.

1 Hurley.
2 Carlaw.
3 { Wiancko.
  Gies.
5 Beckett.
6 Graham.
7 Crealy.
8 { Aylsworth.
  Eaton.
10 Yuill.
11 Carpenter.
12 Brown.
13 Story.
14 Harvey.
15 Honsberger.
16 Ruthven.
17 { Silverthorn.
  Tolton.
  Burns.

Curzon, A.
Moody.

Practical Horticulture.

Class II.

1 Soule.
2 Shaw.
3 Day.
4 Bell.
5 { Curzon, S.
  Harcourt.
7 Dyer.
8 Beckett.
9 Crealy.

Class III.

1 Hurley.
2 Gies.
3 Ruthven.
4 Harvey.
5 Yuill.
6 { Story.
  Carlaw.
8 Wiancko.
9 Aylsworth.
10 { Honsberger.
  Carpenter.
12 Graham.
13 Eaton.
14 Brown.
15 Curzon, A.
16 Silverthorn.
17 Tolton.
18 Burns.

Moody.

Class Lists (Midsummer Examinations)—*Concluded.*

SECOND YEAR.

Breeds of Horses and Veterinary Obstetrics.

Class I.

1 Day.
2 Beckett.
3 Shaw.

Class II.

1 Silverthorn.
2 Bell.
3 Harcourt.
4 Soule.
5 Gies.

Class III.

1 Burns.
2 Wiancko.
3 Honsberger.
4 Carpenter.
5 Story.
6 Curzon, S.
7 Carlaw.
8 Moody.
9 Dyer.
10 Graham.
11 Aylsworth.
12 Brown.
13 Hurley.
14 Eaton.
15 Crealy.
16 Tolton.
17 Ruthven.
18 Yuill.
19 Curzon, A.
20 Harvey.

Literature.

Class I.

1 Soule.
2 Day.
3 Shaw.

Class II.

1 Beckett.
2 Carpenter.
3 Curzon, S.
4 Harcourt.
5 { Silverthorn.
{ Dyer.
7 Burns.
8 { Bell.
{ Harvey.

Class III.

1 Wiancko.
2 Brown.
3 Crealy.
4 Honsberger.
5 Eaton.
6 { Ruthven.
{ Yuill.
8 Story.
9 Hurley.
10 Graham.
11 Moody.
12 Gies.
13 Tolton.
14 Carlaw.
15 Aylsworth.

Curzon, A.

Road-Making.

Class I.

1 Day.
2 Shaw.
3 { Beckett.
{ Harcourt.
5 Dyer.
6 Bell.
7 Honsberger.
8 Carpenter.
9 Soule.

Class II.

1 { Burns.
{ Graham.
3 Carlaw.
4 { Crealy.
{ Wiancko.
6 Gies.
7 { Hurley.
{ Eaton.

Class III.

1 Aylsworth.
2 { Moody.
{ Yuill.
4 Silverthorn.
5 Story.
6 Harvey.
7 { Ruthven.
{ Brown.
9 Curzon, S.
10 Tolton.
11 Curzon, A.

General Proficiency.

1 Day.
2 Shaw.
3 Beckett.
4 Dyer.
5 Bell.
6 Soule.
7 Harcourt.
8 Wiancko.
9 Gies.
10 Graham.
11 Crealy.
12 Hurley.
13 Burns.
14 Yuill.
15 Carpenter.
16 Silverthorn.
17 Harvey.
18 Carlaw.
19 Curzon, S.
20 Ruthven.
21 Aylsworth.
22 Eaton.
23 Story.
24 Tolton.
25 Honsberger.
26 Brown.