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SIXTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

1890.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

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1891.

LETTER OF

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MINISTER OF AGRICULTURE

HON. JOHN DRYDEN, TORONTO.

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

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THOMAS SHAW .. .. .. Professor of Agriculture and Farm Superintendent.
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J. HOYES PANTON, M.A., F.G.S. .. Professor of Natural History and Geology.
F. C. GRENSIDE, V.S. .. .. Professor of Veterinary Science.
H. H. DEAN, B.S.A. .. .. Professor of Dairy Husbandry.
E. LAWRENCE HUNT, B.A. .. .. Assistant Resident and Mathematical Master.
CAPTAIN WALTER CLARKE. .. .. Instructor in Drill and Gymnastics.
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SIXTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM.

GUELPH, January 2nd, 1891.

To the Honourable JOHN DRYDEN,

Minister of Agriculture:

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

In this Report we have reviewed briefly the work of the year 1890 under the following heads:—

I have the honor to be, sir,

Your obedient Servant,

JAMES MILLS,

President.

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PART I.

REPORT OF THE PRESIDENT.

Once more we are called upon to give an account of our stewardship. Another year has gone with its labors, cares, and anxieties; and what shall we say of the results, in so far as they affect our students, ourselves, and the interests of agriculture throughout the Province which we have the honor to represent?

COLLEGE VACATIONS AND FARMERS' INSTITUTES.

It may perhaps seem strange to introduce the question of our college vacations at the outset, and it is scarcely what one would expect in an annual report of the college. But within the last two years a good deal has been said by a few persons upon this question; and less than six months ago a misleading letter on the subject was sent the rounds of the Ontario press, with a view to create the impression that the President of the college was very much to blame, that farmers would not send their sons to the college, and that the interests of Canadian agriculture were suffering, all because of a change which was made in the length of our Christmas vacation six years ago. This letter was professedly written by a farmer, explaining why young farmers would not take a course at the Ontario Agricultural College; but in reality it was written by one who never wrought a month on a farm in his life. Under these circumstances, I think it is proper that I should say a few words by way of explanation and self-defence.

Total Length of Vacations Unchanged.

During all the time of my predecessors in office and for the first five years of my administration, there were three vacations each year, as follows:—

At Christmas	½ month.
At Easter	½ "
At the end of the college year (31st August)	1 "
Total	2 months.

But since the beginning of the year 1885, there have been only two vacations—

At Christmas	1 month.
At the end of the college year (31st August)	1 "
Total	2 months.

Reasons for Changing Vacations.

I was not long in the position which I now occupy, as head of the institution, till I discovered that we (the professors of the college), were not reaching the agriculturists of this Province. The great majority of the farmers were personally unacquainted with the professors. They had heard very unfavorable reports of them; but they knew little or nothing about either their attainments, their conduct, or the work which they were endeavoring to do. This state of things being very undesirable, I naturally sought for some means of bringing the professors and the farmers together. The farmers were quite willing to hear the professors, but the difficulty was to find a time suitable for both. Some of the professors were free in the summer months, but farmers could not attend public meetings at that season of the year; and the farmers had a slack time in January and February, but the professors were then engaged with their college work. So, after considerable thought and deliberation on the part of the Hon. A. M. Ross and myself, it was decided, in the fall of 1884, to abolish the Easter vacation; to add two weeks to the Christmas vacation (making it a month); to organize Farmers' Institutes; and to send the professors throughout the Province to address institute meetings during the last three weeks of the Christmas vacation (2nd to 22nd January inclusive).

Results of Changing Vacations.

By the change in the college vacations, the professors were enabled to attend institute meetings, without interfering with their college work. We went out in January, 1885. We have done so every winter since, and the beneficial results have far exceeded our most sanguine expectations. The work began on a small scale, but the number of institutes has increased so rapidly that we have had to arrange for no less than 90 meetings in January, 1891. The professors have been benefited by listening to statements of experience made by practical farmers, and the farmers have been helped by the enunciation and discussion of the scientific principles which underlie the best farm practice. The college has been strengthened by the increased and ever increasing confidence of the farming community; and the country at large has been stirred up to a broader, deeper, and more intelligent interest in the great subject of agriculture. All this, as intimated above, is, I think, largely the result of arranging our college vacations in such a way that the professors are able to spend three weeks of the most suitable time each year at institute meetings throughout the Province.

Objection Urged.

From the first, we admitted that there was one objection to the present arrangement, viz., that the students are absent from the college in January two weeks longer than is desirable. January is a good month for study, and we would prefer to have our boys return from their holidays two weeks sooner than at present. After all, this is only a slight objection, because it is always difficult for us to find suitable out-door employment for our students in winter; and for that reason two weeks in the month of June are of more advantage to a boy at an agricultural college than the same length of time in any of the winter months.

For the first four years after the change was made (the abolition of the Easter vacation and the addition of two weeks to the Christmas vacation, to enable professors to assist at farmers' institute meetings), no fault was found by any one. No objection was raised by students, by parents, nor by anyone else till about two years ago, when an agitation was begun, not by students nor by their parents, but by one or two others, to have our Christmas vacation made two weeks shorter and lectures end two weeks earlier in June—say on the 6th instead of on the 20th of that month.

To this agitation I have hitherto been opposed, because I have felt that its success would mean the severance of the connection which now exists between the College and the Farmers' Institutes.

Conclusion on This Question.

In conclusion, however, I wish to say that I have no personal interest to serve in this matter. Already I have had a great amount of labor in connection with the Institutes—voluntary labor for which I have received no remuneration; and I have no objection whatever to any change which will benefit both the college and the institutes, or strengthen either without injuring the other. So, if it is thought better for the College, the Institutes, and the Province at large, that our Christmas vacation should be made two weeks shorter and our professors should give up the institute work, with the exception of an occasional meeting—if, I say, this is thought better by those who are most interested, I shall offer no opposition to the proposed change.

WORK IN 1890.

The work in the different departments of the Institution has gone on smoothly and successfully during the past year. Nothing specially noteworthy has occurred; but good work has been done in all the departments.

The College.

There has been no change in our staff during the year. Full courses of lectures have been given in all the departments—

I. Agriculture, Live Stock, and Dairying;
II. Natural Science;
III. Veterinary Science;
IV. English Literature and Political Economy;
V. Mathmetics and Book-keeping.

As usual, we have laid special stress upon the three branches embraced in department No. 1. We have sought to keep prominently in view what we believe to be the first duty of an agricultural college, viz., to make its students good farmers—men well versed in the theory and practice of general agriculture, stock-breeding, stock-feeding, dairying, etc. At the same time, we have endeavored to do thorough and sufficiently comprehensive work in all the other departments. So far as we are aware, nothing has been neglected; and the students have done as hard and good work as those of any former period. We never had a more pleasant and successful year.

We have not had the pleasure of seeing any new buildings erected during the year; but we have done quite a little in the way of repairs and alterations—laying new hardwood instead of old pine floors in the College halls, painting and papering the President's office, putting in a new high pressure steam-boiler, fitting up a hospital in the College, and making the alterations necessary to get a new Y. M. C. A. hall.

For several years, the student's weekly prayer-meeting and our Sunday Bible-class were held in one of the College class-rooms, but always with more or less inconvenience or interruption. At length, in the fall of the year 1888, a branch of the Young Men's Christian Association was organized in the College. From that time the religious activity of the students gradually increased, and the necessity for a separate room for their meetings became more and more apparent. So in September last, by removing two or three partitions and by some expense in flooring, painting, papering, etc., we succeeded in making a very commodious, bright, and beautiful room, which shall henceforth be known as the Y. M. C. A. Hall. This hall is well lighted, is furnished with chairs for 100 students, and with a good organ for the musical part of their services. The organ, I may add, was purchased by the students themselves.

Smoking in the College.

In the changes which were necessary in order to make the Y. M. C. A. Hall, I had to abolish the old smoking-room. This I did without hesitation; but at the same time I set apart another room for the use of smokers, with the new regulation that it should be

open only three times a day, for three-quarters of an hour immediately after breakfast, after dinner, and after tea; and that at those times it should be under the direct control and supervision of one of the College officers. None but smokers are admitted to this room; and since the change, I am pleased to say, there have been only three smokers in the College.

College Hospital.

Owing to the very healthful situation of the College, and the mercies of a kind Providence, we have hitherto been almost entirely free from all the most serious forms of disease. During the eleven and a half years of my connection with the Institution, we have not had a single case of typhoid fever, and it is doubtful whether we have had a case of real diphtheria. During the same period we have had only one death, and that was caused by hemorrhage of the lungs in the case of a young Englishman who came to this country in a very delicate state of health. So, all considered, I think I may say that we have been singularly fortunate in our exemption from sickness. At the same time we must admit that we have not been entirely free, We have had attacks of measles two or three times; and in the fall of the year, our students are frequently troubled with colds, sore throats, and various ailments which arise from exposure, sudden changes of temperature, and other well-known causes. In all such cases, prompt attention is required; and, in some instances, suitable means of isolation from the rest of the students are almost a necessity.

Hitherto, however, we have not had any room or rooms properly heated, furnished, and insolated for the use of sick students. Our faithful physician, Dr. E. W. McGuire, has often and persistently urged the need of a hospital of some kind in the College; but various difficulties stood in the way till a few weeks ago, when the Minister of Agriculture gave his consent to the alterations and expenditure necessary to fit up, heat, and furnish a section in the upper story of one of our dormitory buildings for hospital purposes. The work was at once undertaken; and already we have a first-class hospital on a small scale—a medium-sized room for one bed, a larger room for two beds, and a bath-room, with hot and cold water, bath-tub, wash-basin, and water closet, all well heated, well lighted, well ventilated, nicely painted, suitably furnished, and properly isolated from the rest of the building.

Department of Chemistry.

The chief items of general interest in this department are the analysis of sugar-beets and a change in our method of teaching elementary chemistry. During the autumn months, a good deal of time was spent in analysing samples of sugar-beets which were sent here from various parts of the Province. One hundred and seventeen samples were analysed, and the results were published in a bulletin issued by the Department of Agriculture about the middle of December A fuller statement of facts and conclusions will be found in Professor James's report in Part III. of this Volume.

Until 1890, we followed the usual method of teaching the first principles of chemistry to our students, that was, by a systematic course of lectures and experiments in the class-room. This method was fairly successful; but, about six months ago, Professor James decided to introduce the method of putting every student to work in the laboratory from the very beginning. Our chemical lecture-room and the student's portion of the laboratory are close together. Hence it takes only a moment to pass from the one to the other. At the beginning of the term, every student has a place allotted to him in the laboratory and the necessary outfit of chemicals and apparatus placed at his disposal; and the work is carried on daily by the Professor illustrating and stating a few facts or principles in the lecture-room, after which the students proceed at once to repeat the experiments in the laboratory, each working by himself and all under the supervision and direction of the Professor. By this method the students do not advance so quickly, but they take greater interest in their work and understand it much better.

Department of Natural History.

For a full account of the work done in this department, I would refer the reader to Professor Panton's report in Part II. of this Volume. There will be found many items of interest relating to the department proper, and the annual statement of facts and figures regarding our reading-room, library, and museum. Professor Panton has given much time to the practical study of botany during the last two or three years, and has devoted special attention to the noxious weeds of this Province. Early last year, at Professor Panton's request, and with a view to assist him in his work, we constructed a large case with a glass front, 54 feet long, against one wall of the museum; and, for the information of students and visitors, Professor Panton is placing in this case a large number of samples of weeds collected from different parts of the Province and arranged so as to exhibit, as far as possible, the root, stem, leaves, and flower of each sample.

Dairy Department.

In the Department of Dairying, we have been without a Professor during the past year; but the work has not been neglected. The usual course of lectures in that department was given in the spring by our old Professor of Dairying, J. W. Robertson, who is now employed as Dairy Commissioner for the Dominion; and the work in connection with the Creamery and Experimental Dairy has been successfully managed throughout the year by George Harcourt, B.S.A., who has been acting as assistant in the Dairy Department.

Mr. Harcourt, having rendered faithful and efficient service in the Dairy Department, has lately been appointed to the position of assistant chemist, with an increase of $200 a year in his salary; and H. H. Dean, B.S.A., also one of our own graduates, has been chosen for the professorship of dairying, to enter upon his duties on the first January, 1891. Mr. Dean took Professor Robertson's full course of lectures on dairying, stood high in his final university examination on that subject, spent the past summer at practical work in the creameries and cheese factories of Ontario, and has, for the last few months, been employed as dairyman of the New York Experiment Station, at Geneva, N. Y. Mr. Dean has been brought up on a Canadian farm. He is a good scholar, a fluent speaker, and a hard worker. Hence we entertain hopes that he will be successful in the important position which he has been called upon to fill.

Experiments.

Our experimental work has been rapidly extending within the last year or two. Since C. A. Zavitz, B. S. A., was appointed assistant director in that department and allowed to devote his whole time and thought to it, much valuable work has been done. Fifty acres, divided into plots varying from one acre to 1-20th of an acre, are now devoted to experiments; and during the past year, (under the supervision of Professor Shaw), Mr. Zavitz, with such help as he needed, and with the special assistance of Mr. Alexander Cuppage in feeding and looking after cattle and pigs, has made a large number of more or less important experiments—has tested 270 varieties of grain (wheat, oats, peas, and barley), thirty varieties of potatoes, and ninty varieties of turnips, beets, and mangels, and has also tried different methods of cultivation, several kinds of fertilizers, different dates of seeding, etc. With cattle and pigs also, a number of experiments are being conducted, in order to determine, as far as possible, the respective merits of different breeds and the comparative values of various kinds of food and methods of feeding. For full information on these points, see Professor Shaw's and Mr. Zavitz's report in Part VII. of this volume.

Farm Proper.

On the farm proper, Professor Shaw, with the help of Mr. J. E. Story, our very faithful and efficient farm foreman, has continued his special efforts for the destruction of noxious weeds, a few varieties of which, especially Canadian thistles, are still more numerous than they should be on a model farm. He has also spent much time, a good deal of hard work, and a considerable sum of money in grading our farm lane, and in grading and gravelling some of the public roads adjoining the farm. When this work is finished, it will add very much to the beauty of the farm and its surroundings..

Garden, Lawn, Etc.

The work on our large lawn and in the vegetable garden has gone on as usual during the year. Nothing specially noteworthy has occurred; and all I need do, is to emphasise and re-emphasise our great need of new Green and Propogating Houses, in order to make the Horticultural Department of real service to the College and the country.

Last spring, our gardener, Mr. James Forsyth, made a considerable addition to our fruit garden, by setting out in the field adjoining his own residence a considerable selection of trees and plants, such as he thought necessary to make our fruit supply all that is required. This addition consists of 217 apple trees, 20 pear trees, 137 grape vines, 245 gooseberry bushes, 271 currant bushes, 815 raspberry plants, and 1,830 strawberry plants.

Clumps of Forest Trees.

It may not be amiss, at this stage in our history, to submit a few notes on the results of our experience in the planting and growing of forest trees. Much might be said on this subject; but we shall state only a few facts as follows:—

Black walnut.—In 1881 we planted with black walnuts, from twelve to fifteen inches high, a piece of clay loam, a little less than half an acre, on the side of a slope exposed to the west and north-west winds. The plants were obtained from seed which we had sown two years before, and were set out with a view to form a clump of valuable shade trees. They were set in rows six feet apart and the same distance from one another in the rows. The soil between the rows has been ploughed lightly once a year and cultivated twice, with a little hoeing, to kill weeds and keep the ground open.

Regarding this plantation we beg now to report that the trees have all grown well, without damage from frost or any other cause. During last summer they looked quite healthy and seemed likely to do well in future, notwithstanding the severity of our Guelph climate. In the month of August we measured a number of them and found that in nine years they had attained a growth of from twelve to twenty feet high, being $3\frac{1}{2}$ to 5 inches in diameter near the root, and $2\frac{1}{2}$ to $3\frac{3}{4}$ inches in diameter four feet above the ground. About half of them are of the larger size.

We may add that in the cultivation of these walnuts and other trees we have proved beyond doubt that, when the soil around trees is kept clean and loose by stirring occasionally in dry weather, the trees grow much more rapidly than when the ground around them becomes hard or grass is allowed to grow about them.

European larch.—In the same year, 1881, we planted also another plot of ground, about a quarter of an acre, with European Larch, of the same size as the walnuts, namely twelve to fifteen inches high. We raised the plants from seed and set them in rows five feet apart and the same distance from one another in the rows. Our object was twofold: (1) to conceal a gravel pit from view, and (2) to test the European Larch in this locality and climate.

For the first five years after planting, the ground was cultivated more or less with the plough, scuffler, and hoe. Since that time the space has been completely occupied, so that we have not had room for either ploughing or hoeing among the trees.

During last summer this plantation presented a beautiful appearance, not only concealing the unsightly gravel pit as we desired, but adding an element of beauty and interest to the landscape. The trees were found to be from twelve to twenty-four feet high, growing nicely and looking very thrifty. They vary in diameter from 3 to 5½ inches near the root, and from 2½ to 4½ inches five feet above the ground.

For the informatian of those who are not familiar with the European Larch, we may say that it is of the same genus as the Canadian Tamarack, which is known as the American Larch (*Larix Americana*). The European Larch resembles the Tamarack, but is a different species and is much more valuable. The timber of the European Larch is difficult to split, is very durable, and in value is equal to Douglas Pine.

I may add that one of the best trees in this plantation is growing on the edge of the gravel ridge in almost pure gravel.

Ash-leafed maple (*Negundo Aceroides*).—We have a third clump consisting of a variety of trees planted in 1882. It would, perhaps, be interesting to compare these trees as to height, thickness, &c., but at present we shall speak of only one species, viz., the ash-leafed maple of Manitoba and the North-west. Among the other trees of this clump several of this so-called maple were planted eight years ago; and at the present time they are very much larger than any other kind of tree in the plantation, being from twenty-two to twenty-five feet high, averaging eight inches in diameter near the root, and six inches in diameter five feet above the ground. The tree is not so handsome as our common hard or soft maple, but it makes a nice shade tree and grows much faster than any other tree on this farm.

Forest tree plantation.—Our gardener, Mr. James Forsyth, who planted and has taken care of the clumps mentioned above, also lately (last spring) replanted a four-acre field with a variety of forest trees—white oak, white ash, black walnut, hickory, maple, catalpa, pine &c. This field was gradually cleared to furnish firewood; and when the stumps had pretty well rotted, we ploughed it up and took two crops off it (potatoes and peas), after which we ploughed, harrowed, and re-planted it with trees in rows eight feet apart, and in such a way that it can be cultivated in three directions with the plough and scuffler.

We have found that where horse cultivation is to be used, trees in clumps or plantations should not be planted nearer than eight feet, even when it is intended to remove some of them after a few years growth.

Importance of replanting.—There are many barren knolls and stony or gravelly fields throughout the Province that would be greatly improved by replanting. They are now only so many eye-sores in the landscape, little or no use to the owners; and in most cases they detract from the value of good land in the immediate neighborhood. If replanted, protected, and looked after for a few years, these same pieces of land would soon become the most beautiful spots in the country; and before long the trees grown on them would be a source of profit to the growers.

Students in Attendance.

The attendance during the past year has been quite satisfactory—twelve more than the year before. The total number on the roll is 146, seventy-five per cent. of whom are from the Province of Ontario. Thirty-three counties of Ontario are represented, and the largest representation is from the counties of Grey, Middlesex, York, Prince Edward, Huron, and Waterloo. Of the forty-nine who entered in October last, seventy-seven per cent. are farmers' sons; and I have no hesitation in saying that never before in the history of the College were our students so quiet, industrious, and well-behaved as they have been during the term which ended on the 22nd of December last.

Analysis of Roll.

Counties, Etc.	No. of Students.	Counties, Etc.	No. of Students.
Brant	4	Norfolk	
British Columbia	4	Northumberland	
Bruce	2	Northwest Territories	
Carleton	3	Nova Scotia	
Cape Breton	1	Ontario (County)	
Dufferin	2	Oxford	
Dundas	1	Peel	
England	16	Perth	
France	2	Prince Edward County	
Frontenac	1	Prince Edward Island	
Grey	8	Quebec	
Haldimand	1	Rainy River District	
Hamilton	1	Scotland	
Hastings	2	Simcoe	
Huron	5	Stormont	
India	2	Switzerland	
Kent	4	Toronto	
Lanark	2	Victoria	
Lincoln	4	Waterloo	
Leeds	4	Welland	
Lennox	2	Wellington	
Middlesex	6	Wentworth	
Muskoka	2	York	
New Brunswick	1		
New York, U. S. A	1	Total	146

Religious Denominations.

Methodists	44	Evangelical Association	
Episcopalians	39	Mennonites	
Presbyterians	39	Plymouth Brethren	
Baptists	6	Disciples	
Congregationalists	6		
Roman Catholics	5	Total	146
Friends	3		

Age of Students.

11	16 years	4	23 years
20	17 "	6	24 "
24	18 "	6	25 "
24	19 "	4	26 "
20	20 "	2	27 "
11	21 "	2	28 "
12	22 "	1	29 "

Average age, 20 years.

COUNTY STUDENTS.

Of those in attendance during the year, forty-five 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, Carleton, Dufferin, Dundas, Frontenac, Grey, Hastings, Haldimand, Huron, Kent, Lanark, Leeds, Lennox, Lincoln, Middlesex, Muskoka, Norfolk, Northumberland, Ontario, Peel, Prince Edward, Rainy River District, Simcoe, Stormont, Victoria, Waterloo, Welland, Wellington, York.

CLASS-ROOM WORK.

Our class-room work has gone on as usual during the past year. The candidates for degrees were all successful in passing their examinations, and a fair proportion of first and second year students gained a respectable standing ; but the number of failures is still much larger than it should be.

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.—

E. C. Jeffrey, B.A	English Literature.
W. A. Douglas, B.A	Political Economy.
E. L. Hill, B.A	Botany.
J. A. Craig, B.S.A	Entomology.

Bachelors of the Science of Agriculture.

Five 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 convocation of the University of Toronto, on the 10th of June. The list is as follows :—

Brodie, G. A	County of	York, Ont.
Dean, H. H	"	Brant, Ont.
McCallum, W	"	Middlesex, Ont.
Monteith, S. N	"	Perth, Ont.
Shantz, A	"	Waterloo, Ont.

Recipients of Associate Diplomas.

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

Brown, H. H	Chatham, Kent, Ont.
Buchanan, D	Hensall, Huron, Ont.
Campbell, C. S	Brantford, Brant, Ont.
Cowan, J. H	Galt, Waterloo, Ont.
Cowan, R. E	Galt, Waterloo, Ont.
Dolsen, W. J	Chatham, Kent, Ont.
Elliott, R	Seaforth, Huron, Ont.
Field, H	Cobourg, Northumberland, Ont.
Hadwen, G. H	Mons en Bareul, France.

RECIPIENTS OF ASSOCIATE DIPLOMAS—*Continued.*

Harcourt, J.	St. Anns, Lincoln, Ont.
Hewgill, E. A.	Heathcote, Grey, Ont.
Holliday, W. B.	North Shields, England.
Hutt, H. L.	South End, Welland, Ont.
Macfarlane, T. W. R.	Ottawa, Ont.
McKergow, J. G.	Montreal, Quebec.
Monk, W. D.	South March, Carleton, Ont.
Mulholland, F.	North Toronto, York, Ont.
Sleightholm, J. A. B.	Humber, Peel, Ont.
*Webster, F. E.	Creemore, Simcoe, Ont.
*Wells, E.	Chilliwhack, B. C.
*Wilson, F. G.	Green River, Ontario Co., Ont.
*†Wood, W. D.	Cornwall, Stormont, Ont.
Whitley, C. F.	Enfield, Middlesex, England.

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 1890:—

FIRST YEAR.

1. *Burns, J. A. S.*, Halifax, N. S.—In two departments; Agriculture and Natural Science.
2. *Carlyle, W. L.*, Chesterville, Dundas, Ont.—In two departments; Agriculture and Veterinary Science.
3. *Gibson, D. Z.*, Willow Grove, Haldimand, Ont.—In four departments; Agriculture, Natural Science, Veterinary Science, and English Literature.
4. *Harris, J. E.*, Calne, Wilts, England.—In one department; Agriculture.
5. *Morgan, R. N.*,* Kerwood, Middlesex, Ont.—In four departments; Agriculture, Natural Science, English Literature, and Mathematics.
6. *Willin, F. A.*, Calgary, North-West Territory.—In three departments; Agriculture, Veterinary Science and Mathematics.
7. *Wills, H. G.*, Toronto, Ont.—In one department; Mathematics.

SECOND YEAR.

1. *Buchanan, D.*, Hensall, Huron, Ont.—In two departments; Agriculture and Veterinary Science.
2. *Cowan, R. E.*, Galt, Waterloo, Ont.—In two departments; Agriculture and Veterinary Science.
3. *Hadwen, G. H.*, Mons en Bareul, France.—In two departments; English Literature and Mathematics.
4. *Harcourt, J.*, St. Anns, Lincoln, Ont.—In three departments; Agriculture, Natural Science, and Veterinary Science.
5. *Hutt, H. L.*, South End, Welland, Ont.—In three departments; Agriculture, Natural Science, and Veterinary Science.

* Required to take Milton's "L'Allegro and "Il' Pensoroso" again.
† Has to pass another examination in Veterinary Anatomy.

6. *Sleightholm, J. A. B.*, Humber, Peel, Ont.—In one department; Agriculture.
7. *Whitley, C. F.*, Enfield, Middlesex, England.—In two departments; Agriculture and English Literature.

Medallists.

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 Medalist.—H. L. Hutt, South End, Welland, Ont.
First Silver Medalist.—J. Harcourt, St. Anns, Lincoln, Ont.
Second Silver Medalist.—R. E. Cowan, Galt, Waterloo, Ont.

First Year Prizemen.

Agriculture and Dairying.—1st, D. Z. Gibson, Willow Grove, Haldimand, Ontario; 2nd, W. L. Carlyle, Chesterville, Dundas, Ont.

Natural Science.—1st, J. A. S. Burns, Halifax, N. S; 2nd, D. Z. Gibson.

Veterinary Science.—1st, D. Z. Gibson; 2nd, F. A. Wilkin, Calgary, N. W. T.

English Literature and Composition.—1st, D. Z. Gibson; 2nd, W. F. Newcomen, Epping, Essex, England.

Mathematics and Book-keeping.—1st, F. A. Wilkin; 2nd, H. G. Wills, Toronto.

General Proficiency.—1st, D. Z. Gibson; 2nd, J. A. S. Burns; 3rd, F. A. Wilkin.

Second Year Prizemen.

Agriculture, Live Stock, Dairying,—1st, H. L. Hutt; 2nd, J. Harcourt.

Natural Science.—1st, H. L. Hutt; 2nd, J. Harcourt.

Veterinary Science.—1st, R. E. Cowan; 2nd, H. L. Hutt.

English Literature.—1st, C. F. Whitley; 2nd, G. H. Hadwen.

Mathematics.—1st, G. H. Hadwen; 2nd, H. L. Hutt.

General Proficiency.—1st, H. L. Hutt; 2nd, J. Harcourt; 3rd, R. E. Cowan; 4th, C. F. Whitley.

Closing Exercises.

Our closing exercises took place on the 30th June. The weather was fine and the attendance large. There were between 400 and 500 people present from Guelph and the surrounding district, many having driven from fifteen to twenty miles to spend a few hours with us. We were favored especially with the presence of the Hon. Charles Drury, Minister of Agriculture, and Sir Daniel Wilson, president of the University of Toronto. Both these gentlemen took part in the formal exercises and delivered addresses, which were very much enjoyed by those who had the pleasure of hearing them. James Innes, M.P., D. Guthrie, M.P.P., and several other leading men from Guelph were also present and assisted in the presentation of medals and prizes.

Valedictory Addresses.

The second year men chosen by their fellow students to deliver the Valedictory Addresses at the closing exercises were F. C. Whitley and H. L. Hutt.

FARMERS' INSTITUTES.

The work of the Farmers' Institutes is still increasing in magnitude and importance. We gave assistance at 75 meetings in January, 1890, and have arranged to attend 95 meetings in January and 4 in February, 1891.

The following is the list of Institute meetings to be held in January, 1891, as arranged by myself, under instructions from the Minister of Agriculture, and in consultation with Nicholas Awrey, M.P.P., president of the Central Farmers' Institute:—

Division No. 1.

P. of. Grenside; T. Raynor, B.S.A.; T. H. Race, Esq.—Tara, 2nd January; Port Elgin, 3rd January; Paisley, 6th January; Walkerton, 7th and 8th January; Listowel, 9th January; Milverton, 10th January; Brussels, 12th and 13th January; Smith's Hill, 13th and 14th January; Exeter, 16th and 17th January; Lucan, 19th January; Park Hill, 20th January; Thorndale, 21st and 22nd January.

Division No. 2.

John I. Hobson, Esq.; C. A. Zavitz, B.S.A.; D. W. Beadle, Esq.—New Hamburg, 2nd and 3rd January; St. Mary's, 6th January; Wyoming, 7th and 8th January; Appin, 9th and 10th January; Chatham, 12th January; Wallaceburg, 13th January; Dawn Mills, 14th January; Belle River and Woodslee, 16th and 17th January; Kingsville, 19th and 20th January; Highgate, 21st January; West Lorne, 22nd January; Shedden, 23rd January.

Division No. 3.

President Mills; W. H. McNish, Esq.; L. Woolverton, M.A.—Freelton, 2nd and 3rd January; Embro, 6th January; Norwich, 7th and 8th January; Aylmer, 9th and 10th January; Delhi, 12th January; Port Rowan, 13th January; Vittoria, 14th January; Caledonia, 15th and 16th January; Waterford, 17th January; Welland, 19th January; Port Colborne, 20th January; Pelham, 21st and 22nd January.

Division No. 4.

John McMillan, M.P.; F. J. Sleightholm, Esq.; E. D. Smith, Esq.—Weston, 2nd and 3rd January; Brampton, 6th January; Milton, 7th January; Burlington, 8th January; Hamilton, 9th and 10th January; Jordan, 12th and 13th January; St. George, 14th and 15th January; Burford, 16th and 17th January; Berlin, 19th and 20th January; Guelph, 21st and 22nd January.

Division No. 5.

Professor J. H. Panton; D. E. Smith, Esq., B.A; and A. H. Pettit, Esq.—Newmarket, 2nd and 3rd January; Bondhead, 6th January; New Lowell, 7th and 8th January; Thornbury, 9th January; Owen Sound, 12th January; Markdale, 13th January: Shelburne, 14th and 15th January; Erin, 16th January; Glenallan, 19th January; Drayton, 20th January; Durham, 22nd January.

Division No. 6.

*Professor H. H. Dean; N. F. Fraser, Esq.; *W. Cowan, V.S.; and P. C. Dempsey, Esq.*—Markham, 2nd January; Uxbridge, 3rd January; Cannington, 6th January; Little Britain, 7th and 8th January; Bobcaygeon, 9th January; Fenelon Falls, 10th

January ; * Peterboro', 12th and 13th January ; * Harwood, 14th January ; * Keene, 15th January ; Warkworth, 16th and 17th January ; * Brechin, 19th January ; * Orillia, 20th and 21st January ; *Alliston, 22nd and 23rd January.

Division No. 7.

Professor C. C. James ; Edward Jeffs, Esq ; and G. C. Caston, Esq.—Oshawa, 2nd and 3rd January ; Bowmanville, 6th January ; Orono, 7th January ; Baltimore, 8th January ; Cold Springs, 9th January ; Picton, 10th January ; Napanee, 12th and 13th January ; Centreville, 14th and 15th January ; Sunbury 16th and 17th January ; Delta, 19th January ; Lansdowne, 20th January ; Lyn, 21st January.

Division No. 8.

Professor Thomas Shaw ; George Harcourt, B.S.A. ; and E. Morden, Esq.—Perth, 2nd and 3rd January ; Lanark, 6th January ; Carp, 7th and 8th January ; Renfrew, 9th January ; Rockland, 12th and 13th January ; Vankleek Hill, 14th and 15th January, Alexandria, 16th and 17th January ; Cornwall, 19th and 20th January ; Morrisburg, 21st and 22nd January.

Supplementary List.

Hon. Charles Drury and Prof. H. H. Dean.—Kenilworth, 3rd February ; Bracebridge, 5th February ; Utterson, 6th February ; Thessalon, 9th and 10th February ; Sault Ste. Marie, 11th and 12th February.

In this list the speakers were so arranged that each deputation consisted of a Professor, a practical farmer, and a representative of the Fruit Growers of Ontario. The only exceptions were in the case of Mr. Hobson, Mr. McMillan, and Hon. Charles Drury, who took the place of professors at the meetings for which they were announced. By this arrangement it was thought that the meetings might be made were interesting and profitable to all classes and sections of the farming community.

FINANCIAL STATEMENT,

I.—College Expenditure.

(*a*) *Maintenance.*

1.	Salaries and wages	$12,962 58
2.	Food—	
	Meat, fish, and fowl	2,771 78
	Bread and biscuits	559 42
	Groceries, butter, and fruit	3,412 33
3.	Household expenses—	
	Laundry, soap, and cleaning	134 15
	Women servants' wages—cooks, housemaids, etc	1,607 60
4.	Business Department—	
	Advertising, printing, postage, and stationery	1,212 09
5.	Miscellaneous—	
	Laboratory—chemicals, apparatus, etc	402 51
	Library—books, papers, and periodicals	372 13
	Medals	71 32
	Unenumerated	926 68
		$24,432 59

(b) Maintenance and Repairs of Government Buildings.

Furniture and furnishings	$ 697 00	
Repairs and alterations	1,134 92	
Fuel	2,275 73	
Light	862 60	
Water	650 00	
Sewage disposal	159 91	
		$5,780 16
		$30,212 75

COLLEGE REVENUE.

1. Tuition fees	$1,655 37	
2. Laboratory fees for gas and chemicals used by third year students	212 00	
3. Balances paid for board, after deducting allowances for work on farm, etc	3,842 66	
4. Fines, breakages, etc	89 33	
5. Charges for supplemental examinations	36 75	
6. Sales of bones	3 61	
7. Sale of old iron	2 00	
		$5,841 72
Net cash expenditure of College		$24,371 03

The net sum voted by the Legislature for the maintenance of the College (see estimates for 1890, pp. 35 and 40) was $26,585. Hence, the unexpended balance for the year is $2,213.97

II.—FARM.

(a) Farm Proper.

1. Permanent Improvements—fencing, road-making, moving sheep barn, etc	$ 873 87	
2. Farm maintenance—		
Salaries and wages	3,159 52	
Live stock	4,105 43	
Maintenance of stock	1,291 14	
Seeds	227 66	
Binding twine	39 10	
Repairs—lumber, blacksmithing, etc	450 00	
Furniture and furnishings—pails, tools, etc	463 78	
Implements	293 44	
Advertising, printing, postage, and stationery	598 15	
Fuel and light	23 28	
Contingencies	233 72	
		$10,885 22
		11,759 09
Less farm revenue		7,004 49
Net expenditure of Farm Proper		$4,754 60

(*b*) *Experiments.*

Salaries and wages—		
Assistant Superintendent	$800 02	
Instructor (part wages)	93 74	
Labor	880 26	
		$1,774 02
Seeds		138 23
Fertilizers		40 33
Manures		196 98
Live stock for experimental feeding		10 00
Furniture, furnishings, repairs, etc		365 93
Printing, postage, and stationery,		36 11
Implements		329 93
Feed and fodder—oil cake, etc		99 93
Exhibitions		265 74
Contingencies		8 00
		$3,265 20

III.—Experimental Dairy.

Salaries and wages—		
Salary of Assistant	$600 00	
Labor	600 80	
		$1,200 80
Live stock—pigs		80 15
Feed and fodder		505 82
Furniture, furnishings, repairs, etc		121 04
Laboratory expenses—gas, chemicals, etc		31 93
Printing, postage, and stationery		22 63
Contingencies		7 62
		$1,969 99
Less revenue—		
Cows sold (capital)	$ 123 15	
Sales of pigs, butter, milk, etc	1,243 71	
		1,369 86
Net expenditure of Experimental Dairy		$600 13

IV.—Garden, Lawn, Etc.

Salaries and wages—		
Foreman (part salary)	$ 499 00	
Assistant	440 00	
Second Assistant	216 90	
Teamster	305 25	
Laborers	1,183 34	
		2,644 49
Manure		104 25
Seeds, bulbs, plants, trees, etc		171 23
Furniture, furnishings, repairs, etc		144 09
Fuel and light		26 06
Contingencies		6 05
		3,096 17
Less cash revenue (vegetables and colt sold)		146 30
Net expenditure of Horticultural Department		$2,949 87

V —Instruction.

Salaries and wages—		
Farm foreman (part salary)	$400 00	
Gardener (part salary)	201 00	
Carpenter (part salary)	400 00	
Instructor (part wages)	125 00	
Cattleman (part wages)	99 99	
		1,225 99
Lumber, nails, oil, paint, etc., for practice		
Furniture, furnishings, tools, etc., for practice		42 25
Fuel		18 87
		$1,287 11

Total net expenditure for Maintenance in all Departments in 1890.

College	$24,371 03
Farm Proper	4,754 60
Experimental Plots and Feeding	3,265 20
Experimental Dairy	600 13
Garden, lawn, etc	2,949 87
Instruction	1,287 11
	$37,227 94

A comparison of these figures with the estimates for 1890, will show that there is an over expenditure as follows: Farm proper, $1,519.60; Experimental Plots and Feeding, $285.20; and Garden, Lawn, etc., $1.87 —making a total over-expenditure of $1,806.67; but, against this, there are unexpended balances—College, $2,213.97; Experimental Dairy, $1,079.87; and Instruction, $112.89. Hence, when all is added together, the total maintenance expenditure for the year is $1,600.06 less than the sum voted by the Legislature for that purpose.

VI.—College in Account with Farm and Garden.

(*a*) *With Farm.*

To 567 bushels of potatoes, at 40c	$226 80
" 4,248 gallons milk, at 12c	509 76
" cartage for College	30 00
" feed for College horse (without attendance)	75 00
" feed for Bursar's horse (without attendance)	75 00
" carpenter work by students, etc	15 00
	$931 56

(*b*) *With Garden.*

To fruit and vegetables (for items and prices, see Mr. Forsyth's Report, Part V.)	591 91
Total	$1,523 47

By amount paid by College for student labor on Farm and Garden (mostly on farm)	$3,027 34	
" half of farm superintendent's salary	1,000 00	
		4,027 34
" balance to credit of College		$2,503 87

Buildings Needed.

In conclusion, I may say that we still require four or five additional bulldings to put us in a position to do satisfactorily and efficiently the work which we have undertaken. Those which are most urgently needed are :—

(1) A building to be used as a Convocation Hall and Gymnasium.

(2) New green and propagating houses.

(3) A house for the Professor of Chemistry.

(4) A house for the Professor of Natural History.

Hoping that you may find it possible to erect some of these buildings before the close of the year 1891,

I have the honor to be, sir,

Your obedient servant,

JAMES MILLS,
President.

PROFE

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PART II.

REPORT OF THE

PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE.
GUELPH, December 31st, 1890.

To the President of the Ontario Agricultural College:

SIR,—In submitting to you a report of the department of Natural History, it will be convenient to consider it under the following topics:—

1. Museum.
2. Library.
3. Reading-room.
4. Practical work.

1. COLLEGE MUSEUM.

During this year some improvements have been effected in our museum.

A collection of weeds has been made, which forms an attractive centre to many visitors. It contains sixty-five full sized specimens, representing twenty-three orders, fifty-seven genera and sixty-five species.

These typical plants are not pressed, but put in the case and allowed to dry. Root, stem, leaf, flower and seed are secured as far as possible so that the collection may be interesting, attractive and instructive. Each plant is labelled with the common and scientific name by which it is known. A large card in each division bears the name of the family or order. Many of the plants retain their form well and present characters by which they may be readily known.

In connection with this we are endeavoring to secure a collection of weed seeds. These will be placed along with the plants, so that the thoughtful student will be enabled to identify the seeds of injurious plants as well as the plants that bear them. The following is the results of our work this season:—

ORDER I.

Ranunculaceæ (Crowfoot Family).

Ranunculus Sceleratus ..... Cursed Crowfoot.
Aconitum Napellus ..... Monkshood.

ORDER II.

Cruciferæ (*Mustard F*).

Lepidium Virginicum ..... Pepperwort.
Sinapis arvensis ..... Common Mustard.
Capsella Bursa-pastoris ..... Shepherd's Purse.
Thlaspi arvense ..... Penny Cress.
Camelina sativa ..... False Flax.

ORDER III.

Caryophyllaceæ (*Pink F*).

Lychnis vespertina ..... White Cockle.
Silene inflata ..... Bladder Campion.
Lychnis Githago ..... Cockle.
Stellaria media ..... Chickweed.

ORDER IV.

Portulacaceæ (*Purslane F*).

Portulaca oleracea ..... Purslane.

ORDER V.

Malvaceæ (*Mallow F*).

Malva rotundifolia ..... Mallow.
Malva moschata ..... Musk Mallow.

ORDER VI.

Leguminosæ (*Pulse F*).

Vicia cracca ..... Wild Tare.
Melilotus officinalis ..... Yellow Melilot.
" alba ..... White "

ORDER VII.

Onagraceæ (*Evening Primrose F*).

Oenothera biennis ..... Evening Primrose
Epilobium angustifolium ..... Willow-herb.

ORDER VIII.

Anacardiaceæ (*Cashew F*).

Rhus venenata ..... Poison Sumach.

ORDER IX.

Dipsaceæ (Teasel F).

Dipsacus sylvestris ..... Wild Teasel.

ORDER X.

Compositæ (Composite F).

Senecio vulgaris ..... Groundsel.
Ambrosia artemisiæfolia ..... Ragweed.
Maruta Cotula ..... May-weed.
Sonchus oleraceus ..... Sow-thistle.
Erechthites hieracifolia ..... Fire-weed.
Arctium Lappa ..... Burdock.
Cichorium Intybus ..... Chicory.
Rudbeckia hirta ..... Cone-flower.
Leucanthemum vulgare ..... Ox-eye Daisy.
Taraxacum officinale ..... Dandelion.
Achillæa Millefolium ..... Yarrow.
Tanacetum vulgare ..... Tansy.
Solidago Canadensis ..... Goldenrod.
Erigeron Philadelphicum ..... Fleabane.
Cnicus arvensis ..... Common Thistle.
Cnicus lanceolatus ..... Bull Thistle.

ORDER XI.

Plantaginaceæ (Plantain F).

Plantago major ..... Common Plantain.
P. lanceolata ..... Ribgrass.

ORDER XII.

Scrophulariaceæ (Figwort F).

Verbascum Thapsus ..... Mullein.
Veronica peregrina ..... Neckweed.
Linaria vulgaris ..... Toadflax.

ORDER XIII.

Verbenaceæ (Vervian F).

Verbena hastata ..... Vervian.

ORDER XIV.

Labiatæ (Mint F.)

Nepeta Cataria ..... Catnip.
Leonurus Cardiaca ..... Motherwort.

ORDER XV.

Borraginaceæ (*Borage F*).

Cynoglossum officinale.....Hounds-tongue.
Echium vulgare.....Blue-weed.
Echinospermum Lappula.....Stickseed.
Lithospermum arvense.....Pigeon-weed.

ORDER XVI.

Convolvulaceæ (*Convolvulus F*).

Convolvulus arvensis.....Bind-weed.

ORDER XVII.

Solanaceæ (*Nightshade F*).

Datura Stramonium.....Thorn Apple.

ORDER XVIII.

Asclepiadaceæ (*Milkweed F*).

Asclepias cornuti.....Milkweed.

ORDER XIX.

Euphorbiaceæ (*Spurge F*).

Euphorbia Cyparissias.....Yellow Spurge.

ORDER XX.

Chenopodiaceæ (*Goosefoot F*).

Chenopodium album.....Lamb's-quarters.
C. capitatum.....Strawberry Blite.

ORDER XXI.

Polygonaceæ (*Buckwheat F*).

Rumex crispus.....Dock.
Polygonum aviculare.....Doorweed.
Rumex acetosella.....Field Sorrel.

ORDER XXII.

Amarantaceæ (*Amaranth F*).

Amarantus retroflexus.....Pigweed.

ORDER XXIII.

Graminea (*Grass F*).

Avena fatua	Wild Oat.
Bromus secalinus	Chess.
Setaria glauca	Foxtail.
Agropyrum repens	Couch-grass.
Panicum crus-galli	Barnyard-grass.
P. capillare	Old-Witch Grass.

We have also added to our collection of insectivorous birds, and hope by the end of another year to have a complete list that will represent birds which are beneficial to the farmer and the fruit-grower.

During 1890 we have received a few donations to the museum, for which we express thanks to the donors, and hope that they and others will remember we are always ready to receive any specimens that will aid us in teaching.

The following is a list of the contributors:—Miss Vail, Guelph, peculiar growths upon stems; Nelson Monteith, B.S.A., crow's nest; Wm. Shaw, Agrl. College, nest and eggs of the cedar bird; Mrs. Barnett, Niagara Falls south, a Bolivian dress; J. B. Bealey, student, wasp's nest; Jacob Stroh, Waterloo, marl from banks of Grand River; J. Hoyes Panton, Agrl. College, eggs of salmon and white fish, specimens of newly hatched fish; specimens from Mammoth Cave, Ky., Wyandot Cave, Ind., and Yellowstone Park illustrating facts in geology.

Library.

Several useful books have been added this year and our list is gradually embracing a most valuable collection of books for students reading along the lines of agricultural science. A special catalogue has been prepared for the use of students. This contains the names of 800 books, which are the best suited for the present use of students. Experience has taught the Librarian, that our students, especially those of the first year, are at a loss to know what books to select from the 5,600 upon the shelves. By making a special catalogue of 800 of the most important, the number becomes limited and very little mistake is made, if any one is selected.

Our Library now contains 5,690 volumes, of which 207 have been added this year. The books added may be grouped as follows:—

Reports, chiefly agricultural	80
Botany	7
Geology	1
Agriculture	22
Chemistry	14
Literature	19
Encyclopædias	9
General Science	3
Parliamentary reports	15
Examination papers, bound	1
Biography	8
History	23
Horticulture	5
	207

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:—

Papers and Magazines.

(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	St. Catharines.
10. Canadian Entomoloist	London, Ont.
11. Bee Journal	Beeton.
12. North York Reformer	Newmarket.
13. Acton Free Press	Acton.
14. Ontario Evangelist	Erin, Ont.
15. Evangelical Churchman	Toronto.
16. Montreal Witness	Montreal.
17. Farmers' Review	Chicago.
18. Welland Tribune	Welland.
19. Paris Transcript	Paris.
20. Canadian Independent	Toronto.

(b) *Furnished by the College.*

Name.	Where Published.
1. Daily Globe	Toronto.
2. " Mail	"
3. " Empire	"
4. " Mercury	"
5. " Herald	Guelph.
6. Rural Canadian	"
7. Grip	Toronto.
8. Poultry Review	"
9. Farmers' Advocate	"
10. Canadian Stock Raisers' Journal	London, Ont.
11. Nor'-West Farmer	Toronto.
12. Breeders' Gazette	Winnipeg.
13. North British Agriculturist	Chicago.
14. Farmers' Gazette	Edinburgh (Scotland).
15. Mark Lane Express	Dublin (Ireland).
16. American Garden	London (England).
17. American Naturalist	Greenfield (Mass).
18. Veterinary Journal	Philadelphia.
19. Veterinarian	London (England).
	"

Name.	Where published.
20. Cultivator and Country Gentleman	Albany, N.Y.
21. Scientific American	New York.
22. Live Stock Journal	England.
23. Live Stock Journal	Chicago.
24. American Dairyman	New York.
25. Botanical Gazette	Crawfordsville, Indiana
26. Agricultural Science	Geneva, N.Y.
27. Canadian Honey Producer	Brantford.
28. Literary Digest	Boston.
29. Entomological News	Philadelphia.
30. Canadian Agricultural and Home Magazine	Peterboro.
31. Hoard's Dairyman	Ft. Atkinson, Wis.
32. Maritime Agriculturist	New Brunswick.

4. Practical Work.

In the department of Natural History much has been done to make the study of science popular and practical. For use in the third year we have now some ninety-five drawings illustrating microscopic plants injurious to garden, orchard and field crops.

These are also drawn upon slides for the magic lantern, and can be used for instructive purposes.

On the canvas rust, blight, mildews, etc., appear like plants 4–7 feet in height. The diagrams and slides are arranged in the same order as the subjects are treated in the lecture-room.

This affords great aid to students and impresses lessons, which might soon be forgotten. We are constantly preparing slides for this purpose so that science will be illustrated on board, paper and canvas, and so presented as to be attractive, popular and instructive. In all we have upwards of 300 slides for the stereopticon, illustrating facts in Zoology, Botany and Geology.

In the spring of this year much time was occupied in completing the bed of plants used in connection with lectures in botany. This botanical instructive bed has become an important adjunct of the work in the class-room.

It is 224 feet in length and 15 feet in width. The rows containing the plants are 13 feet long, and a certain number of rows are set apart to illustrate typical plants in each order according as the order is large or small. Some orders have six rows, others only one, consequently a student knows at once whether the order is a common one or not by the number of plants set apart to illustrate it. In the Compositæ he sees 30, Ranunculacæ, 20, Papaveraceæ, 1, etc.

In the whole bed we have 40 orders, 275 genera and 550 species, which are arranged as follows :—

1. A systematic arrangement embracing 40 orders, 225 genera, 325 species.
2. A promiscuous arrangement embracing 225 species not grouped in orders. This is to test the student's knowledge of the orders to which the various plants belong.
3. An arrangement to illustrate the various methods of arranging plants in beds, such as carpet, mass, ribbon, and miscellaneous bedding.

Every plant is labelled so that students and visitors can readily identify them. In front of the first plant in each order the name of the order is indicated upon a large label. The divisions, polypetalous, gamopetalous and epetalous are also shown by larger labels The following is a list of the plants found in the first bed, illustrating the systematic arrangement of the flowers into orders as discoursed in the class-room :—

To James Goldie, Esq., of Guelph, we are much indebted for many of the plants that have enabled me to fill up what certainly would have been blanks, were it not for his generosity. Few men, if any, possess a garden with as many species as he, and we are very fortunate to be so near him, and have always found him ready to aid us along the line of horticultural work.

ORDER I.

Polypetalous Exogens.

Ranunculaceæ (Crowfoot Family.)

Row 1—

1 Hepatica acutiloba ..... Liver-leaf.
2 H. triloba ..... Lobed "
3 Anemone pulsatilla ..... Pasque-flower.
4 A. nemorosa ..... Wood Anemomy.
5 Ranunculus acris ..... Buttercup.

Row 2—

1 Adonis vernalis ..... Spring Adonis.
2 Coptis trifoli ..... Goldthread.
3 Aconitum Napellus ..... Monkshood.
4 Pæonia tenuifolia ..... Cut-leaved Pæony.
5 P. officinalis ..... Pæony.

Row 3—

1 Aquilegia Canadensis ..... Columbine.
2 Thalictrium dioicium ..... Meadow Rue.
3 " speciosum .....
4 Aquilegia cærulea ..... Cærulean Columbine.
5 Delphinium splendens ..... Larkspur.

Row 4—

1 Clematis viorna ..... Clematis.
2 C. corymbosa ..... "
3 Helleborus-viridis ..... Hellebore.
4 Eranthis hyemalis ..... Winter Aconite.
5 Nigella Damascena ..... Love-in-the-mist.

ORDER II.

Berberidaceæ (Barberry F.).

Row 5—

1 Epimedium Alpinum ..... Epimedium.
2 Caulophyllum thalictroides ..... Blue Cohosh.
3 Podophyllum peltatum ..... Mandrake.
4 Epimedium .....
5 Berberis purpurea ..... Purple Barberry.

ORDER III.

Papaveraceæ (Poppy Family).

Row 6—

1 Sanguinaria Canadensis ..... Blood-root.
2 Papaver Orientalis ..... Poppy.
3 Chelidonium majus ..... Celandine.
4 Glaucum luteum ..... Horn Poppy.
5 Bocconia cordata ..... Bocconia.

ORDER IV.

Fumariaceæ (Fumitory F.).

Row 7—

1 Dicentra Canadensis ..... Squirrel-corn.
2 " Cucullaria ..... Deer-fly.
3 " spectabilis ..... Bleeding-heart.
4 Adlumia cirrhosa ..... Climbing Fumitory.
5 Corydalis aurea ..... Golden corydalis.

ORDER V.

Cruciferæ (Cress F.).

Row 8—

1 Iberis umbellata ..... Candytuft.
2 Brassica napus ..... Turnip.
3 Lepidium Virginicum ..... Pepperwort.
4 Arabis ..... Rock-cress.
5 Sinapis arvensis ..... Wild Mustard.

Row 9—

1 Sisymbrium officinale ..... Hedge Mustard.
2 Dentaria diphylla ..... Toothwort.
3 Lunaria biennis ..... Honesty.
4 Camelina sativa ..... False flax.
5 Sinapis alba ..... White Mustard.

Row 10 —

1 Alyssum maritinum ..... Sweet Alyssum.
2 Brassica oleracea ..... Cabbage.
3 Capsella Bursa pastoris ..... Shepherd's-purse.
4 Rhaphanus sativus ..... Radish.
5 Matthiola annua ..... Stock.

ORDER VI.

Violaceæ (Violet F..)

Row 11—

1 Viola pubescens ..... Yellow Violet.
2 " blanda ..... White "
3 " Canadensis ..... Canadian "
4 " culcullata ..... Common Blue Violet.
5 " tricolor ..... Pansy.

ORDER VII.

Caryophyllaceæ (Pink F.).

Row 12—

1 Cerastium arvense ..... F. Mouse-ear Chick-weed.
2 Tunica saxifraga ..... Tunica.
3 Dianthus deltoides ..... Deltoid Pink.
4 Lychnis vespertina ..... White Cockle.
5 Dianthus barbatus ..... Sweet William.

Row 13—

1 Cerastium vulgatum ..... Mouse-ear Chickweed.
2 Saponaria officinalis ..... Bouncing Bet.
3 Silene inflata ..... Bladder Campion.
4 Lychnis Githago ..... Cockle.
5 Dianthus Chinensis ..... China Pink.

Row 14—

1 Arenaria serpyllifolia ..... Thyme-lea'd Sandwort.
2 Saponaria Caucasia ..... Soapwort.
3 Spergula arvensis ..... Spurrey.
4 Stellaria media ..... Chickweed.
4 Lychnis diurna ..... Red Lychnis.

ORDER VIII.

Portulacaceæ (Purslane F.).

Row 15—

1 Claytonia Virginica ..... Spring Beauty.
2 Portulaca grandiflora ..... Portulaca.
3 " oleracea ..... Purslane.
4 " grandiflora ..... Portulaca.
5 Calandrina discolor ..... Calandrina.

ORDER IX.

Malvaceæ (Mallow F.).

Row 16—

1 Malva rotundifolia ..... Mallow.
2 Abutilion striatum ..... Indian Mallow.
3 Malope trifida ..... Malope.
4 Malva moschata ..... Musk Mallow.
5 Althaea rosea ..... Hollyhock.

ORDER X.

Linaceæ (Flax F.)

Row 17—

1 Linum flavum ..... Yellow Flax.
2 " grandiflorum ..... Red "
3 " usitatissimum ..... Common "
4 " perenne ..... Perrenial "
5 " usitatissimum ..... Common "

ORDER XI.

Geraniaceæ (Geranium F.).

Row 18—

1 Geranium sanguineum ..... Crimson Geranium.
2 Impatiens balsamina ..... Balsam
3 Oxalis versicolor ..... Sorrel.
4 Tropaeolum majus ..... Nasturtium.
5 Pelargonium cordatum ..... Pelargonium.

Row 19—

1 Tropaeolum majus ..... Nasturtium.
2 Geranium ..... Bronze Geranium.
3 " ..... Silver "
4 " Robertianum ..... Herb Robert.
5 " maculatum ..... Wild Geranium.

ORDER XII.

Leguminosæ (*Pulse F.*)

Row 20—

1 Lotus corniculatus ..... Bird's-foot Trefoil.
2 Vicia cracca ..... Wild Tare.
3 Pisum sativum ..... Pea.
4 Trifolium rubens ..... Crimson Clover.
5 Baptisia tinctoria ..... Wild False Indigo.

Row 21—

1 Medicago lupulina ..... Black Medick.
2 Trifolium arvense ..... Rabbit-foot Clover.
3 Medicago sativa ..... Lucerne.
4 Onobrychus sativa ..... Sainfoin.
5 Melilotus officinalis ..... Sweet Clover.

Row 22—

1 Trifolium repens ..... White Clover.
2 Trifolium pratense ..... Red "
3 Lathyrus latifolius ..... Everlasting Pea.
4 Vicia sativa ..... Tare.
5 Lupinus perennis ..... Lupine.

ORDER XIII.

Rosaceæ (*Rose F.*).

Row 23—

1 Waldsteinia fragaroides ..... Barren Strawberry.
2 Fragaria vesca ..... Wild "
3 Geum uniflorum ..... Avens.
4 Spiraea ..... Spiraea.
5 Rosa rugosa ..... Single Rose.

Row 24—

1 Potentilla argentea ..... Cinquefoil.
2 " verna ..... Green Cinquefoil.
3 " sulphurea ..... Yellow "
4 Spiraea ..... Spiraea.
5 Rubus strigosus ..... Raspberry.

ORDER XIV.

Saxitragaceæ (*Saxifrage F.*).

Row 25—

1 Saxifraga ..... Saxifrage
2 Mitella diphylla ..... Bishop's Cap.
3 Tiarella cordifolia ..... False Mitrewort.
4 Hydrangea hortensia ..... Hydrangea.
5 Ribes rubrum ..... Red Currant.

ORDER XV.

Crassulaceæ (Orpine F.).

Row 26—

1 Sedum acre ..... Stone-crop.
2 Sedum Telephinum ..... Live-forever.
3 Sempervivum tectorum ..... House-leek.
4 Sedum ternatum .....
5 Sedum Sieboldii .....

ORDER XVI.

Onagraceæ (Evening-primrose F.)

Row 27—

1 Circaea lutetiana ..... Enchanter's Night-shade.
2 Fuchsia ..... Fuchsia.
3 Clarkia pulchella ..... Clarkia.
4 Oenothera biennis ..... Evening Primrose.
5 Epilobium angustifolium ..... Willow-herb.

ORDER XVII.

Umbelliferæ (Parsley F.)

Row 28—

1 Carum petroselinum ..... Parsley.
2 Apium graveolens ..... Celery.
3 Daucus carota ..... Carrot.
4 Pastinaca sativa ..... Parsnip.
5 Eryngium amethystinum ..... Eryngo.

ORDER XVIII.

Cucurbtaceæ (Gowad F.)

Row 29—

1 Cucurbita verrucosa ..... Vegetable marrow.
2 Cucumis melo ..... Musk-melon.
3 Cucumis melo .....
4 Citrullus vulgaris ..... Cucumber.
5 Cucurbito pepo ..... Water-melon. Pumpkin.

ORDER XIX.

GAMOPETALOUS EXOGENS.

Compositæ (Composite F.)

Row 30—

1 Achillæa Millefolium ..... Yarrow.
2 Gaillardia grandiflora ..... Gaillardia.
3 Coreopsis .....
4 Achillæa filipendula .....
5 Ambrosia artemisæfolia ..... Golden Yarrow. Ragweed.

Row 31—

1 Taraxacum officinale ..... Dandelion.
2 Senecio vulgaris ..... Groundsel.
3 Cineraria maritima ..... Cineraria.
4 Maruta cotula ..... Mayweed.
5 Pyrethrum roseum ..... Pink Feverfew.

Row 32—

1 Centaurea Cyanus ..... Bluebottle.
2 Tanacetum vulgare ..... Tansy.
3 Rudbeckia hirta ..... Cone-flower.
4 Anthemus tinctoria ..... Yellow Chamomile.
5 Solidago Canadensis ..... Goldenrod.

Row 33—

1 Bellis perennis ..... Daisy.
2 Leucanthemum vulgare ..... Ox-eye Daisy.
3 Arctium Lappa ..... Burdock.
4 Erigeron Philadelphicum ..... Fleabone.
5 Helianthus annuus ..... Sunflower.

Row 34—

1 Cirsium arvense ..... Thistle.
2 Hieracium auranticum ..... Hawkweed.
3 Echinops sphaerocephalus ..... Bee-plant.
4 Circium lanceolatum ..... Bull Thistle.
5 Chicorium Intybus ..... Chicory.

Row 35—

1 Sonchus oleraceus ..... Sow-thistle.
2 Gazania splendens ..... Gazania.
3 Gnaphalium polycephalum ..... Everlasting.
4 Dahlia variabilis ..... Dahlia.
5 Inula Helenium ..... Elecampane.

ORDER XX.

Lobeliaceæ (*Lobelia F.*)

Row 36—

1 Lobelia speciosa ..... Lobelia.
2 " " ..... "
3 " inflata ..... Indian Tobacco.
4 " syphilitica ..... Great Blue Lobelia.
5 " Cardinalis ..... Cardinal Flower.

ORDER XXI.

Campanulaceæ (*Campanula F.*).

Row 37—

1 Campanula Carpathica ..... Low Harebell.
2 " Americana ..... Tall Wild bell.
3 " medium ..... Cantebury Bell.
4 " latifolia ....
5 " rotundifolia ..... Harebell.

ORDER XXII.

Plantaginaceæ (*Plantain F.*).

Row 38—

1 Plantago major ..... Plantain.
2 " lanceolata ..... Ribgrass.
3 " lanceolata ..... Ribgrass.
4 " " ..... "
5 " media ..... "

ORDER XXIII.

Primulaceæ (*Primrose F.*).

Row 39—

1 Primula veris ..... Cowslip.
2 " Sieboldi .....
3 " .....
4 Dodecatheon Meadia ..... Shooting-star.
5 Lysimachia vulgaris ..... Loose-strife.

ORDER XXIV.

Scrophulariaceæ (*Figwort F.*).

Row 40—

1 Veronica peregrina ..... Neckweed.
2 Linaria purpurea ..... Purple toadflax.
3 Mimulus ringens ..... Monkey-flower.
4 Penstemon pubescens ..... Penstemon.
5 Chelone glabra ..... Turtle-head.

Row 41—

1 Pedicularis Canadensis ..... Wood Betony.
2 Linaria vulgaris ..... Toadflax.
3 Antirrhinum majus ..... Snapdragon.
4 Digitalis purpurea ..... Foxglove.
5 Verbascum Thapsus ..... Mullein.

ORDER XXV.

Verbenaceæ (*Vervian F.*).

Row 42—

1 Verbena venosa ..... Verbena.
2 " " ..... "
3 Lantana camara ..... Lantana.
4 Phryma leptostachya ..... Lopseed.
5 Verbena hastata ..... Vervian.

Row 43—
1
2
3
4
5

Row 44—
1
2
3
4
5

Row 45—
1
2
3
4
5

Row 46—
1
2
3
4
5

Row 47—
1
2
3
4
5

Row 48—
1
2
3
4
5

ORDER XXVI.

Labiatoæ (*Mint F.*).

Row 43—

1 Marrubum vulgare.....Horehound.
2 Perilla Nankinensis.....Perilla.
3 Coleus Veitchii.....Foliage Plant.
4 Salvia officinalis.....Sage.
5 Lavandula vera.....Lavander.

Row 44—

1 Thymus variegata.....Thyme.
2 Mentha viridis.....Spearmint.
3 Leonurus Cardiaca.....Motherwort.
4 Nepeta Cataria.....Catnip.
5 Monarda fistulosa.....Wild Bergamont.

ORDER XXVII.

Borragniaceæ (*Borage F.*).

Row 45—

1 Myosotis palustris.....Forget me-not.
2 Cynoglossum officinalis.....Burr.
3 Echinospermum Lappula.....Stickseed.
4 Echium vulgare.....Blueweed.
5 Symphytum officinalis.....Comfrey.

Row 46—

1 Lithospernum arvense.....Redroot.
2 Heliotropium Peruvianum.....Heliotrope.
3 Borage officinalis.....Borage.
4 Anchusa officinalis.....Anchusa.
5 Lithospermum Arvense.....Pigeonweed.

ORDER XXVIII.

Polemoniaceæ (*Phlox F.*).

Row 47—

1 Phlox subulata.....Low Phlox.
2 " " ..... "
3 " divarieata.....Wild "
4 Gilia tricolor.....Gilia.
5 Polemnonium caeruleum.....Jacob's Ladder.

ORDER XXIX.

Convolvulaceæ (*Convolvulus F.*).

Row 48—

1 Convolvulus arvensis.....Bindweed.
2 Ipomaea purpurea.....Morning-glory.
3 C. arvensis.....
4 I. purpurea.....
5 " " .....

ORDER XXX.

Solanaceæ (Nightshade F.)

Row 49—

1 Petunia nyctaginfolia.....Petunia.
2 Datura fastuosa.....Datura.
3 Nicotiana rustica.....Tobacco.
4 Lycopersicum esculentum.....Tomato.
5 Solanum tuberosum.....Potato.

ORDER XXXI.

Asclepiadaceæ (Milkweed F.)

Row 50—

1 Asclepias tuberosa.....Butterfly-weed
2 .....
3 A. Cornuti.....
4 A. incarnata.....Milkweed.
.....Swamp Milkweed.

ORDER XXXII.

APETALOUS EXOGENS.

Chenopodiaceæ (Goosefoot F.)

Row 51—

1 Blitum capitatum.....
2 Spinosa oleracea.....Strawberry Blite.
3 Atriplex rubra.....Spinage.
4 Beta Vulgaris.....Atriplex.
5 Chenopodium album.....Beet.
.....Lamb's-quarters.

ORDER XXXIII.

Amarantaceæ (Aramanth F.)

Row 52—

1 Achyranthes.....Achyranthes.
2 Gomphrema globosa.....Everlasting.
3 Celosia cristata.....Cockscomb.
4 Iresine Lindeni.....Iresine.
5 Amarantus retroflexus.....Pigweed.

ORDER XXXIV.

Polygonaceæ (Buckwheat F.)

Row 53—

1 Polygonum aviculare.....Doorweed.
2 Rumex acetosella.....Sorrel.
3 Fagoyprrum esculentum.....Buckwheat.
4 Rumex crispus.....Dock.
5 Rheum Rhaponticum.....Rhubarb.

ORDER XXXV.

Euphorbiaceæ (*Spurge F.*)

Row 54—

1 Euphorbia maculata ..... Spotted spurge.
2 " hypericifolia .....
3 " Cyparissias ..... Cypress spurge.
4 .....
5 Ricinus communis ..... Castor-oil Plant.

ORDER XXXVI.

ENDOGENS.

Araceae (*Arum F.*)

Row 55—

1. Arisaema triphyllum ..... Indian Turnip.
2. Symplocarpus foetidus ..... Skunk Cabbage.
3. Acorus Calamus ..... Calamus.
4.
5. Calla Ethiopica ..... Calla Lily.

ORDER XXXVII.

Iridaceae (*Iris F.*)

Row 56—

1. Crocus vernus ..... Spring Crocus.
2. Gladiolus cardinalis ..... Gladiolus.
3. Paradanthus Chinensis ..... Blackberry Lily.
4. Sisyrinchium Bermudiana ..... Blue-eyed Grass.
5. Iris versicolor ..... Common Flag.

Row 57—

1. Iris arenaria ..... Flag.
2. " Sibirica ..... "
3. " Germanica ..... "
4. " fimbriata ..... "
5. " Persica ..... "

ORDER XXXVIII.

Lilaceae (*Lily F.*)

Row 58—

1. Convallaria majalis ..... Lily-of-the-Valley.
2. Tulipa Gesneriana ..... Tulip.
3. Scilla rosea ..... Scilla.
4. Uvularia grandiflora ..... Bellwort.
5. Yucca filamentosa ..... Yucca.

Row 59—

1. Erythronium Americanum ..... Dog-tooth Violet.
2. Polygonatum ..... Solomon's-seal.
3. Funkia variegata ..... Funkia.
4. Allium stellatum ..... Star Onion,
5. Lillium tigrinum ..... Tiger Lily.

Row 60—

1 Allium tricoccum ..... Leek.
2 Hyacinthus Orientalis ..... Hyacinth.
3 Trillium grandiflorum ..... Trillium.
4 Fritillaria ..... Fritillaria.
5 Lilium ..... Orange Lily.

ORDER XXXIX.

Amaryllidaceæ (*Amaryllis F.*).

Row 61—

1 Galanthus nivalis ..... Snowdrop.
2 Narcissus pseudo-narcissus ..... Daffodil.
3 Narcissus poeticus ..... Narcissus.
4 Polianthes tuberosa ..... Tuberose.
5 Agave Americana ..... American Aloe.

ORDER XL.

Gramineæ (*Grass F.*).

Row 62—

1 Festuca ovina ..... Sheep's Fescue.
2 T. pratensis ..... Meadow "
3
4 Dactylis glomerata ..... Orchard-grass.
5 Triticum repens ..... Couch-grass.

Row 63—

1 Poa pratensis ..... Kentucky Blue-grass.
2 P. Compressa ..... Wire-grass.
3 Phleum pratense ..... Timothy.
4 Alopecrus pratensis ..... Meadow Foxtail.
5 Setaria glanca ..... Com. Foxtail.

Row 64—

1 Panicum Crus-galli ..... Barnyard-grass.
2 Arrenatherum avenaceum ..... Tall Oat-grass.
3 Lolium perenne ..... Perennial Rye.
4 Bromus secalinus ..... Chess.
5 Avena fatua ..... Wild Oat.

Row 65—

1 Phalaris arundinacea ..... Ribbon-grass.
2 Hordeum vulgare ..... Barley.
3 Triticum vulgare ..... Wheat.
4 Avena sativa ..... Oat.
5 Zea Mays ..... Indian corn.

40 orders. 225 genera. 325 species.

Besides this collection we have undertaken to lay out a bed containing the most common wild flowers of Canada. A suitable place has been selected, and already many plants put in. This has been done with a view to familiarize our students with our wild flowers, many of which are very beautiful. Another, year will add much to the appearance of this practical bed of plants.

The following bulletins have been issued from the Natural History Department during 1890:

BULLETIN LII.—AGRICULTURAL COLLEGE.

GUELPH, JUNE 16, 1890.

BLACK-KNOT ON PLUMS.

In a late bulletin issued from the Bureau of Industries my attention was called to the fact that the black-knot upon plum-trees is very prevalent and appears to be spreading rapidly. This is easily accounted for when we understand the nature of the plant that causes it, and remember how little is done to check its progress by those upon whose trees it appears. The writer has on several occasions at Farmers' Institutes referred to this trouble and endeavored to show the necessity of united action being taken to extirpate it, or at least to some extent lessen its distribution. With a view to extend information regarding the cause and nature of this trouble to a large number of readers this Bulletin is written.

LIFE HISTORY OF THE FUNGUS.—An examination of the knot in its earliest stages shows innumerable small, transparent threads, only seen by aid of the microscope. They branch among the cells which compose the tissue of the inner bark of the tree, and form the so-called *mycelium* or vegetable part of the fungus. The threads become very intricately twisted together in bundles as development proceeds, beginning in the growing layer of the bark and radiating outwards. As spring advances, the threads increase and reach a more matured condition. As growth proceeds, the knot assumes a velvety appearance; this is the result of the threadlike structures sending off many short-jointed filaments, on the ends of which are borne egg-shaped spores known as *conidiospores*. These are very small, requiring the aid of a microscope to see them. When ripe, they are readily disturbed, may be blown by the wind and thus reach new starting points so as to give rise to knots similar to that upon which they were developed. This mode of reproduction in the "knot" continues till the summer is well advanced, when another class of spores begins to develop, and which reach maturity about February. The surface of the knot during winter shows spores that can be seen by the naked eye; these open into cavities, on the walls of which are two kinds of structures, one consisting of slender filaments (*paraphyses*) the use of which is not known; the other club-shaped (*asci*). In the *asci* towards the close of winter *ascospores* are developed, usually eight in each *ascus*, out of which the spores come through an opening at the end; these spores become new starting points for the parisitic plant, when they reach proper conditions for development. Other cavities also are found among those with the *asci*; these contain very minute oval spores divided by cross partitions into three parts, and borne on slender stalks. These are called *stylospores*, the use of which is not known, but they are generally believed to be concerned in the perpetuation of the species. Still other cavities exist containing slender filaments (*spermatia*) which also seem to be concerned in reproduction. Besides the cavities referred to, sometimes spaces more flattened than these, and in some cases showing a triangular form, appear; they are lined with short, delicate filaments that end in a minute oval body. These bodies are produced in great numbers and are discharged in masses, being held together by a sort of jelly. They have been called *Pycnidiospores*, and also seem to be connected with the perpetuation of the fungus.

REPRODUCTIVE ORGANS.—In the case of this parasitic plant we have then five kinds of reproductive organs, viz.: conidiospores, ascospores, stylospores, spermatia and pycnidiospores, all more or less connected with the spread of the fungus. Until the true nature of this fungus became known it was generally believed that the "knots" were caused by insects, but since the life history of the plant has been made out the insect theory has been abandoned. The following objections may be made against it: (1) The knots do not resemble galls made by insects. (2) Insects may be found in old knots, but seldom, if ever,

in young. (3) The insects are of various species, some of which are found on trees where knots never occur. (4) Wherever the knot is found the fungus described invariably is present, and is never seen, but associated with the knot and can be observed in the stem before anything like a knot is visible.

REMEDIES.

1. Hitherto most orchardists have found the best thing to do is to cut off affected limbs and destroy them. Where a tree is badly attacked, destroy the whole tree.

2. Some experiments in applying linseed oil to the knots with a small brush so as to saturate the knot have been effective. This is done three or four times during the summer, as soon as the knots appear.

3. Coal oil may be used, but it must be applied carefully. If it runs over the branch it will kill it.

4. Wild choke-cherry trees near orchards should be destroyed. It is unfortunate that so little regard is paid to the law which requires affected trees to be destroyed. These trees are scattering millions of spores yearly, and thus spreading the disease to all parts of the Province. Blighted trees stand as monuments of the indifference and ignorance of those who should co-operate in fighting against a common foe.

BULLETIN LVI.—AGRICULTURAL COLLEGE.

GUELPH, DECEMBER 9, 1890.

SMUT: ITS HABITS AND REMEDIES.

Smut is a disease well known to farmers, and though good remedies have been found to prevent it, yet there are many ignorant of them if we judge from the number of questions sent to the College on the subject. As there are several varieties of smut, we shall consider the habits of some of the most common, and then give some remedies.

TILLETIA CARIES (*Bunt or Stinking Smut*).—When wheat is affected by this variety the grains are shorter and more swollen than usual, and present a greenish-drab color. Sometimes they are cracked. These affected grains are completely filled with minute round black spores, having an unpleasant smell, and presenting under the microscope a somewhat roughened appearance. They are much larger than the spores of the common smut. When they reach favorable conditions, heat and moisture, germination takes place, and a series of reproductive bodies result, which give rise to the vegetative portion of the fungus. This is an exceedingly slender jointed thread that ultimately bears perfect spores in the wheat plant after reaching the seed. These reproductive bodies, called sporidea or sporules, are produced outside of the wheat plant, but when they come in contact with the young host they find their way into its tissues, and running up the stem between the cells, they finally reach the seed, and bear spores on tiny stalks. It has been calculated that one grain may contain 40,000,000 spores, inclosed within the thin skin, and not exposed, as in the common smut of wheat and oats.

USTILAGO CARBO (*Common or Loose Smut*).—In cases of attack from this form, the affected plants are readily observed, as it shows itself very distinctly by covering the ear with smut. The spores have no bad odor and are exceedingly minnte, being much smaller than those of *Bunt*. When they reach favorable conditions, germination takes place, and reproductive structures result; these, as in *Bunt*, give rise to the vegetative portion of the fungus which reaches the young plant, and a course is followed, much the same as in *Bunt*. Investigation indicates that the trouble in plants attacked comes from the ground and travels upwards; that the results of the attack manifest themselves in the head, and especially in the grain; that seed, dusty from smut, results in much of the grain being smutty.

USTILAGO ZEÆ MAYS (*Corn Smut*).—In this case the smut is not so local as in the preceding. The affected parts are not confined to the ear alone, but sometimes are found elsewhere. The spores form inside of the threads of the vegetative structure, and not upon little stalks, as in the other smut, and thus are widely different in development. When the spores germinate they give rise to a sort of tube-like structure in which several cross partitions are formed and the tube divides into cells. At the tip of these sporules form; they germinate singly and produce structures that may penetrate the tissues of the corn plant at its most tender point (the lowest joint of the stem), when the plant is young. During the growing period of the fungus, up to the time when spore formation takes place, it consists only of that portion which necessarily begins its growth near the surface of the ground, since it enters when the corn is very young. As the plant increases the fungus grows upwards to the place where it forms spores. The fruiting time of the corn marks also the period when spores are developed, usually upon the young kernels. About this time the thread-like structures branch where spores are to be formed. The tips of the branching threads swell, and granules appear in the contents. These finally develop into spores imbedded in the substance within the threads; the cell walls become gelatinous as spore formation proceeds, and this gives a slimy character to the mass of smut; but in the course of time, further changes take place, and very little remains but dry, round, dusty spores. It is injurious to feed cattle with smutty corn, as it acts upon the animal economy much the same as ergot of rye. Passing through the animal system does not destroy the germinating power of smut, consequently the spores in manure are in a condition to spread the trouble. As it is readily seen on affected parts and may be picked off, it should be gathered and destroyed by fire or otherwise. It is not sufficient to pick off the smut and throw it upon the ground, as the spores will still continue to form.

REMEDIES.—With such facts before us we are in a position to suggest some remedies, which are applicable to the several varieties of smut:

1. Sow clean seed.

2. Steep seed five minutes in a solution of copper sulphate (1 lb. to 1 gallon of water); constantly stir so as to wet the grain evenly; then spread it on a floor to dry, or add some land plaster or slacked lime, and mix until dry. One gallon is about enough for 4 bushels. Some prefer using a weaker solution and allowing a longer time: *e.g.*, 1 lb. copper sulphate to 4 gallons of water, and steep twenty-four hours.

3. 1 lb. caustic potash in 6 gallons of water; let soak a day. Or take 40 lb. hard-wood ashes to 10 gallons water; let this stand a day, stirring from time to time, and the water poured off will be a solution about the same strength as the preceding.

4. Brine strong enough to float an egg does very well if the seed is kept in it for several hours with occasional stirring.

5. Immersing the grain in hot water (135° F.) for 5 minutes, or 132° F. for 15 minutes, destroys smut spores without injury to the grain. A temperature 5° above or below this fails in its results.

By keeping the seed in a sack made of coarse material it may be readily dipped into any of the solutions recommended.

In the department of Natural History we are constantly adding improvements so as to render the teaching of this subject attractive. We are now able to use the stereopticon in the class-room during the day. Hitherto we used it in the evening only, but we have had curtains put upon the windows so that the room can be darkened at any time.

We have under consideration now an arrangement by which we shall be able to use the lime-light instead of the ordinary oil lamp. This will enable us to throw upon the screen, objects in the microscope, without requiring to have specially prepared slides for the lantern. This will be a great step in advance, and at once place us in a position to use apparatus of great use in teaching botany and allied subjects. The expense will be about fifty dollars, and all the fixtures will be of use in a new laboratory when such is built. We think the time has arrived when a new greenhouse should be erected, and in connection with it a lecture-room, etc., for the use of the students in botany. Every department has had much money spent upon it except this, and we have patiently waited, hoping the time would soon come when the equipment of the botanical

department would equal that of the chemical. Our institution should have it, in fact, there are some high schools able to boast of instruments we have not been able to get yet, owing to the want of suitable accommodation.

During the present year an additional orchard has been laid out. It was found that field 10 was poorly adapted for fruit-growing, and that the time had arrived to try another location. About six acres were selected in field 13, where the soil seems favorable and naturally well drained. The following trees, etc., have been planted :

Apples.

Northern Spy, 12 ; Walbridge, 17 ; Fameuse, 10 ; Duchess of Oldenburg, 7 ; Yellow Bellflower, 7 ; Wealthy, 6 ; Golden Russet, 5 ; Wagener, 5 ; Yellow Transparent, 5 ; Magog Red Streak, 5 ; St. Lawrence, 5 ; Colvert, 5 ; Red Astrachan, 5 ; Ben Davis, 3 ; Ribston Pippin, 3 ; Alexander, 3 ; Bailey's Sweet, 2 ; Salome, 1 ; Aucubifolia, 1 ; Russian Apples, Nos. 60, 182, 270, 322, 599.

Pears.

Ritson, 10 ; Beurre Hardy, 2 ; Beurre de Anjou, 2 ; Sheldon, 2 ; Flemish Beauty, 2 ; Clapp's Favorite, 2.

Grape Vines.

Worden, 30 ; Salem, 30 ; Moore's Early, 14 ; Delaware, 10 ; Lady, 10 ; Red Wyoming, 10 ; Early Victor, 5 ; Moyer, 5 ; Rogers No. 4, 5 ; Montgomery Red, 4 ; Agawam, 4 ; Concord, 3 ; Brighton, 3 ; Rogers No. 28, 2 ; Lindley, 2.

Raspberries.

Cuthbert, 325 ; Philadelphia, 220 ; Marlboro, 120 ; Golden Queen, 50 : Hilborn, 50 ; Tyler, 50.

Currants.

White Grape, 50 ; Fay's Prolific, 50 ; Cherry, 27 ; Champion, 24 ; Lee's Prolific, 50 ; Naples, 25 ; Saunder's Seedling, 45.

Gooseberries.

Downing, 75 ; Houghton, 50 ; Whitesmith, 45 ; Industry, 25 ; Smith's Improved, 25 ; Pearl, 25.

Strawberries.

Dominion, 500 ; Crescent Seedling, 500 ; Wilson's Albany, 230 ; Manchester, 150 ; Clouds, 150 ; Rubach, 130 ; Haverland, 50 ; Jessie, 60 ; Sharpless, 60.

About four acres on the east side of Field 4 has been laid out with forest trees, embracing the following kinds :—Ash, Maple, Hickory, Birch, Mountain Ash, American Chestnut, Walnut, Sycamore, Catalpa and Austrian Pine. This has been done with a view to learn something regarding the effect of cultivation upon trees of this class.

Our former vineyard in Field 17 has been reduced to about two acres, these containing none but the hardiest varieties. In the old vineyard we had some 96 varieties, but experience has taught us that only a limited number will ripen with us and these are retained. The others are destroyed, and that portion of the vineyard devoted to other crops.

Our clumps of Larch, Walnut and mixed collections are doing well. The hedge plants and trees grown in the nursery, situated in the corner of the Experimental Field, are also progressing favourably. From these we are able to remove from time to time trees and shrubs to other parts where required.

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1890.

Observations are regularly taken at the hours of 7 a.m., 1 p.m., and 9 p.m. daily, and recorded in a book printed for the purpose. The instruments in use are as follows :—

Anemometer—Recording the direction of the wind and indicating the number of miles travelled. During the greater part of '89 this has been out of order.

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

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

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

Hygrometer—With *dry* and *wet* bulb thermometer, for the purpose of showing the condition of the atmosphere with reference to moisture.

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 monthly summaries the condensed statement of the year's meteorology is made up.

Form of Monthly Summary.

Meteorology.

A summary of the meteorological observations taken at Ontario Agricultural College during the month of.....

Normal height of barometer at Guelph (1,100 feet above sea level and 858 feet above Lake Ontario, 28.86 inches. Latitude north 43°-38'.

Barometer—

Highest barometer.
Lowest "
Highest mean barometer.
Lowest " "
Monthly " "
Monthly range.

Thermometer—

Highest thermometer.
Lowest "
Highest mean thermometer.
Lowest " "
Monthly " "
Monthly range.

Pluviameter—

Days rain fell.
Greatest rainfall.
Days snow fell.
Greatest snowfall.
Total precipitation.

Anemometer—

Direction of wind.
Greatest number of miles travelled in twenty-four hours.
Greatest velocity per hour.
Mean velocity per month.

Summary of the Meteorological Results for 1890.

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Barometer—												
Highest barometer	inches. 29.474	inches. 29.342	inches. 29.270	inches. 29.294	inches. 29.038	inches. 29.140	inches. 29.958	inches. 29.910	inches. 29.192	inches. 29.128	inches. 29.600	inches. 29.960
Lowest barometer	28.116	28.213	28.134	28.054	28.362	28.600	28.600	28.400	28.622	28.126	28.100	28.218
Highest mean barometer	29.415	29.260	29.186	29.260	28.955	29.124	29.256	29.151	29.192	29.100	29.341	29.276
Lowest mean barometer	28.426	28.408	28.154	28.175	28.520	28.610	28.672	28.615	28.706	28.176	28.545	28.275
Monthly mean barometer	28.938	28.056	28.779	28.101	28.273	28.844	28.882	28.896	28.944	28.514	28.943	28.783
Monthly range	1.358	1.129	1.136	1.240	.676	.540	1.358	1.470	.570	1.002	1.600	1.742
Thermometer.												
Highest temperature	degrees. 65.0	degrees. 3.7	degrees. 5.2	degrees. 74.0	degrees. 75.5	degrees. 89.9	degrees.	degrees. 104.3	degrees. 89.3	degrees. 75.8	degrees. 71.2	degrees. 55.5
Lowest temperature	10.0	.5	.9	19.0	25.0	35.6	43.5	39.4	30.0	26.0	20.5	-4.0
Highest mean temperature	43.0	35.5	31.1	.....	63.3	75.3	75.6	75.7	71.6	60.4	47.9	31.7
Lowest mean temperature	11.3	11.9	11.1	.....	39.7	51.8	55.4	49.4	42.6	33.0	19.7	6.4
Monthly mean temperature	26.4	26.3	24.9	.....	49.9	73.4	66.0	61.9	55.9	44.5	34.8	25.5
Monthly range	55.0	52.0	51.1	55.0	50.5	54.3	66.5	68.9	59.3	49.8	50.7	59.5
Pluviameter.												
Number days rain fell	2	2	.....	.....	1	9	8	6	7	11	10	1
Number days snow fell	3	.....	1	.....	.....	.....	.....	.....	.....	.....	2	1.5
Greatest rainfall, inches	1.14	7	.....	.....	.21	1.36	.47	.69	.29	.43	1.45	.....
Rainfall for month, inches	1.53	1.10	.....	.....	.21	4.96	1.45	1.32	.58	1.91	3.16	.....
Greatest snowfall, inches	1.5	.....	1	.....	.....	.....	.....	.....	.....	.....	1.75	3.00
Snowfall for month, inches	3.3	.....	1	.....	.....	.....	.....	.....	.....	.....	2.80	7.5
Total precipitation	1.86	1.10	.1	.....	.21	4.96	1.43	1.32	.58	1.97	3.44	.75
Anemometer.												
Predominating winds	Not in running order.											
Greatest number of miles in 24 hours												
Mean velocity for the month												

With reference to the subjects discussed in the lectures delivered during the year it is unnecessary to give an outline of the work, as that is shown in that portion of your report which gives a syllabus of the subjects taught in each Department. In conclusion I would direct your attention more particularly to what are the pressing wants of the Natural History Department.

1. The construction of gas cylinders in the Botanical Laboratory at an expenditure of not more than fifty dollars.

2. The purchase of four additional microscopes at an expense of one hundred dollars. This results from the increased attendance in the third year.

3. The purchase of specimens for the Museum, for which at least one hundred dollars should be granted.

4. The erection of a new greenhouse, and in connection with it a Botanical Laboratory, Lecture-room and suitable accommodation for students in Microscopy. Owing to our limited quarters this year I have been necessitated to divide the class in practical work, and thus have been employed alternate afternoons with classes doing the same work. We certainly are much in need of accommodation in this direction, and it is hoped you will be able to prevail upon those who have it in their power to put us on an equal footing with other institutions as far as this Department is concerned.

Your obedient servant,

J. HOYES PANTON.

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PART III.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

To the President of the Ontario Agricultural College:

SIR,—I beg herewith to submit to you my report of the work done at the Chemical Laboratory during the year 1890. As my details of analysis, etc., are somewhat extensive I shall condense my remarks in this introduction to as brief a space as possible.

My chief report in regard to instruction is in reference to the elementary work with the first year. For the first time we have attempted the teaching of this class in a thoroughly practical manner. Instead of lectures only we now have two afternoons during the week given to laboratory practice, supplemented by one lecture each week. In a word, I may say that I am more than ever satisfied that, though a little more expensive, this is the only satisfactory manner of imparting instruction in this subject. When we have covered an entire year's work with this class I shall be able to report to you more fully as to the general effect. The increase of work thus resulting demands increased room, apparatus and attention from the chemical department; but in all these respects I trust that by the liberal aid of the management we shall, during the coming year, be more fully equipped.

Through your kindness in arranging for my summer duty I was enabled to spend part of the summer of the past year in the organic department of the chemical laboratory of Harvard University. I would suggest that in no surer way can the controlling power of this institution increase its usefulness and create a feeling of enthusiasm and energy on the part of the staff than by making it possible for the various members of its staff to regularly visit and spend some time in the leading laboratories and experimental stations of America and Europe.

I submit my report to you under the following five heads in order

1. Fodder Corn, and Corn for Ensilage.
2. Corn Ensilage.
3. Report on Fish and Fish Refuse.
4. Sugar Beets.
5. Soil Temperatures and Drainage Waters.

FODDER CORN AND CORN FOR ENSILAGE.

At the beginning of 1890 extensive analysis of samples of corn grown by Prof. Robertson in connection with the dairy department were in progress. These were partially completed and reported upon to him early in January. Since then the unfinished work has been overtaken and I here present our complete analysis in this undertaking. Those who may be interested in this will find by reference to pp. 196-202 Report of Ontario Agricultural College and Experimental Farm for 1889, much that will prove interesting and valuable as supplementary to this. Messrs. Zavitz, Harcourt and Lehmann have been engaged at various stages of this work, which has required an immense amount of time and careful labor. There are in all forty-one results given which are the averages in each case of two closely agreeing duplicates, so that in all eighty-two samples of corn were analyzed.

First—I shall give the composition of the *Field Corn*, which was divided into three classes, according to size, viz., small, medium and large. Each of these classes is separated as shewn, according to the stage of maturity, and these further subdivided for analysis into leaves, stalks and ears. The names of the varieties are given which were in every case thoroughly mixed together before being analyzed.

TABLE I.

Field Corn.

Chemical Analysis of Fodder Corns Grouped together.

		Varieties of Corn in each group.		Chemical analysis of each group.					
				Water.	Crude Protein.	Fat or Ether Extract.	Soluble Carbo-hydrates.	Crude Fibre.	Ash.
SMALL.	"Out of bloom" and "Early milk stage."	Pearce's Prolific Stabler's 2nd Early Tuscarora Golden Dew Drop	Ears....	67.58	2.53	1.14	24.08	4.41	.26
		Golden Dew Drop Longfellow Angel of Midnight Self Musking	Stalks...	73.38	1.79	.57	16.42	7.46	.38
		100 Day Corn Crosby Sweet Fodder Hickox, Sweet	Leaves..	33.02	5.53	1.75	37.18	18.78	3.74
	"Silking stage."	North Star Yellow Dent	Ears....	72.25	3.04	.99	20.73	2.77	.22
		Egyptian Sweet	Stalks .	73.90	2.37	.62	15.66	7.13	.32
			Leaves..	25.73	8.48	1.99	38.19	21.32	4.29
MEDIUM.	"Out of bloom" and "Early milk stage."	White Flint Longfellow Early Adams or Burlington Wisconsin White Flint Pride of the North Calico Dent	Ears....	66.23	2.79	1.13	25.17	4.39	.29
		Edmunds Premium Dent Wisconsin White Flint Longfellow Flint Corn King Phillip Flint Canada Yellow Horse Tooth	Stalks .	70.71	1.28	.95	20.40	6.32	.34
		Early White Flint Compton's Early Evergreen Sweet Asylum Sweet Sibley's Pride of the North	Leaves..	81.53	5.60	1.66	38.87	18.49	3.85
	"Silking stage."	Brazilian Flour Corn	Ears ...	78.68	2.20	.53	16.72	1.70	.17
		Wisconsin Yellow Dent	Stalks..	69.32	1.80	1.30	19.31	7.92	.35
		Woodsworth's Yellow Dent	Leaves..	33.03	5.56	1.49	38.91	18.01	3.20
	"Out of bloom and "Early milk stage."	Chester No. Mammoth	Ears ...	75.01	2.03	.17	18.25	3.75	.19
		Giant Prolific Sweet Ensilage	Stalks..	75.86	1.19	.61	15.11	6.98	.25
			Leaves .	26.17	7.38	1.81	41.44	18.65	4.55
LARGE.	"Silking stage."	Horse Tooth Cranberry White Dent Leaming Dent Garrish White Dent.	Ears ...	78.90	2.01	.70	15.95	2.27	.17
		Hickory King South Western Sheep's Tooth White Western	Stalks..	71.65	1.77	.93	16.93	8.43	.29
		Red Bob M. S. S.	Leaves..	32.34	7.22	1.92	38.85	16.07	3.60

Conclusions.

1. In fodder corns the water is greatest in the stalks, least in the leaves, more than twice as much being found in the former as in the latter. The water in these samples appears to have increased with age in ears and leaves and decreased in stalks; but too much reliance cannot be placed on this last conclusion as the varieties are to a great extent quite different.

2. The nitrogenous material or crude protein is greatest in the leaves and least in the stalks, the difference being greater the larger the plant. In immature plants such as these a large portion of the nitrogenous compound is of an inferior nature, chemically known as *non-protein*, which as the plant matures becomes changed into true protein or muscle and flesh forming material.

3. By fat we more correctly mean ether-extract, everything that can be dissolved out of the dried substance by ether. In addition to fats or oils, the ether readily dissolves gummy substances and chlorophyl, and, as fat or oil is not one of the compounds formed in the early stages of plant growth, these figures are controlled to a great extent by the greenness of the plant. The excess in the leaves of this constituent is thus explained: Fodder corns of all kinds contain little, if any, true fat.

4. By soluble carbohydrates we mean starch, sugar and the readily digestible portion of the woody fibre. In this respect again the leaves have the large percentage, about double that of the stalks.

5. In crude fibre the order of percentage in every case is leaves, ears, stalks.

6. As the leaves are the manufacturing headquarters of the plant and also the avenues of ash excretion to a great extent, we here find the great excess of the ash or mineral matter.

7. Pound for pound the three parts of these plants are to be valued in this order leaves first, then ears, then stalks.

TABLE II.

Hill Corn.

Chemical Analysis of Fodder Corns Grouped together.

	Varieties of Corn in each Group.		Chemical Analysis of each Group.					
			Water	Crude Protein.	Fat Ether (Extract.)	Soluble Carbohydrates.	Crude Fibre.	Ash.
SMALL. "Out of bloom" and "Early milk stage."	Longfellow, Smutt Nose Flint, Sucet Fodder, Crosby Corn, Moore's Early Concord, Early Mammoth, Livingstone's Evergreen	Ears....	71.93	2.52	.95	19.23	5.12	.25
	Pee & Kay Corn, Late Mammoth Sugar, Stowell's Evergreen, Early Minnesota, Black Mexican, Hickox Sweet, Pearce's Prolific	Stalks...	75.73	1.40	.65	14.59	7 32	.32
	Golden Dewdrop, Canada Yellow, Self Massing, White Flint	Leaves..	37.18	6.12	1.11	35.49	16.56	3.54

TABLE II.—*Continued.*

		Varieties of Corn in each Group.		Chemical Analysis of each Group.					
				Water.	Crude Protein.	Fat Ether (Extract.)	Soluble Carbohydrates.	Crude Fibre.	Ash.
SMALL.	"Silking stage."	Triumph, Asylum Sweet, Japanese Maize, Old Colong, Brazilian Flour Corn, Tuscarora	Ears	83.22	1.65	.59	15.88	1.56	.10
			Stalks	78.05	1.45	.52	13.46	6.28	.24
			Leaves	44.94	8.05	1.35	26.99	16.09	2.58
MEDIUM.	"Out of bloom and "Early milk stage."	Woodsworth's Yellow Dent, Pride of the North No. 23, Wisconsin Yellow Dent, Wisconsin White Dent, Calico Dent, King Phillip, Wisconsin White Flint, Sibley's Pride of the North, Stabler's 2nd Early, Early Adams or Burlington, Horse Tooth, 100 Day Corn, Compton's Early	Ears	66.73	2.70	.72	25.31	4.25	.29
			Stalks	72.31	1.26	.63	17.13	8.35	.32
			Leaves	29.63	6.07	1.51	39.37	19.35	4.07
	"Silking stage."	Leaming Yellow Dent, Thoroughbred Flint, Egyptian Sweet, Evergreen Sweet, Giant White Southern	Ears	87.66	1.60	.53	8.50	1.64	.07
			Stalks	73.59	1.53	.71	15.60	8.28	.26
			Leaves	29.92	7.18	1.38	37.89	19.22	4.11
LARGE.	"Out of bloom and "Early milk stage."	Stimpson's Yellow Dent, Edmund's Premium Dent, Chester County Mammoth	Ears	78.68	2.01	.43	15.21	3.51	.16
			Stalks	71.00	1.00	.89	18.27	8.52	.32
			Leaves	20.27	7.97	1.69	43.84	21.22	5.01
	"Silking stage."	Garrish White Dent, Hickory King, Cranberry Dent, North Star Yellow Dent, Red Cob Ensilage, Giant Prolific S. E., M. S. S., Sheep's Tooth, South Western, White Western	Ears	82.26	3.91	.67	9.82	3.19	.15
			Stalks	72.35	3.45	.54	14.81	8.54	.31
			Leaves	38.75	10.84	1.33	29.88	15.94	3.26

General Conclusion.

As in the case of the field corn, we here find that the leaves contain less water and more crude protein, soluble carbohydrates, fibre and ash, than the stalks or young ears.

TABLE III.

ENSILAGE CORNS.—(DRILLS 3 FEET APART.)

This investigation was carried out in connection with five varieties, as stated in the following table. 160 plants were taken weighing in green state 300.75 lb., in dry condition, 169.18 lb. These, therefore, in drying, lost in water 131.57 lb. or 43.7 per cent. of the entire weight. This table gives the analysis calculated to their green condition :

Varieties.		Water.	Crude Protein.	Ether Extract.	Soluble Carbohydrates.	Crude Fibre.	Ash.
M. S. S. Red Cob Ensilage Grand Prolific S, Ens. Pearce's Prolific Sibley's Pride of N.	Ears	8.82	1.63	0.49	13.98	2.97	0.11
	Stalks	72.87	1.25	0.58	16.69	8.35	0.26
	Leaves	28.14	6.87	1.52	40.37	18.82	4.28

The entire crop was made up as follows, by weight :

Ears	19.1	per cent.
Stalks	60.5	"
Leaves	20.4	"

So that reckoned to pounds, a ton of such corn would contain : ears, 38.2 lb. ; stalks, 1210 lb. ; leaves, 408 ; made up as follows :

Pounds per ton of Green Crop.

——	Water.	Crude Protein.	Ether Extract.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Ears	308.73	6.22	1.87	53.41	11.35	0.42
Stalks	881.73	15.12	7.02	201.95	101 04	3.14
Leaves	114 81	28.03	6.20	164.71	76.79	17.46
Total	1305.27	49.37	15.09	420.07	189.18	21.02

Percentage, distribution of the different constituents in various parts.

	Water.	Protein.	Ether Extract.	Carbohydrates.	Fibre.	Ash.
Ears	23.6	12.6	12.4	12.7	6.1	2.0
Stalks	67.5	30.6	46.5	48.0	53.3	15.0
Leaves	8.9	56.8	41.1	39.3	40.6	83.0

Composition of entire Green Plant.

Water	65.26 per cent.
Crude Protein	2.46 "
Ether Extract	9.75 "
Starch, sugar, etc	21.00 "
Crude Fibre	9.45 "
Ash	1.05 "
	99.97

From the above tables it will be seen how large a portion of valuable food is stored up or contained in the leaf. Two-thirds of the water is found in the stalk; more than half of the crude protein is in the leaf; the starch, sugar and fibre are in the stalk and leaf in about the proportions of five to four; over four-fifths of the ash or mineral matter (bone material) is contained in the leaf. The high feeding and fertilizing value of the leaf of the fodder is thus demonstrated.

TABLE IV.

Broadcasted Corn.

Forty stalks of four varieties grown broadcast were separated into leaf and stalk, and duplicate analyses made of the samples, thus obtained:

Varieties.		Water.	Crude Protein.	Ether Extract.	Soluble Carbohydrates.	Crude Fibre.	Ash.
M. S. S Red Cob Ensilage Giant Prolific S. Ens. Pearce's Prolific	Stalks	65.49	0.97	0.65	23.66	8.86	0.37
	Leaves	26.15	4.48	16.5	42.08	21.85	3.79

The former conclusions are at once found to hold true here also, in comparing leaf with stalk. The high feeding and manurial value of the leaf is thus shown in all varieties of fodder and ensilage corn, at all stages, and in broadcast and drill treatment.

CORN ENSILAGE.

The corn produced at the farm here during the year 1889 and fed during the winter of '89-90 was placed in two silos, one situated at the dairy barn and one at the large farm barn. The corn was of a varied nature and of varied degrees of maturity, as it had been grown for experimental purposes to test both variety and method of growing. The result was that the quality was not quite equal to the average, as the analysis given in the following table shows :

——	Water.	Crude Protein.	Fat, or Ether Extract.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Dairy ensilage	81.72	1.06	0.73	11.52	3.93	1.04
Farm ensilage	81 47	1.18	1.12	10.82	4.30	1.11

The question arises at once as to how this compares with the average, the best and the worst. That this may be seen, and that the possible variations in the composition of corn ensilage may be seen, I give the average of 100 samples, also the maximum and minimum amounts of the different constituents as given by Dr. Jenkins of Connecticut :

——	Water.	Crude Protein.	Fat, or Ether Extract.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Average	79.83	1.59	0.73	10.62	5.94	1.29
Minimum	64.40	0.70	0.20	5.10	3.00	
Maximum	87.00	2.80	1.80	22.20	10.00	

Investigation Elsewhere.

During the past year the experimental stations in connection with nineteen of the neighboring states have been investigating the ensilage and corn question, whilst in England, France and Germany much valuable work has been carried on of late years. The most important conclusions from these places have been embodied in reports and bulletins, and I propose to select the most valuable results and include them in this bulletin for the information of the farmers of Ontario. The name of the state or station will in this work sufficiently indicate the source of selections.

VARIETY OF CORN.

"Those varieties that will reach a fair degree of maturity are the best for fodder and ensilage purposes."—(*Cornell, New York*, 1889.)

"It is now generally believed that the more mature the grain while the stalk remains green, the better the ensilage will be. So that early maturing varieties are now considered most valuable."—(*Michigan*, 1889.)

For conclusions from an Ontario experiment see Ontario Agricultural College and Ontario Experimental Farm report for 1889, page 202, (Prof. Robertson's report.)

Method of Growing.

The general conclusion of experiments at all stations, based on chemical analysis and actual feeding tests, is that the best ensilage is produced from corn that has been drilled and not broadcasted. Every stalk of corn should be grown so that it has plenty of soil room in which to develop its roots, plenty of rich soil to draw nourishment from, plenty of air-breathing space, and plenty of sunlight falling directly upon all of its leaves. The immaturity of closely growing corn depends principally upon its lack of sunlight.

Prof. Roberts (*Cornell Experimental Station, New York*, 1888) valued as follows:—

One acre of hay, 1.5 tons	$18 00
" broadcasted corn	19 72
" drilled corn	35 74

"Special attention is called to the fact that heretofore it has been a common practice to sow or plant corn for fodder and ensilaging entirely too thick. Starch and sugar are not fully developed without an abundance of sunlight."—(*Cornell*, 1890.)

Wisconsin is the banner state for corn and ensilage. Its report is as follows: "After urging that no variety be used that will not mature in ample time to be gathered into the silo before there is danger of frost, another precaution is that the corn be planted so thin that considerable grain will mature. The ordinary varieties of field corn, either dent or flint, will prove satisfactory for ensilage."

"To obtain mature corn, there must be more room for each plant, so thinner seeding is now practiced."—(*Michigan*, 1889.)

Maryland Experiment Station reported in 1888 as follows in reference to fodder corn (p. 68):

	Height.	Date cut.	Yield, lb.
Drills, 3 ft. apart	9 feet.	Sept. 22	19,540
" 18 in. "	7 "	" 25	15,584
" 9 in. "	5½ "	" 26	12,700
Broadcast	5 "	" 27	11,464

The height of corn, date of cutting (maturity condition) and yield are all in favor of the drilled corn in this case.

"Thick seeding appears to cause a decrease in the relative amount of nitrogen in the albuminoid form. This diminishes the value of the fodder, as the amide nitrogen is considered to have a less nutritive value. The product of an acre of corn as ordinarily grown has usually a food value little more than half as great as the product of the same in drills as above advised."—(*Maryland*, 1888, *Hy. E. Alvord.*)

"In the culture of ensilage corn the main object is to produce a large yield, and the best way to secure such a result is the important question. The most successful way to reach this end is to plant in drills, and I would recommend that the rows should be three feet apart, with the grains about four inches apart in the row.

"Experience indicates that it is best that the corn should be almost out of the milk state, or just beginning to glaze."—(*Ohio, June*, 1889.)

When to Cut for Silo.

At this point especially chemical analysis of the corn product is of exceedingly great value, as the total weight alone of any green crop is not a safe test of its true feeding value. The latter depends upon the amount and digestibility of the dry constituents, such as protein, fat, sugar, starch, etc. So long as a plant is increasing in size, lengthening its stalks, leaves and roots, growing taller, not much protein, fat, sugar and starch will be deposited or accumulated as a surplus. Analysis has shown that the later stages of development of the corn plant add an enormous amount of the most valuable feeding constituents to the plant, and that cutting the plant too young means a great loss to the ensilage produced from it, whereas allowing it to mature more fully diminishes the percentage of water and greatly increases the weight of valuable food per acre.

"Repeated experiments have shown that to obtain the maximum amount of nutritive matter the corn must be allowed to reach a certain degree of maturity. The proper condition is apparently obtained when the corn has just passed the glazing stage in the flint, and is well dented in the dent corns. Experience and analysis indicate that corn cut at this stage is in the best possible condition for the silo.—(*Wisconsin*, '89)

"For some years corn was put into the silo when very green. We now know that to make ensilage of greatest value the corn should be more mature. The practice among those the most successful with the silo is to cut when the grain is beginning to glaze."—(*Michigan*, '89.)

"To get the most food value on an acre of corn it should not be cut till the plants begin to show signs of drying and withering and the seeds begin to glaze."—*Maryland*, 1888, *Hy. E. Alvord.*)

Date of Cutting.	Yield per acre.	Dry matter.	Protein.	Fat.	Carbohydrates.	Value.
	lb.	lb.	lb.	lb.	lb.	$
July 24	18,762	2,000	250.6	42	1,543.6	14 05
August 8	24,578	4,039	368.4	81.99	3,328.9	26 16
September 8	27,674	7,214.2	585.8	199.1	6,166.7	47 33

"From the above facts it will be seen that the real feeding value of the corn increased 166 per cent. after it had tasseled out, and 80 per cent. after it had nearly reached the roasting ear stage. This being so, the greatest care should be taken to select those varieties of corn intended for ensilage that will fully mature before frost in the localities where it is proposed to grow them, a less number of tons of mature corn being in all cases more valuable than a much larger number of tons of immature corn."—(*Cornell*, 88.) In March, 1890, Profs. Roberts and Wing, of Cornell, issued a bulletin on corn and ensilage. Basing their conclusions on their own work of 1889, the work of New Hampshire, Pennsylvania and the Geneva Station, New York, they state: "It would seem as though the proper time to cut corn for ensilage was definitely settled by these experiments. An increase of more than two hundred per cent. between the periods of bloom and ripening cannot be ignored, even though the proportion of the more valuable albuminoids is somewhat lessened. What gives the matter additional strength is that these experiments, including all the work so far done in this direction that has come to our notice, are unanimous in their conclusions."

"Bulletin 9, 1889, Missouri Experimental Station, discusses the life history of corn, and contains this among many important statements: "The considerable increase between September 10 and September 17 (amounting to 24 per cent. of the total weight) indicates clearly that a crop of corn should remain in the field as long as possible, the weather permitting, to reach its greatest perfection."

The Massachussetts report for 1885 says (p. 53): "One ton of green fodder corn in tassel contained in one case 307.2 lb. of dry vegetable matter; whilst in the case of the seed just beginning to glaze, 463.8 lb. of dry vegetable matter are found in one ton, a difference of 156.6 lb. in favour of the more matured state of the growth." And the report for 1886 says: "The ensilage of a more matured fodder corn has a higher feeding value pound per pound, compared with that cut at an earlier stage of growth."

It may be interesting to know what the great increase in dry matter consists of that takes place in the later development of the plant. Let me refer again to the Massachusetts report for 1885 (p. 53), cited above, to show the composition of dry matter in fodder corn:—

	July 22.	July 29.	August 5.	August 13.	August 27.	September 3.
Ash	8.54	8.00	5.95	5.69	4.70	4.22
Cellulose	26.61	27.28	26.40	24.11	24.30	20.93
Fat	3.24	2.65	2.26	2.13	1.81	2.63
Protein	17.19	14.42	11.86	11.23	8.87	9.17
Carbohydrates	45.02	47.64	53.53	56.84	60.32	63.05

Thus we see that the increase is principally in the form of soluble carbohydrates (starch and sugar), which are formed from the air and do not deplete the soil. This table, it must be carefully noted, gives merely the percentage composition, not the total quantity per acre.

Next let us refer to an investigation made by Mr. E. F. Ladd, at the New York Agricultural Experimental Station, Geneva, (1889), Report pp. 88, *et seq.* The figures are in pounds per acre.

Per acre.	Tasseled July 30.	Silked Aug. 9.	In milk Aug. 21.	Glazed Sept. 7.	Ripe Sept. 23.
Total yield	18,045	25,745	32,600	32,295	28,460
Water	14,426	22,666	27,957	25,093	20,542
Dry matter	1,619	3,078	4,643	7,202	7,918
Ash	138.91	201.30	232.15	302.48	364.23
Protein	239.77	436.76	478.69	643.86	677.78
Crude fibre	514.19	872.93	1,261.97	1,755.85	1,734.04
Carbohydrates	653.91	1,399.26	2,441.29	4,239.82	4,827.60
Fat	72.20	167.75	258.90	259.99	314.34

"From the date of full tasseling until ripe the dry matter increased 4.8 times, from 1,619 pounds to 7,918 pounds per acre. From full silking until ripe the increase in dry matter was 2.5 times."

On page 90 the conclusions of two years' investigations are thus stated by Mr. Ladd: 1. That the greatest weight of green fodder is between the period of full silking and the milk stage of kernel. 2. That the total weight diminished after this date, but the total dry matter increased. 3. That as the corn approaches maturity the per cent. of amide nitrogen diminishes, while the albuminoid nitrogen increases, thus seemingly increasing the feeding value of the crop. 4. That the sugars and starch increase rapidly during the later period of growth and maturing of the corn plant, and that these are the most valuable portion of the nitrogen free extract (soluble carbohydrates). 5. That between the period of glazing and full ripening of corn there was a large increase in amount of sugar and starch. 6. That for the greatest nutriment, considered from a chemical standpoint, corn should not be cut before it has well ripened. 7. That the B. and W. corn cannot in ordinary culture be matured in this latitude.

"The general conclusion to be drawn from our experiments, then, as to the proper time of harvesting corn, is that it should be allowed to stand as long as the climate of the locality and the purpose in view will permit, since it is continually increasing in value per acre.—(*Pennsylvania*, '88.)

A bulletin was published in April 1890 by Wm. H. Caldwell, of the Pennsylvania Agricultural Experimental Station on "Indian Corn as a grain and forage crop." He states: "The results of work done at several of the agricultural experiment stations last season show that a great deal of the dry matter (food material) of the corn crop is lost by cutting the crop before it reaches maturity. Last season's work showed such a large increase of dry matter from the time the kernels began to glaze, until matured and field-cured (being more than previous to that time) that it was deemed advisable to determine the increase only between these last two stages of growth this season."

YIELD PER ACRE—DRY MATTER.

——	When kernels began to glaze.	In field-cured material.	Gain by allowing crop to mature.
Average of Flints, 1889	3,404	4,785	1,385
Average of Dents, 1889	7,078	8,318	1,240
Average of Dents, 1888	5,259	7,159	1,900

"The results show that fully 20 per cent. of dry matter is gained by allowing the crop to mature."—*Pennsylvania, 1890.*

——	July 26.		August 5.		August 19.		September 16.	
	Water.	Dry material	Water.	Dry.	Water.	Dry.	Water.	Dry.
Southern	91.25	8.75	89.18	10.82	84.95	15.05	75.40	24.60
Northern Field Corn	87.75	12.25	86.10	13.90	81.45	18.55	72.40	27.60
Sanford	90.85	9.15	86.79	13.21	86.75	13.25	77.20	22.80
Pride of the North	90.65	9.35	87.56	12.44	82.25	17.75		29.55

PERCENTAGE INCREASE OF DRY SUBSTANCE.

	July 26 to Sept. 16.	August 9 to Sept. 16.
Southern	181 per cent.	63.4 per cent.
Northern Field Corn	125 "	48.8
Sanford	149 "	72
Pride of the North	216 "	66.4 "
	671	250.6
Average	167.75 per cent.	62.6 per cent.

i.e. 167¾ per cent. is the average increase from July 26 to September 16—(52 days.)
62.6 " " " August 19 to September 16—(28 days.)

From August 19 to September 16, the increase in dry matter is 37.3 per cent. of the total increase from July 26 to September 16.—(*New Hampshire, 1888, G. H. Whitcher.*)

CHANGES AND LOSSES IN SILO.

There is always a loss in the material put into the silo during the continuance of the process; it will vary from a very small amount to one-half of the total dry matter. The loss is due principally to the productions of acids by fermentations; some of these acids and the other compounds produced at the same time escape and are a total loss; even if retained the acids, of course, are not so valuable as foods as the substance out of which they have been formed. The sourness or acidity of a sample of ensilage is therefore an indication of the destruction of valuable plant material, and the production of as sweet a sample as possible is recommended for many obvious reasons. The acid will vary from .02 per cent. to over 2 per cent. When there is little acid the ensilage is called sweet; when there is much acid, it is called sour. The changes taking place in fermentation affect the constituents of the plants in the following order: sugar, starch, fibre, nitrogenous compounds. It becomes therefore a very important question to know how the fermentation and the consequent loss of from 5 to 30 per cent. may be checked.

Water—The presence of a large quantity of water in the corn certainly increases its tendency to fermentation. We know that matured grains, straws, well cured hay, succulent food thoroughly dried, manure deprived of its moisture will not ferment. By putting in the corn then with not too much water we shall prevent souring. As corn matures its percentage of water gradually diminishes; this has been proven in our experiments here and at many other stations. The following table shows the percentage of water in fodder corn at different stages as given in the Massachusetts report, 1885:

	July 22.	July 29.	August 5.	August 13.	August 27.	Sept. 3.
Water	88.61	85.76	84.64	82.08	81.15	75.81
Solids	11.30	14.24	15.36	17.92	18.85	23.19

"The change from sour to sweet ensilage has accompanied a greater maturity of the corn; each year the corn has been planted a little thinner and allowed to become more

mature before being put in the silo, and each year has seen a less degree of acidity in the ensilage. Examination of the analysis of ensilage received from various silos in the state, as well as our own, would seem to indicate that the acidity varies with the amount of water present in the corn; the more water the greater the per cent. of acid."—*Winsconsin, 1889.*

Condition at Maturity—"The marked increase of nitrogen free extract (members of the starch family) as the corn matures and the progressive decrease of acid in the ensilage show how greatly the corn improves as it approaches ripening. The relatively large amount of water and crude fibre in the young plant justifies the epithets 'slush' and 'swill' as applied to the ensilage from such material."—(*Michigan Experimental Station Report, 1889*). This statement accompanies a table of analysis of ensilage from which the following is taken:

No. 1,	August	25, wilted two days, then ensiled,	1.10	per cent. acid.
" 2,	"	27, put in fresh.....	1.02	"
" 3,	September	1, wilted two days.....	0.95	"
" 4,	"	3, put in fresh.....	0.91	"
" 5,	"	8, wilted two days.....	0.87	"
" 6,	"	10, put in fresh.....	0.80	"
" 7,	"	13, put in fresh.....	0.81	"
	September	14, killing frost.		

The more matured a plant, the more fixed, less changeable are its constituents, *i.e.* the constituents of a young plant will suffer change or decomposition more rapidly than those of the same plant more matured.

Temperature—Mr. George Fry of England, in his work "Sweet Ensilage," laid great stress on the necessity of raising the ensilage to 122° F., thereby to stop the various ferments. The most favorable temperature for the development and working of the various ferments is about 95° F., and most of them cease at 122° F., but some continue active to 140° F. Fry says that excess of water in succulent food prevents this rise of temperature and that sour ensilage thereby results, as the ferments are not then destroyed.

In opposition to Fry, Prof. Alvord, of Maryland Experimental Station, says: "Temperatures 110° to 140° F. are most favorable for their development and activity, and it requires at least 185° F. to destroy them, while fermenting, ensilage does not often exceed 140° F., and no authentic record of 150° F. can be found."

Along the same line Prof. Johnson, of Michigan, says: "I am of opinion, however, that positive evidence to sustain this theory is almost, if not entirely, wanting. Enough careful work has not been done to demonstrate it beyond question."

Upon the subject of ensilage, Dr. Burrill, of Illinois, makes the following remarks in a bulletin published November, 1889.

"It is plain that a body cannot be raised to a higher temperature through the process of fermentation than the organism causing such fermentation is capable of enduring. There seems, indeed, to be no reason for supposing that the heat should be greater than that under which the organism finds its best development, because above this point the action is retarded; hence less heat is produced. When slow filling and consequent high temperature is relied upon, the resulting product is in a widely different state as to fermentive changes from that so-called sweet ensilage obtained without heat. There is much less loss through fermentation in the latter case. The best results are obtained by the most nearly perfect exclusion of the air. For this purpose, uniform distribution upon filling the silo is of more importance than persistent trampling, because the pressure of the mass must be mostly relied upon."

All things considered the main points undoubtedly are (1) to have the corn well matured, (2) to house it and fill it uniformly, so as to exclude air, (3) to keep it as free from air as possible; with these well observed, a fair sample of sweet ensilage may always be expected.

Effect on the nitrogenous compounds.—During the changes taking place in the silo a decided and important change is effected upon the protein or muscle-forming portion of the food; some of it is changed from the protein to the non-protein form, from a condition capable of producing flesh and muscle to a condition incapable of this.

Michigan Experimental Station, Bulletin 49, May, 1889, states: "A small loss of crude protein is common in the silo, but the change from albuminoid to amide condition of the nitrogen compounds is the most striking feature of ensiling. These two facts point to a loss of value in ensilage as compared with the fresh corn stalks, or even the dry material, when it has been rapidly and perfectly cured."

The same conclusion was arrived at by Dr. Voelcker in 1886-87, and reported upon to the Royal Agricultural Society, of England, Report XLVI., p. 403. Silage was made from grass, and compared with hay from the same. "The total loss due to fermentation, evaporation, etc., in making the silage was 7.29 per cent. on fresh grass; of this 3.25 per cent. consisted of water. The loss of total nitrogen when, as here, no drainage is allowed to flow away, is very slight; but the nitrogenous bodies have undergone considerable change from the albuminoid to the non-albuminoid condition. The woody fibre, as indeed the whole of the fibre, has been diminished; insoluble albuminoids are lessened, and the soluble albuminoids increased. In the hay the nitrogen has undergone but little change."

Lawes and Gilbert, of England, report as follows, 1884-85: "Not only is there a loss of nitrogenous food material, but a very considerable proportion of the nitrogenous substance which remains is degraded into compounds, some of which are of no value as food (ammonia for example), whilst others, forming a much larger proportion, are, to say the least, of reduced food value. Further, besides the loss and the degradation of nitrogenous substance, it has been shown that there was also more or less loss of non-nitrogenous matter; whilst there is no evidence that woody fibre of a certain degree of induration has been rendered more soluble." (*Experiments on Ensilage, p. 23.*)

Effect on Nitrogen.—"The analyses show a decrease in the total nitrogen of 0.29 per cent., or a loss of 14.6 per cent. of the total nitrogen in the fodder. There was a decrease of 2.58 per cent. of albuminoids in the total solids, equivalent to a loss of 24.5 per cent. of the total albuminoids put in the silo. It will be understood that the albuminoids are indispensable nutrients of any food ration, and are not replaceable by any other class of nutrients. The loss is in part due to their reduction into amides and other degraded nitrogenous compounds. Thus, while there was only 0.3 per cent. of non-albuminoid nitrogen in the corn fodder, there was 0.4 per cent. in the ensilage. Of the total nitrogen in the corn fodder, only 15.15 per cent. was in the form of non-albuminoid nitrogen, while in the ensilage there was 25.44 per cent. These degraded forms are supposed to have about the same feeding value as the soluble carbohydrates." (*Illinois, Aug., 1888, Thos. J. Hunt*).

"The amides of sweet and field corn ensilage increased in silo from 8.69 per cent. to 18.94 per cent., a distinctive loss." (*Missouri, Prof. Sanborn.*)

Ensilage as a Food.

Water.—The water varies from 64.4 to 87.0 per cent. From our investigations it appears that the best, the sweetest, and the greatest amount of ensilage will be produced when the amount of water lies near 75 per cent., between that and 80 per cent.

Crude Protein.—In food analyses, this of course includes the less valuable amides, which are not flesh and muscle formers but heat producers. The following table gives a few analyses separating the true protein from the amides or non-protein. I have said

before that in the silo true protein will be changed to amides to a certain extent ; this in addition to the amides always existing in young growing plants, will give us a high per cent. of non-protein :

	Total crude protein.	True protein.	Amides or non-protein.	Per cent. of true protein.	Per cent. of non-protein.
New York, 1886	0.85	0.50	0.35	58.83	41.17
" "	0.85	0.45	0.40	52.95	47.05
" "	1.08	0.75	0.33	69.45	30.55
" "	1.17	0.73	0.44	62.40	37.60
Wisconsin, 1888	1.92	0.99	0.93	51.58	48.42
Dr. Voelcker, 1884	1.12	0.68	0.44	61.10	38.90
Pennsylvania, 1889	2.15	.3	0.72	66.52	33.48
" "	2.35	.75	0.60	74.47	25.53
" "	2.43	0.98	0.45	81.48	18.52
" "	2.34	1.0	0.74	68.42	31.58
Michigan, 11 analyses, 1889	1.32	.....	0.50	62.12	37.88
Average	.....	.....	.....	63.36	36.64

German investigators have found non-protein in considerable quantities in roots, potatoes, malt sprouts and fodder plants of all kinds, the average in the last case being about 30 per cent, In four analyses of malt sprouts Kellner found an average of 27.40 per cent. (Armsby). The average so far found in corn ensilage is in excess of that usually found in the freshly gathered plants, and this large quantity of non-protein to a certain extent takes from the value of the ensilage and demands a liberal addition of nitrogenous foods to it to make complete rations.

Fat.—There is little or no true fat in corn ensilage, unless it be made from corn well matured. The fat represented in our tables is ether-extract more properly, and consists largely of chlorophyll, waxy matters and acids. The amount of fat, therefore, may be considered as of little or no value.

	Water.	Protein.	Fat.	Soluble carbohydrates	Fibre.	Ash.	Nutritive ratio.
Colostrum	71.7	20.7	3.4	2.5	.....	1.8	1: 0.5
Whole milk	87.0	4.0	3.7	4.6	.....	0.7	1: 3.3
Grass	75.0	3.0	0.8	13.1	6.0	2.1	1: 7.0
Corn ensilage	79.8	1.6	0.7	10.6	6.0	1.3	1:11.0

Nature's feeding is from colostrum, to whole milk, to green grass. By consulting our table we see that corn ensilage is alone not sufficient to take the place of either whole

milk or good pasture grass, that the great lack is in nitrogenous constituents, flesh and muscle formers, and that the use of ensilage in a ration demands the addition of foods containing protein and fat, such as good hay, grains, bran, cake, in such proportions as must be regulated by the circumstances of the feeder and market prices.

In the early history of ensilage it was usually considered a complete ration; experience, however, does not seem to justify this conclusion, but better results follow the use of some more nitrogenous food in connection with the ensilage, such as oil meal, wheat bran, clover hay, or other nitrogenous foods." (*Ohio, June, 1889*).

Corn Silage *vs* Field Beets as Food for Cows.

1. "The dry matter of corn silage and of field beets is at least equal in value to the dry matter of the better grades of stock feed in ordinary use, when fed in properly adjusted rations.

2. Corn silage is slightly superior to field beets as a flesh or fat producer, and beets are slightly better than corn silage for milk production." (*Ohio, June, 1889, Hickman.*)

"The large accumulation of the data of Europe and America in my possession fail to show that a ton of dry matter taken out of a silo is superior to a ton of dry matter drystored." (*Missouri, Prof. Sanborn*).

"The silo goes with high pressure farming; those who are satisfied to carry more cattle than can consume the straw and corn-stalks usually produced on the farm have little need of a change. The farmer who needs the silo is one who is carrying a large number of cattle upon a given area and needs more 'roughage' for them. Before adopting the silo many should change their system of farming." (*Prof. Henry, Wisconsin, 1889*).

Conclusions.

1. Poor corn will make poorer ensilage.
2. The best ensilage can be made only from the best corn.
3. Choose early maturing varieties.
4. Sow in drills so as to allow to mature.
5. Cut when well on to maturing.
6. Put in a proper silo.
7. Feed in moderate quantities.
8. Supplement by foods rich in fat and nitrogen.
9. Ensilage will not pay unless well made.
10. Do not expect too much from its use.

REPORT ON FISH AND FISH REFUSE FROM BRITISH COLUMBIA, RECEIVED MARCH, 1890.

SAMPLE I.—Head and entrails of large fish, (salmon).
SAMPLE II.— " " " "
SAMPLE III.—Finely divided refuse from canning factory.
SAMPLE IV.—Herrings whole.

Taken from the cans as received these consisted of the following amounts of water and dry substance :—

——	I.	II.	III.	IV.
	Percentage.	Percentage.	Percentage.	Percentage.
Water	70.41	77.17	77.04	77.50
Dry matter	29.89	22.83	22.96	22.50

By drying as thoroughly as possible the amount of water was reduced to about five per cent. so that in drying the original material was reduced to nearly one-fourth of its original weight.

The dried material gave the following by analysis :—

——	I.	II.	III.	IV.
	Percentage.	Percentage.	Percentage.	Percentage.
Water	5.91	5.76	2.08	7.48
Ash	17.62	18.48	13.54	10.15
Organic matter	76.47	75.76	84.38	82.37
Oil or fat	27.21	25.55	66.95	18.29
Nitrogen	6.32	7.80	5.55	7.96
Phosphoric acid	5.70	6.67	4.79	2.72
Potash	0.36	0.51	0.58	0.21

If the materials were deprived of their oil or fat and manufactured into a dried we powdered fertilizer without the admixture of anything foreign or additional, it wou

have about the following composition, as far as its most valuable fertilizing constituents are concerned.

——	I.	II.	III.	IV.
	Percentage.	Percentage.	Percentage.	Percentage.
Water	10.00	10.00	8.00	10.00
Nitrogen	8.50	10.00	12.00	9.50
Phosphoric acid	7.50	8.50	11.00	3.50
Potash	0.50	0.50	1.00	0.30

"An analysis by Arendt of Norwegian fish-scrap gave of:

Moisture	17 per cent.
Nitrogen	10½ "
Phosphoric acid	4 "
Organic matter	72 "
Ashes	12 "

other samples have shown more phosphoric acid (13 to 15 per cent.) and less nitrogen (8½ to 9 per cent.). Some of them were of scrap than had been steamed to remove the oil." (*Prof. T. H. Storer*).

It will thus be seen that a most excellent fertilizer can be produced from any one or all of the samples of fish refuse sent here for analysis by (*a*) extracting the fat or oil, (*b*) removing the excess of moisture by drying, (*c*) thoroughly pulverizing. The fertilizer thus produced would be rich in nitrogen and phosphoric acid, but would be deficient in potash, to make a *complete* fertilizer of it an addition of sulphate of potash might be made. Norwegian fish potash guano thus produced contains as follows according to Dr. Griffiths ("Artificial Manures.")

——	Cod and potash.	Herring and potash.
	Percentage.	Percentage.
Nitrogen equal to ammonia	7.00	7.05
Phosphates, (fish bone)	20.00	8.00
Potash, (sulphate)	15.00	15.00
Magnesia	10.00	10.00
Sandy matter	1.00	1.00
Water	5.00	5.00

"These fish guanos are shipped from Jensen's works in the Lofoden Islands (Norway) and conveyed to England;" according to the same authority English fish guanos

(without potash) sell from £5 10s. to £6 per ton. American fish and potash sells at from $25 to $35 per ton. Potash and phosphates are added to the fish refuse and they contain from 2½ to 4½ per cent. of nitrogen from 3 to 13 per cent. of phosphoric acid, and from 3 to 6 per cent. of potash.

Norwegian Fish Guano.—In the report of the transactions of the Highland and Agricultural Society of Scotland for 1886, Mr. William Watt, of Aberdeen, thus describes (p. 201) the Norwegian method of treating the cod refuse. "The raw material principally used at the Norwegian manufactories are the heads and bones of cod, with the tissue of livers from which the oil has been extracted; but use is made also of the softer parts of the fish, the heads and viscera of herring, the flesh of whales and sharks and all kinds of damaged or otherwise useless fish, whether dried or fresh. First quality guano is produced from the bones and head of cod, in the proportion of one of the former to five of the latter, and the manner of manipulation may be thus described:—The raw materials are spread out to dry in the sun, the heads being first strung together for convenience in handling. They then go to the factory and are there first chopped small by a mincing machine, and next passed on to a kiln where the remaining water is sent off in vapour. Up to this point the bones and heads are treated separately, but now they are mixed together in their due proportions and ground between large millstones, the result being a 'grey guano' ready for sale. When salty or oily materials are used the mass, after being chopped, but before reaching the kiln, is first exposed for a time to steam pressure in a suitably constructed iron cylinder. In lieu of this mode of extraction the materials may be put into a jacketed pan and exposed for a time to steam heat, with constant stirring and the removal of the oil set free, the elimination being completed by hydraulic pressure. Without the complete extraction of oil and salt and effective drying, a finely pulverised guano cannot be obtained."

Prof. Storer, of the Agricultural Department of Harvard, in his "Agriculture in some of its relations to Chemistry" thus describes the method adopted in the Eastern States: "The American fish guano is a product obtained incidentally in the manufacture of oil from a coarse sort of herring called the menhaden or pogy. In order to get their oil the pogies are boiled in water to a sort of porridge or thick soup, which is pressed in a mill, just as ground apples are pressed in the manufacture of cider. The oil that was contained in the flesh of the fish collects upon the surface of the expressed liquid, while the half-dry pomace or residue left in the mill is the fish scrap. Sometimes this product is pressed into barrels at once for transportation, though more commonly perhaps it is left in loose heaps to heat and dry out to a certain extent. Occasionally the pomace is spread out upon platforms to dry pretty thoroughly and is afterward ground in a mill."

Uses of the oil thus obtained.—I am not in a position to say from the samples, as they were very offensive and the quantity of oil obtained very small to what uses the oil could be put—the probability is that it could be easily disposed of for manufacturing purposes. Mr. Watt on p. 203 of the article above referred to says: "The oil from the herring is serviceable for a great many industrial purposes—for the preparation of leather, in the treatment of vegetable fibres prior to spinning, in the manufacture of soap (which is the great use to which the analogous menhaden oil is turned in America), and for lubrication and burning."

Commercial Value of the Material.—From one ton of undried refuse and herrings there should be obtained at least 100 lb. of oil, and perhaps much more, and from 400 to 500 lb. of fish guano or fertilizer, the latter worth between $20 and $30 a ton, or the ton of raw fresh material should produce oil and fertilizer worth at least $15 and perhaps $20. On this question of value production Mr. Watt speaks as follows: "From ten tons of average herrings in the fishing season there would be obtained 1½ ton of oil perhaps and two tons of fish guano. If say 300 gallons of oil were obtained, which is a moderate estimate, and the price to be 2s. a gallon, which might probably be realised, the oil of ten tons of fish would produce £30. Then there would be 2 tons of guano at £10 per ton. Thus if these estimates are at all trustworthy something like £5 a ton

might be realised through the manipulation of herrings as a raw material of oil and manure." The above value of £5 per ton is, perhaps, too high for this country, but, making allowance for that, our valuation of $15 to $20 per ton will not be much astray.

CONCLUSION.—From the consideration of the whole question, I am of the opinion that the manufacture of the refuse into fertilizer is strongly to be recommended because:

1st. It will thus utilize a bye-product that otherwise is a total loss.

2nd. It will prevent the waters from becoming contaminated.

3rd. Its proper management must tend towards a more healthful surrounding.

4th. Its return to the soils of the farm will partly offset the waste of our cities by sewage carried to the lakes and rivers.

5th. If properly handled *it will pay well.*

From the great importance of this question to the health of the community, the welfare of the fishing industry and the progress of agriculture, I have endeavored to reply at this length.

ANALYSIS OF BEETS GROWN AT THE ONTARIO EXPERIMENTAL FARM, GUELPH, 1890.

TABLE I.

ANALYSIS BY C. C. JAMES.

Lot.	No. of Beets.	Net Weight.	Analysis of Juice.			
			Brix.	Sugar.	Purity.	
		lbs. oz.				
1	4	4 8	17.05	15.00	85.07	Fair shape, average, one above ground.
2	4	3 4	20.05	17.05	85.03	Fair shape, smaller.
3	5	3 13	21.00	16.00	76.02	
4	4	4 8	16.03	14.05	88.09	Exceptionally good.
5	4	4 4	17.03	14.08	85.05	Good shape.
6	5	4 4	16.03	14.00	86.00	Good shape.
7	1	3 3	14.00	10.00	71.04	Large, misshapen, above ground.
.....	27	27 12	.....	.....	.....	
Average 1890		1 0½	18.03	15.08	83.64	
Average 1889		2 1½	21.50	18.00	83.70	

TABLE II.

Analysis by W. Skaife.

——	Weight.	Analysis of Juice.		
		Solids.	Sugar.	Purity.
	lbs. oz.			
26 beets divided into 5 lots, taken from carts as they arrived from the field.....	.....	18.00	14.06	81.11
	.....	19.00	15.03	80.53
	.....	17.05	14.05	82.85
	.....	18.00	15.00	83.33
	28 12	18.00	14.08	82.22
Average of 26 beets.....	1 1 3/8	18.01	14.84	82.00
Extra large beets, outside row, 3 beets	10 8	13.05	9.05	70.04
5 beets	7 11	16.05	12.05	75.08
Average of 8 beets.....	2 4 3/8	15.04	11.04	74.03

Our beets for 1890 were, therefore, smaller than those of 1889, lower in sugar, but of the same degree of purity.

Sugar Beets.

In the following pages are given the results in detail of the chemical investigations of the sugar beets grown experimentally during 1890 in the Province of Ontario. By reference to our report for 1889, it will be seen that during the preceding year a similar experiment upon a smaller scale was carried out and the results published. The seed for both of these series of experiments was furnished by Mr. Wilfrid Skaife, B.A. Sc., sugar expert and manufacturer, of Montreal, Que., it having been imported from the establishment of Herrn Karl Krueger, Muecheln, Germany. As indicated in the following tables, these beets were grown in various parts of the province, whence fair samples were taken and shipped to this laboratory by Mr. Robt. H. Lawder, who was specially deputed for that purpose. Here they were analyzed by Mr. Skaife and myself. In some cases the tables contain the results of work done separately, in other cases, as stated, the results represent our combined work. In every case the utmost effort has been made to obtain accurate average results of the beets produced ; in a few cases where the beets were a long time on the journey, a little wilting has evidently produced a slight effect.

In all cases the analyses state :

Solids = total solids found in the juice expressed.
Sugar = sugar " " " "
Purity = $\frac{\text{sugar}}{\text{solids}}$ " " " "

In determining the amount of sugar in the beets it is usual to take 95% of the amount of sugar found in the juice. We have left all our calculations, however, as sugar in juice or polariscope reading.

For further information as to amount of produce and cost see Prof. Shaw's report on sugar beets found in this same volume (1890 Ontario Experimental Farm report). These results we have given in detail, and by themselves, as one acre of roots were grown at the farm here. The only other experiment reported upon in this series of equal extent is that of Mr. T. B. Carlaw, of Warkworth, who also grew one acre. For this report see under Cobourg District, in following tables.

Next I shall give our summary of results by districts, and average for the whole province, reserving the detailed analysis for the end.

In this table the number in each case is the number of samples analysed :

District.	No.	Solids.	Sugar.	Purity.
Guelph	28	17.21	13.52	78.56
Whitby	32	17.40	13.35	78.54
Cobourg	11	17.07	14.28	79.23
Bay of Quinte	8	16.93	13.35	78.43
Oakville	11	16.09	13.37	78.41
Esseex	8	16.74	13.41	78.63
Various	19	17.37	13.92	80.10

General Summary for the Province.

Total number of beets analysed 419
" weight " " ..... 518 lbs. 2 oz.

	No. of Samples.	Average Weight.	Solids.	Sugar.	Purity.
78 Beets over 2 lbs. each in weight	35	2 14	16.45	12.35	75.1
341 Beets under 2 lbs. each in weight	82	0 14	17.41	14.10	81.02
Average of all	117	1.4	17.12	13.58	79.32

The 1889 samples analysed at the Chemical Laboratory, Guelph, (26 in number), showed an average weight of 2 lb. 2 oz., solids 18.95 per cent., sugar in juice 14.35 per cent., and purity 75.7 per cent., from which it will be seen that the beets of 1890 were smaller, slightly lower in sugar, but higher in purity, and represent a class of beets much

more profitable for sugar making th those of 1889. The difference in value between large and small beets is clearly brou out in the above general summary, the smaller beets being the richer and of higher purity.

The following table, (C. C. James), presents results based upon the cultivation of the beet. So many samples came in having green tops, showing lack of covering or cultivation, that it was thought advisable to present the growers with direct evidence of the great value and necessity of thorough cultivation in the production of beets for sugar making. Beets of various sizes were taken so that we here have a comparison based on size as well as on cultivation.

——	——		No.	lb. oz.	Solids in Juice.	Sugar in Juice.	Purity.
Well cultivated ..	Small, well grown good shape	tops....	4	2 0	20.50	17.00	82.9
		bottoms	4	2 0	21.00	18.00	85.7
	Large, well grown good shape	tops....	2	3 8	17.00	14.00	82.4
		bottoms	2	3 8	19.00	15.25	80.3
Poorly cultivated.	Large, much above ground	tops....	3	4 4	14.25	10.00	70.2
		bottoms	3	5 13½	15.00	12.00	80.0
	Large, much above ground	tops....	2	3 12	16.00	12.00	75.0
		bottoms	2	3 12	16.50	13.00	78.8
	Medium, much above ground	tops....	2	2 0	18.00	13.00	72 2
		bottoms	2	2 6	20.00	16.00	80.0
	Medium, much above ground	tops....	2	2 6	13.50	6.75	50.0
		bottoms	2	2 11	16.50	10.75	65.0
	Medium, much above ground	tops....	5	4 10	18.00	12.75	70.8
		bottoms	5	4 13	18.50	15.50	83.8
	Medium, much above ground	tops....	5	3 11	18.00	14.00	77.7
		bottoms	5	5 0	19.00	14.50	76.3

In each case the tops and bottoms are of the same beets. In the well grown beets the roots were equally divided by weight, in the poorly grown they were divided by the ground line on the roots. The second sample proved to be remarkable beets, they came from the Bay of Quinte district. In every case more sugar is found in the bottoms and as shown in the following summary the higher purity belongs to the well grown samples.

——		Solids.	Sugar.	Purity.
Well grown, average of	tops....	18.75	15.5	82.7
	bottoms	20.00	16.6	83.0
Poorly grown, average of	tops....	16.3	11.4	69.9
	bottoms	17.6	13.6	77.2

The analyses contained in the preceding tables confirm what has elsewhere been universally observed, viz., that there is a very great difference between the out-of-ground portion, of a poorly grown beet and the under-ground portion; that not

only is there less sugar but the purity is much less, and that to produce sugar beets of the best quality they must be kept well covered. In this respect many of the samples grown in Ontario are faulty, whereas even in the case of larger beets which have been carefully covered the percentage of sugar and purity have both been high.

Conclusions by C. C. James.

Yield.—As to this we have but little reliable information, calculations from a row or two not being always trustworthy. The calculation of Mr. T. B. Carlaw, of Percy, Northumberland county, is interesting, as he grew an acre of beets, the product being estimated at 26.7 tons.

Shape and Size.—Great irregularity was manifest in most of the samples; in many cases, however, the ideal of the French and German was attained. Our results certainly lead to the conclusion that the tapering, well shaped beet weighing from $\frac{3}{4}$ to $1\frac{3}{4}$ lb. is the very best sugar producing beet if kept well covered. Green tops, showing lack of cultivation, were very common, and the analyses of the tops and bottoms prove conclusively that the amount of sugar, but especially the degree of purity, has been greatly lowered thereby.

Sugar.—Our average is nearly 14 per cent., much exceeded in some well-grown beets, and not attained by over-grown and poorly cared for samples. Some analyses available, taken from Washington report for 1890, may prove interesting for comparison, as the following:

Locality.	Sugar in Juice.	Purity.
Ontario		
California	13.58	79.32
Kansas	14.38	83.70
Nebraska	10.85	72.64
Wisconsin	12.55	58.30
Michigan	14.31	
Indiana	12.04	
France (large)	11.76	
France (small)	10.91 to 12.24	
	15.50 to 18.60	

Purity.—This is an improvement upon 1889 beets, but can still be further increased by attention to size and cultivation. The larger the beet the lower the purity, and the more out of ground the lower the purity.

General Conclusions by W. Skaife.

The analyses are valuable evidences of the fact that sugar beets of fine quality may be grown in many parts of Ontario with proper care. Wherever the roots were well cultivated, both as regards keeping them below the ground and keeping the soil loose, the result was satisfactory. There are some instances also of roots sown in stony or very

lumpy ground turning out well because of their being kept well below the surface. There are further instances of roots which have been well cared for, but have not succeeded owing to unsuitable soil or climate. But on the whole it may be said that the analyses would have averaged at least 14.5 per cent. sugar had the printed instructions been carefully followed, and much higher had the roots been grown in larger areas so as to have the benefit to be derived from close planting. This they lost through being, in the vast majority of instances, planted in but one or two rows. The richest beets received were grown by Mr. R, Willis, of Whitby. The finest and most regular lot, and those which would probably give the highest yield of sugar per acre, were from Mr. Thomas Ballantyne, of Stratford. The most remarkable beet was sent by Mr. Aaron Schantz, of Waterloo, being 4 lb. 8 oz. in weight and analysing 13.2 sugar, with 82.3 purity coefficient. The general appearance of the samples, together with their net weight and analyses, seems to point to the general conclusion that the yield per acre in the Province of Ontario would be higher than in Europe, while the percentage of sugar would be as high under intelligent cultivation.

During our investigation five samples of beets came in that had been grown from seed other than that imported for these experiments. We give an analysis of these in a separate table. The average is below that of our former table both in sugar and purity, though one sample (J. & R. Millar's) turned out very well.

SUGAR BEETS FROM OTHER SEED.

Grower.	Locality.	Seed.	Solids.	Sugar.	Purity.
O. E. Farm	Guelph	Dudgeon's white	16.0	11.5	71.8
"	"	" red.	16.0	12.5	78.1
"	"	Bruce's white	17.5	13.5	77.1
J. & R. Millar	"	Dudgeon's	18.7	15.5	82.3
Wm. Richmond	Dumfries	Red sugar beets	14.5	11.5	79.3
Average			16.54	12.90	77.9

The following extended tables contain the combined results of our work upon the separate samples, so far as we could identify them. One or two samples appear to have gone astray in shipment. We give the name of the grower or sender; the locality usually refers to the township; the nature of the soil is given where we have that information; "M" in fourth column means that the ground was manured for this crop; "A" means grown *much* above ground; "a" means grown slightly above ground; "B" means grown all below ground; "brix" refers to solids in juice.

Guelph District.

Name of Grower.	Locality.	Kind of Soil.	Manured or not.	Date of Sowing, May	Date of Extraction, Oct.	No. of beets analysed.	Net Wt. of samples analysed.	Above or below ground.	Analyses of Juice. Brix.	Sugar.	Purity.	Remarks.
							lb.oz.					
James Laidlaw	Guelph					4	4.12	B	17.25	15.00	86.8	Very good shape.
McBride Duncan	Waterloo	Sandy loam				10	6.13	a	17.00	14.00	82.3	Good shape but too small.
Aaron Schantz	"	"				1	4.8	B	16.0	13 2	82.5	Very large, perfectly-shaped root.
"	"	"				5	8.11	B	18.25	15.4	84.[illegible]	Very good shape. Regular lot.
B. Schumacher	"	"				2	5.11	A	18.0	12.0	66.[illegible]	Large, well-shaped beets.
"	"	"				3	3.7	A	18.75	13.7	73.0	Fair shape.
David Betzner	"	"				6	7.7	B	17.75	14.7	82.8	Very fine, regular lot.
"	"	"	M			1	2.3	B	17.0	14.0	82.3	Very fine beet.
At. Werner	"	"				5	6.9	B	17.25	14.0	81.1	Very irregular shape.
"	"	"	M			1	3.13	B	16.0	12.0	75.0	Large round beet.
Peter Weaver	"	"				3	5.2	B	16.25	12.7	78.1	Very regular lot, but poor shape.
Brubacher and Schmitt	Woolwich	Clay loam	M	1st	21st	4	11.8	A	13.50	10.0	74.7	Large round beets.
"	"	Sandy loam	M	12th	15th	4	6.10	a	17.50	12.5	72.0	Fair shape.
"	"	"				3	4.8	B	17.75	14.2	80.0	"
W. Wenger	Normandy					2	6.9	a	17.0	12.0	70.5	Large well-shaped beets.
A. Hume	"					2	2.6	a	17.0	14.0	82.3	Fair shape.
Thos. Todd	Galt	Sandy loam		18th	20th	4	6.15	a	15.0	12.0	80.0	"
Thos. Ballantyne	Stratford	Clay loam		10th	23d	10	12.2	B	20.0	16.5	82.5	Very regular, perfect lot
Tilman Schantz	Berlin	Clay	M			3	7.6	a	18.25	14.75	80.8	Fair shape.
George Barrie	Dumfries	Clay loam				4	15.12	a	17.0	12.5	73.5	Large beets, poor shape.
"	"					4	6.10	...	16.4	13.0	79.2	Fair shape,
Alex. Scott	"	Light loam	M	1st	25th	4	5.4	B	19.0	16.0	84.2	Very good shape.
Wm. Richmond	"	Rich loam	M	1st	29th	3	5.4	B	18.0	14.5	80.5	Very fine beets.
David Goldie	"	Garden		1st	22d	6	13.0	B	15.5	11.75	76.1	Fair shape but too large.
Erskine Stewart	"	"		3d	22d	3	7.6	B	16.5	13.0	78.7	Fair shape.
James Lilie	Blenheim	Sandy loam	M	3d	22d	10	6.8	a	19.0	15.0	78.9	Good shape but very small.
?	Fergus					1	3.12	A	17.0	11.0	64.8	Very large and poorly grown.
Ont. Exp. Farm	Guelph					27	27.12	B	18.03	15.08	83.64	

Whitby District.

Name of Grower.	Locality.	Kind of Soil.	Manured or not.	Sowing, May	Extraction, Oct.	No. of beets analysed.	Net Wt. of samples analysed.	Above or below ground.	Brix.	Sugar.	Purity.	Remarks.
S. McConnachie	Pickering	Clay loam	M	25th.	11th	3	3.14	a	16.5	14.0	84.8	Three fine beets.
"	"					4	2.10	A	16.5	14.0	84.8	Small beets good shape.

Whitby District.

S. McConnachie	Pickering	Clay loam	M	25th.	11th	3	3.14	a	16.5	14.0	84.8	Three fine beets.
"	"	"				4	2.10	A	16.5	14.0	84.8	Small beets good shape.
G. Long	"	Clay loam	M	15th	11th	5	6.60	B	16.0	13.0	81.2	Good shape, rather rooty.
Hy. Westgate	"	Heavy clay		1st	11th	1	3.8	A	16.0	12.0	75.0	Very woody fibre, fair shape.
"	"	"		1st	11th	4	6.0	a	16.3	14.0	85.8	"
S. H. Grierson	Whitby					3	3.10	B	19.5	15.8	81.0	Fine looking roots, but rather short.
"	"					2	2.8	A	16.5	13.0	78.6	Good shape.
Hon. J. Dryden	"	Black loam		1st	12th	4	6.8½	A	16.5	13.5	81.8	Good shape, but irregular in size.
Dr. Lick	"			12th	11th	12	12.3	a	15.0	11.0	73.3	Very irregular lot; largest, 2 lb. 9 oz.; smallest, 3 oz.; several hollow.
R. Willis	"	Clay loam	M			4	3.12	B	17.5	15.0	85.7	Good shape, but rather rooty; not ripe.
"						4	3.4	B	20.0	17.5	87.5	Very fine beets.
R. Lynde		Clay loam	M	30th	15th	5	8.11	a	16.5	12.0	72.7	Rounded, short beets.
Wm. Jeffrey		"	M	20th	15th	2	4.4	a	18.0	14.5	80.5	Fair shape.
"				20th	15th	2	2.4	B	20.0	17.0	85.0	Very fine beets.
David Briggs						6	5.6	B	19 25	14.17	76.3	Good shape, but too small.
C. C. Kellet	Port Perry	Sandy loam	M	1st	15th	3	9.6	a	15.25	12.2	80.0	Very large, round beets.
Wm. McGill	"	"	M	15th	13th	3	7.1	a	13.0	9.25	71.1	Badly shaped round beets.
"	"	"	M	15th	13th	4	5.8	a	18.0	13.2	73.2	Good shape.
Wm. Pearson	each	Clay loam	M	30th	11th	2	5.4	a	16.0	12.0	75.0	"
J. M. McClintock	"	Sandy loam	M	15th	11th	3	3.6	a	16.0	12.0	75.0	Very good shape.
J. Whitfield	"	Clay loam		1st	11th	6	16.12	B	16.5	12.0	72.7	Fair shape, but rooty.
F. & J. Manderson	"	"	M	30th	11th	10	4.8	a	21.0	13.25	63.0	Very small, unripe beets from 4 oz. upwards
"	"	"	M	30th	11th	2	3.4	B	16.0	11.25	70.3	Good shape, but unripe.
John Heard	"	"	M	15th	14th	3	4.0	a	18.25	14.7	80.5	Good shape.
"	"	"	M	15th	14th	2	3.4	B	18.0	14.7	81.6	"
James Cootes	Cartright	Sandy loam	M	30th	13th	4	3.13	B	19.28	16.2	84.1	Exceedingly long, irregular, rooty lot.
George Steele	"	"	M	20th	13th	5	6.0	a	20.5	16.5	80.4	Very regular, well shaped lot.
Wm. Steele	Reach					6	8.1	A	20.25	16.2	80.0	" "
M. Stonehouse	Scugog	Clay loam	M	1st	13th	6	6.0	a	17.75	14.2	80.2	Fair shape, but rooty.
"	"					8	2.9	a	20.5	16.7	83.5	Very small beets, like carrots.
John Whitfield	Reach	Clay loam		1st	11th	3	7.10	B	14.0	10.0	71.4	Fair shape.
"	"	"			11th	3	6.8	B	15.5	12.0	77.4	Better shape and size.

Cobourg District.

Alfred Bell	Hamilton	Clay loam		22nd	14th	1	2.11	A	16.0	11.4	71.2	Large, hollow, round beet.
"	"	"		22nd	14th	2	2.13	a	17.5	12.5	71.4	Good shape.
John Bowman	"	Clay	M	15th	14th	2	5.0	a	17.25	12.1	70.1	Large beets, good shape.
"	"	"	M	15th		1	3.8	A				Good shape, but too large.
W. Riddel	"	Clay loam	M	June 20th	17th	6	6.11	B	19.0	16.0	84.2	Very regular, well shaped lot.
James Russel	"	Black clay	M	April 27th	8th	4	5.4	a	17.25	14.0	81.1	Fine regular lot.
W. J. Westington	"	Clay loam	M	May 1st	14th	1	3.0	A	19.25	15.4	80.0	Large, round beet.
"	"	"		1st	14th	2	4.2	A				Good shape.
Thos. Hoskins	Haldimand	Heavy clay		10th	17th	4	6.13	B	19.0	15.3	80.5	Very good shape.
W. F. Mulholland	"	Clay loam	M	14th	12th	3	7.9	B	18.0	14.4	80.0	Large, fine beets.
T. B. Carlaw	Percy	"	M	10th	30th	3	4.0	B	19.0	15.5	81.6	Grew one acre of roots, product calculated, 26.7 tons.
						2	3.14	B	18.0	15.0	83.3	
						3	4.0	B	17.5	15.5	88.5	

Essex District.

Name of Grower.	Locality.	Kind of Soil.	Manured or not.	Date of Sowing, May.	Date of Extraction, Oct.	No. of beets analysed.	Net Wt. of samples analysed.	Above or below ground.	Analysis of Juice. Brix.	Sugar.	Purity.	Remarks.
							lb. oz.					
Billings & Wagstaff	Gosfield	Gravelly loam	....	4th	.....	3	3.14	B	11.0	11.0	73.3	Fair shape.
A. Wilson												
J. Walter												
R. Wigle	Maidstone	Rich loam	....	14th	4th	4	4.4	B	16.5	13.5	81.8	Good shape.
R. Croft	"	"	....	14th	4th	1	2.11	B	16.5	13.5	81.8	Very fine shape.
D. Hensam												
Ellis	"	"	....	.....	.....	2	2.13½	B	17.5	13.5	77.2	Small, round beets.
David Hensam	"	"	M	.....	.....	2	1.6	B	18.0	14.5	80.1	Small, slender roots.
John Walters	Colchester	"	....	.....	.....	2	2.3	B	19.0	16.0	84.2	Small; very good shape.
Milne	"	"	....	.....	.....	2	2.5	B	17.5	13.8	78.9	Small, round beets.
A. McDonald	Ridgetown	Gravelly loam	M	27th	25th	2	8.3	A	16.0	11.5	71.8	Very long roots.

Oakville District.

John Wilson	Trafalgar	Sandy loam	M	1st	10th	2	4.6	a	18.5	14.2	76.7	Good shape.
"	"	"	....	1st	10th	1	3.0	A	16.5	13.2	80.0	Fair shape.
John Hilton	"	Clay loam	....	1st	10th	2	2.9	B	18.0	14.8	80.5	Very good shape.
"	"	"	....	1st	10th	1	2.3	B	18.25	14.7	80.5	Very perfect shape.
James Hill	"	Sandy loam	....	8th	10th	1	4.12	A	13.25	10.0	75.4	Very large beet.
"	"	"	....	8th	10th	2	3.6	B	16.5	14.1	84.8	Very fine beets.
"	"	"	....	8th	10th	2	1.5	B	16.25	14.0	86.1	
E. H. Robson	Waterdown	"	....	24th	10th	3	3.11	B	19.0	14.2	74.4	Well-shaped, regular lot.
Chas. Fothergill	Appleby	Clay loam	M	24th	10th	1	3.12	A	16.5	11.7	70.9	Large, well-shaped beet.
"	"	"	M	24th	10th	2	1.14	B	18.7	14.2	75.9	Well-shaped beets, but too small.
David Allen	N. Grimsby	.....	....	.....	.....	3	5.7½	a	15.5	12.0	77.4	Fair shape.

Bay of Quinte District.

Name of Grower.	Locality.	Kind of soil.	Manured or not.	Date of Sowing, May.	Date of Extraction, Oct.	No. of beets analysed.	Net weight of samples analysed.	Above or below ground.	Analyses of Juice. Brise.	Sugar.	Purity.	Remarks.
Chas. Fothergill	Appleby	Clay loam	M	24th	10th	1	3.12	A	16.5	11.7	70.9	Large, well-shaped beet.
"	"	"	M	24th	10th	2	1.14	B	18.7	14.2	75.9	Well-shaped beets, but too small.
David Allen	N. Grimsby					3	5.7½	a	15.5	12.0	77.4	Fair shape.

Bay of Quinte District.

Rathbun	Deseronto					6	7.7	B	18.5	15.0	81.0	Very regular, well shaped.
C. Weese	Ameliasburg					2	3.0	B	16.0	13.0	81.3	Fair shape.
"	"					2	5.7	A	15.25	11.0	72.1	Large, green tops.
W. R. Dempsey	"					2	5.2	B	19.00	15.8	83.1	Good shape, better than preceding.
O. Hinch	Camden					2	3.11	A	17.5	13.0	74.3	Fair shape.
"	"					2	8.10	B	15.0	11.0	73.3	Very large; poor shape.
"	"					2	3.14	B	17.5	14.0	80.0	Fair shape.
						2	3.12	B	17.0	14.0	82.4	Best of the sample.

Various.

E. Berwick	Shelburne	Heavy clay				2	4.11	A	18.7	13.3	71.1	Good shape.
C. B. Hunt	South London	"				10	5.6	B	17.0	14.0	82.3	Very good shape, but too small.
John Hunt	"	Clay loam				4	2.14	B	19.0	16.5	81.5	Small, well-formed beets.
James Leslie	Toronto					10	7.10	a	17.75	13.5	76.0	" "
Rathbun	Deseronto			15th	26th	6	7.7	B	18.5	15.0	81.0	Very regular, well-shaped lot.
Wm. Cowan	Pickering					1	3.12½	A	15.8	11.0	68.9	
E. E. Burkinshaw	Gravenhurst	Garden, vegetable.		21st	29th	3	10.6	A	17.0	11.0	64.7	Very large, poor beets.
J. & J. Witchell	Vaughan					5	3.14	B	19.5	16.0	82.1	Fine beets.
"	"					4	3.9	B	18.0	15.0	83.3	"
"	"					3	5.8	B	16.8	13.5	80.3	Larger beets.
T. R. Wadsworth	Weston					3	4.0	a	14.0	10.8	77.1	Fair shape, above ground.
"	"					3	5.8	a	15.0	11.0	73.3	Larger size.
"	"					3	3.14	a	15.5	12.0	77.4	
J. & J. Neilson	Scarboro'					4	3.8	A	17.8	13.0	76.6	Large.
"	"					3	4.5	a	19.0	15.0	78.9	Larger, but better grown.
"	"					3	5.18	a	18.5	15.0	81.1	Better beets.
S. Page	Pelham					4	3.9	B	21.0	17.5	83.3	Small; little withered.
B. W. Murray	Toronto					4	6.4	a	17.3	14.0	80.9	
	Parkhill					4	18.4	A	14.0	9.5	67.8	Enormous, poorly grown.

REPORT OF THE METEOROLOGICAL OBSERVATIONS, LYSIMETERS, SOIL THERMOMETERS, DRAINAGE WATERS, Etc.

Made and Compiled by C. A. Zavitz, B.S.A., for the Chemical Department.

Observations on soil, temperature, drainage waters, etc., were taken this season as during the previous years. The instruments were placed in order on April 30th and a record of the readings made, commencing at May 1st and continuing until September 30th.

About the 1st of July a number of ground thermometers of different depths were unfortunately broken, and as these instruments are obtained from New York the vacancies could not be filled in time to be of much practical value during the present year.

No. 1 lysimeter was loam with sod, No. 2 loam with barley, No. 3 loam with bare fallow, No. 4 sand with barley, No. 5 clay with barley, and No. 6 loam with barley. On May 1st, 1889, a fertilizer containing nitrogen, phosphoric acid and potash was applied to each lysimeter at the rate of 600 lbs. per acre.

The following tables give the condensed summaries of the various observations taken during five summer months of 1890.

Rain gauge.—The rain which fell during the five months (May 1st to September 30th) as compared with that for the same period of the three previous years was as follows:

	1887.	1888.	1889.	1890.
	in.	in.	in.	in.
May	1.58	1.08	3.59	2.18
June	2.36	2.92	4.25	5.31
July	.61	2.21	2.67	1.44
August	2.71	2.16	1.92	1.74
September	1.52	1.55	1.04	.72
	8.78	9.92	13.47	11.39

Lysimeters.—The amounts of drainage water received from the lysimeters for each month was as follows:

May —Sod loam	5,140	cubic centimetres.
" Sand	8,877	"
June—Sod loam	8,140	"
" Barley loam	7,675	"
" Loam	4,055	"
" Sand	4,745	"
July—Fallow loam	3,915	"

Average for each thermometer for each month and for whole period.

Instruments.	May.	June.	July.	August.	September.	Average of the whole.
Barometer	28.752	28.852	28.893	28.916	28.955	28.
Attached thermometer	52.5	78.6	71.9	66.2	58.6	63.9
Temperature of air	50.7	65.4	68.2	62.8	55.4	60.5
Temperature, maximum	62.2	75.6	78.8	74.1	68.1	71.7
Temperature, minimum	40.2	56.2	54.2	51.6	43 9	49.2
Soil temperature 3 inches in sand	51.6	66.8	70.1	67.7	58.4	62.7
" 3 " clay	51.4	65.9	71.9	68.6	60.6	63.6
" 3 " loam	51 0	65.1	69.3	68.3	58.9	62.4
" 9 " clay	49.9	64.4	68.9	67.2	58.7	61.7
" 9 " loam	49.4	63.8	68.6	67.3	58.8	61.5

Greatest variation in temperature of each thermometer between two readings (*a*) Increase, (*b*) Decrease.

Situation of Thermometer.	Increase.				Decrease.			
	Date.	From.	To.	Variation.	Date.	From.	To.	Variation.
Temperature of air	Sept. 30.	34.1	69.3	35.2	June 26. Sept. 30.	83.0 69.3	62.0 48.3	21.
Thermometer in sand at depth of 3 inches....	Aug. 7.	59.2	86.4	27.2	May 26.	73.4	57.7	15.7
" clay " 3 "	Aug. 7.	59.0	91.3	32.3	Aug. 8.	94.6	72.8	21.8
" loam " 3 "	Aug. 7.	57.6	88.8	31.2	June 2.	77.2	60.6	16.6
" clay " 9 "	Aug. 15.	60.0	69.4	9.4	May 3.	65.8	51.2	14.6
" loam " 9 "	May 19.	42.0	51.7	9.7	July 29.	79.6	69.4	10.2

Tables of highest single readings of thermometers at different depths in three kinds of soil with date of same (for air also).

Situation of Thermometer.	Date of maximum temperature.			Maximum temperature.
	Month.	Day.	Hour.	
Temperature of air	August.	4	1 p.m.	88.1
Thermometer in sand at depth of 3 inches.....	"	1	1 p.m.	89.8
" clay " 3 "	July.	29	1 p.m.	95.5
" loam " 3 "	August.	8	1 p.m.	91.4
" clay " 9 "	"	4	9 p.m.	78.5
" loam " 9 "	"	3	9 p.m.	81.3

In addition to these investigations there has been the usual amount of correspondence with farmers and others in reference to matters of interest to them. On the whole the year's work has been both pleasant and, I trust, profitable, and has shown marked signs of development. With increased help and still greater scope for our work I trust the work of the year 1891 may prove still more pleasant and more profitable.

Through you to the Minister of Agriculture I beg to submit this report.

Yours respectfully,

C. C. JAMES,
Professor of Chemistry.

CHEMICAL LABORATORY,
ONTARIO AGRICULTURAL COLLEGE,
December 31st, 1890.

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PART IV.

REPORT OF THE

PROFESSOR OF VETERINARY SCIENCE.

To the President of the Ontario Agricultural College:

SIR,—In submitting my annual report I am glad to be able to state that the health of the stock upon the farm has been good on the whole. Considering the amount of stock kept, we have had very little sickness and not many fatalities.

HORSES.

The horse stock has been unusually healthy, and beyond a few slight cases of colic and minor casualities there has been very little trouble.

For appearance sake at least, I would like to see the horses in rather higher flesh, and present a more vigorous appearance. Unfortunately, these animals labor under the same unfortunate circumstances that the horse stock upon most of the farms of Canada do. That is, that they have not nearly enough work during the winter to give them exercise, and what work they have comes by fits and starts, so that it would not be safe to give them full rations. All at once in the spring they are plunged into hard, heavy work, when they are not in a condition that fits them for it; so that they fail rapidly and never have a chance to recover, as they are worked to their fullest capacity until the season falls again, when their work is not sufficient to allow of their being got into good condition.

A WEAK FOAL.

A mare that works in the garden dropped a foal that was somewhat weak. Her supply of milk was small, and it did not appear to be properly constituted, as the foal took to scouring profusely, which we could not arrest, until we fed the young animal on cow's milk and with-held the mother's.

However, it did not gain in strength and could not get on its feet without being lifted, and soon became a victim to that bane of colt flesh called "Joint Ill," so that we considered it more humane to put it out of its suffering, as there seemed little chance of its ultimate recovery in the face of such discouraging complications.

The year before the same mare dropped a fine, strong, healthy foal that never ailed a day—a full sister to the one that died—and nearly every one that saw the mare prophesied that her foal would not do well, as she was so very fleshy. This year she was very decidedly lower in flesh, and as I have explained had ill-luck with her foal.

This is some evidence that a high state of flesh is not always to be assigned as a cause of ill-success in breeding; although there is no doubt that moderate condition is more favorable in the majority of instances

Tape-Worms in Lambs.

I explained in former reports losses that have resulted from the action of tape-worms upon the College lambs. Last spring we had a similar experience, although the mortality was kept within smaller limits, only some half-dozen lambs succumbing from the ravages of the worms, as we were enabled from the benefit of past experience to take prompt action in the administration of medicine to cause their expulsion. As I explained in a former report, Oil of Male Shield Fern is the agent used, and we give from ten to twenty-five drops at a dose according to the size of the lambs.

They should not be allowed any solid food for twelve hours, and should be encouraged to drink linseed tea prior to getting the Shield Fern. We used to give raw linseed oil in preparing for the dose, and although the laxative action produced by it was an advantage in aiding the action of the Sheild Fern, still we found it had an extremely nauseating effect, causing much coughing and depression, and I intend in the future to with-hold it, and rely upon starving and the linseed tea.

The medicine should be mixed with a wineglassful of linseed tea and poured down. If the expulsion of worms has not been as free as it should have been, the dose may be repeated in twelve hours.

Since I previously reported upon this subject I have made some inquiries as to the existence of this trouble in other parts of the continent, and find that its occurrence is by no means rare. I have also come in contact with it on numerous occasions in different parts within a radius of ten miles from Guelph. It is regretable that helminthologists have not yet discovered the life history of this worm—*Tænia expansa*—as we might then be in a position to prevent its ravages upon lambs.

I do not know of any cases where injury has been done to adult sheep by these worms.

It is considered by helminthologists that tape-worms in order to complete their life history, or in other words to develop from eggs to mature tape-worms, must pass through some other form of animal life before they can reach their mature stage, and infest the animal which they are naturally inclined to attack. For instance, after the eggs leave the segments of the tape-worms, that are expelled from lambs, these eggs are not simply taken up again by lambs and developed into worms in the lambs bowels, for if they were so taken up, they would never complete their life history in these hosts, but would be expelled without maturing. So it has been determined, that these worms in their undeveloped stages or larval form, have to enter some other living host, in order to proceed with their development. Now, if this intermediary bearer or host can be discovered and destroyed, then the development of these worms and their consequent ability to do harm is arrested. Acting upon the theory that some slug or mollusc might be the intermediary bearer, we determined to try a heavy dressing of salt on the pasture that the lambs were put upon two years ago last spring; as salt has been found to be destructive to these low forms of animal life, as in the case of the mollusc that harbors the immature stage of the liver fluke that causes "Bot" in sheep, in the old country. However, it had no marked influence in checking the development of the worms, for they again attacked the lambs that year.

An Experiment.

Last autumn a pure-bred Ayrshire cow seven years old was purchased and brought to the farm. Towards the spring, her attendant finding she was not doing well, requested me to examine her, which I did. I made up my mind at once that she was the victim of "tuberculosis" and had her immediately isolated for further observation. As she was milking at the time, and as there was an available calf, out of a Durham grade cow by a pure-bred Polled-Angus bull, it occurred to me that it would be a good opportunity to test the transmissibility of tuberculosis, through the medium of the milk.

It is a point, that has by no means been satisfactorily settled by observers. Authorities are almost unanimous in the belief that where the tubercular deposit involves the udder, there is the utmost danger to susceptible individuals consuming the milk from that udder; but many hold the view that if the mammary glands are not involved in the deposit, that the danger is slight. In this case the udder was perfectly healthy, hence the opportunity for an experiment was very favourable.

Our patient rapidly declined, in fact from the very first, she presented the symptoms of a typical case of galloping consumption. We kept her for about one month, allowing the calf to suck her during this time. As she began to get pretty weak, we resolved to destroy her and make a *post mortem* for the benefit of the students. Upon opening her we found very extensive deposits of tubercles, both in the chest and abdomen, in fact almost all the organs in these cavities were seriously involved.

The calf was put away by himself and fairly well fed and housed for seven months, when we killed and opened him. During this time he appeared healthy and throve fairly well, his appetite being good, and there was no cough.

I examined him, and took his temperature occasionally, but found nothing abnormal. Upon opening him, however, we found widespread deposits of incipient tubercles. Both pleurae were dotted all over with small clusters of tubercles, and in the abdomen the liver was spotted externally in a like manner, and also there was a good crop on the sheet of membrane—mesentery—that envelops the bowels, and suspends them to the root of the abdomen.

In fact it was astonishing to observe the extent of the deposits, after having witnessed the apparently healthy state of the young animal during life.

It was consistent, however, with my past observations, that if the tubercular deposits are not sufficiently extensive to interfere with the functions of important organs, there is no appreciable evidence of ill-health resulting from their presence. In order to make this experiment as complete as it might have been made, this calf should have been kept separate, to avoid the chance of infection through the medium of the air, or food of the foster-mother, of which they would both partake from the same box. Unfortunately, however, this calf could not be got to drink milk from a pail, and if he had been let into the cow's box twice a day to suck, he would have been subjected to the same danger from the breath of the cow or from her sputum though in a less degree.

As a matter of fact, I think we are justified in assuming, that the milk was the medium of transmission in this case.

Although recognising that there is some foundation for the theory of infection through the medium of the air, where healthy cattle are kept with tubercular ones, and also from feeding out of the same manger, still concluding from my own experience, I am of the opinion that the danger is slight when compared with that of consuming the milk from a tubercular subject.

Both the sire and dam of the calf are said to be healthy.

It is pretty generally recognised now that human and bovine "tuberculosis" are one and the same disease; hence the necessity for caution in using the milk from a cow, in which there is any suspicion of "tuberculosis," for it would appear that it is just as liable to be transmitted to the human being as to young bovines in this way.

Respectfully submitted,

F. C. GRENSIDE.

PART V.

REPORT OF THE FOREMAN

OF THE

HORTICULTURAL DEPARTMENT.

ONTARIO AGRICULTURAL COLLEGE,
December 31st, 1890.

To the President of the Ontario Agricultural College:—

SIR,—At the close of another year it becomes my duty to show, in some form, the amount of garden produce supplied to the college throughout the year. In doing so it is unnecessary for me to make anything in the way of a report, as I have no doubt Prof. Panton, as heretofore, will do ample justice to the department in that way. I would just say that notwithstanding a favourable season for vegetation and growth generally, through climatic and other causes beyond our control, the fruit crop was poor, both in quantity and sample; but culinary vegetables, of which we had all the leading varieties, were good and abundant in their seasons, sufficient to meet all the requirements of the college, and, as usual, a supply stored for winter use, also a small surplus sold and added to revenue, as shown in the following statement.

Supplied to the College during the year:

January.		
Cabbage, 9¼ doz. at 65 cts	$ 6 01¼	
Celery, 16½ doz. at 60 cts	9 90	
Onions, 1½ bush. at $1.50	2 25	
Parsnips, 3¼ bush. at 40 cts	1 30	
Carrots, 3 bush at 30 cts	90	
Beets, ½ bush. at 35 cts	17½	
Turnips, 1 bush at 20 cts	20	
Herbs, 5 bunches at 5cts	25	
Sundries	45	
		$21 43¾
February.		
Beets, 1 bush. at 35 cts	35	
Parsnips, 5 bush. at 40 cts	2 00	
Carrots, 5¼ bush. at 30 cts	1 57½	
Onions, 3 bush. at $1.50	4 50	
Cabbage, 11 doz. at 65 cts	7 15	
Celery, 1 doz. at 60 cts	60	
Herbs, 14 bunches at 5 cts	70	
Sundries	60	
		17 47½

March.

Carrots, 6 bush. at 30 cts	$1 80	
Beets, ½ bush. at 35 cts	17½	
Parsnips, 7¼ bush. at 45 cts	3 26¼	
Onions, 3½ bush. at $1.50	4 87½	
Cabbages, 10 doz, at 65 cts	6 50	
Herbs, 6 bunches at 5 cts	30	
Sundries	30	
		$17 21¼

April.

Carrots, 7 bush. at 30 cts	2 10	
Beets, 1½ bush. at 35 cts	52½	
Parsnips, 7¼ bush. at 45 cts	3 26¼	
Shallots, ½ bush. at $1.50	75	
Cabbage, 6½ doz. at 70 cts	4 55	
Sundries	60	
		11 78¾

May.

Lettuce, 13 bush. at 60 cts	7 80	
Parsnips, 4 bush. at 35 cts	1 80	
Rhubarb, 7½ bush. at 70 cts	5 25	
Carrots, 3 bush. at 30 cts	90	
Asparagus, 360 bunches at 4cts	14 40	
Sundries	75	
		30 90

June.

Rhubarb, 15½ bush. at 60 cts	9 30	
Lettuce, 8 bush. at 50 cts	4 00	
Spinach, 17 bush. at 40 cts	6 80	
Peas, ½ bush. at $1	50	
Asparagus, 940 bunches at 4 cts	37 60	
Onions, 130 bunches at 5 cts	6 50	
Gooseberries, 42 qts. at 6 cts	2 52	
Strawberries, 73 boxes at 7 cts	5 11	
Sundries	30	
		72 63

July.

Lettuce, 14 bush. at 40 cts	5 60	
Peas, 8¾ bush. at $1	8 75	
Rhubarb, 7¾ bush. at 50 cts	3 87½	
Spinach, 2 bush. at 40 cts	80	
Potatoes, 6½ bush. at $1.50	9 75	
Asparagus, 320 bunches at 4 cts	12 80	
Onions, 61 bunches at 5 cts	3 05	
Beets, 47 bunches at 5 cts	2 35	
Carrots, 58 bunches at 5 cts	2 90	
Strawberries, 217 boxes at 6 cts	13 02	
Raspberries, 197 boxes at 7 cts	13 79	
Cherries, 8 boxes at 6 cts	48	
Currants, 145 boxes at 6 cts	8 70	
Currants, black, 21 qts. at 12 cts	2 52	
Gooseberries, 156 qts. at 6 cts	9 36	
Beans, 80 qts. at 5 cts	4 00	
Herbs, etc	30	
		102 04½

August.

Potatoes, 19 bush. at 70 cts	$13 30	
Lettuce, 3¾ bush. at 30 cts	1 12½	
Beets, 1¼ bush. at 30 cts	37½	
Peas, 3½ bush. at $1	3 50	
Rhubarb, 10½ bush. at 50 cts	5 25	
Carrots, 1 bush. at 40 cts	40	
Apples, hand-picked, 15 bush. at 60 cts	9 00	
Apples, fallen, 1½ bush. at 30 cts	45	
Tomatoes, 6 bush. at 75 cts	4 50	
Cabbages, 6½ doz. at 50 cts	3 25	
Corn, 44 doz. at 8 cts	3 52	
Celery, 7½ doz. at 50 cts	3 75	
Vegetable marrow, 1½ doz. at 50 cts	75	
Cucumbers, 20½ doz. at 10 cts	2 05	
Cucumbers, pickling, 2,705, per 100, 20 cts	5 41	
Beans, 48 qts. at 5 cts	2 40	
Raspberries, 21 boxes at 7 cts	1 47	
Onions, 15 bunches at 5 cts	75	
Herbs, 7 bunches at 5 cts.	35	
Sundries	20	
		$61 80

September.

Potatoes, 11½ bush. at 40 cts.	4 60	
Apples, picked, 5¼ bush. at 50 cts	2 62½	
" fallen, 2 bush. at 25 cts	50	
" crab, 4¼ bush. at 60 cts	2 55	
Tomatoes, 17½ bush. at 60 cts	10 50	
" green, 8 bush. at 50 cts	4 00	
Lettuce, ½ bush at 40 cts	20	
Onions, ½ bush at $1	50	
Pears, 2 bush. at 80 cts	1 60	
Corn, 21 doz. at 8 cts.	1 68	
Cabbage, 5¼ doz. at 50 cts.	2 62½	
Cauliflower, 5½ doz. at 75 cts	4 12½	
Celery, 6¾ doz. at 50 cts	3 37½	
Cucumbers, 1½ doz. at 10 cts.	15	
Peppers, 2 doz. at 12 cts	24	
Plums, 400 qts. at 4 cts	20 00	
Grapes, 250 lb. at 5 cts	10 00	
Grapes, 147 lb. at 3 cts.	4 41	
Melons, 15 at 5 cts.	75	
Squash, 6 at 5 cts	30	
Herbs, etc	25	
		74 98

October.

Potatoes, 113 bush. at 40 cts.	45 20	
Turnips, 7 bush. at 15 cts.	1 05	
Onions, 3¾ bush. at 90 cts	3 37½	
Tomatoe, 1¼ bush. at 70 cts	87½	
Apples, good, 59 bush. at 50 cts	29 50	
" inferior, 2 bush. at 25 cts.	50	
Beets, 2 bush. at 30 cts.	60	
Carrots, 1¾ bush. at 30 cts	52½	
Parsnips, 2 bush. at 40 cts.	80	
Celery, 23 doz. at 50 cts	11 50	

Corn, 14 doz. at 8 cts	$1 12	
Cabbages, 10¾ doz. at 50 cts	5 37½	
Cauliflower, 12½ doz. at 70 cts.	8 75	
Melons, 142 at 4 cts	6 48	
Citrons, 100 at 6 cts	6 00	
Vegetable Marrow, 250 at 5 cts	12 50	
Bos. M. Squash, 28 at 6 cts	1 68	
Herbs, 7 bunches at 5 cts	35	
Sundries	45	
		$136 63

November.

Onions, 2 bush. at $1	2 00	
Turnips, 5¾ bush. at 15 cts	86¼	
Carrots, 2¼ bush. at 30 cts	67½	
Parsnips, 3¾ bush. at 40 cts	1 50	
Beets, 1½ bush. at 35 cts	52½	
Artichokes, 1 bush. at $1	1 00	
Celery, 19½ doz. at 60 cts	11 70	
Cabbage, 4¾ doz. at 50 cts.	2 37½	
Cauliflowers, 4 doz. at 70 cts.	2 80	
Cabbage, pickling, 50 at 5 cts	2 50	
Herbs, 13 bunches at 5 cts.	65	
Sundries	45	
		27 03¾

December.

Onions, 1¼ bush. at $1	1 25	
Salsify, 1½ bush. at $1	1 50	
Parsnips, 2½ bush. at 40 cts.	1 00	
Carrots, 1 bush. at 30 cts	30	
Turnips, 3½ bush. at 15 cts	52½	
Beets, ½ bush. at 35 cts.	17½	
Cabbage, 6½ doz. at 50 cts.	3 12½	
Celery, 15½ doz. at 60 cts.	9 30	
Herbs, 10 bunches at 5 cts.	50	
Sundries	30	
		17 97½
Total supplied to College at current rates		$591 91
Sold for Cash		79 55

Your obedient servant,

JAMES FORSYTH.

December 31st, 1890.

PART VI.

REPORT OF THE PHYSICIAN.

To the Honorable JOHN DRYDEN,
Minister of Agriculture:

SIR,—I have the honour of presenting to you my Annual Report.

Owing to the almost simultaneous appearance of an epidemic of measles and la grippe, after the Christmas holiday of eighteen hundred and eighty-nine, we could not prevent the spread of those diseases, as no provision had been made for isolating the patients that were under treatment.

Several of the students who never had measles before had to run the course of both diseases before making final recovery.

I am glad to be able to report that, according to instructions given by you, two comfortable rooms with their appurtenances are almost ready for use.

During the rest of the year, we have had nothing of an unusual character occur.

The college is in a good sanitary condition.

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

E. W. McGUIRE, M.D.,
College Physician.

December 31st, 1890.

PROF

To the President

SIR,—I hav
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PART VII.

REPORT OF THE

PROFESSOR OF AGRICULTURE.

ONTARIO AGRICULTURE COLLEGE AND EXPERIMENTAL FARM,
31st December, 1890.

To the President:

SIR,—I have the honor of herewith submitting my report for the year of 1889 for the respective departments of this institution under my more immediate supervision. These include in addition to my own report, those of Mr. C. A. Zavitz, assistant in the experimental departments, and Mr. J. E. Storey, the farm foreman.

The year 1890 was not more favorable to successful farm management in Ontario than the year 1889, owing to the unusual amount of the rainfall during the months preceding the reaping of the harvest. So excessive was this rainfall in the neighborhood of Guelph, that for days in succession during the month of May and the first half of June, no work could be done on the land in the line of cultivation. The growth resulting from so great an amount of moisture in the soil was excessive, and the promise of an enormous yield on the approach of harvest was most cheering, but the hot days of July during the formative period of young grain in the ear soon rendered it apparent that this hope was illusive.

The year, however, has on the whole been a very successful one, as will be apparent to all who can find time to examine the financial statement on another page. From this statement it is manifest that the farm proper has more than paid its way during the year 1890. It was publicly announced by the Hon. Chas. Drury, during his term of office, that he thought the farm proper separate from the work of an experimental nature should not be a burden to the farmers of this Province, but that on the other hand it should at least produce revenue enough to cover the expenditure. During the year 1889 it was simply useless to attempt to realize this object, because of the confusion in management resulting from the burning of the buildings. The effort was made, however, during the year now drawing to a close, with the result which has already been mentioned.

While I am free to admit that the mere making of the farm proper pay its way, is not by an means the most important object of its existence or that is sought in its management, it is of much importance to the farmers of this country to know that it is managed with a due regard to economy. The most convincing evidence of economical management is to be found in a balance sheet on the right side. I do not know that it is the mind of the department to have the accounts so kept in future that the gain

or loss from the farm proper may be known from year to year. If this should be decided upon, however, it is my firm conviction that good management would show a balance sheet on the right side every year, or if not every year, the average of gains would more than overbalance the average of losses.

The improvements undertaken during the year relate chiefly to the repairing of fences, the re-making of roads bordering upon and within the farm, the destruction of weeds and the removal and reconstruction of a sheep barn.

Improvement of Roads bordering on the Farm.

In the month of August the portion of the road between the Townships of Guelph and Puslinch which was left without gravel last year was completed. The construction of this road is given in the report for 1889, page 103. As soon as the ground was dry enough in the spring, mixed grasses were sown along the side of this road on the entire space between the gravel and the fence on either side. It grew luxuriantly and was twice cut with the mower. This not only prevented any weeds from going to seed, but added much to the pleasing appearance of the road.

The Brock road running in front of the college grounds was taken in hand in the spring as soon as the grain had been sown. The fences on its sides were removed and the sod turned over from the head ridge in the bordering fields to the travelled portion of the road. The ploughing was repeated three times on some portions and four times on others, and the ground was harrowed and levelled between the ploughings. The bordering ditches were then made by first marking them out with the plough, and after this by using the scraper in the grading. The road-bed was made 38 feet wide between the outmost edges of the ditches. The slope from the centre outward was made just enough to drain the water off readily, and not so violent in any part as to hinder the use of the mower in cutting grass or weeds.

Before any ploughing was done the stones were gathered from the sides of the road where they had been deposited sometime, by some one, in numerous heaps in the years that are gone, and were drawn away to be put in the bottom of another road. It seems to be the practice with some road-masters in caring for gravel roads to throw aside into the grasses upon the borders all the stones that work up through the gravel, instead of breaking them or drawing them entirely away. This practice renders the borders very unsightly. It is not fair to the owner of the property bordering upon the road. It was from this source, however, that a number of the stones came which were removed from this road. There is very much public travel on this road and this accounts for the more than average width of the road-bed decided upon, and for the further fact that when the gravel was put on it was spread to the width of eighteen feet. This allows two teams to pass ordinarily without leaving the gravel.

The gravel was applied as soon as the grading was completed. It was spread by Mr. Squirrel this year again and with an evenness fully equal to that evidenced in this work the previous year. In the centre of the road the depth would be fully six to seven inches and less toward the sides. No stones were drawn in the gravel larger than one's fist and but few half so large. At least this was the aim, and even these were continually raked forward and covered as the work proceeded. After the gravel had been put on it was twice raked toward the centre and twice rolled with a heavy roller, insomuch that it became very smooth and solid by freezing up time. When the teams were unloading the gravel they were required to go forward a short distance and turn in one place. This prevented the scattering of the gravel where it was not wanted and the making of an unsightly job, while the time lost in consequence was scarcely appreciable.

The county bore a part of the expense of drawing the gravel. Another portion was borne by the Government, and a portion of the work was done by the farm teams. The whole of the labor of ploughing and leveling the sides of the road was done by the farm teams and farm help, as was also the removal of the stones and the grading of the road. It was also done without any special grant for the purpose. Such times were chosen for doing it as would not interfere seriously with other farm work. The borders between the fences and the travelled portion will be sown with grass in the spring.

The grading done late in the autumn of 1889 on the private road on the north side of the Brock road was much marred by the excessive rains of early spring, insomuch that it was determined to re-summer fallow the borders again. This was done and alsowhatever additional grading was required. Posts were also set eight feet apart and one foot from the outer edge of the ditches which border on the roadway. On a portion of this line of posts the fence is completed. It consists of a bottom board 1x1½ inches, planed, and a top piece 2x4 also of pine and planed. This piece is nailed upon the side of the posts. The top side of this scantling is three feet from the ground. The bottom piece is let into the posts one inch, the top piece 1½ inches. The space between these two pieces is filled with wire netting. The object of this inner fence is to protect the trees which, in the spring, are to be planted along the borders

The private road on the south side of the Brock road was also taken in hand. After the whole road had been ploughed, the road-bed was scraped out to the width of nine feet and to the depth of say ten inches. This cavity was then filled with small stones to the depth of six to eight inches, deeper in the centre and slightly sloping toward the sides. These stones were gathered from the fence corners of the fields and also from portions of the road itself, where they had been strewn about in objectless accumulations. The work on this road stands thus, and will be pushed to completion another season. In all these improvements the rule has been followed thus far to do no more than can be accomplished by the staff of farm workers, and by the farm teams when the labor of these is available, without in any other way neglecting the other farm work. Thus it is that the ordinary farmer carries on his work if it is to be economically done, and I see no reason why this rule should be departed from here. It can never be said regarding the improvements on the farm that they are completed so long as the principle of decay is operative, hence the widsom on the part of the progressive farmer, of continuing these from year to year.

The Destruction of Weeds.

The war against the multitudinous forms of vagrant weed-life which infested the farm and also the bordering highways, was renewed with the coming of the springtime, but the strong effort in this direction was made after the middle of June, and more especially in the months of August, and early in September. But little, comparatively, can be done in ordinary farming in early spring, in destroying weeds, other than what is accomplished by the usual modes of cultivation. The thistle crop was not so abundant after the scourging of the previous year. This may also be said of the wild flax, the ragweed, the mustard, the blue weed, the sow thistle and the burdock. The ox-eye daisy gave but little trouble after the treatment described in the report of last year. The couch grass has been given one more year of life. Hitherto it has been entrenched mainly behind the protection of meadow land, and so has been thus far unmolested.

The means adopted for the destruction of weeds were similar to those of last year, and included (1) hand pulling, (2) the use of the spud, (3) the growth of hoed crops, and (4) autumn cultivation.

The *hand* pulling is specially applicable to the eradication of mustard and wild flax. It is only possible, however, when these exist in limited quantities in the crops, as otherwise the cost of the operation would be too much. It can be best done in conjunction with spudding, when other weeds requiring this are present. Wild flax is usually present only in meadows and fields sown to autumn grains, as rye or winter wheat, and unless pulled shortly after blossoming, the seed will shed abundantly. Wild flax is one of the most dangerous weeds now found in this province, and one of the most difficult to dislodge. Mustard is more troublesome, as is generally known, in spring sown grains, and so long as it is allowed in any degree to ripen on a farm, that farm will never be entirely free from it.

Spudding is applicable to the destruction of nearly every form of weed life found in meadows, grain crops, or pastures. Its utility is subject to the same restrictions as hand pulling, depending largely on the numbers in which the weeds are present. When they are very numerous, some other mode of eradication must be rssorted to. It will be found especially serviceable when fields have once been virtually cleaned, in keeping them in this

condition. When this plan is adopted, any of the more troublesome forms of weed life are detected at the outset, and so do not easily get a foothold. I am fully impressed with the conviction that when once a farm is made fairly clean, it cannot be kept so without resorting to this plan, and that in no other form can labor be expended with this object in view that will give so good a return for the outlay. The grain fields were all gone over, spud in hand. The pastures were gone over twice, including the unbroken land enclosed along with the forests. The number of hours employed in this way during the summer of 1890 was 498½ or 49 4.5 days of one person's labor.

Our great reliance for the eradication of weeds on this farm is the growing of *hoed crops.* Where these will grow well, I do not see any necessity for the use of the bare fallow. We are cleaning this farm without resorting to its use at all. We had 108 acres in hoed crops the past summer. Of this amount, 54 acres were rape, 19 acres corn, 20 acres field roots, and 7 acres potatoes. All of this was badly infested with thistles and other forms of weed life. It would not be incorrect to say that it is clean now, so far as this can usually be said of any piece of land. In addition to the work done by the horse hoe on the hoed crop, it was gone over twice at least with the hand hoe, so that by harvest time no weeds could be found upon it at all approaching the blossoming stage.

Of all the crops which we grow, as aids in the destruction of weeds, rape is with us the favorite, and the potato crop is least in favor. With the latter, the tops die so soon, and cultivation ceases at a period so early, that the thistles at least put in an appearance again, and regain much of that hold upon the soil, of which the earlier cultivation had deprived them. When the rape is grown in conjunction with rye and properly cared for, the weeds have small chance of a long lease of life. The rye is sown in autumn, and in the spring is cut for the silo, or pastured as may be desired. The ground is then ploughed about the first of June, or a little later, and the rape is sown about the last week in June. The turning over of the ground in June, and the after cultivation during a dry period of summer is most efficacious in destroying the weeds. The rank growth of the rape leaves so excludes the light after the cultivation ceases, that there is small chance for the growth of weeds. If any weeds are allowed to go to seed along the line of the row, this is a very weak point in the cultivation. The weak point, usually, in all cultivation of hoed crops is usually discernible in the later stages of growth. If they were gone over once or twice with the hand hoe after all horse labor ceases, and all stray weeds and thistles cut off, the farmer would be abundantly remunerated for his outlay. The time occupied in this work when the preceding cultivation has been of the right sort, need not be more than one day for three or four acres.

The cheapest labor factor in the destruction of weeds is probably that of *Autumn cultivation*, and it is certainly one of the most effective. It consists in ploughing the land lightly as soon as possible after harvest, where a crop of grain or grass has been grown, and on which a spring crop is to be sown the following year. The gang plough will answer very well where thistles are not plentiful. Where they are plentiful, the ordinary plough with a clean cutting share should be used, and the ploughing should not only be light, but most carefully and thoroughly done. When fresh weeds appear plentifully on this upturned soil, it will well repay the labor to run over it with the harrow some weeks before it is finally turned over for the crop, when the freezing time is approaching. All the land we had which required this treatment received it.

I desire here to say to the farmers of this province, I see no reason why we should not have clean farms in all Ontario. It remains with each farmer to say that his farm will be clean, and so it shall be. The method which allows the farm generally to accumulate the elements of weed life and which then makes a dash at one field by means of the bare fallow will never prove completely successful. There must be unremitting vigilance all along the line and through all the years. The objection has already been raised that it is comparatively easy for us to clean a farm, and to keep it clean, where we have so much available labor. I answer, we account for all labor employed on the farm, and pay for it from the same.

The Removal of the Sheep Barn.

The sheep barn, which was removed and remodelled, stood directly in the line of the private road which runs past the creamery barn. It was old and infirm, and bordered very closely on the realms of unsightliness and dilapidation. This building, which had no sills, was taken down and re-erected on the southerly side of the yard connected with the creamery barn. A good foundation of stones was placed under it, and a commodious loft put into it for the storing of hay and bedding. It has ample yard room in front.

The uses to which this sheep barn is to be devoted are three-fold. First, it will provide shelter in time of autumnal storms for lambs that may be pasturing on rape or otherwise. Second, it will answer well for the wintering of sheep belonging to the farm, owing to the roominess of the building and of the yards in front; and third, in the summer season it will provide accommodation for any kind of stock when this may be necessary.

Special Crops Grown upon the Farm During 1890.

The special crops grown upon the Farm during 1890 consisted of tares or vetches, rye for pasture and soiling, rape, and sugar beets. The term *special* here is applied to these crops for the reason that they are not usually grown by the Ontario farmer, and they have all been grown by us for purposes of experiment.

Tares or Vetches.—This crop was grown with the following objects in view, viz.: —(1) To ascertain whether the crop is a paying one in this locality, or whether it can be made so. (2) To ascertain whether they can be so grown that no trouble will arise with the succeeding crop from the prolonged presence of the tares in the soil. (3) Whether they may not be grown in Ontario in sufficient quantities to reduce the cost to the farmer when purchasing seed The growth of tares in conjunction with oats, or with oats and peas for soiling purposes, is rapidly on the increase in this country, but the farmer has hitherto paid about two dollars per bushel for his seed. When I mention this I do not in any way intend to reflect upon the seedsmen of this province. I affirm, however, that it is more than the farmer can well afford to pay for his tares. If the price of the seed could be brought down to one dollar per bushel, the growth of tares for soiling purposes would be very much extended. As one factor in a soiling crop they are very useful, and the growth of soiling crops is happily coming more and more into favor with the farmers every year.

The attempt this year could not be called a success by any means. The tares were sown on a loamy soil, and on a fall-ploughed piece of land where oats had grown the previous year. They were sown with the drill May 1st, and at the rate of 1½ bushel per acre. They grew with great rapidity during the following weeks of very showery weather. On June 25th they presented a beautiful appearance, but closer inspection made manifest a rankness, and at the same time a sappiness and tenderness of straw that were ominous. About July 1st the whole plot was covered with purple blossoms, and in its attractiveness was full of deceitful promise. During the early days of July, which were intensely warm, the rankest portions of the field withered like the gourd. Other portions of lightest growth retained the dark shade of luxuriant growth, and intermediate portions took on a lighter tinge, indicating considerable derangement in the processes of nutrition. The crop evidently ripened prematurely and yielded only from five to six bushels per acre. These brought when sold, $1.50 in the Toronto market. Pease in the same field and sown about the same time, yielded twenty-five bushels per acre. The tares, when removed, were followed by a crop of rye, which is being grown for the silo, and which will be followed by a crop of rape.

Rye for Pasturing and for the Silo.—Twenty-six acres of rye were sown in the autumn of 1889 to produce pasture. The open winter injured the portions of the field containing a humus soil, by the constant succession of freezings and thawings. The pasturing commenced soon after the rye had made a good start in the spring, and continued until June 10th, when the field was ploughed for rape. It was pastured with both cattle and sheep, and the results were fairly satisfactory.

Twenty acres of rye were also sown in field No. 1 in the autumn of 1889 with the object of cutting it with the binder, curing one-half of the rye in the shock and putting the other half into the silo. It was our intention to use the cured portion as hay, that is, to run it through the cutting box and mix with other food as we now use the hay which is given to the cattle. The open winter also injured this crop somewhat in the low parts where black soil was plentiful. The excessive rains in June rendered it impossible to cut the rye at the proper stage for curing, and before a team could do the work of cutting at all in the low parts without poaching, the crop had passed even the best stage at which it should go into the silo. It was cut at length about the middle of June, run through a cutting box and put into the silo. It had no other covering in the silo than from six to twelve inches of cut straw. When the rye was removed from this field the ground was at once ploughed for rape, which was sown during the first days of July.

The silo was opened about August 1st and the stock kept inside were given a portion of the rye along with a sprinkling of meal intermixed with it. The animals did not take kindly to it for the first two or three days, but eventually became very fond of it, and so far as we could judge did well upon it. As we had anticipated, a portion of the rye adjoining the walls of the silo was injured because of the over woody stage at which it was put into the silo. All the rest of it was sweet and good.

The fields chosen for the rye were both overrun with thistles, and to clean them was one principal object in view when the rye was sown. When followed by a crop of rape that is sufficiently cared for, this object can be attained in finest form. A crop of rye and a crop of rape can both be secured from the land, and the land will at the same time be as effectively cleaned as though it had been summer fallowed. It will also be somewhat richer than when the rye was sown if both rye and rape are eaten off upon the land, as both these crops draw their stores largely from the atmosphere and from the subsoil.

Forty acres of rye were sown during the first week of September. It is the intention to use this also as a cleaning crop in conjunction with rape. Some of it will be cured to use as fodder if the season is suitable and a part will be put in the silo. The amount sown per acre was two and one-half bushels, and it was sown with a drill. It should be remembered, however, that this mode of cleaning land is only suitable for soils which are adapted to the successful growing of rape.

Rape for Pasturage.—As intimated in the paragraph relating to rye, forty-six acres of rape were grown after the rye, viz., twenty-six acres after rye pastured until June 10th and twenty acres after rye cut about the middle of June and put into the silo. The ground in the first instance was ploughed, commencing June 17th, and in the second commencing June 28th. The former field was sown during the last week in June and the latter during the first week in July. In the first instance the ground was sufficiently damp to bring up the rape almost at once. In one portion of the field a heavy rain which fell immediately after the seed was sown so impacted the ground that the seed was slow in coming up, and this portion of the crop never equalled the other in strength and vitality. In the second instance the weather had become so dry by the time the seed was sown that the rape only came up at first in the damp portions, although the sowing followed close upon the drilling and the precaution had been taken to roll the drills with a heavy roller immediately after the sowing of the seed. A light shower of rain which fell three weeks later brought up the seed in the other portions of the field. This gave the crop an uneven appearance for a time, but before many weeks the rapid growth which followed soon obliterated all indications of unevenness.

A third plot was sown still later. It consisted of eight acres. This field was being fitted up for experimental purposes. It sustained a rank growth of thistles. These were permitted to grow until they were beginning to blossom. They were then turned under, the ground harrowed and drilled, and sown to rape July 31st. This field had received a liberal coating of manure before the ploughing, in view of the experimental crops to be grown upon it later. The weather was very dry when this field was ploughed, worked down and sown, which was good for the destruction of the thistles but bad for the growth of the rape. It did not germinate for some weeks. A shower which fell

during the last week in August caused quick germination and rapid growth. This field soon became covered with a strong mass of green leaves, but evidently was quite inferior to the earlier sown both in the amount of nutriment furnished and in its suitability for maintaining a good condition of system in the lambs. It neither fed them so long acre for acre, nor did they gain in flesh nearly so rapidly upon it as when feeding upon the earlier sown rape. The first hard frosts had the effect of so softening the stalks that they presented an appearance that may almost be termed one of wilting.

All three fields were drilled with the double mould board plough with marker attached. The drills were not made high and were twenty-three inches apart. One pound of seed was used to the acre, and in the earlier sown field a less quantity. The variety sown was the Dwarf Essex. The horse hoes commenced work soon after the rape had shot up into the rough leaf, and they were kept going at short intervals until the leaves from the drills which bordered upon each other had met. These fields were twice gone over with the hand hoe and all weeds removed from the line of the drills. The first time of doing this hand hoeing took one day of one man for every two acres, and the second one day of one man for every three acres.

By the 10th of September these fields, especially the two first sown, presented a beautiful appearance. There was one mass of luxuriant foliage from side to side in both without either bare ground or weed in sight. In field No. 1 the drills were made up to the travelled part of the Brock road in front of the College grounds. The reasons for doing this will be understood if reference is made to the cultivation of these road sides described on page 90. It was distinctly observable that the rape was strongest on the road side, evidencing its fondness for a soil rich in the humus formed by the decaying grass roots.

In field No. 11 the ground was gang-ploughed after the fall wheat had been removed and was sown to rape broadcast at the rate of three pounds of seed to the acre. This also was pastured, but I would not like to say without another trial whether the return was much in excess of the outlay. Of this I have no doubt, however, that if a meadow, which is in any event to be broken up, be ploughed just after the crop is removed and sown broadcast with rape that the land will be much better employed than if engaged in perfecting rape weed.

The fifty-four acres of rape in fields Nos. 16, 1 and 17 afforded a very large amount of pasture. On September 15th 18 head of steers, two and three years old, were put upon a portion of the rape and were given food from no other source until November 5th, a period of fifty-one days. They were only allowed to remain on it for an hour or two at a time at first, and ultimately as long as they cared to remain except at night when they were driven off to an adjoining pasture. They were not stabled until November 5th as the autumn was mild. They were then put in at night and allowed to pasture on the rape during the day until November 21st, which would be about equivalent to eight more full days' pasturage upon the rape. On October 4th 344 sheep were put upon the rape and remained on until 1st December, or for fifty-seven days. On October 18th 145 more sheep were put upon the rape and remained on it until 1st December, or for forty-three days. On October 23rd 100 of the lambs were shorn and were then only allowed on the rape during the day and in fair weather for thirty-seven days. If we assume that the pasture of these lambs after shearing would cover seventeen full days we must then deduct the pasture of 100 lambs for twenty days in making the final computation of the amount of pasture furnished. Now on the supposition that one steer requires as much as eight lambs, since they were all large animals, we get the following as the amount of pasture furnished by the rape. Very much to our regret what would cover fully seven acres of the ground was uneaten when the winter came, but as stated before, through no neglect of ours. The statement stands thus :—

Pasture of	18	steers	for 59	days	equal to the pasture of one lamb for.....	8,496 days.
"	344	lambs	for 57	"	" " " "	19,608 "
"	145	sheep	for 43	"	" " " "	6,235 "
						32,215 "
Less pasture of 100 lambs for 20 days or of one lamb for						2,000 "
						30,215 "

This is equivalent to saying that the forty-seven acres of rape eaten bare, kept 503 lambs for an average of sixty days or two months. Each acre of the rape, therefore, pastured nearly eleven lambs for two months. The lambs, however, received a small grain ration of oats per day for a little more than half the time they were on the rape. This was during the latter portion of the time and the quantity used did not exceed one-half pint per day. The above computation does not take into account the time when odd lambs were lost by death and for which no deduction of pasturage is made.

Sugar Beets.—One acre was measured off in field No. 5, and prepared for growing sugar beets as early in the spring as the season would permit this work to be done properly. We did not know last autumn that we in common with a number of the farmers in many parts of Ontario would be asked to grow sugar beets this year, with a view to ascertain the capabilities of the country in this respect, or we would have prepared the ground differently.

The aspect of the plot chosen was high, near the summit of one of the largest swells on the farm. The soil was a loam, rather gravelly in texture, and it lies on a subsoil of gravel, rather near the surface to favor the retention of moisture in a dry time. The manure on hand was not sufficiently decomposed for the purpose, and was not applied until the spring. Lower land, a milder loam, and a subsoil farther from the surface would have been more suitable, as would also the autumn application of farm-yard manure. At the late hour, however, at which it was determined to try the experiment, the most available location was chosen, weather and all other influences considered.

The land was ploughed in the fall and again in the spring. It was then harrowed and drilled, the drills being made 18 inches apart, or as near to this distance as the work could be done with the ploughs which were available. The seed was sown as directed by those engaged in promoting the industry at the rate of 16 pounds per acre. The plot was horse hoed four times, hand hoed once, and gone over again later to completely remove all weeds.

The cutworm so far preyed upon the crop that the blank spaces in the drills would comprise from one-third to one-fourth of the whole. A dry spell in August further checked the growth of the crop, as also that of the mangel crop adjoining, insomuch that the latter only gave a return of 300 bushels, or 9 tons per acre.

The harvesting commenced October 4th. The entire crop was weighed, a portion of it washed and trimmed, that is, freed from the rootlets and earth, and, from the results, the estimate for the whole was made. These results were as follows :—

Total weight of uncleaned and untrimmed roots..20,504 lbs., or 10.252 tons.
Total weight cleaned and trimmed.....19,073 lbs., or 9.536 tons.
Loss in weight in the washing and trimming, nearly 7 per cent.

The average per cent. of sugar obtained by actual chemical analysis from samples taken from all portions of the field was 15.08.

The value of the crop at $4.25 per ton for the beets when delivered at the factory would be $40.52. The price mentioned is the value per ton, which the promoters of the industry propose to pay for beets of this quality when delivered. This sum varies with the percentage of sugar which the crop yields.

The value of the mangel crop grown side by side with the beets, if put at 8 cents per bushel in the root cellar was $24.00 per acre, leaving a margin of $16.52 cents in favor of the beets, less the difference in the outlay for labor. This difference is mainly one arising from the longer time required in hand-hoeing and thinning the sugar beets, and also in handling them when taken up. It should not be more than $5.00 per acre. The yield of turnips per acre in the same field was 440 bushels, which at 8 cents per bushel would be worth $35.20. On the same basis of computation as that used in comparing the mangel crop with that of the sugar beets this turnip crop would be worth about the same as the beet crop. The yield of the three crops was very low, much lower than the average, but it is surely my duty to state, with equal candor, the failures as well as the successes of our work on this farm.

The yield of the outside row of the plot furnishes material for careful reflection. It bordered upon an open space about three feet in width, where the cultivation was deeper than that given the ground between the drills of the beets. This row yielded at the rate of about 20 tons per acre, and the percentage of sugar realized was 11.04. The large yield of this row as compared with the rest of the plot was probably caused by the deeper cultivation on one side of it. If this view is correct, it is evident that if the rows are to be not more than 16 to 18 inches apart, our cultivators at present in use are not well adapted to the purpose.

About the 1st of July an intruder appeared in the form of a grub, which preyed upon the leaves without disturbing either of the outer surfaces. It caused some of the leaves to appear somewhat blighted in a portion of their length, and no doubt injured the growth of the roots. The blighted appearance of the leaves continued for several weeks.

As this question is to the fore at present, and as the cultivation of sugar beets is as yet but little understood in this country, it may not be amiss to append some observations in reference to the methods adopted in growing sugar beets.

The most favorable climates in the world for the growth of sugar beets are such as may be denominated "wine climates," and which are therefore a shade milder than those of the larger portions of Ontario. The important requisites as to climate are moderate temperatures, with a sufficiency of moisture during the germinating period, followed by a season of warmth and moisture such as we usually possess in the months of May and June. As the season advances weather rather dry and sunny is desirable, such as we usually have in August and September. It is during this latter period that saccharification is most rapid in the roots. It cannot be said, therefore, that our climate is the very best in the world for the growth of the sugar beet. That it is well adapted, however, to produce sugar beets both in sufficient quantities to the acre, and with a sufficiently high yield of sugar, has been set at rest by the actual trials conducted in the province during the year. No less than 240 samples of seed were last spring distributed through nearly all parts of the province by the promoters of the industry to enable the farmers to conduct these trials. From the beets thus grown no fewer than 117 samples were collected and analyzed at this college by Prof. James, M.A. and Wilfred Skaife, B.A. Sc., of Montreal. The average percentage of sugar obtained was 13.58, which is higher than the average obtained from beets grown in several of the states of the American union most favorable to the industry, and is quite equal to the averages obtained in France and Germany. It may be proper also to mention that the diffusion of more knowledge regarding the methods of cultivation would secure a still higher percentage of sugar. In the analysis referred to above, the respective averages of sugar obtained from the upper or uncovered portion of well grown beets, and the lower portion were 15.5 and 16.6 per cent., and with those poorly grown, 11.4 and 13.6 per cent. The percentages of purity in the first instance were 82.7 and 83.0, and in the second 69.9 and 77.2.

In respect to the comparative yields per acre the statements are conflicting, and in nearly all of them the estimates are probably too high, as in almost every instance they are based upon the figures obtained from the growth of a single row or of a very small plot, which will give results too high for average acre plots, as will be manifest from what has been said in reference to the outside row of our own plot, and to which special reference has already been made. Nearly all the estimated average yields are over 20 tons per acre, which is manifestly too high. It is possible, however, that it may yet be demonstrated that good cultivation will give an average of 15 tons per acre, which would be quite as high as the averages of the foremost of the continental beet growing countries.

The most suitable soils are those possessing a mild, moist loam, deep and easy of cultivation. Where a stratum of loam marl is found lying underneath them, and lower still a subsoil of sand, the conditions are considered very favorable. Such soils have an absorptive power in a very marked degree. Depth of soil is absolutely necessary to success, as the beet roots take their nourishment very largely from the lower portions of the surface soil. A porous subsoil is also essential, as unless the ground drains readily

of itself or is thoroughly underdrained the soil remains too cold in the early part of the season, and capillarity is too much checked at a later period. Of clay soils those only which are mild and loamy answer well. Strong clays are not good and the same may be said of sandy soils unless those which may be denominated loamy sands.

The soils must be rich in themselves or they will require to be heavily manured. The sugar beet does not possess the power in a marked degree of gathering food from the soil, hence if the latter is not rich it is not likely to succeed.

Barn-yard manures should be applied in the fall, as when put on in the spring they induce too large a growth of leaf and this retards the ripening process. Manures that are highly nitrogenous produce a similar result. Manure made from horses is best, and that from sheep is the least useful, as its presence increases the amount of salts in the beets.

It is considered good practice to use artificial fertilizers in conjunction with barn-yard manures. When the former are used prominence should be given to those rich in phosphoric acid. When thus applied about 10 tons of fairly well decomposed farm-yard manure may be applied per acre in the autumn, and in the spring 80 to 100 lbs. super-phosphate of lime and 80 to 100 lbs. Chili saltpetre. When the barn-yard manure is used alone, or when the commercial fertilizers just named only are used, the respective amounts may be doubled. Farm-yard manure should not be applied oftener than once in five years. When farm-yard manure is not to be had and nitrogen is wanted, it may be applied in the form of nitrate of soda, and in quantities varying from 100 to 150 pounds per acre. When potash is required it may be applied in the form of kainite, and at the rate of 200 to 400 lbs. per acre. The quantities will, of course, vary to suit the requirements of each particular case.

The cultivation is similar in many respects to that required for mangels. It is imperative that the ground be deeply ploughed in the autumn. Beets will not push their way down into a hard soil, and the portion grown above ground is comparatively useless. The sowing should be early, as soon indeed as the ground is in fine condition. There is difficulty in making the drills close enough with our ordinary ploughs and the cultivators now in use cannot get down deeply enough between the drills. It is probable that it will be found here, as in France, that the proper way will be to drill on the level, with a drill that will sow several rows at once and to cultivate with a two-horse cultivator that will also cultivate several rows at once. The cultivating had better commence soon after the rough leaf is well developed and the more frequently it can be done the better are the results likely to be. The thinning and first hand-hoeing should be done just after the first cultivating. The plants are to be left about 8 inches apart in the row. The last cultivating should be done by an implement made for the purpose, which draws the earth around the plants so that the exposed portion of the roots is covered. The lifting is done by an instrument made for the purpose, which is drawn by horses.

The largest roots that may be grown are usually lower in the percentage of sugar which they yield than smaller ones. The medium sized beet weighing from 1 to $1\frac{1}{2}$ or $1\frac{3}{4}$ pounds, which is regularly formed and tapering, usually gives the best results. When grown in rows wide apart and with wide distances in the row they attain too large a size to yield a high percentage of sugar. When thinned to the distance of eight inches in the row, when the rows are 18 inches apart, the yield would be $21\frac{1}{2}$ tons, providing the beets averaged 1 pound each. It is difficult, however, to grow a field without some blanks, which will reduce the yield proportionately.

The estimates for the cost of production per acre varied, but few of them, however, exceeded $35.00, and most of them were under this sum. They include the rental of land, and the cost of the proportion of the manure used by the crop. I incline to the opinion that this estimate is too low, where all the labor of men and teams is to be hired if the drawing to the factory is also included.

The Season and the Crops.

The early part of the season was unusually wet as has been already intimated. In the amount of the rainfall until about July 20th it is probably without precedent during recent years. A first result of this was the great difficulty in carrying on field

operations, a second was the submerging of the grain in some parts, but in this respect we did not suffer very much, a third was the tendency in the ground to impact when dry weather came at length, and a fourth was the difficulty in removing weeds from amongst the grain, owing to its constantly wet condition.

The adverse influences of the weather, however, told most severely on the filling of the grain. The growth of straw was most luxuriant, and almost up to the time of ripening the casual observer would have looked for an extraordinary yield. This remark applies to all kinds of grain grown upon the farm and in all the grain fields. The weather of the ripening period was warm, but not perhaps more than ordinarily so. But the straw was unusually succulent, and when the ripening stage was reached the straight upright lean look of the heads told its own tale before the binder was set to work at all.

There was some rust, more or less of it indeed on nearly all the grain, but not nearly so much as during the preceding year. And yet the shortage in the grain, except in the experimental plots, was much more acre per acre than during the previous year. By referring to the report of the farm foreman we find 12½ acres of barley in field No. 3 yielding 19½ bus. per acre. In field No. 7 the crop of oats from twenty acres was 17 bus. per acre, where 50 bus. per acre might justly have been looked for before the earing out period. In field No. 11 the yield of Egyptian oats was 16 bus. per acre, with straw sufficient for 70 bus., and the 13 acres of fall wheat, which by the straw indications should have yielded 25 bus. per acre gave an actual return of less than 7 bus. per acre. The straw was not lodged to any great extent, and this fact renders the poor yield all the more remarkable.

It is not pleasant to state these facts, but they are unfortunately too true and will go far to explain why large quantities of grain have to be purchased to keep the heavy stock going which it is necessary for educational and other reasons to keep upon the farm. It will also serve to show in one sense at least the difficulty which is encountered in so managing the farm that the balance sheet will be on the right side.

The hay and pea crops were all that could be desired. The potato crop suffered the most from the wet, and mainly from lack of under drainage. The rape crop and root crops were on the whole very good, although the mangels and turnips were both, comparatively speaking, small crops.

The exceedingly wet weather in the later autumn again retarded operations in the fields and on the roads most seriously, but notwithstanding when winter came the autumn work was well advanced.

The Experimental Work of 1890.

This work may be spoken of under two heads, viz., Field Experiments and Live Stock Experiments. These were conducted on a scale far in advance of anything hitherto attempted here, if we consider the character and extent of the work. The same difficulties were encountered this year again which have been emphasized in previous reports. These relate to sudden variations in soil and subsoil, low aspect of the land and rust, and these conditions have been further intensified during the last two years by undue moisture during the growing period.

We hope for better things, however, in future. During the past season field No. 18, northward from the grapery was fitted up for the reception of the grain plots. It is one of the most elevated fields upon the farm and one of the most uniform in the character of both soil and subsoil. We hope by this change to be able to keep rust influences somewhat at bay and to get better yields of grain. This field was manured in the early part of the season, and rape was then cultivated upon it to make it clean.

Field Experiments.

These experiments include the following :—

1. 54 varieties of barley including 69 plots; 54 varieties of spring wheat including 54 plots; 92 varieties of oats including 103 plots; 27 varieties of peas including 27 plots; and 53 varieties of fall wheat including 55 plots. Some of these varieties were failures as was to be expected, and are not reported upon. (For further particulars see pages 101 and 155).

2. The testing of oats, wheat and barley, sown at different dates to ascertain the extent of the advantages of early sowing. (See pages 101 and 154).

3. The testing of different quantities of seed in growing barley, to ascertain the relative merits of thick and thin sowing. For several reasons this experiment was not deemed sufficiently satisfactory to report upon this year.

4. The growing of 11 varieties of carrots, 29 varieties of mangels and 48 of turnips, to ascertain their relative value for feeding purposes, quantity and quality considered. (See pages 112 and 174).

5. The growing of some 28 varieties of potatoes, to determine their profitableness relatively. (See pages 112 and 173).

6. The growing of a large number of plots of rape which include several experiments. These relate to the advantages of thick and thin sowing, broadcasting or in drills and cultivation in drills or on the level. (See pages 113 and 178).

7. The growing of different varieties of millet, which were tested both with and without fertilisers. The objects sought were the determining of the relative value of the millets, and also of the fertilisers. The low location of the plots, which of necessity had to be chosen for this experiment, in connection with the wetness of the season, rendered the experiment of no practical value.

8. The growing of 12 plots of grasses which include as many varieties, and which have been laid down for eight years. The object is to test their permanency. (See page 181).

9. The growing of a number of plots of mixed grasses and clovers which were sown in 1883, 1884, 1886 and 1887 respectively, with the view also of testing their permanency. (See page 181).

10. The growing of several plots of various grasses of spring and fall seeding, to ascertain the relative advantage or disadvantage from sowing such grasses at these seasons respectively. (See page 182).

11. The growing of several plots of lucerne sown in various ways, as in drills and broadcast, to ascertain if cultivation will repay the labor and also to determine the proper quantities of seed to sow.

12. The growing of a number of plots of corn, both broadcast and in drills, with different quantities of seed, to ascertain the relative values of these respective modes of cultivation. (See page 185).

13. The conducting of tests with artificial fertilisers in growing oats and rape respectively. The object here was to ascertain the intrinsic value of these fertilisers, and in the case of the oats to ascertain their value as compared with barnyard manure. (See pages 184, 179).

14. The growing of an acre of sugar beets to ascertain the yield per acre, and the percentage of sugar that may be obtained from beets grown on soil similar to that of this farm. (See page 196).

15. The growing of tares to ascertain (*a*) the yield, (*b*) whether this crop can be grown with material advantage here, and (*c*) whether it can be so grown that the tares will not prove troublesome in the crops that come after. (See page 93).

16. The growing of a number of cereals in plots varying from $\frac{1}{8}$ of an acre to 5 acres. These include nearly fifty different varieties of grain. About 50 acres were devoted to grain experiments in plots of one acre and less, and fully one hundred acres of the crop grown was for experimental purposes. The objects in view were (*a*) to confirm the accuracy of the small tests with the more important kinds of grain, (*b*) to secure larger amounts of seeds from the more valuable sorts, and (*c*) to increase the revenue derived from the farm by devoting much of it to uses so important.

The labor arising from the extension of this work is very considerable, and in part accounts for the large outlay in conducting the work of the farm. The plots require first to be measured. Great care is necessary in sowing them. The separating borders require to be kept clean throughout the season. The labor of harvesting is tedious. The threshing which is done in the open air is also a labored work, as the machine requires to be thoroughly cleaned after each plot has been threshed. The same applies to the winnowing of the grain. (For further particulars see pp. 155).

The report of Mr. Zavitz on the plots of spring grains grown in the experimental department, commencing with page 152, furnishes a very complete summary of the work done in this line. The following bulletin, issued on the subject about the end of the year, brings out the points which are of most vital importance to the farmer :—

Bulletin LVIII.

Experiments with Spring Grains in 1890.

The tendency with every variety of grain that has ever been produced is to deteriorate when grown long upon the same kind of soil and in the same locality. The necessity, therefore, for the introduction of varieties from other countries or from distant parts of the same country, and of producing varieties which are entirely new, will always exist. In this fact we find a perpetual argument for the existence of experimental farms.

The object of this bulletin is to make known to our farmers (1) the varieties of spring grains which grew most successfully at this farm during the summer of 1890 ; and (2) important comparisons relating to all the varieties grown. These comparisons relate (1) to yield, weight of grain, weight of straw, and date of maturing in all the varieties mentioned ; (2) to color, and other peculiarities of growth, to the structure and weight of the grains, to the relative percentage of the hull, and to proneness to injury from rust in some of the varieties named ; (3) to the number of varieties tested from different countries and the average yields obtained from them, and (4) to six-rowed and two-rowed barleys respectively, with and without hulls.

The information thus given has been obtained from tests made with 54 varieties of barley, 54 varieties of spring wheat, 20 varieties of pease, and 92 varieties of oats. The different varieties of each kind of grain were grown under similar conditions as to soil and treatment. They were sown side by side upon plots containing one-fiftieth of an acre each in the case of the barleys, one-sixtieth of an acre in that of the pease, and one one-hundredth of an acre in that of the spring wheat and oats. In the tables given below the yields are based upon the standard weights obtained from the measured bushel, and from samples that were thoroughly cleaned.

Barley.—The information given in Table I. relates to the ten varieties of barley which gave the highest yields in 1889 and 1890. The average yield is given for the two years. The varieties grown in 1889 were sown April 15th, and those grown in 1890 April 19th.

TABLE I.

Name of variety.	Kind.	Country whence obtained.	Yield per acre.	Weight of grain per bushel.	Weight of straw per acre.	Number of grains per ounce.	Date of maturing.
			bush.	lbs.	tons.		
Cheyne	2-rowed	Germany	48.5	53½	2.18	670	6th August.
Chevalier	"	France	47.5	52⅝	1.13	726	7th "
Mandschurei	6-rowed	Russia	47.3	51¼	1.70	755	31st July.
Oderbrucher	"	Germany	45.8	54¼	1.42	743	1st August.
Empress	2-rowed	England	45.4	51¼	1.92	720	6th "
Early Black	6-rowed	France	44.8	51	1.61	591	31st July.
Scotch Improved	"	Ontario	44.4	52	1.27	805	31st "
Selected Chevalier	2-rowed	England	43.0	50½	1.75	758	7th August.
Common	6-rowed	Ontario	41.7	54½	1.29	819	31st July.
Golden Drop	2-rowed	Germany	41.4	53½	1.8	646	5th August.

In addition to these the following varieties went over 40 bushels per acre, viz.: Hallett's Pedigree (Germany), Italian Rice (Germany), and Imperial (France). Carter's Prize Prolific is not included in the above list as with us the average yield for the two years was 32.3 bushels per acre on the small plots, and the return this year for the acre plot was 31½ bushels, and the weight of the crop of 1890 was 52 pounds per bushel. It appears, however, to have done much better in many other localities.

SPRING WHEAT.—The information given in Table II. relates to seven varieties of spring wheat which gave the highest yields in 1890. They were sown April 25th.

TABLE II.

Name of variety.	Country whence obtained.	Yield per acre.	Weight of grain per bushel.	Weight of straw per acre.	Rust tendency.	Date of maturing.
		bush.	lbs.	tons.		
Herison Bearded	France	27.2	64	1.90	Very slight	8th August.
White Fyfe	Ontario	26.9	60	1.39	Considerable	14th "
Bart Trimenia	Greece	26.3	64	1.06	Very slight	10th "
White Russian	Ontario	22.1	57¼	1.91	Considerable	11th "
Red Fern	Ontario	21.9	60	1.76	Slight	11th "
Pringle's Champion	Germany	21.2	59½	1.90	Very slight	12th "
Holben's Improved	Germany	20.4	58½	1.70	Medium	14th "

The Herison Bearded has been tested for two years, and was last year ahead of all the foreign varieties, and also of all the Canadian varieties except the Wild Goose. It is a fairly strong grower, stands up well, and is almost entirely free from rust. The head is short but compact and is bearded; the chaff is red and the berry is rather small but plump, and is also red.

The Bart Trimenia, though a good yielder and weighs well, is rather coarse in the berry.

PEASE.—The information given in Table III. relates to five varieties of pease which gave the highest yields in 1890. They were sown April 24th.

TABLE III.

Name of variety.	Country whence obtained.	Yield per acre.	Weight per bushel.	Weight of straw per acre.	Date of maturing.
		bush.	lbs.	tons.	
Sweet Jessie	England	31.16	62½	0.82	11th August.
Early Race-horse	"	29.29	64½	1.06	10th "
Mummy	Ontario	28.60	65½	1.26	11th "
Early Britain	England	28.37	60	0.57	11th "
White Wonder	New Zealand	27.67	64¾	0.80	5th "

OATS.—The information given in Table IV. relates to the ten varieties of oats which gave the highest yields for 1889 and 1890. The average yields are given for the two years. They were sown on April 22nd of each year.

TABLE IV.

Name of variety.	Country whence obtained.	Yield per acre.	Weight of grain per bushel.	Yield of straw per acre.	Tendency to rust.	Character of head.	Color of grain.	Number of grains per gram.	Percentage of hull.	Date of maturing.
		bus.	lbs.	tons						
Joanette Black	France	71.7	34½	2.7	Slight	Spreading	Pale black.	51	27.0	9th July.
Houdan Black	"	69.1	34¾	2.0	Slight to medium.	"	"	66	28.9	9th "
Chenailles	"	69.1	34⅝	2.9	Slight	"	Black	55	26.0	8th "
Oderbrucher	Germany	66.6	31½	2.3	"	"	White	41	33.5	6th "
Danebrog	"	64.0	32	2.7	"	"	"	41½	30.0	9th "
Siberian	France	63.6	34¾	2.1	Medium to slight.	"	"	51	30.0	2nd "
Black Etampes	"	62.3	36½	2.5	Slight	"	Black	41	26.8	9th "
Probsteier	Germany	61.8	33	2.6	Slight to medium.	"	White	44	30.8	6th "
Pringle's Progress	Ontario	61.8	28½	2.7	Slight	"	"	39	35.0	4th "
Improved Besthorne	Germany	61.8	32¼	1.9	Considerable	"	Yellow	45	30.6	9th "

It will be observed that all but one of these best varieties are foreign, although 21 varieties of Canadian oats were grown, including nearly all the old standard varieties. The average yield of the ten varieties given in the table was 64.1 bushels per acre,

while the average yield of the ten poorest was 27.8 bushels, that is, the ten good varieties yielded 230 per cent. more than the ten poor ones. It is also worthy of note that these good varieties all possess the spreading head.

The Joanette Black, Houdan Black, Chenailles and Black Etampes are very much alike in all essential characteristics. The straw is strong and of medium height, or a little less. It stands exceptionally well, is not coarse, and is almost entirely free from rust. They are somewhat inclined to shell easily when ripe, as is often the case with valuable grains. They also yield well and weigh well, and have a small percentage of hull as compared with the kernel.

Average Yields of Barleys.

The average yields of barleys grown from seed obtained in the five countries named are as follows :—

Germany	17	varieties	Yield per acre,	35.6 bushels.
England	13	"	"	42.2 "
France	7	"	"	37.6 "
Ontario	4	"	"	38.2 "
Sweden	4	"	"	33.5 "

Average Yields of Oats.

The average yields of oats grown from seed obtained in the seven countries named are given below :—

Ontario	21	varieties	Yield per acre,	35.6 bushels.
France	19	"	"	47.8 "
Germany	15	"	"	48.0 "
Scotland	13	"	"	41.8 "
England	9	"	"	41.8 "
Russia	5	"	"	42.7 "
Australia	4	"	"	32.6 "

Two-rowed and Six-rowed Barley.

Table No. 5 gives information regarding the 54 varieties of barley grown with and without hulls as to yields, weight of grain per bushel, and the size of the grains.

Table V.

Character of head.	With or without hulls.	Number of varieties.	Average yield of grain per acre per bushel.	Average weight of grain per bushel.	Number of grains per ounce.
Six-rowed	With hulls	9	37.45	51.22	772.2
	Without hulls	5	31.00	61.80	848.2
Two-rowed	With hulls	39	37.84	51.87	685.1
	Without hulls	1	21.90	63.00	478.0

It should be borne in mind (1) that the average yields obtained in growing these grains is more than the average is likely to prove in the country generally, for they were all grown under very favorable conditions. (2) That similar weights are not likely to be realized unless the grains are thoroughly cleaned, and (3) that the facts in this bulletin will be valuable mainly in localities with soil and climatic conditions similar to those here. The soil where these plots were grown may be termed a mild clay loam, containing a considerable quantity of humus, and it is somewhat low in aspect. The average mean temperature for the past four years for the five months commencing with May 1st, has been 61°, 43′, F.

Conclusions.—The following conclusions may safely be drawn from the experiments which have been summarized as above:—

(1) It is highly probable that some of the foreign varieties of barley named in the table will be found to give higher yields than the varieties now grown in Ontario when they shall become more generally introduced.

(2) It is probable that in some localities the Herison bearded spring wheat will be found to be an improvement on many of the varieties that are now grown.

(3) From present indications based upon the trial given in the table and upon a trial on a larger scale upon the farm, the Mummy pea is likely to become a generally useful variety, although the straw is not highly valued for feeding purposes, owing to its coarse habit of growth.

(4) That four varieties of French oats, viz., the Joanette Black, the Houdan Black, the Chenailles and the Black Etampes are likely to prove of much value to the farmers of this province, as they possess in common and in a marked degree nearly all the most valuable characteristics of oats. Their color will, however, discount them in the estimation of the oatmeal millers. The behavior of the Oderbrucher, also a white variety from Germany, has been such as to entitle it to the favorable consideration of the farmers. It has been most favorably recommended by the oatmeal millers.

(5) Judging from the experience of the past two years, the English barleys give on the whole the best results, but some fair growing and yielding varieties come from Germany and France. In reference to oats, the French varieties should be placed first, all things considered, although some kinds from Germany do nearly as well.

(6) The average yields obtained from the two-rowed and six-rowed varieties of barley are not far different, nor is there much difference in the average weights of the two classes.

(7) The average returns from the foreign varieties are in a majority of instances superior to those from the old standard varieties.

Additional Notes Regarding Spring Cereal Grains.

Average Yields of Barleys.—A complete list of the average yield of barleys for 1890 and the countries which furnished them is given below:—

Germany	17	varieties	Yield per acre,	35.6	bushels
England	13	"	"	42.2	"
France	7	"	"	37.6	"
Ontario	4	"	"	38.2	"
Sweden	4	"	"	33.5	"
New Zealand	2	"	"	47.8	"
Russia	2	"	"	33.9	"
Scotland	2	"	"	29.1	"
Australia	1	"	"	8.9	"
Italy	1	"	"	38.8	"
Hungary	1	"	"	51.0	"

One of the New Zealand varieties gave a yield of 44.3 bushels per acre. It is the thirteenth in the order of yield. The weight per bushel was 54.62 lbs. It was one of the finest samples grown.

The Early Black, one of the ten best yielding varieties, was badly affected with smut during both years of its growth.

While the average yield per acre of the five best varieties of barley grown was 46.9 bushels per acre, that of the five poorest varieties was only 23.6 bushels.

Barleys Grown in Large Plots.—Amongst those were the common Ontario and Carter's Prize Prolific, which were grown in acre plots, and the yields from them, were as follows :—

Common Ontario, 39 bushels per acre.

Carter's Prize Prolific, 31½ bushels per acre. (See page 170.)

Average Yields of Oats.—This enumeration gives a complete summary of the varieties of oats grown from the different countries and the comparative yields obtained from them :—

Ontario	21	varieties	Yield per acre,	44.8	bushels.
France	19	"	"	47.8	"
Germany	15	"	"	48.0	"
Scotland	13	"	"	41.8	"
England	9	"	"	41.8	"
Russia	5	"	"	42.7	"
Australia	4	"	"	32.6	"
Sweden	1	"	"	39.0	"
Hungary	1	"	"	39.7	"
California	1	"	"	42.7	"

White and Black Oats Compared.—This table gives the particulars of comparison between the white and black oats grown in these experiments in the most important essentials :—

Color of grain.	No. of varieties.	Average period of maturing.	Rust tendency.	Percentage of hull.	No. of grains per gram.	Yield of straw per acre.	Average weight of grain.	Average yield per acre.
						tons.	lbs.	bus.
White	22	7th July.	2.32	35.32	39.06	2.30	34.92	48.25
Black	70	10th July.	2.26	34.70	51.38	2.60	31.66	45.59
Mean averages	92		2.28	35.06	49.59	2.37	34.14	43.82

The most marked difference is in the size of the grains, in which the white varieties have the advantage. In this table and the following the number 10 is used to denote the maximum of rust tendency.

Mane oats and the spreading varieties compared.—This table gives the particulars of comparison between the varieties of oats grown with the head on one side and those with the spreading head :

——	No. of varieties.	Agerage yield per acre.	Average weight per bush.	Rust tendency.
		bush.	lbs.	
Mane Oats	20	46.30	32.34	2.75
Spreading variety	72	43.02	34.66	2.16

The opinion is somewhat widespread that the Mane varities are the best yielders, and the results given in this table certainly tend to justify that idea, but it should be borne in mind that in the table containing the best ten yielding varieties, they all possess the spreading head. The Mane oats seem decidedly more prone to rust.

Oats grown upon large plots.—Thirteen varieties of oats were grown in plots varying from one-third of an acre in size to one acre. The highest yields were as follows :—

White Poland ..... 49.2 bushels per acre.
Black Etampes..... 47.1 " "
American Banner..... 45.4 " "

For full particulars see the report on page 171.

Barley sown at different dates.—This table gives the results from sowing barley in duplicate plots at three different periods :

Dates of sowing.	Average yield per acre.	Agerage weight per bushel.	Average weight of straw per acre.
	bush.	lbs.	Tons.
May 1	37.3	49.88	1.02
May 9	31.2	46.25	1.04
May 17	18.0	41.88	.77

Spring Wheat sown at different dates.—This table gives the results from sowing spring wheat at different periods :

Dates of sowing.	Yield per acre.	Weight per bushel.	Weight of straw per acre.
	bush.	lbs.	Tons.
May 1	10.65	57.4	1.35
May 9	6.26	56.5	1.15
May 17	5.04	56.0	1.04

Oats sown at different dates.—This table gives the results from sowing oats in duplicate plots at different periods :

Dates of sowing.	Average yield per acre.	Agerage weight per bushel.	Average weight of straw per acre.
	bush.	lbs.	Tons.
May 1	30.9	30.5	2.07
May 9	25.0	24.5	1.73
May 17	19.1	21.5	1.66

These experiments with sowing three varieties of grain at different periods emphasize the importance of sowing grain at the earliest possible moment in the spring after the ground becomes dry. It would have added much to the value of the experiments if the first sowing had been earlier, but the wet condition of the ground put aside for the purpose rendered this impossible.

WINTER WHEAT EXPERIMENTS.

These experiments, the full details of which are given on pages 164, 165 were summarized in the bulletin, given below, which appeared before the sowing of the winter wheat crop :—

Bulletin LIII.

Winter Wheat Experiments of 1890.

It is the natural tendency with all cereal grains to deteriorate when grown long in one locality without change, the full reasons for which have never yet been given to the world. Because of this the necessity arises for a change of seed, and ultimately for the introduction of new varieties. In selecting the most suitable of these for his locality the farmer frequently finds difficulty. This arises in part from the unreliable nature of the information not unfrequently given by those who introduce these new varieties, and in part from the absence of information that would enable the purchaser to compare the merits of these with those of standard varieties. With a view to give such information this bulletin—the first issued on growing winter wheats on this farm—has been prepared, and it is hoped that it will reach the farmers in time to serve the intended end.

From the information given in the subjoined table, the farmer who understands the nature of his soil can readily decide as to which of the kinds thus compared, are most likely to give satisfactory results when grown on his land. If his soil does not naturally produce a stiff straw, he can reject all varieties that are weak in this respect. If it requires strong growing varieties, he knows which possess these qualities; and if rust is practically unknown in his locality, as is sometimes the case, he need not of necessity reject those most inclined to rust, as they may possess other qualities of much value.

Fifty-two varieties in all have been tested on the farm during the present year, of which twenty-one are Canadian and thirty-one foreign. Of the foreign varieties, fifteen samples came from England, eight from France, five from Germany, one from Russia and one from Scotland. Some of these varieties stood the winter well, and possess much promise for the future. Full particulars will be given regarding them in the next annual report.

Of the eighteen Canadian varieties contained in the subjoined table, some are old standard sorts, grown with the object of rendering more valuable the comparisons of the new varieties. The tests were made on plots of one-hundredth of an acre each, in a soil which may be termed a clay loam, but somewhat sandy in its texture. It possessed a decided slope to the south-west, and was therefore fully exposed to the sweep of cold winds while the ground was bare so much of the time last winter.

The following is a list of the Canadian varieties, with the most important particulars regarding their growth and behavior :

Varieties.	Matured, July.	Chaff.	Rust tendency.	Strength of straw.	Color of grain.	Yield per acre.		Weight of grain.
						Straw.	Grain.	
						lbs.	Bush.	lbs.
Golden Drop	25	Ba.	2	M	G	4,675	32 1-2	61 1-5
Surprise	19	Ba.	1½	S	W	5,656	29 3-5	58 2-3
Manchester	23	Ba.	5	M	A	4,825	30 2-5	61
Bonnell or Landreth	25	Ba.	1	S	W	5,025	32 1-12	61
Seneca or Clawson	25	Ba.	1	S	W	3,475	25 2-5	59
Rogers	27	Ba.	2	S	A	5,475	34 3-5	60 3-4
Hybrid Mediterranean	21	Be.	3¼	W	A	4,708	32 1-12	60 1-6
Martin Amber	27	Ba.	2	S	A	4,050	32 1-2	62 1-2
Standard	24	Ba.	3	S	W	4,250	31 7-10	59 1-3
Red Velvet Chaff	23	Ba.	2	S	R	4,950	35 4-5	61
Lancaster	20	Be.	2	W	R	6,650	33 1-3	61 2-3
Early Red Clawson	22	Ba.	2	S	R	5,025	32 1-12	58
Volunteer	19	Be.	3	M	R	6,350	36 1-4	58 1-2
Golden Cross	20	Be.	3	S	R	5,125	27 9-10	58
New Monarch	27	Ba.	3	S	R	3,756	20	56 2-3
Red Lion	23	Be.	2	S	R	4,400	29 1-6	60
Democrat	28	Be.	4	S	A	4,350	20	56 1-2
Garfield or Natural Cross	28	Ba.	2	S	W	3,300	15 4-5	57

NOTE.—The first twelve varieties were sown on 10th September, Volunteer on the 12th, Golden Cross, New Monarch and Red Lion on the 19th, Democrat on the 27th and Garfield on October 7th. The late sowing of the two varieties last named was owing to an oversight in shipping on the part of the seedsman from whom they were ordered. In the third column "Ba" denotes bald chaff, and "Be" bearded chaff. In the fourth column "1" denotes freest from rust tendency. In the fifth column, strength of straw, "M" denotes medium, "S" strong and "W" weak. In the sixth column, color of grain, "A" denotes amber, "G" golden, "R" red and "W" white. In the eighth column the yield per acre is computed from the yield of the plot, and in the ninth column the weight of grain is per measured bushel.

In regard to the foregoing it will be observed :

1. That while none of the yields are so large as on some other soils, they are all fairly good. The largest yielders per acre are the Volunteer and the Red Velvet Chaff, and the heaviest yielders per measured bushel are the Martin Amber and the Lancaster.

2. That the varieties least susceptible to rust are the Bonnell or Landreth and the Seneca or Clawson, about equal, followed by the Surprise, while those most susceptible are the Manchester and Hybrid Mediterranean, of which the test was not a fair one owing to the late period of sowing it. These varieties both rusted badly in field plots, the former in 1889 and the latter in the present year.

3. That in the opinion of competent judges the best varieties for milling purposes are the Lancaster, Red Lion and Velvet Chaff among the red wheats, and the Bonnell or Landreth among the white. This feature is very important, as no variety unsuitable for grinding will retain its place long, whatever good qualities it may otherwise possess.

4. That the best varieties for this locality, taking into consideration yield, weight, strength of straw, freedom from rust and value for milling purposes, are perhaps the Red Velvet Chaff, Lancaster, Martin Amber and Volunteer, in the order named, and probably the best single sort is the Red Velvet Chaff. It is a rather new variety, grows strong and tall and stands well, has a long and uniform head, yields well and weighs well, but is considered a trifle soft. It should be remembered however that this wheat is not the same as another variety called Canadian Velvet Chaff, a white wheat and one not yet tested by us.

5. None of the newer varieties are so decidedly superior to the older ones as to render it certain that they will become decided favorites. The safe plan will be to test them by sowing one or two bushels, which, if they do well, will provide abundant seed for another year.

Of the thirty-one foreign varieties of winter wheat sown in the autumn of 1889, no less than twelve completely succumbed to the severity of the winter. There are therefore only nineteen varieties to report from. The table below gives the particulars regarding the four varieties of foreign winter which proved themselves superior :—

Name of variety.	Country whence obtained.	Yield per acre.	Weight of grain per bushel.	Weight of straw per acre	Tendency to rust.	Date of maturing.
		Bush.	lbs.	Tons.		
Galezien Summer.....	Germany ..	32.5	62⅔	2.05	Very slight....	25th July.
White Square Head	Germany ..	32.08	57½	2.22	Considerable...	30th "
Russian Odessa..	Russia... .	28.33	60⅔	2.05	Considerable...	30th "
Lamed Hybrid.....	France	26.25	59	1.79	Considerable...	30th "

The Galezien Summer stood up perfectly, and was almost entirely free from rust. The only other variety that could be pronounced ahead of it in this respect was the Rietti from France, which killed out considerably during the winter, but yielded notwithstanding 19.13 bushels to the acre. The Galezien Summer is a bald wheat with a white chaff and a medium sized kernel of excellent quality. The return was the most satisfactory obtained from any variety grown, Canadian or foreign, if yield and weight per bushel are considered.

The One-grained Spelz fall wheat could not be considered in striking averages, as the kernel was enclosed in a hull after threshing. It requires the use of special machinery to separate the grain from the hull. It appears to be very hardy and was this year entirely free from rust. As the yield was 47.33 bushels per acre, it is quite possible that it may be found useful in time to grow for feeding.

EXPERIMENTS WITH FIELD ROOTS, POTATOES AND RAPE.

A large number of varieties of field roots were grown in rows, in most instances three rows of each variety. These rows were alongside of each other and in the same range of fairly even soil in field No. 17. There were also grown in the same range a large number of varieties of potatoes and of these three rows were grown of each variety. In fields Nos. 3 and 14, a number of rape plots were grown and in various ways. A summary of the more important results of these experiments is given in the succeeding paragraphs, which relate to each respectively :—

Field Roots.—These comprised forty-eight varieties of turnips, twenty-nine of mangels and eleven of carrots. The ground was ploughed out of sod the previous year, and was liberally manured in the spring. The sod had been skimmed with a light ploughing just after harvest and this was followed by a deep ploughing later.

Turnips.—Of these sixteen of the varieties grown were white or yellow fleshed and thirty-two were of the Swedish sorts.

Of the white and yellow varieties, the following took the lead :—

Name of variety.	Yield per acre.	Average weight of each root.	Color of flesh.
1st. Red Globe Norfolk	26.52 tons or 884 bushels.	4.60 lbs.	White.
2nd. Red Top Strap Leaf	20.68 " 689⅓ "	6.88 "	White.
3rd. Mammoth White	20.15 " 671⅔ "	6.64 "	White.

Of the Swedish varieties, the best are given in the statement below :—

Name of variety.	Yield per acre.	Average weight of each root.
1st. Carter's Elephant Swede	20.98 tons or 699⅓ bushels.	2.26 lbs.
2nd. Fetticairn	20.91 " 697 "	2.54 "
3rd. Royal Norfolk	20.19 " 673 "	2.14 "
Skirving's Purple Top Swede	12.38 " 412⅔ "	1.81 "

It should be borne in mind that these three varieties are new, or not very long introduced. The seed of the Red Top Strap Leaf came up rather sparsely or it probably would have given the best yield. Carter's prize Elephant Swede was introduced into this country by the seed firm of old London after whom it is named. It is an oblong turnip, and holds its width well down. Skirving's Purple Top Swede is an old standard variety and was introduced here solely for purposes of comparison. The comparison shows the necessity of introducing new varieties from time to time. (See page 174.)

Mangels.—Of the 29 varieties of mangels grown, those which took the lead stand in the order named :—

Name of variety.	Yield per acre.	Average weight of each root.
1st. New Giant	14.62 tons or 487⅓ bushels.	2.00 lbs.
2nd. Yellow Intermediate	14.23 " 474⅓ "	2.44 "
3rd. Pearce's Clan Giant	14.04 " 468 "	1.75 "

The Yellow Intermediate is a tried variety, hence, judging by this test we have nothing much superior. (See page 176).

Carrots—Of the 11 varieties of carrots grown, the three best yielders are mentioned :—

Name of variety.	Color.	Yield per acre.	Average weight of root.	Average length of root.
1st. White Vosges or Giant Short.	White.	17.78 tons or 592⅔ bus.	.85 lbs.	10 inches.
2nd. Mitchel's Perfected	Deep Orange.	17.02 " 567⅓ "	.59 "	9⅓ "
3rd. White Belgian	White.	16.64 " 554⅔ "	.67 "	12½ "

The White Belgian is a standard variety, so that in this instance we have an excellent standard of comparison. The White Vosges took a decided lead last year. It is of large size, a clean grower, not too long, and, therefore, easily harvested. Mitchell's Perfected is a new Canadian variety, introduced by a gentleman of St. Mary's, and it is full of promise. (See page 176).

Potatoes.—The 28 varieties of potatoes grown, which are first in point of yield, in regard to mealiness, flavor, and mealiness and flavor combined, are given in the order named below :—

Name of variety.	Yield per acre.	Early or late.	Best as to mealiness.	Best as to flavor.	Best as to mealiness and flavor.
	bushels				
Thorburn	162	Early	Clark's No. 1	Beauty of Hebron.	Beauty of Hebron.
Empire State	162	"	Daisy	Convoy	Daisy.
Daisy	157½	"	Convoy	Daisy	Convoy.
Early Puritan	139½	"	Beauty of Hebron	Green Mountain.	Thorburn.
Clark's No. 1	139¼	"	Thorburn	Thorburn	
Summit	137	"			
Beauty of Hebron	99	"			
Late Rose	94½	Late.			

The Beauty of Hebron and Late Rose are mentioned for the purpose of comparing yields, both being tried and standard varieties. From the comparison we must conclude that for large yields in our soil the Thorburn and Empire State stand at the head, but it will be noticed they do not rank high for table uses. Taking them all in all the Beauty of Hebron, the Daisy, and the Convoy rank highest for table use in the order named. If yield and suitability for table use are considered, the Daisy should probably get the first place. The testing of the quality was done in a somewhat practical way. Twelve potatoes of each of the varieties named were given to three different heads of departments, who were to take notes of the qualities of the potatoes when boiled with their skins on and at the time of the meal. These findings were compared, with the result which has been stated. There was much agreement between the reports. (See page 173.)

Rape grown on four kinds of soil.—A most interesting and instructive experiment was carried on with growing rape on four different kinds of soil on plots that were made. These were loam, marl, clay and muck. The plots were in duplicate and on one only of each salt had been applied with the two previous crops at the time of sowing them, and at the rate of 400 pounds per acre each year. The crop of 1889 was oats and that of 1888, barley; no salt was applied with the rape. The rape plants were equally thinned to enable them to develop well and to equalize the conditions.

The table below gives the results:

Kind of soil.	With or without Salt.	Yield per acre.	Average yield per acre.
		Tons.	Tons.
Loam	Salt.	9.45	8.005
	No salt.	6.56	
Marl	Salt.	6.72	5.320
	No salt.	3.92	
Clay	Salt.	2.81	2.605
	No salt.	2.40	
Muck	Salt.	4.77	4.525
	No salt.	4.28	

The point brought out here in reference to salt is of much significance. The salt it will be remembered was applied during the previous years. The oats of the previous year and the barley preceding that, gave the best returns where the salt was applied, and this year the difference in the yield of rape on the same plot is marked. From this we draw the conclusions (1) That salt acts beneficially on a rape crop where applied plentifully the two years preceding the growing of the rape, and (2) that it does so in a marked degree. It is also apparent from this experiment that while loam is good for growing rape, clay is of no use practically for this purpose. The results from the humus or muck-soil are not of much consequence, owing to the injury which the plots received from the wet. (See p 178.)

Rape with Fertilizers.—In this experiment rape was grown in small plots, and the different fertilizers named in the table below were applied when the plants were about one-third grown. The estimated yield of the rape was made from averaging four different plots similarly treated. These plots comprised two rows each 66 feet long,

and all in the same range. They were 22 inches apart and between each plot fertilized one row was grown without any fertilizer. The table subjoined gives a summary of the results :

Name of fertilizer.	Quantity of fertilizer applied per acre.	Yield of rape per acre.
	lbs.	Tons.
Sodium nitrate	150	10.012
Dried blood and scrap	300	9.034
Salt	300	8.685
Superphosphate	300	8.111
Unleached wood ashes	750	8.111
No fertilizer		8.044

As was to be expected the quick action of the nitrate of soda produced the most marked results. Until we ascertain more definitely the approximate value of rape per ton, we cannot draw safe conclusions as to the real value of these fertilizers in growing rape.

Rape grown in Drills and on the Level.—This experiment resulted as it did last year in favor of level culture (see Report for 1889, p. 140). The return was

From the drills ..... 8,520 lbs.
From drills grown on the level ..... 10,095 "

There is an important problem yet to be solved for the farmer in the relative merits of growing roots and rape on the level or in drills. It is quite possible that it may yet turn out that the former method is preferable if we only had the machinery which would enable us to sow a number of drills at once and to cultivate as large a number. It would require to be drawn by two horses. Here is an unoccupied field for the inventor. (See p. 179).

Rape thinned and not thinned.—In this experiment the rape was sown in drills. Four pounds of seed was used to the acre. In the plots thinned the distance between the plants was 15 inches. The thinning was done when the plants were about one-third grown, which was, it may be, rather late. The late sowing of the rape, about the middle of July, probably tended to reduce the relative yield of the thinned plots. The yield was

From the unthinned plots ..... 27,376 lbs. per acre.
" thinned " ..... 5,505 "

These results should lead us to hesitate about using too small a quantity of seed. It may turn out as further investigation is made in this direction, that less than one pound of seed per acre as now recommended is too small an amount to sow.

LIVE STOCK EXPERIMENTS.

The experiments in live stock follow each other in a constant succession, and as frequently as room can be obtained for conducting them. While the field for live stock experiments is without limit, the facilities for conducting them with us are circumscribed, although we compare well in this respect with other institutions. While experiments in the field may only be circumscribed by the ambition of the parties controlling them and the amonnt of means and suitable land at their disposal, those with live stock are largely circumscribed by the amount of the building accommodation. Live stock experiments require relatively a large amount of room. Each animal or group of animals requires a separate apartment which must also be sufficiently commodious, otherwise the value of the experiment will be impaired. The farmers who say to us, as they not infrequently do, "Why don't you conduct this experiment or that" will please bear in mind what I have stated above. Give us the clay and the straw, and we will render unto you the full tale of bricks.

The following are the principal of the live stock experiments for the year:

1. The fattening of cattle on corn ensilage and meal; corn ensilage, hay and meal; and roots, hay and meal. The object sought was to ascertain the relative cost and suitability of these respective rations for fattening purposes. (See pages 156 and 226).

2. The fattening of lambs on rape, and subsequently on a winter ration of hay, grain and roots, to determine the value of this system of producing mutton. (See pages 118 and 189).

3. The feeding of pigs on ensilage and meal, roots and meal, and meal alone, to determine the suitability of these respective rations in producing pork, and also their relative cost. (See pages 120 and 190).

4. The feeding of pigs on a ration of peas and barley whole, on the same grains ground, and on a mixture of various kinds of meal, with the object of testing these rations intrinsically, and as pitted against each other in making pork. (See pages 122 and 192).

5. The feeding of pigs on meal alone, and meal with cut green food added in different proportions, to ascertain the proportion of green food that should be added to the meal. (See pages 125 and 193).

6. The feeding of cows in the stable on green food, to ascertain the average required to sustain a cow during the soiling season. (See pages 127 and 196).

7. The rearing of grade steers of the various breeds, embracing the Shorthorn, Hereford, Aberdeen-Poll, Galloway, Holstein, Devon, and native or scrub. The objects of this experiment include the following along with others: (1) To ascertain the comparative merits of these respective breeds for beef making purposes; (2) the relative gains at different periods of growth, and (3) the cost of production. (See pages 128 and 196).

FATTENING STEERS FOR EXPORT ON DIFFERENT RATIONS.

The opinion has hitherto extensively prevailed that beef cannot be made at a profit in winter in sections of the country where roots cannot be grown successfully. If this were true, it would then follow that this product could not be grown in large sections of this province. This experiment was undertaken with the object of ascertaining some mode of beef-making in the stall that would prove successful without the aid of roots, and if possible at no greater outlay. The results are given below in bulletin XLIX., issued May 28th, 1890.

Bulletin XLIX.—Corn Ensilage as a Food for Making Beef.

The idea that beefing animals cannot be fed at a profit has been pretty generally indulged in of late, owing to the relatively low prices obtained for some time past compared with those of former years. The experiment conducted at this institution last winter with the utmost care and precision, the details of which are given below, happily disproves the correctness of this idea.

Ten good Shorthorn grade steers, two and three years old, were purchased and brought to the farm, October 19th, 1889. The price paid for them was $500, which was a little extreme, owing to the difficulty of getting a uniform lot and for other reasons. They were sold 16th May following for shipment to Britain for $897.30, or an advance of $397.30, the price received being 5¾c. per pound live weight.

From the date of their arrival at the farm until the close of the year they did not much more than pay for the food fed them, because of the imperfect facilities for feeding, arising from the unfinished state of the new buildings.

Six of the ten, all three years past, were selected for a feeding contest which commenced 31st December, 1889, and closed 29th April, 1890, thus lasting 119 days. The primary object of the test was to ascertain the value of corn ensilage and meal for beef making as compared with (*a*) corn ensilage, hay and meal, and (*b*) roots, hay and meal he ration usually fed.

Feeding.—Group 1, comprising lots 1 and 2, were each fed an average of 79.4 lb. of ensilage per day and 12.7 lb. of meal. There was left uneaten of the ensilage 18 lb. per day of the coarser portions, but the whole amount fed was charged against the steers.

Group 2, comprising lots 3 and 4, were fed daily 41.6 lb. ensilage, 11.3 lb. hay and 12.7 lb. meal. There was left uneaten of the fodder 13½ lb. per day, which amount was also charged against the steers.

Group 3, comprising lots 5 and 6, were fed daily 14.3 lb. hay, 41.6 lb. roots and 12.7 lb. meal.

The meal consisted of equal parts by weight of pease, barley and oats, and was always mixed with the other food. The hay (clovery and not extra in quality) was cut and mixed with the other food, and the roots were pulped and mixed likewise. The food was fed in three feeds daily, and water was virtually given in the stall ; everything given except bedding and water was accurately weighed.

Charges for Food, Bedding and Labor.—The food given, except roots and ensilage, was charged at the average market values in Guelph, viz : Pease 55c., barley 40c., and oats 28c. per bushel, or an average of ⅞c. per lb. for the mixture ; hay $6.50 per ton, roots 8c. per bushel in the cellar, and ensilage $2.50 in the silo.

The bedding used was estimated at 15 lb. per head per day, and charged as worth $1.50 per ton in the barn.

The labor was estimated on the assumption that one attendant at $25 per month would feed and care for 40 head as ordinarily fed ; that $2.50 per week would pay for the additional outlay in assisting the said laborer in cutting, grinding and pulping the food, and that the *additional* help in preparing the food in this contest be charged at half this rate, on the ground that the ensilage was already prepared.

Estimated Value of the Manure.—The manure was estimated at 75 lb. per day per head, and valued at $1.50 per ton, as the standard value of manure made from ordinary stock is usually put at $1 per ton in the yard.

Increase in Weight and Daily Cost for Food.—The particulars are given in the following table:

Groups.		Weight at commencement.	Weight at close.	Total gain.	Average daily gain of each group.	Average cost of feed per day.
		lb.	lb.	lb.	lb.	cents.
1	1	1,515	1,762	247	1.85	21.02
	2	1,327	1,520	193		
2	3	1,469	1,691	222	1.857	20.74
	4	1,393	1,613	220		
3	5	1,477	1,696	219	1.697	21.40
	6	1,341	1,526	185		

Aggregate weight of the six steers at commencement of the contest	8,522 lb.
Estimated value at 4¼c. per lb. live weight	$362 18
Aggregate weight at close	9,808 lb.
Estimated value at 5 7-12c. per lb. and equivalent to 5¾c. the selling price when shrunk 15 days hence	$547 61
Increase in value in 119 days	185 43
Total cost of food	150 32
Increase in value over cost of food	35 11
Total estimated cost of attendance	18 00
Cost of bedding, 10,800 lb.	8 10
Value of manure, 27 tons	40 50
Value of manure over cost of attendance and bedding	14 40
Weight May 15th at 8 p.m.	10,149 lb.
Weight May 16th at 8 a.m., the steers lying out in yard over night	9,763 lb.
Average loss by shrinkage	64⅛ "

Financial Summary.—The financial results of the experiment stands thus:

Direct gain on food fed	$35 11
Indirect gain from the value of manure over the cost of bedding and attendance	14 40
Direct and indirect profit	$49 51
Or a profit on each animal of	8 25⅙

To this may be added in all fairness the profit from raising the food fed, whatever that might be, for this was estimated at market values.

Conclusions.—The above experiment certainly tends to establish the following important conclusions:

(1) That shipping steers can be fed at a fair profit with prices of grain as at present, when of good types, when they are purchased at reasonable rates and where there are suitable facilities for feeding.

(2) That corn ensilage and meal will fatten as effectively and as cheaply as a ration of roots, hay and meal and with a less expenditure of labor.

(3) That steers fasted twelve hours by simply turning them into a yard at night will shrink from 60 to 70 lb. each.

(4) That with food at present prices, such as that used above, steers weighing from 1,300 to 1,500 lb. can be made to gain on an average 1.801 lb. per day, and at an average cost of 21.053c. per day for the food fed.

(5) That the value of the animals for beefing purposes was increased by the fattening process an average of 1½ cents per pound from commencement to finish.

It will be observed that the ensilage left uneaten by the steers was not wasted but was given to other cattle not under the pressure of high feeding. (See p. 186).

FATTENING LAMBS.

The fattening of lambs or even of sheep has not hitherto received much attention from the Ontario farmer and is therefore not well understood by many. Our object in this and kindred experiments which are to follow, is to ascertain not only the practicability of autumn and winter feeding, viewed from the standpoint of profit, but also the cheapest method of accomplishing this end. Full details of this experiment are given in the bulletin subjoined, which was issued on June 9th, 1890 :—

Bulletin LI.—Fattening Lambs on Rape and Finishing them on a Winter Ration.

This experiment, so encouraging in its results, was commenced Oct. 10th, 1889, and concluded on February 10th, 1890, but the 22 ewe lambs of the lot were not delivered as sold until 14th March, nor the wether and ram lambs until 24th March. They were slaughtered in Guelph and shipped to Halifax.

The Lambs.—Forty-eight grade lambs were purchased from the farmers in the vicinity and were brought to the farm October 9th, 1889. They consisted of Leicester, Cotswold, Oxford Down and Shropshire Down grades, the majority being Cotswold and Oxford-Down grades of good types. They were weighed October 10th and were turned in on the rape to pasture the same day. They remained there until December 3rd, when owing to a snow storm they were brought in to the sheep sheds and were again weighed on December 10th, two months after the commencement of the experiment. While on the rape they were fed in troughs one-half pound each of oats daily and were given salt at will, but they were not given any water.

The Rape.—The portion of the rape field pastured by the lambs comprised eight acres. The rape was sown in drills on July 10th, about ten days later than was intended owing to the wet weather of that time. The field was an outlying one, which was very badly in need of cleaning. The hilly portions which were dry and gravelly had received a light but insufficient coat of barnyard manure. The crop of rape was fair in the valleys but light on the hills. The eight acres, however, would have well sustained 70 to 80 lambs during the period of pasturing, as much of it was still uneaten when the lambs were removed.

Results from Feeding on the Rape.

Aggregate weight of 48 lambs at the commencement of the experiment, October 10th	4,612 lb.
Aggregate weight December 10th, a period of 62 days, of which the last 7 days were spent in the sheds	5,476 "

Aggregate gain	864 lb.
Average weight at commencement	96 "
Average weight at close	114 "
Average gain in 62 days	18 "
Average gain per month	9 "
Average gain per lamb per day	.29 "

Price paid for 48 lambs, October 9th, the date of purchase	$184 70
Average price paid per head	3.84 4/5
Price paid per pound live weight	.04
Estimated value of 48 lambs, December 10th	273.80
Estimated average value	5.70 5/12
Estimated value per pound live weight*	.05
Aggregate increase in value in 62 days	89.10
Average increase in value	1.85 5/8

Feeding Rations in the Sheds.—From December 10th, 1889, to the close of the experiment, February 10th, 1890, the lambs were fed the following daily rations: Grain, consisting of whole oats only, 1.057 lb.; turnips, sliced, 5.107 lb.; clover hay, of rather poor quality, what they would eat.

*This estimated value per pound on December 10 is fixed upon as five cents, as that price could have been obtained for the lambs delivered in Guelph at that date.

RESULTS FROM FEEDING IN SHEDS.

Aggregate weight of 48 lambs, December 10	5,476 lb.
Aggregate weight of 47 lambs (one having died), February 10	6,020 "
Aggregate increase in 59 days	544 "
Average weight per head, December 10	114 "
Average weight per head, February 10	128 "
Average increase per head in 59 days	14 "
Average increase per head per day	.237 lb.

The whole lot were separated into two and sometimes more than two divisions as occasion required, and were allowed to run in small yards at will except in times of storm. One lamb which weighed 140 lb. died one night in January from the effects of getting on its back. The inferior quality of the hay was caused by coarseness and some damage from stacking. It is to be regretted that owing to lack of facilities the hay was not weighed, as we are thus prevented from getting exactly at the cost of the winter ration, but we feel justified in concluding from the data which we have, that the increase in value during the term of feeding in sheds, including the value of the manure, exceeded the cost of the food, bedding and attendance. They had access to water all the time.

Summary.—Following is a summary of the experiment from beginning to close:

Average weight of 48 lambs at time of purchase, October 10	96 lb.
Average weight of 47 lambs delivered 14th and 24th March respectively, after a fast of twelve hours	137 "
Average increase in weight from October 10	41 "
Aggregate weight of 47 lambs when sold after fasting twelve hours	6,440 "
Price paid for 48 lambs October 9, at 4.005c. per lb. live weight	$184 70
Price received for 47 lambs on the dates already given at $5\frac{3}{4}$c. per lb. live weight	370 30
Increase in value	$185 60

Average price paid per head October 9	3.84 4/5
Average price received per head when sold	7.71 2/5
Average increase per lamb	3.86 2/5
Increase per lb. live weight	.01$\frac{3}{4}$

The 22 ewe lambs delivered March 14th weighed on an average 129 lb., and the 25 wether and ram lambs 144 lb. It will also be observed that the lambs were sold for more than *twice* the sum paid for them and that the loss of one lamb lessens the return by about $8.50.

Conclusions.—The following conclusions may be drawn from the above experiment :

(1) That good grade lambs may be made to gain 9 lb. per month when pasturing on rape with a supplement of ½ lb. oats per day.

(2) That the same class of lambs may be made to gain 7 lb. per month on a winter ration of clover hay, and say 1 lb. oats and 5 lb. roots per day.

(3) That lambs pastured on rape for two months, with a supplement of ½ lb. oats per day, may be made to increase in value about $2 per head.

(4) That good lambs judiciously purchased at the ordinary selling rates in autumn, and treated as described in this experiment, may be made to increase in value more than the sum paid for them in say 5⅓ months time and on the condition that the buying and selling prices are relatively the same as in this experiment.

(5) That lambs thus purchased and fed may be made to increase in value 1¾c. per lb. live weight.

Note.—Ontario has extensive areas very suitable for growing rape. Would it not be well if the farmers would greatly increase the acreage of this crop and thus adopt an easy mode of manuring their land, an effective way of cleaning it, and a profitable way of disposing of their lambs?

THE RELATIVE VALUES OF CORN ENSILAGE AND FIELD ROOTS FOR PRODUCING PORK.

Corn ensilage has been clearly shown to be of great value in milk production. Its value for making beef is also becoming recognised. There is not so much known regarding its value in pork production. This experiment was undertaken in the hope that more knowledge of this nature would be forthcoming. The bulletin issued on the subject appeared 1st October, 1890. It is given below :

Bulletin LIV.—Corn Ensilage and Roots as Food Factors in Swine Feeding.

This experiment was commenced on January 10th, 1889, and terminated on March 28th, thus covering a period of 77 days. Its primary object was to ascertain the value of corn ensilage and roots, both essentially and relatively, when used as food adjuncts in feeding swine in the winter season. Several other facts of great interest and much value to the farmer were, however, brought out in the experiment, such as the large profits from the judicious feeding of swine, the rate of the daily increase in weight which results from such feeding, and the extent of the mistake in keeping them simply on a maintenance diet.

The Animals Selected.—The animals chosen for the experiment were grade Berkshires, bred upon the farm from a pure sire, and out of three different dams from the same litter. They were divided into three groups. Each group contained three animals, two barrows and one sow. The individuals of each group were from different dams, and one of each of the three was in every instance from the same dam. They were all in good store condition. The conditions therefore at the outset were very similar.

Period of Preparation.—Two weeks prior to the commencement of the experiment each group was put in a separate pen 6 ft. by 10 ft. (all the room available), after having been carefully weighed. They were at once put upon the food ration which was to be given them throughout the experiment. At the commencement of this period the pigs in group 1 fed on meal, weighed 618½ lb. ; those in group 2 fed on roots and meal, weighed

583½ lb. ; and those in group 3 fed on ensilage and meal, weighed 602½ lb. During this preparatory period the pigs in group 1 gained 37 lb., those in group 2 gained 12 lb., and those in group 3 lost 12 lb., as they did not take kindly to the ensilage.

Food and Feeding.—The pigs in group 1 were fed 18 lb. of meal per day for a time. Toward the close of the experiment this was increased to 19½ lb., which however proved a larger quantity than they would eat clean and so cloyed their appetites that the quantity had to be reduced to 12 lb. per day. The average amount fed per day throughout the experiment was 16½ lb. This meal ration consisted of ground oats, ground barley, ground pease and wheat middlings in the proportions by weight of 1, 1, 2 and 1 respectively. Those in group 2 were fed all the sliced turnips they would eat clean, which was 60 lb. per day on an average. They took rather more toward the close of the experiment than at the outset. To the roots was added a meal ration similar in kind to that given to the pigs in the first group, but only one-third of the amount. It averaged therefore 5½ lb. per day, and when fed it was sprinkled upon the sliced turnips. The pigs in group 3 were fed daily 35 lb. of ensiiage on an average. The meal fed was similar in quantity and kind to that fed to the pigs in group 2, and was likewise sprinkled upon the ensilage. When feeding the ensilage was masticated by the pigs, but a large proportion of it was not swallowed by them. It had been cut in 1½ inch lengths, which is manifestly too coarse for feeding swine. The food was given in three feeds per day and all the water was supplied that the pigs would take. Those fed on roots took but a small quantity ; those fed on ensilage required more. The water given to the pigs in group 1 was poured on the meal when it was put in the trough.

Value of the Food.—Estimating oats to be worth 28 cents per bushel, barley 40 cents, pease 55 cents and wheat middlings $15 per ton, the average value of the meal ration per pound was seven-eighths of a cent. The roots were valued at 8 cents per bushel and the ensilage at $2.50 per ton.

The following table gives the relative increase in weight and the cost of food during the experiment for each group :—

		1	2	3
Weight at commencement	lb.	655½	595½	590½
Weight at close	lb.	926	735	671
Total gain	lb.	270½	139½	80½
Average daily gain of one animal in each group	lb.	1.170	.604	.348
Cost of feeding for 77 days	$	11.11	9.87	7.07
Cost of food for one animal per day	cts.	4.81	4.27	3.06

The next table gives the relative values at the beginning and at the close of the experiment, and the net gain or loss :

		1	2	3
Value at commencement of the experiment	$	29 50	26 80	26 57
Value at close of the experiment	$	48 61	36 75	31 87
Advance in value	$	19 11	9 95	5 30
Net gain or loss	$	8.00 gain.	.08 gain.	1.77 oss.

The pigs were all valued at 4½ cents per pound live weight at the beginning of the experiment, as this was the price given for such pigs at the time in the Guelph market. At its close those in group 1 were sold at 5¼ cents per pound live weight, those in group 2 were valued at 5 cents per pound, and those in group 3 at 4¾ cents per pound. It may be well to note here that the direct profit on the original investment arising from feeding the pigs in group 1 for 77 days was no less than 27.11 per cent. on the investment, while the direct profiton fattening the steers referred to in Bulletin xlix. was only 9.69 per cent. on the investment in 119 days. The value of the manure made in feeding the pigs would considerably more than pay the cost of the labor. The pigs in groups 2 and 3 were fed for 41 days after the close of the experiment. They were given the same meal ration as before, and each group took on an average 22 lb. per day. They were sold at 5¼ cents per pound live weight on May 9th. During this period the pigs in group 2 increased in weight at the rate of 1.58 lb. each per day, and those in group 3 at the rate of 1.95 lb. each. Those in group 2 were ripe sooner than those in group 3, and this may account for the less rapid gain per day of the former. The total profit on the pigs in group 1 for 77 days was $8.00, that on those in group 2 in 118 days was $4.19, and that on the pigs in group 3 for 118 days was $6.28. In the first instance the whole percentage of profit on the original investment was 27.11 per cent., in the second 15.63 per cent. and in the third 23.63 per cent.

Conclusions.—The following conclusions may be fairly drawn from the above experiment:—

1. That it pays the farmer handsomely to fatten store pigs in winter on a meal ration such as that used in this experiment, when the prices of food and pork bear the same relation to each other.

2. That it does not pay the farmer sufficiently well for the trouble to feed store pigs on a ration of roots in winter when the meal ration used is a small percentage of the whole ration.

3. That when store pigs are fed in winter on corn ensilage and a meal ration, which is but a small percentage of the whole ration, they are fed at a loss.

4. That it will pay better to use a meal ration in winter that will ripen store pigs for market in 77 days, than to first use a ration which tends mainly to develop bone and muscle during that period, followed by a meal ration that will ripen them for market in 41 days.

5. That in fattening pigs it is a serious mistake to attempt to hasten the process by giving any more food than will be eaten clean when it is given.

MAKING PORK FROM GRAINS GROUND AND UNGROUND.

It is a common practice with farmers to feed grain whole in the winter season to store swine, simply because it is the most convenient mode of feeding. This experiment was undertaken to ascertain the extent of the loss arising from this mode of feeding. The subjoined bulletin, issued on December 2nd, gives the more important particulars relating to the experiment and the lessons to be learned therefrom:

Bulletin LV.—Feeding Swine on Grain and Meal.

This experiment began on January 17, 1889, and closed on May 31, covering a period of 134 days. The primary object of the experiment was to ascertain the extent of the advantage arising from feeding swine on a suitable ration of various kinds of meal, mixed, as compared with a grain ration of pease and barley, ground and unground; or, in other words, to demonstrate to the farmers that swine should not be confined to a ration of unground grain in winter, as they oftentimes are, simply because this mode of feeding them may be convenient.

The Animals Selected.—The animals selected for the experiment were Berkshire grades and pure Berkshires, bred upon the farm. They were by a pure Berkshire sire, out of a grade Berkshire dam in the one case and a pure bred Berkshire dam in the other. They were divided into three groups, each group comprising four animals. Three of the four in each group were grades and from the same dam; two of the three were barrows and the third a sow; the fourth animal in each case was a pure Berkshire sow. The grades were farrowed October 4, 1889, and the pure breds September 13.

Period of Preparation.—From December 12, 1889, until January 10, 1890, they were all fed a similar ration of meal and refuse from the college. On January 10, they were divided into three groups, and each group was placed in a separate pen and put upon the ration fed to it during the experiment proper, which commenced on January 17.

Food and Feeding.—The pigs in group 1 were fed pease, barley and oats ground and wheat middlings in the proportions of 2, 1, 1 and 1 parts respectively. Those in group 2 were fed equal parts by weight of ground pease and barley, and those in group 3 were given a similar ration but unground. They were fed three times a day and in quantity all they would eat clean. To the pigs in groups 1 and 2 the water was given along with the meal, and for those in group 3 it was put into a separate trough. They were allowed to run out at will once or twice a week in mild afternoons during cold weather, and more frequently in warm weather.

Estimated Value of the Food.—The food was estimated at the current market values in Guelph, viz.: Pease 55 cents per bushel, barley 40 cents, oats 28 cents and wheat middlings $15 per ton. The average value therefore of the ration fed to the pigs in group 1 was 95c., to those in group 2, 96c. and to those in group 3, 88c. per 100 lb. An allowance of 8 cents per 100 lb. is included in this estimate for grinding the food.

Food Eaten.—The following table gives the food consumed per average animal in each group, (1) throughout the experiment, (2) for the first 28 days thereof and (3) for the last 15 days:

	1	2	3
	lb	lb	lb
Throughout the experiment	3.07	2.70	2.36
For the first 28 days	2.02	1.87	2.72
For the last 15 days	4.07	2.72	3.32

Increase in Weight.—The next table gives the average weight of the pigs in each group at the commencement of the experiment and at its close, and also the average increase in weight:

	1	2	3
	lb	lb	lb
Weight at commencement	57.75	52.33	56.12
Weight at close	166.62	133.66	130.00
Increase in weight	108.87	81.33	73.88

Increase in Value.—This table gives the average value of the pigs in each group at the commencement of the experiment and at its close, the average cost of the food fed to each animal, the average increase in value, and the average gain per cent. :

	1	2	3
	$	$	$
Value at commencement	3.47	3.14	3.37
Cost of food	3.93	2.92	2.79
Value at close	8.75	6.55	6.37
Increase in value	1.35	.49	.21
Gain per cent. on the original investment	38.9	15.6	6.20

The pigs were valued at 6 cents per pound live weight at the commencement of the experiment, which is probably what could have been obtained for them at the time for feeding purposes as they were young. Those in group 1 were sold at the close of the experiment for 5¼c. per pound live weight, and those in groups 2 and 3 were valued at the same time at 4.9c. per pound, as they were not in condition for selling. The value of the manure in this experiment would exceed the cost of the litter and labor.

Additional Particulars.—The pigs in groups 2 and 3 did not look well throughout the experiment. They were dry in the hair and skin, and there was a lack of plumpness about them.

One of the pigs in group 2 became so rheumatic 43 days before the close of the experiment that it had to be removed to another pen and put upon another diet. During the 43 days it gained but 11 pounds. Two of the pigs in group 3 also became stiffened in their limbs. The recovery of these rheumatic animals was very slow and imperfect.

Seven of the pigs in groups 2 and 3 were fed fairly well on a suitable ration until September 11, when they were sold at 5 cents per pound live weight. Their average live weight when sold was only 170 lb., or about 9 lb. more than the average weight of the pigs in group 1 at the close of the experiment more than three months earlier.

The average gain of each of the thoroughbred animals during the experiment was 94.66 lb., while the average gain of each of the grades was but 86.37 lb. or 8.29 lb. less.

While the average daily food consumed by each of the twelve animals during the first half of the experiment was 2.06 lb., and during the last half 3.02 lb., the average daily gain during these respective periods was .72 lb. and .60 lb. ; that is to say, the daily gains were greater during the first half of the experiment although the food consumed was much less.

Conclusions.—The following are the more important of the conclusions from the experiment :

1. That it will pay the farmer well to feed swine of the age indicated in this bulletin, and at the season of the year corresponding, on a ration similar to that fed to the pigs in group 1, the prices of feed and pork bearing the same relations, as the gain in this instance was 38.9 per cent. on the original investment in 134 days.

2. That feeding swine for 134 days on a mixed meal ration similar to that given to the pigs in group 1 is more than twice as profitable as feeding them on a ration of equal parts of ground meal and barley, and more than six times as profitable as feeding them on a ration of equal parts of the same two grains unground.

3. That in feeding swine a mixed meal ration comprising several kinds of grain properly blended is far superior to one composed of but two varieties of the same, even though these two may form important ingredients of the more comprehensive ration.

4. That in feeding swine of the age indicated a mixed meal ration that is well balanced will prepare them for market in a far shorter period than one of either ground or unground grains not so balanced.

5. That in feeding swine the respective rations given to the pigs in groups 2 and 3 give results that are far from satisfactory. In both instances one or more of the pigs became affected with rheumatism, in neither case were they ready for the market at the close of the experiment, and in the after feeding the increase in weight was slow. It is indeed probable that they were fed at a loss when the whole results are considered.

6. That in feeding swine when they become rheumatic through feeding a ration too concentrated and stimulating, it will not pay to keep them longer, owing to the slow gains which they make during the period of recovery.

7. That feeding pure bred swine is more profitable than feeding grades, yet too much should not be made of this owing to a little difference in the respective ages.

8. That in feeding swine the cost of producing pork increases with the age of the animal.

FEEDING SWINE ON MEAL AND GREEN FODDER.

The opinion that swine do much better in summer on a ration of grass and meal than on a ration of meal only is almost universal. While this is probably true in the main, it is quite possible that during recent years too much stress has been laid on the importance of pasture in pork production. This experiment was undertaken in the hope of gathering information in regard to the relative values of a meal ration only as compared with a meal and green fodder ration intermixed in producing pork. The bulletin which is given below, and which has recently been issued, gives all the principal details

Bulletin LIX.—Green Fodder as a Food Factor in Feeding Swine.

This experiment began on June 7th, 1890, and closed October 8th, covering a period of 123 days. The after experiment growing out of it lasted 40 days. Its primary object was to ascertain whether green fodder used as a food adjunct in summer, along with a suitable meal ration, effected a saving in the cost of producing pork, and if so to what extent. A second object was to ascertain whether a large or a small quantity of the green food used in this way furnished the cheaper ration. A third object was to test the correctness of the theory advanced by some scientists which claims that some bulky food mixed with a meal ration in feeding swine secures a more thorough digestion of the meal, since it prevents impaction of the same in the stomach.

The Animals Selected.—The animals selected for the experiment were pure Berkshires and Berkshire grades, all bred upon the farm. There was one of the former in each group. The grades were by a pure Berkshire sire and out of a high grade Berkshire dam, and the pure breds were by the same sire. They were divided into three groups, each group comprised three animals, two of which were barrows and one a sow. The individual animals in each group were from different litters and one animal in each group was in every instance from the same litter. These litters were farrowed at the respective dates, September 11th, 1889, November 25th and December 1st, the pure breds being the oldest. They were all in good store condition at the commencement of the experiment

Period of Preparation.—For one week before the experiment commenced the pig. in the different groups were put upon the ration fed during the experiment. Before thas time they had been fed very similarly on meal and refuse from the college. t

Food and Feeding.—The pigs in group No. 1 were fed all the meal they would take without waste. Those in group No. 2 were fed about three-fourths as much meal as the pigs in group 1, and also a quantity of green fodder. The pigs in group 3 were fed about one-third as much meal as those in group 2. The aim was to make the quantities of meal used in these two instances exactly two-thirds and one-third respectively of the amount fed to the pigs in group 1, but slight variations were caused by the consumption of the latter of quantities of meal not always the same from day to day, when definite changes were made in the quantities of food fed they were always made at the weighing periods, which were every two weeks. The meal ration consisted of ground pease 2 parts, ground barley 1 part, ground oats 1 part and wheat middlings 1 part. These proportions

were by weight. The green food consisted of clover, oats and vetches, and corn and millet as these came in season. It was cut into lengths of about one-half inch by running it through a cutting box, and when fed the meal was mixed with it. Water was always given along with the food.

Estimated Value of the Food.—The food was estimated at the current market values in Guelph, viz.: Pease 55 cents, oats 35 cents and wheat middlings $15 per ton. Eight cents per 100 lbs. were allowed for grinding the meal. The price of the meal mixture used was, therefore, one cent per pound. The green food was charged at $2 per ton.

Food Eaten.—The following table gives the food consumed (1) by each individual animal daily on an average throughout the experiment and (2) the whole amount consumed by the pigs in each group:

——	1	2	3
	lb	lb	lb
By each animal	4½ meal.	3.09 meal. 1.85 green fodder.	1.39 meal. 3.77 green fodder.
By each group	1,520 meal.	1,140 meal. 628 green fodder.	514 meal. 1,392 green fodder.

Increase in Weight.—This table gives the average weight of the pigs in each group (1) at the commencement of the experiment, (2) at its close, the average individual increase in weight and the average individual daily increase:

——	1	2	3
	lb	lb	lb
Weight at commencement	151.0	147.3	147.3
Weight at close	248.3	221.3	167.0
Average increase	97.3	74.0	19.7
Average daily increase	79.0	60.0	16 0

Values.—This table gives (1) the average value of one animal in each group at the commencement of the experiment, (2) the cost of food for one average animal throughout the experiment, (3) the average value of one animal in each group at the close of the experiment, (4) the average individual gain or loss and (5) the average individual gain or loss per cent., (*a*) on value of animals at commencement of the experiment, and (*b*) on value of animals at commencement of the experiment with market value of food included.

——	1	2	3
	$	$	$
Value at commencement	6 79	6 63	6 63
Cost of food	5 07	4 03	2 18
Value at close	12 17	10 84	7 10
Gain or loss	.31 gain.	.18 gain.	1.71 loss.
Gain or loss per cent. on animals	4·56 gain.	2 71 gain.	27.00 loss.
Gain or loss per cent. on animals and food	2.61 gain.	1.69 gain.	19.41 loss.

The pigs were all valued at 4½ cents per pound live weight at the commencement of the experiment, as prime animals brought 5¼ cents per pound at that time. At its close the pigs in groups 1 and 2 were valued at 4 9-10 cents per pound, which was the market value, and those in group 3 were valued at 4¼ cents. As to condition, the animals in group 1 were fat, those in group 2 prime, while those in group 3 were not improved in condition. It will also be observed that the market values had fallen in the meantime. The manure is supposed to form more than an offset to the cost of the labour.

After Experiment.—At the close of the experiment proper on October 8th, a second experiment was commenced to ascertain the probable effects of feeding green food upon pork making during the subsequent fattening period. During this experiment the pigs were all fed upon a ration similar in kind to that fed to the pigs in group No. 1 during the first experiment. This after experiment continued 40 days. At its close on November 17th the pigs were all sold at 4 1-10 cents per pound live weight. The detailed results would unduly enlarge this bulletin. It may be mentioned, however, that though there was a slight relative increase in the rate of gain with the pigs in groups 2 and 3 as compared with those in group 1, it was not at all marked. The prices for prime pork had, in the meantime, fallen from 4½ to 4 1-10 cents per pound, so that the pigs during this period were fed at an actual loss.

Conclusions.—The following are the most important of these :—

1. That while (1) pigs fed for 123 days on a suitable meal ration and housed in summer increase in weight at a rate of 64 per cent., (2) pigs fed on two-thirds the quantity of the same meal ration, the balance of the food being made up of green fodder cut and mixed with the meal, increase at a rate of 50 per cent., and (3) pigs fed on one-third the quantity of the same meal ration, the balance of the food being made up of green fodder cut and mixed with the meal, increase at a rate of only 13.37 per cent., the labor of feeding being also relatively greater where green fodder is given.

2. That when the prices of food and pork are the same, as in this experiment, the gain from feeding pigs, as in group 1, for 123 days in summer will be but 4.56 per cent. on the first cost, as in group 2 but 2.71 per cent., and when fed as in group 3 the loss will be 27 per cent.

3. That in pork making the questions of market values and of the best season to market are of great practical importance.

4. Farmers should study to avoid marketing their pork in the months of October and November, when prices are usually lower than at any other season of the year.

5. That a ration of which the major portion consists of green food, as in the case of that fed to the pigs in group 3, will fail to bring them into a marketable condition.

6. That of the rations given to the pigs in the three groups in this experiment the meal ration fed to those in group 1 has proved in every way the most satisfactory hence,

7. If feeding a bulky fodder along with meal to pigs is any aid to digestion, it must be given in a less proportion than that used in feeding the pigs in group 2 in this experiment.

The Feeding of Cows in the Stable on Green Food.—The object of this experiment was to ascertain the acreage of ground required to sustain one cow during the ordinary season of pasturage, when the food is given to the cow in the stable. Two cows were thus fed from June 10th to September 26th, a period of 108 days. The food was cut from the fields adjoining the stables and consisted of permanent grasses, red clover, lucerne, pease and oats, each being cut in its season. The acreage required to feed two cows for 108 days was 1.559 acres, or for one cow .779 acres. To feed one cow for 165 days, or 5½ months, the average term of pasturage would, therefore, require 1.190 acres. This fact is full of significance, as three acres of pasture are usually allowed for this purpose.

Rearing Grade Steers of Different Breeds.—This experiment was commenced during the winter of 1889-90. Grade calves by pure bred sires and out of common dams were secured of the following breeds :—

	Date of Birth.
Galloway	November 3rd, 1889.
Shorthorn	December 28th, 1889.
Aberdeen Angus Poll	January 1st, 1890.
Hereford	January 5th, 1890.
Devon	January 8th, 1890.
Holstein	February 17th, 1890.
Shorthorn	April 1st, 1890. (Fed on skim milk.)
Native or Scrub	April 16th, 1890.

The Shorthorn grade reared on skim milk was bred on the farm. The others were secured by purchase wherever they could be obtained of a suitable character. The dams, except in the case of the native, were good common cows, possessed of a good share (more or less) of Shorthorn blood. The sires in every instance were registered, except in the case of the native. The calves are all males. Those purchased reached the farm when but a few days old, except in the case of the Galloway, which was 53 days old when it arrived. It was donated to the farm by the breeder, W. Keough, Esq., Owen Sound. Up to the period of its arrival it had been raised upon the dam, and in the transition period, during which it was being taught to drink from the pail, it failed considerably in flesh. This so far detracts from the value of the experiment, but no other grade Galloway calf could be secured at the time.

They were all reared by the pail and were fed on whole milk until six months old. To this diet was added a ration made up of cut hay, timothy and clover, meal consisting of peas, oats and small wheat ground and bran in equal quantities, and green fodder, consisting of clover, peas and oats, when these were in season. After a time oil-cake was added. All the food given to them was carefully weighed and they also were weighed monthly. They were confined in loose box stalls until about six months old. They were then kept tied in double stalls and were allowed to exercise a short time daily in the yard.

It is proposed to keep them until they are two and a half years old and to confirm the experiment by repeating it again and again.

The objects of the experiment should be of great practical value. They include the following :—

1. To ascertain the cost of rearing calves on whole milk.

2. To ascertain the cost of rearing calves on skim milk.

3. To ascertain the cost of rearing calves on whole milk as compared with skim milk.

4. To ascertain the relative cost of rearing during different periods of growth.

5. To ascertain the relative increase in weight during the different periods of growth.

6. To ascertain the relative percentage of gain during different periods of growth in proportion to the food consumed.

7. To ascertain the cost of producing beef up to the age at which it is now most commonly marketed.

8. To ascertain the relative cost of rearing beef animals when fed on whole milk and skim milk respectively during the early stages of their growth.

9. To ascertain the relative value of grades of the beefing breeds and of the native breed, respectively, for beef production.

10. To ascertain the relative value of the different grades used in the experiment for beef production.

At six months old the weights of the different individual animals were :

Class of animal.	Weight, lb.	Gain per day, lb.
Galloway	457	2.54
Shorthorn	530	2.94
Aberdeen Angus Poll	485	2.69
Hereford	545	3.02
Devon	434	2.41
Holstein	535	2.97
Shorthorn (skim milk)	454	2.52
Native	386	2.14

When the calves have all reached the age of one year a bulletin will be issued with full particulars.

Stable Confinement in Calf Rearing.—In this experiment the object was to ascertain the effects of continued confinement on a young animal of the bovine tribes. An Ayrshire grade was put in a box stall, 11 ft. 6 in by 8 ft. 4 in., on 24th May when but four days old, and was so confined for 190 days. At the end of that period it had become so stiffened that it had to be removed and to be allowed exercise daily in the yard. It was fed on a ration of whole milk at first, then whole and skim milk, then skim milk, and as soon as it would eat was given in addition a ration of meal, hay, roots and green fodder. This ration was continued after removal from the stall. It required but two weeks under the changed conditions to entirely remove the stiffness. (See p. 200.)

Berkshire and Yorkshire Pigs.—This short contest was between a pure Berkshire and a Yorkshire boar. It commenced August 19th and ended December 19th, thus lasting four months. A pure Berkshire boar, farrowed June 18th and weighing 25 lbs., was put in one pen August 19th, and the same day a pure Yorkshire boar, farrowed July 4th and weighing 25½ lbs., was put in another The Berkshire was, therefore, ½ lb. less in weight than the Yorkshire at the commencement of the experiment though 16 days older than the latter. During the contest the Berkshire took 30 pounds more meal than the Yorkshire and gained 12½ pounds more in weight. When the experiment closed the Berkshire weighed 167 pounds and the improved Yorkshire 155 pounds. The food consisted of milk, meal and a few roots.

This experiment does not decide very much owing to its short duration and because there was but one animal in each contest and these were not castrated. It is but the introduction to other experiments in this line of much more import.

Grade Lambs Fattened on Rape.—As mentioned elsewhere 54 acres of rape were grown upon the farm. It was our intention to purchase the lambs for feeding off the rape during August, but for reasons which need not be given here we were quite unable to do so. This fact is to me at least a matter of much regret, for had it been in our power to purchase these lambs in the first half of August I am satisfied that our profits on the venture would have been from $100 to $300 more than we realised.

As soon as we were in a position to purchase, the farm foreman set out to buy the lambs in our own and in the neighbouring counties. He became convinced at length that it was hopeless to try and secure them in sufficient numbers in these localities and at prices which we would be justified in paying. Immediately after the McKinley Act was passed dealers at once secured nearly all the lambs available in the localities where they are grown in best form. A search of many days resulted in the purchase of 48 lambs all told and 17 steers. The latter cost $47.50 per head and weighed 1,250 pounds some 10 days after they were brought home. The 48 lambs had been put on the rape during the declining days of September.

The foreman then visited the counties of Lanark and Carleton and purchased 344 grade lambs and ewes (32 of the latter), which reached the farm October 4th and were at once put on the rape.

We then decided that the number was insufficient to feed off all the rape, applied for a fresh grant, obtained it with a commendable promptness and then secured 145 more lambs near Pontypool, in the county of Durham. These reached the farm on the 18th of October, and were at once put upon the rape.

One hundred and three of these lambs (ewes and wethers) were then selected and shorn early in October, with the object in view of preparing them for shipment to Britain It has been stated by those who should be able to give an opinion of much value that if the fleece be removed in the autumn that the animal thus shorn will not only feed better but also ship better than one not so treated. We wish therefore to test the correctness of this theory. We would much rather have had the shearing done about September 1st, had we been in a position to do this. The wool would then afford better protection in winter.

This lot was kept in at night after the shearing and were only allowed to feed on the rape during days of favorable weather. They are now being fed on a ration of hay, meal and roots.

The wool shorn from them and from the lot referred to below averaged about 4 lb. per fleece unwashed and brought 13 cents per pound.

On December 2nd, a lot of 20 lambs was selected and of these 10 were shorn. The two lots will be pitted against each other during the winter in a feeding contest.

The following is a summarized statement of the cost of these lambs and of the net return received for them including the value of those now on hand.

Net Cost of 537 Lambs and Ewes.

505 Grade lambs averaging $3.33⅓ each	$ 1,684 17	
32 " ewes " $4.22½ each	135 20	
Cash paid in purchasing	$ 1,819 37	
Expenditure in buying	54 80	
Freight on 344 lambs (2 cars) from Pakenham to Guelph.	115 20	
Freight on 145 lambs from Pontypool to Guelph	31 20	
Expenses in purchasing	$201 20	
Net cost of 537 ewes and lambs		$2,020 57

Net Returns From 537 Lambs and Ewes.

Dec. 1st 1890, sold 32 ewes @ $5.64 to farmers in neighborhood	$ 180 50	
" 19th, 364 lambs shipped to Buffalo, weight, 35,915 lb., @ $5.62 per 100 lb. live weight	2,018 43	
" " For seven lambs slaughtered and 11 pelts	26 75	
" " 471 lbs. wool @ 13 cts.	61 23	
Net cash return	$2,286 91	

Value of Lambs on Hand.

Dec. 24th, value of 101 lambs, weight 10,100 lb., @ 5 cts. per pound live weight	$505 00
Dec. 29th, value of 20 lambs, weight 2,000 lb., @ 5 cts. per pound live weight	100 00
	$605 00

Net return for 537 lambs and ewes 31st Dec. 1890, including value of those on hand		$2,891 91
Average price paid for each lamb delivered at Guelph	$ 3 76	
Average price received for those shipped to Buffalo	5 54	
Net profit on the whole transaction up to Dec. 31st, 1890.	871 34	
Net profit on each lamb up to Dec. 31st	1 62	

Some twenty-one lambs were lost from the causes stated below :

Strayed	1
Died from bloating	2
Killed by fighting	2
Died from staggers	3
Found dead on back	2
Died from inflammation of lungs and bowels	3
Sent to butcher on first symptoms of dizziness	7
Killed in car	1
Total	21

The loss was of course charged against the lambs. This is one of the difficulties attendant on rape pastured with lambs. Some suffer from scours which if unchecked leads to fatal disorders. The preventives are a grain ration and abundance of salt to which they have access at all times.

They were left on the rape until 1st December, when they were then fed in sheds, getting a ration of hay and grain, consisting of whole pease and oats until they were shipped.

The weather was unfavorable owing to the unusual amount of rain. Sleet storms and heavy cold rains coming on in the night were no doubt the primary cause of some of the losses indicated above.

Our experience this year confirms the opinion that unless farmers attend to the castration and docking of their lambs, the males which are thus neglected will soon cease to be bought for feeding purposes. They evidently do not fatten so readily, they are very restless, and spend too much time in punching each other, are difficult to sell to the shipper, and do not realise so good a price. It is my conviction that the time is at hand when $1.00 per head more will be paid for good wethers than for rams of equal quality.

THE LIVE STOCK OF THE FARM.

The condition of the live stock of the farm during the year 1890 was on the whole satisfactory. The returns from the same were almost the only returns that we received from any quarter. The losses from disease were certainly reduced to a minimum in the case of horses, cattle and swine. The same is not true of pure bred sheep as will be seen below.

Horses.—The horses were kept in fair condition notwithstanding the constancy of the work. Some attention was this year given to breeding. In the month of April the first heavy draught foal came to hand that was ever bred on the farm. On the 24th of December there was another arrival, also a heavy draught. The aim at present is to have the colts come in the autumn with the object (1) of testing the wisdom and practicability of rearing autumn foals and (2) to enable the dams to rear the foals during the season of slack work. We had no losses from deaths during the year.

Cattle.—Our success with cattle during the year has been almost without parallel This is all the more noticeable because of the fact that in former years this farm has not been more than ordinarily free from the ravages of disease. Tuberculosis and abortion have both held high carnival here, and they may do so again, but at present the live

stock of all classes is apparently entirely free from disease in any form. But one matured bovine was lost during the year and only one calf belonging to the farm proper. The former was valued at $40 and the latter at $10. Another calf was killed by way of experiment to ascertain the effects of suckling a young animal on a dam affected with tuberculosis. The matured animal which was lost was a high grade Ayrshire cow. She was purchased as a milker in October, 1889. At the time of purchase she was giving a good flow of milk, was in fair condition and from external appearances no suspicion could possibly be aroused. She was then giving a large flow of milk and was for the time being the sole dependence of a whole household for their milk supply. For reasons which may not be stated here she was not brought to our stables until more than four weeks had elapsed after the purchase had been made. When she arrived it was at once apparent that she had been considerably reduced in flesh, but was still giving a good flow of milk. There was also a dryness of the hair noticeable and a lack of lustre in the eye which was ominous. Fortunately her milk was not used by the college in a single instance as a robust grade Angus calf was given her to nurse the day she came home. In the face of a full and nourishing ration she became still further reduced in flesh. After time a hacking cough manifested itself. Tuberculosis was suspected and in the month of April she was killed in the class room under the supervision of Dr. Grenside who conducted the post-mortem in the presence of the students and with the result that tuberculosis in one of its worst forms was found present as stated in this report. The grade Angus calf which had sucked the cow until the time of her death and which was then about four months old was isolated and fed by hand until October following when it was also killed in the presence of the students. Tuberculosis had also become developed in a marked degree in the calf as described by Dr. Grenside in the same report. The lesson here is one of great significance and is well worthy of the attention of scientists in every land. The alarming feature of this disease is its insidious nature. It could not be certainly known even by an expert that the calf was assuredly diseased on the morning on which it was slaughtered. It is because of the stealthy way in which its advances are made, that tuberculosis has come to be the greatest scourge of the North American continent amongst the bovine tribes. The calf which was lost and is referred to above as belonging to the farm proper had some affection of the lungs but no indications of tuberculosis was found in the post-mortem. It was simply a case of decline from the effect of a contraction of cold. The cow cost $40. and the calf was worth about $10. A Galloway cow met with an accident in a joint of one leg and was marked down $50 at the annual stock taking. A shorthorn heifer carefully purchased failed to breed and was marked down $10 the difference between the buying and selling value. A pure Angus bull-calf developed unwelcome scurs and was castrated, which however, did not represent a loss so much as a failure to realize a profit. A Galloway bull-calf developed undesirable shapes in a breeding animal and was cut down in value in the annual estimate $18.43. A Jersey cow failed to breed and was also reduced in price $50. A Devon cow not breeding at present was reduced in value $40 although she may yet breed, and two aged bulls sold, an Ayrshire and a Devon realized together $28 less than they were valued at at the commencement of the year. The total value of the pure bred cattle on the farm at the end of 1890 was $5,086.57, of grade cattle $1,894.40 and of horses $2,035. This gives the value of the cattle and horses as $8,993.97. The total loss therefore from death during the year from stock valued at $9,015.97 was only $50. This is a result almost without parallel in the management of live stock, and affords much ground for thankfulness. It is doubtless a result which never before was attained in the history of this farm and in all probability will never be realised again. It reflects much credit on the care and skill of Mr. John Harvey, the cattleman in charge.

It will be remembered that in 1889 two cows were lost from milk fever. Since that time we have taken the precaution to keep the cow in a box stall for some time before calving, and on a ration which is non-stimulating and non-milk producing. After parturition she is given a purgative in the form of one pound of Epsom salts.

Sheep.—The same fortunate record cannot be given regarding the sheep, especially the pure breds. To say that they have done badly is putting it mildly. They wintered well. The crop of lambs were both vigorous and abundant. From 26 breeding ewes

42 lambs were dropped, some few were lost when quite young, but only a small number. When turned out on pasture they made an excellent showing. Some of them soon began to dwindle; now and then one would be found dead in the morning. An examination revealed one form of inflammation or another. At one time it would be in the bowels at another in the lungs. The losses were during the year. The full reasons for the various forms of decline and death which overtook them have not all been ascertained, and with the light that we now have may not be ascertained. This much is clear, that during the two years that the pure bred sheep have been under my supervision they have not done well, not much better, if any, than during the preceding years.

I would fain give all the reasons for this if I could. Much of the soil on the farm is low and produces a grass that is rank and strong, just such grass as is not good for young lambs. It is vain to urge a drainage that will render it impossible for such grass to grow until the elements of nature shall so remould the farm that this will be possible. It is idle to urge that the sheep should be kept on higher land on a farm without one field that has not one or more of those low spots in it which are so fruitful in the elements of sheep producing disorders. It will not avail to argue that good sheep were reared on this farm long years ago, for then the morasses had not been cleared, and as a consequence were completely avoided by the sheep. It should not afford satisfaction to any one to say that sheep do well on adjoining farms, for there are few farms indeed which have no fields without low damp spots in them. I hope that we may in coming years be able to present a more favorable report, but to me at least the outlook is not very encouraging. To those who argue in the meantime that an experimental station should be able to overcome all impediments and obstacles in the way of success, I answer that we will do this just as soon as the unalterable laws of nature that relate to sheep breeding become changed or cease to operate.

Some of the breeds gave better returns than the others, as was to be expected. Adaptability produced effects that were to be looked for. The Southdowns, which are among the lighter breeds and, therefore, better adapted to drier lands, gave the least satisfactory all round results. The Leicester seemed best to withstand the vicissitudes which overtook the sheep. The Dorset-horned came next to the Leicester. They are a decidedly prolific and hardy race of sheep and will in all probability play an important part in the production of early lambs for the Easter markets. It has not yet been fully demonstrated that they will continue to produce two crops of lambs as in England, nor has it been proved that they will continue to breed in autumn at the exact time desired. If experience demonstrates that the Dorset horned breed will produce even one crop of lambs in the late autumn, they will soon become more generally introduced. In that case the lambs could be sold at Easter for high prices, and the dams could also be turned off if desired for the spring markets. We expect much from the Dorsets. They are not only decidedly hardy and prolific, but are of fair size and gentle disposition. The wool is medium and the yield is fair. It may turn out that some grades of mutton are better. If so, a dark-faced ram may be used in crossing. The highest prices have been realised for Shropshires, next to these come the Oxfords.

Notwithstanding our losses with pure-bred sheep, the balance sheet is on the right side. The receipts over the outlay were $219.46 for the year, that is to say, when the inventory of December 31st, 1889, is compared with that of 1890, purchases, sales, losses and deduction in values all being considered, the sum named above shows the profits from the pure-bred sheep, when the food is not taken into account.

Sheep which are brought to the farm for fattening purposes during the later months of the year seem to do remarkably well. This will be at once apparent from the report given regarding this class of sheep, which begins on page 94.

Swine.—The most profitable class of live stock kept on the farm this year was swine. We had but two pure breeds, viz., the Improved Yorkshire and the Berkshire, and in addition a limited number of Berkshire grades. One young Yorkshire sow was on the farm at the commencement of the year and one young boar. Five young sows were imported from England in the month of June at an average outlay of $85 each,

including the cost of purchase and carriage. We had five pure Berkshire sows and one boar, of which one sow was sold at the sale. The two Berkshire grade sows were kept for experimental purposes.

From our limited experience in growing Berkshires and Improved Yorkshires under the same conditions we are not able to throw any light upon the much controverted subject of their comparative merits as pork producers. It would not be safe even to forecast conclusions on this score. Of this we are sure, that both breeds have given excellent results for breeding purposes.

Of the sows which we now have, the Yorkshires seem to require more food to keep them in condition and the same is true of the boars. The Yorkshires are decidedly more prolific. The six litters comprised 54 pigs, the sows in every case being young. The five litters from the Berkshires produced 32 pigs, only two of which were from young sows. The 24 young Yorkshires sold at the sale averaged $10.88 each. The 21 Berkshires averaged $10.95, but the latter were somewhat older. The highest return from one litter of Berkshires was $111. The highest return from one litter of Yorkshires was $112. The total gain on the Yorkshires during the year was $450.25; the total gain on the Berkshires was $359. This does not include the food. The sum received for pork sold to the dealer on foot during the year was $441.30. The total gains from pigs during the year was $1,180.55, which, however does not take any of the food into account, except the refuse of the college, for which $60 is allowed for the year.

The losses of swine were light. Some were lost when the litters were young from the over-lying of the dams, as is so frequently the case, but no active disease of any kind was present during the year. The statement which is brought out elsewhere should be borne in mind—the profits on the pork which was sold on foot before October were much higher relatively than those received on pork sold after that date.

FINANCIAL STATEMENT OF THE ONTARIO EXPERIMENTAL FARM FOR THE YEAR ENDING 31ST DECEMBER, 1890.

At the commencement of the year it was decided to keep an account of the receipts and expenditures which might justly be charged to farm proper, that the farmers of this province might be furnished with an approximate statement of the exact financial standing of the farm proper at the close of the year, separate from all the other departments. Before taking stock at the commencement of the year I requested of the Minister that he should name some competent person who would assist in stock-taking, both at the beginning and the end of the year, who would also examine into the method of keeping the accounts, and who would in fact, do the work of an auditor. The gentleman appointed was John I. Hobson, Esq., of Mosborough.

An inventory of all live stock and implements was therefore taken at the commencement of the year. This inventory will be found in the annual report of the farm foreman for 1889. The value put upon the crop grown that year will also be found in the same report. In keeping this account which involved a great deal of labour, the mode of procedure was as stated below:

The farm was charged with:

(1) A proportion of the salary of the farm foreman, mechanical foreman, three-fourths of the salary of the cattle manager and one-fourth that of the farm instructor. The portion of the salary of the parties just enumerated not charged to the farm was set to the account of the Educational and Experimental Departments.

(2) All wages paid for work done on farm proper, whether of men or teams.

(3) All wages paid for student labor done on farm proper, although the wages so paid for work done under the head of permanent improvements, whether of students, men or teams, was deducted from this sum by a contra entry.

(4) All other running expenses whatever as food for stock, seed grain, blacksmithing, repairs, etc.

(5) Cash paid for implements purchased.

(6) Cash paid for live stock purchased.

(7) Cash paid for permanent improvements (see item 5 below under head of expenditure p. 136.) This, however, was all deducted by a contra entry.

(8) Cash paid for educational purposes in connection with the work of the professor of agriculture (see item 6 below under the head of expenditure p. 136). The larger proportion of this also was deducted by a contra entry, the reasons for which will be manifest.

(9) Cash paid for experimental purposes, (see item 7 under the head of expenditure, p. 136).

There was placed to the credit of the farm :

(1) All moneys received from the sale of produce and live stock which went off the farm.

(2) Cash, supplies and labor expended on other departments including College, Experimental, Educational, Horticultural and Dairy Departments and also permanent and temporary improvements.

(3) Increase in the value of live stock, less the decrease in the value of the same.

(4) Increase in the value of the field produce.

(5) Increase in the value of the implements. (See p. 137).

At the end of the year an inventory was again taken in the presence of Mr. Hobson, of the live stock and implements. This inventory and also the valuation of the farm crops grown are given in the report of the farm foreman (see pp. 139-152). The labor done was charged every evening against the proper department and the statement of receipts and expenditures were taken from the monthly rendering of the Bursar's accounts, so that nothing was guessed at or done at hap-hazard. Mr. Hobson examined with minute care the financial statement, and expressed himself as quite satisfied with the equity of the plan adopted in keeping the accounts. This financial statement might have been given in a form more in consonance with the usages of the most approved methods of book-keeping, but the object aimed at was to furnish a simple statement that anyone would understand. (See letter of Mr. Hobson on p. 138.)

EXPENDITURE.

1. *Salaries and wages*—		
(1) Proportion of salary of farm foreman charged to farm proper	$450 00	
(2) Proportion of salary of the mechanical foreman charged to farm proper	100 00	
(3) Proportion of salary of feeder charged to farm proper	300 00	
(4) Farm instructor	100 00	
(5) Wages paid to hired help by farm	2,137 65	
(6) Wages paid to students for labour	1,995 05	
		$5,082 70
2. Running expenses, feed for stock, seed grain, blacksmith bill, repairs, etc.	$1,728 81	
3. Cash paid for implements purchased	397 00	

4. *Cash paid for live stock purchased—*

(1) Horses	465 00	
(2) Hereford cattle	254 60	
(3) Ayrshire cattle	176 50	
(4) Devon cattle	140 00	
(5) Holstein cattle	801 00	
(6) Jersey cattle (registration fees)	3 10	
(7) Shorthorn cattle "	5 25	
(8) Grade cattle	1,413 50	
(9) Pigs	620 51	
(10) Sheep	2,051 80	
		$5,931 26

5. *Cash paid for permanent improvements—*

Lumber, wire for fencing, nails, etc	725 51

6. *Cash paid for Educational Purposes—*

(1) Fuel, light, etc., for Prof. of Agriculture (2) Printing, stationery, postage, etc., $50 of this charged against farm (see item 4 under the head of Revenue)	345 74

7. *Cash paid for Experimental purposes—*

(1) Repairs, sundry travelling expenses, etc (2) Expenses and pay of board of management	195 52
Net gain	1,709 25
	$16,115 79

REVENUE.

1. *Cash—*

(1) Farm produce, hay, grain, etc	$442 14	
(2) Horse sold	100 00	
(3) Hereford cattle	117 00	
(4) Galloway cattle	146 30	
(5) Aberdeen Angus cattle	124 90	
(6) Ayrshire cattle	92 20	
(7) Devon cattle	119 70	
(8) Holstein cattle	383 09	
(9) Jersey cattle	112 00	
(10) Shorthorn cattle	322 91	
(11) Grade cattle	1,526 15	
(12) Pigs	1,116 53	
(13) Sheep	3,151 53	
		$7,754 48

2. *Cash, supplies and labor expended on other departments—*

(1) College, milk	697 55	
Food for College horse	75 00	
Food for Bursar's horse	75 00	
Labor, drawing ice, etc	181 82	
	$1,029 37	
Less refuse from College	60 00	
		$969 37
(2) Permanent improvements, cash (see expenditure item 5)	$725 51	
Labor of students and teams on public and private roads	497 46	
		$1,222 97

(3) Experimental Department—Cash, see expenditure item 7		
Labor of students and teams	$195 52	
Food for horses	419 47	
	140 00	
		$754 99
(4) Educational Department—Food fed to stock, bulls and rams (see explanation 5 on p. 138)		
Care of same	$373 44	
Depreciation in value of stock bulls and rams	79 69	
Labor of students (instruction), see explanation 5 on p. 97	63 00	
Cash $345.74, less $50, see expenditure, item 6	31 31	
	295 74	
		$843 18
(5) Temporary Improvements—Labor spent on cleaning roads and grounds around the buildings, farm, office work, attending on visitors, etc		343 34
(6) Horticultural Department—Food for two horses and colt, etc		182 00
(7) Dairy Department—Labour of drawing ice, straw, etc		117 45
3. *Increase in value of live stock*—		
(1) Horses	$380 00	
(2) Hereford cattle	200 00	
(3) Ayrshire cattle	165 00	
(4) Devon cattle	25 00	
(5) Holstein cattle	675 00	
(6) Jersey cattle	75 00	
(7) Shorthorn cattle	70 00	
(8) Grade cattle	748 40	
(9) Pigs	639 00	
(10) Sheep	190 00	
	$3,167 40	
Less decrease in value of Galloway cattle	$118 43	
Aberdeen Angus cattle	30 00	
	$148 43	
		$3,018 97
4. *Increase in value of produce, grain, hay, straw, roots, etc*		580 24
5. *Increase in value of implements* (a number were donated)		328 80
		$16,115 79

I now desire to call attention to the following explanations and observations regarding the financial statement just submitted:

(1) The charge made for labor expended on the other departments of the institution was exactly the amount paid to the workmen and students, as the labor was all hired. Team labor was charged at the rate of $3 per day for man and team.

(2) It may be argued that the cash expended on permanent improvements (see item (2) under the head of revenue) should not be all deducted from the net expenditure of the farm, or in other words that part of it should be charged against the farm. Ordinarily this should be done, and perhaps it would have been more equitable to have so charged it this year, but a large portion of this expenditure was incurred for requirements which an ordinary farm would not want. As an offset to this expenditure the improvement of the condition of the farm may be placed. This in the item of weed destruction alone would amount to several hundreds of dollars for the year. One hundred and eight acres were virtually cleaned from a foul condition, and the farm is not credited with this or with any other improvement.

(3) Under the head of temporary improvements (see item 5) of revenue, the farm

is credited with $343.34. Possibly some of this should have been charged against the farm, but not much of it, as the extra labor entailed because of our relations to the public is very considerable. We have visitors in large numbers, and we are glad to have them. They require a guide, and this entails outlay which the farm proper should not bear.

(4) Let it be observed, however, that although the amounts credited as permanent improvements, $725.51, labor of students, men and teams on public and private roads, $497.46, and temporary improvements, $343.34, be added, which gives us $1,566.31, and though this whole sum be charged to the farm, we have still a balance of $143.21 in favor of the farm.

(5) We require to keep stock bulls and rams representing a large number of breeds for educational purposes. We estimated that three-fourths of the cost of the keep of these animals, and of the labor of caring for them should be charged as revenue for the farm (see item 2, (4) under the head of revenue). The animals require to be fed and cared for quite as much as though a full herd or flock of females were kept. The small item of $31.31, charged as labor of students (see item 2, (4) under the head of revenue), arises from loss of time on the part of a number of students attending on machine work, as threshing, etc., while one or other of the number is receiving instruction in such work as feeding the same.

(6) The decrease in values was carefully noted, and was deducted in every instance, whether it applies to live stock or to farm implements.

(7) It may be objected that it is not sufficiently accurate to value the crop grown one year and also that grown another year, and to charge the difference as a revenue or an expenditure for that year. I ask in what way can this be better done? It does not afford a sufficient answer to say that stock should be taken of the crop on hand at the end of the year, for this cannot be done with grain part threshed and part unthreshed, and hay and straw scattered in mows part used and part unused, only in an approximate way. The only real difficulty about our method would arise from a material difference in the amounts of food on hand at the end of the year. But even this difference would in no way affect the accounts for a term of years, although it would affect them for one year. This year a careful calculation has fixed the amount of food on hand December, 31st, 1890, as about equal to the amount on hand 1st January, 1891.

(8) It will be observed that our cash revenue is derived almost entirely from live stock and live stock products sold. Had our dependence been solely or principally on the sale of field produce we would certainly have failed to show any revenue. The methods which we adopted in working the farm are such as may be followed by any farmer. We obtained no extravagant prices for pure bred stock, and a large portion of the return came from meat production.

(9) The balance in favor of the farm is $1,709.25. The size of the farm is 550 acres, of which, say 400 (an approximation) are arable. This is a rental of $3.10 per acre for the whole farm, or for the cultivable portion of $4.27.

(10) It will be observed that there is a difference in the statement of the revenue and expenditure here as compared with the financial statement in Part I. of this report. This difference amounts to some thousands of dollars. It arises mainly from the fact that the farm there, is not credited with supplies furnished by it to the other department, and labor done for the same, nor is it credited with any increase in the value of stock.

The following statement bearing date of January 9th, 1891, was forwarded by Mr. Hobson with the permission to have it appended to the financial statement given above:

Prof. SHAW,

DEAR SIR,—Regarding the accounts it appears to me that they are all right. I do not know that we could apportion them more fairly with perhaps the exception of the amounts charged to temporary improvements. As I understand it a good deal of similar work would require to be done in every well managed farm. However, supposing that to be the case, I am inclined to think that the general improvement of the farm which no credit is taken for in the accounts is enough to offset the items referred to.

Yours respectfully,

JOHN I. HOBSON.

Difficulties in the way.—The difficulties in the way of making the farm pay its way are much greater than appear on the surface to an ordinary observer. The chief of these is connected in one way or another with the question of labor. The work-hands must pay $3.00 a week for board, and washing extra, hence the labor employed is more costly than with the ordinary farmer. Then the student labor cannot be utilized in every instance to the best advantage, owing (1) to its irregularity, as in time of examinations and vacations; (2) to the fact that a large share of it comes at a time of the year when it is not of most value, and (3) to the difficulty of employing a number of persons on many kinds of farm work, to the same advantage as one could be employed.

Will this effort be repeated.—I cannot answer that here. That is not for me to decide, I can only say that I hope it will from year to year. I do not undertake to make the farm proper pay its way every year, but I do think it should be made to pay its way during an average of years.

I feel that I would be recreant to duty if this report were brought to a close without expressing the complete satisfaction given me by faithful assistants in each department, and by the industry and fidelity shown in the work of the farm both on the part of the students and the work-hands.

I have the honor to be, sir,

Your obedient servant,

THOMAS SHAW.

REPORT OF FARM FOREMAN.

To Prof. THOS. SHAW,

SIR,—I have the honor of presenting to you my fourth annual report of the department which it is my duty to oversee.

I am pleased to say that notwithstanding the unfavorable season we experienced, especially as regards our grain crop, that on the whole I consider it the most prosperous year upon which I have had the honor to report.

The instructions received by the students in the practical work of the farm has received as much attention as it is in my power to afford them, but considering that we are still dependent on one team to give instruction on plowing to a class of about 90 students, you must see that the means for that object is not sufficient. We must also bear in mind that the instructor is also expected to run the farm engine which drives the thresher, chopping-mill, cutting boxes and root pulper, and these require to be run at least two afternoons in the week.

During the months of February and March we have ample time to instruct the students in the management and running of the different machines just named. An evidence of this is shown by the able manner in which the majority of the students acquitted themselves in the practical examinations last June.

I am pleased to call your attention to the fact that notwithstanding the decrease of $600.00 in the wages paid to the students, I have found them the most industrious and practical class that I have had the pleasure of overseeing since my coming here, and more work has been accomplished by them.

A large share of student's labor, together with a great deal of the same, from the regular farm hands and farm teams has been utilized in the making of roads in and around the farm.

The amount expended on labor done by the students for this work amounts to $832.00, while the work done by the farm men and horses for roads and other departments amounts to $661.85.

CROPPING.

Owing to the excessive rains which fell in the month of June, our grain crops are certainly below the average.

The crops sown on the low lying ground were injured somewhat by the wet, while those sown on the rolling land were washed off by the continuous heavy thunder showers.

On the other hand our hay crop was above the average, and as there was bright weather for curing it, the principal part came in in good shape.

The following is a list of the field crops as closely as I can estimate :

Field No. 1.—As I stated in my report of 1889, this field was plowed from sod (in the month of September) and sown with rye 2½ bushels per acre. The crop looked rather delicate last spring but afterwards turned out a fair crop.

On the 16th June we commenced cutting, at which time it had attained a height of about 5 feet six inches but showed no signs of maturity.

We cut it with the binder, made large sheaves and shocked it up, and immediately commenced hauling it to the silo, passed it through the ensilage cutter and tramped it tight into the silo.

Six weeks later we opened the silo and commenced feeding it to milch cows, calves and store cattle, all of which ate it with avidity and did well while being fed on it. The return from this field, therefore, in rye is put at 60 tons of ensilage at $1.50 per ton—$90.

When the rye crop was cleared off we immediately plowed the field, harrowed and rolled it and made it into light drills about 23 inches apart and sowed with dwarf Essex rape.

After the rape came up we kept it clean by passing the horse-hoe through as many times as it was possible to do this. A part of it was gone over a fifth time, and the whole of it had four cultivatings.

The rape crop was pastured off by turning on a flock of 505 ordinary grade lambs, purchased in the eastern part of the province, and 32 aged ewes.

The rape crop of fields No. 16 and No. 18 were also pastured off by this flock of lambs.

The lambs and sheep were purchased at a cost of $3.76 per head. This price includes cost of gathering, freight and all expenses in connection with the transaction.

They were turned on at three different dates, viz., 48 in the last week of September, 344 on the 5th of October, and the balance on the 16th of October. A range of small troughs were made to allow them all to feed comfortably by nailing two 6-inch boards together, and each day they were fed some oats.

There is not much danger of overfeeding with oats, as lambs eat very little grain when feeding on rape, and we found that a few of them never eat any oats at all.

The total cost of 537 ewes and lambs purchased by me when delivered at Guelph, including all expenses, was	$2,020 57
The value of the lambs on 31st December, including money received for those sold, was.....	2,891 91
Total gain at that date	871 34

At the time the lambs were taken to the sheds about seven acres of the rape remained untouched ; but it is a difficult matter to calculate how many lambs a field of rape will feed, as a great deal depends on the time that winter may set in.

Field No. 2.—This field contains 17 acres; of which ten acres on the east side were hurdled off to pasture the cows kept by the experimental dairy department, a sum of $4 per acre being charged to that department for pasturage. The balance of the field, seven acres, was meadow and gave a crop of hay yielding 2½ tons per acre.

17½ tons clover @ $6 per ton.....	$105 00
Pasturage, 10 acres @ $4.....	40 00
	$145 00

Field No. 3.—This field contains 20 acres; four acres of which is used by the experimental department in small grain plots. Four acres of a gravel hill on the west side have been planted to trees by the horticultural department. The remaining 12 acres were sown with common six-rowed barley, yielding 19½ bushels per acre.

234 bushels @ 50 cents.....	$117 00
12½ tons straw @ $1.50.....	18 75
	$135 75

Field Nos. 4 and 5.—This field, being one-half of two fields proper, contains 20 acres; the balance of No. 4 being partly planted to trees by the horticultural department, and a part of it, known as the pad lock, was used by the experimental dairy department as pasture. It contains

3 acres @ $4 ..... $12 00

Field known as 4 and 5 was used as the root field this year, from which the following root crops were taken:

1 acre white vosges carrots,	600 bushels	@	11 5-6 cents		$ 71 00
1 " sugar beets,	9½ tons	@	$4.25		40 37
7 " mangolds,	300 bush. per acre, 2,100 bush.	@	8 cents		168 00
3 " potatoes,	154⅔ " 464 "		45 "		208 80
8 " turnips,	440 " 3,520 "		8 "		281 60
Total crop					$781 77

The balance of field No. 5 is woodland.

Field No. 6.—This field contains 20 acres, and was meadow, of a mixture of timothy, rye grass, tall oat grass, and lucerne and alsike clover. It yielded 2¾ tons per acre.

55 tons @ $6 ..... $330 00

Field No. 7 contains 20 acres; this field was plowed from sod in the fall of November, 1889, and on the 19th of April was sown with New Zealand oats. About the 18th of June it was struck with a blight, after which it never did well. It yielded 17 bushels per acre.

340 bushels @ 40 cents	$136 00
10 tons straw @ $2.50	25 00
Total	$161 00

Field No. 8 contains 20 acres, and was meadow yielding 2¾ tons per acre.

55 tons @ $6 per ton $330 00

Field No. 9.—This field also contains 20 acres, and was this year given to the experimental department for the purpose of testing plots of one acre, one-half acre and one-quarter acre each. The yields from these plots were as follows:—

281 bushels oats @ 40 cents	$112 40
54 " spring wheat @ 90 cents	48 60
127 " barley at 50 cents	63 50
17 tons of straw @ $1.50	25 50
Total	$250 00

This field was skimmed over with the two-furrow plows as soon as the crop was cleared off and afterwards plowed deep with single furrow plows.

Field No. 10.—This field contains 20 acres, about one acre of which is taken up with the creamery and stables for dairy cattle, and about five acres are used by the horticultural department as an orchard and for growing small fruits.

The remaining 14 acres were sown with common six-rowed barley and seeded with grasses and clovers of the following mixture per acre:—

5 lbs. timothy,	2 lbs. lucerne clover,
1 " rye grass,	2 " large late clover,
1 " tall oat grass,	1 " alsike.

The barley yielded 21 bushels per acre.

294 bushels @ 50 cents per bush	$147 00
12 tons straw @ $1.50	18 00
Total	$165 00

Field No. 11.—This field contains 20 acres and was cropped as follows: 13 acres of winter wheat, which yielded a very small crop and only of medium quality.

Garfield wheat, 3½ acres, 28 bushels @ 91 cents	$25 48
Bonnell " " 24 " "	21 84
Mediterranean hybrid, 3½ acres, 23 bushels @ 91 cents	20 93
Surprise, 2½ acres, 11 bushels @ 91 cents	10 01
26 tons straw @ $1	26 00
Egyptian oats, 2 acres, 32 bushels @ 40 cents	12 80
New Zealand oats, 2½ acres, 52½ bushels @ 40 cents	21 00
Bavarian " " 65 " "	15 00
10⅙ tons straw @ $1.75	17 81
Total	$180 87

This field was skimmed with the two-furrow plows as soon as the crop was taken off and the 13 acres of winter wheat ground was sown with rape. The seed was scattered broadcast by hand and rolled. The dry season retarded its growth, but the pasturage furnished was worth a great deal to our young stock. After it was pastured off we plowed the field about eight inches deep and then manured it in preparation for root crop next season.

Field No. 12 contains 20 acres and was handed over to the experimental dairy department last spring to be cropped with corn for experimental purposes, and for the purpose of making ensilage, the manager of that department agreeing to fill the farm silo as a rental for the field. A swamp laying near the centre of this field failed to produce corn and was again plowed up and millet sown on it.

The yield from this field was as follows:

Millet, 2 tons at $5.00	$10 00
Corn ensilage, 50 tons at $1.50	75 00
Total	$85 00

The field was plowed with single furrow plow after corn crop was removed. The farm teams prepared the field in the spring and hauled the corn to silo in the fall.

Field No. 13 contains 20 acres four of which was planted with fruit trees last spring by the horticultural department. The balance, 16 acres was meadow yielding 2 tons per acre.

32½ tons hay at $6.00	$195 00

Field No. 14. This field contains 24 acres, 17 of which are used by the experimental department. The balance, 7 acres were meadow and yielded 2½ tons per acre.

17½ tons at $6.00	$105 00
Pasture 14 cows one month for dairy department at $1.00	14 00
Total	$119 00

Field No. 15 contains 20 acres. It was laid down to permanent pasture in 1884 and it still holds out as the best pasture field on the farm.

Field No. 16 contains 26 acres and was sown with rye 2½ bushels per acre in Oct., 1889. The crop was pastured off last May and June by cattle and sheep.

On June 17, we commenced ploughing it and immediately followed by harrowing, rolling, drilling and sowing with rape, 1½ lbs. per acre. The crop was pastured off by sheep mentioned in report of field No. 1.

Field No. 17. This field contains 17 acres and was cropped as follows: 2½ acres corn for Experimental Dairy Department

3 acres green fodder, oats, tares, and green peas valued at $15.00 per acre	$45 00
3 acres which was allowed to mature at $8.00	24 00
3 " millet, one ton per acre at $5.00	15 00
2 " potatoes, 160 bush. at 45c	72 00

Two acres of this field was used by the Experimental department for the purpose of testing various kinds of roots. The root crop was as follows:

White turnips, 300 bushels at 6c	18 00
Mangolds, 133 bushels at 8c	10 64
Carrots, 161 bushels at 12c	19 32
Potatoes, 163 bushels at 45c	73 35
Total revenue	$277 31

Field No. 18. This field contains 13 acres and was manured this year preparatory to its becoming the experimental field proper. The bulk of the manure was hauled from the city last winter by the farm teams and piled in low flat piles so as to destroy all foul seeds. This was carted and spread in the latter part of July and first week of August and plowed under on 8 acres on west end of the field. It was immediately harrowed and drilled and sown with rape.

The rape was a good crop and was pastured off by sheep, referred to in my report of field No. 1.

Field No. 19. This field contains 30 acres and was cropped as follows:

10 acres tares yielding 5 bushels per acre, 50 bushels at $1.50	$75 00
5 tons tare straw at $1.00 per ton	5 00
3 acres of Mummy peas partly threshed, and estimated at 25 bushels per acre.	
75 bushels at 80 cts.	60 00
17 acres Prussian blue peas not yet threshed, estimated at 20 bushels per acre.	
340 bushels at 64 cts	217 60
20 tons straw at $1.25	25 00
Total	$382 60

Field No. 20. This field lays at the north side of the farm and has been in a wild state until this year. A portion of it is swamp thickly wooded and part of it is cleared. Last spring we hauled rails and made a high strong rail fence between No. 20 and No. 19. On the 25th of May, several head of store cattle were driven into this field and found ample pasture up to the 10th of July, when we were obliged to remove the stock, as the swamp had dried up and the want of water compelled us to drive them to No. 15.

I may here say that it is necessary to have a well dug and a windmill set up in No. 20, as the pasture is to a certain extent wasted for want of water.

Field No. 21. This field contains 13 acres and was sown with oats of 3 varieties as follows:

2½ acres white Bonanza, 14 bushels per acre at 40 cts	$14 00
2½ " American Banner, 17 bushels per acre at 40 cts	17 00
8 " Early Calder; 17 bushels per acre at 40 cts	54 40
13 tons straw at $1.50	19 50
103 bags small potatoes at 30 cts	$104 90
Estimated value of crop of 1890	$30 90
	$3,764 10

Live Stock.

We have had a very successful year as regards our live stock department as is shown by the fact that the losses only amount to one grade cow valued at $40 and a grade calf and a number of lambs, the value of which it is not easy to estimate.

Two colts have been bred. One was sold at the public sale on 7th October, and the other is now five days old and promises to be a good one.

The live stock on hand at the present consists of seventy-eight head of cattle, one hundred and sixty-five sheep, forty-nine pigs and eleven horses for farm use and eight more for the use of other departments.

The silo has been recently opened and we find the ensilage in good condition and the stock seem fond of it.

I may here say that the one silo which we have is certainly inadequate for the amount of stock which is being kept. Another silo is necessary so that the experimental department could carry on their work independent of the farm proper.

We are now feeding the farm stock in the following manner. Hay and oat straw 2-1 being mixed at the cutting box on the barn floor and passed through the cutting box is carried by a short elevator to a shute where it drops into the feed room close to the root pulper which is driven by the same power. Here the cut feed and pulped roots are mixed.

The feed is prepared twice each week and we find that all the feed is eaten without waste.

For the average milch cow we find that a ration of 10 lb. hay, 5 lb. straw, 2 lb. of bran, and 2 lb. of meal with about 25 lb. of pulped roots per day and given in three feeds is a fair ration and some cows even require a less quantity.

We endeavor to give each animal only what will be eaten clean.

In preparing the food for horses, we place the cutting-box in the horse stable loft directly over the feed room so that the cut feed drops down. In the winter season when the work is not heavy, we mix oat straw with hay for horses and also feed carrots once each day.

The mangers of the horse stable are so arranged with a close box at one corner and a large space running across the stall with a slat bottom that we can feed long hay if necessary, but we find least waste of hay by feeding it cut and mixing the meal or bran and hay together.

On the 10th of November the herdsman, (John Harvey) resigned, to go to another stock farm. This change disarranged the work somewhat for a few days, when two young men of the 2nd year class, Messrs. Milne and McKenzie took charge of the stock, and I am pleased to say, that notwithstanding the importance of their college work at that season of the year, the stock was carefully attended to by them.

It is necessary that we should keep from nine to eleven milch cows during the college term to supply milk for the use of the college.

The following is a list of the number of gallons supplied each month. Jan. 191½, Feb. 332⅔, March 425, April 428, May 489½, June 412½, July 342½, Aug. 296¾, Sep. 148½, Oct. 412½, Nov. 432⅓, Dec. 346½.

During the year we have purchased a great deal of grade stock, for the purpose off feeding off the surplus crops of hay pasture, silage and soiling crops.

The following is a list of the stock which has been sold off the farm during the year:—

Fat Cows:

One	fat	cow	$67,00,	first cost	$42.00,	purchased	1886.
"	"	"	40.00,	bred on the farm.			
"	"	"	55.00,	first cost	$68.00,	purchased	1888.
"	"	"	55.00,	" "	70.00,	"	"
"	"	"	52.00,	" "	36.00,	"	1890.
"	"	"	52.00,	" "	50.00,	"	"
			$321.00		$266.00		

The following is a list of cows purchased in January for the purpose of supplying milk to the college and were resold as soon as their flow of milk ceased.

One cow	$25.00,	first cost	$20.00,	purchased	in	January	1890.	
" "	42.00,	" "	40.00,	"	"	"	"	
" "	40.00,	" "	37.00,	"	"	"	"	
" "	38.00,	" "	36.00,	"	"	"	"	
" "	52.00,	" "	50.00,	"	"	"	"	
" "	45.00,	" "	42.00,	"	"	"	"	
" "	44.00,	" "	44.00,	"	"	"	"	
" "	50.00,	" "	47.00,	"	"	"	"	
	$336.00		$316.00					

Ten fat steers were sold in May, having been purchased in October of 1889. They cost $500 or an average of $50 each, and were sold for $898 or an average of $89.80 each.

The following cattle were sold that were bred on the farm or purchased when young:

Shorthorns:

One heifer	$ 31 00
" "	170 00
One bull calf	53 00
	$254 00

Herefords:

One bull calf	$ 64 00
" heifer "	53 00
	$117 00

Aberdeen Angus:

One bull calf	$ 42 30
" " "	50 00
" " "	40 00
	$132 30

Galloways:

One heifer calf	$ 77 00
" "	69 30
	$146 30

Jerseys:

One heifer calf	$ 75 00

Devons:

One heifer calf	$55 00

Holsteins:

One cow	$ 80 00
" bull	51 85
" "	76 00
" "	70 00
" "	100 00
	$377 85

Ayrshires:

One bull	$ 55 00
" "	41 00
	$ 96 00

The following is a list of the Sheep sold this year :

Cotswolds :

One ram lamb	$ 6 00
" " "	6 00
	$12 00

Leicesters :

One ewe	$ 6 47
" " lamb	8 00
" ram	9 00
" "	31 00
	$54 47

Oxford Downs :

One ewe lamb	$ 25 00
" ram "	29 00
" ewe "	20 00
" " "	26 00
" " "	21 00
	$121 00

Shropshire Downs :

One ewe	$ 28 00
" "	31 00
" ram lamb	30 00
" " "	14 00
" " "	15 00
" " "	20 00
	$138 00

Southdowns :

One ewe	$ 15 00
" ram lamb	10 00
	$25 00

Horned Dorset :

One ewe lamb	$ 14 00
" " "	14 00
" ram "	12 60
	$40 60

GRADE SHEEP SOLD THIS YEAR.

Lambs :

22 lambs	$163 30
25 "	207 00
1 "	6 00
7 "	21 00
364 "	2,018 23
27 old sheep	155 25
6 " "	31 00
Total	$2,601 78

Swine.

Grade Pigs :

8	pigs	
7	"	$ 81 38
3	"	77 52
6	"	45 00
2	"	94 75
7	"	25 00
1	"	63 65
1	"	10 00
8	"	15 00
1	"	79 00
36	"	2 00
		$493 30

Pure bred Berkshires sold this year.

One	pig	$18 00
"	"	19 50
"	"	7 50
"	"	4 25
"	"	4 00
"	"	8 00
"	"	5 75
"	"	10 50
"	"	13 50
"	"	12 00
"	"	15 00
"	"	18 00
"	"	15 00
"	"	14 00
"	"	13 00
"	"	20 00
"	"	14 00
"	"	11 75
"	"	15 00
"	"	8 00
"	"	9 00
"	"	8 50
"	"	8 25
"	"	25 00
24	pigs	$297 50

Pure bred, improved Yorkshire pigs sold this year.

One	pig	$ 38 00
"	"	8 00
"	"	10 00
"	"	7 00
"	"	6 00
"	"	12 00
"	"	16 00
"	"	13 00
"	"	17 00
"	"	15 50
"	"	16 50
"	"	6 00
"	"	14 00
"	"	6 00
"	"	7 50
"	"	11 00
"	"	10 25
"	"	11 00
"	"	10 00
"	"	8 50
"	"	13 25
"	"	10 25
"	"	6 00
"	"	13 50
"	"	13 00
25	pigs	$299 25

Summary.

Sales of Live Stock made this year :

6	Fat cows	$ 321 00
8	Cows not milking	336 00
10	Store cattle	898 00
3	pure bred Shorthorns	254 00
2	" " Herefords	117 00
3	" " Aberdeen Angus	132 30
2	" " Galloways	146 30
1	" " Jersey	75 00
1	" " Devon	55 00
5	" " Holsteins	377 85
2	" " Ayrshires	96 00
		$2,808 45

Sheep :

452	Grade sheep and lambs	$2,601 78
2	pure bred Cotswolds	12 00
4	" " Leicesters	44 47
5	" " Oxford Downs	121 00
6	" " Shropshire Downs	138 00
2	" " Southdowns	25 00
3	" " Horned Dorset	40 60
		$2,992 85

Swine :

42	Grades	493 30
24	pure bred Berkshires	297 50
25	" " Improved Yorkshires	299 25
		$1,090 05

Total revenue from stock, including hides, service fees, etc. $7,212 34

The following is a valuation of the live stock at present in the stables :

Horses :

One span work horses for farm use		$ 330 00
"	" "	375 00
"	" "	475 00
"	" "	450 00
Single cart horse		70 00
One mare for general use		60 00
"	foal 5 days old	25 00
"	span horses for experiment and instruction	250 00
		$2,035 00.

CATTLE.

Herefords :

1	Bull, " Conqueror"	$100 00
1	Cow, " Jeranium "	300 00
1	" " Sibyl "	200 00
		$600 00

Galloways :

1	Cow, " Gem "	$75 00
1	Steer, " McCrea," 1 year old	31 57
		$106 57

Aberdeen Angus :

1	Bull, " Bognia of Kinnoul Park "	$250 00
1	Cow, " Kyma "	170 00
1	" " Blooming Rose "	300 00
		$720 00

Ayrshires :

1	Cow, " Nelly May 2nd "	$ 60 00
1	" " Tena "	75 00
1	" " Susie "	125 00
1	" Heifer calf	40 00
		$300 00

Devons :

1 Cow, "Beauty" $100 00

Holsteins :

1 Bull, "America's Grandson" $150 00
1 Cow, "Artis" 375 00
1 " "Alvo" 200 00
1 Bull calf 50 00

$775 00

Shorthorns :

1 Bull, "Baron of Waterloo" $600 00
1 Cow, "Maud 2nd" 150 00
1 " "Lady Joyful" 120 00
1 " "Authoress" 90 00
1 " "Laundress" 125 00
1 " "Matchless of Elmhurst" 350 00
1 Heifer, "Flower of Riverside" 125 00
1 " calf, "*dam Laundress*" 25 00

$1,585 00

Jerseys :

1 Bull, "Pogis of Flamboro" $100 00
1 Cow, "Lisgar's Rose" 300 00
1 " "Helen St. Helier" 100 00
1 " "Oakla Belle" 300 00
1 Heifer calf (dam Lisgar's Rose) 50 00
1 Bull calf (dam Oakla Belle) 50 00

$900 00

Grade Cattle.

Cows :

10 Milch cows @ $43.00 ..... $430 00

Steers :

16 Shorthorn grade steers, 2 and 3 years old, weighing *21,931* lb, @ 4 cents per lb $877 24
1 Galloway grade steer, 2 years old (1,390 lb.) @ 4¾ cts. per lb. 66 00
(Under one year old.)
1 Shorthorn grade steer, 1 " " (1,256 lb.) @ 4 " " 50 24
1 " " " 1 " " (1,212 lb.) @ 4½ " " 54 54
1 " " " 1 " " (1,245 lb.) @ 4½ " " 56 02
1 " " " 8 months (669 lb.) @ 4½ " " 30 10
1 " " " 9 " (741 lb.) @ 4½ " " 33 34
1 Aberdeen Angus grade steer weight (685 lb.) @ 5 " " 34 25
1 Shorthorn " " " (835 lb.) @ 5 " " 41 75
1 Galloway " " " (865 lb.) @ 5 " " 43 25
1 Devon " " " (733 lb.) @ 5 " " 36 65
1 Holstein " " " (757 lb.) @ 5 " " 37 85
1 Shorthorn " " " (600 lb.) @ 4 " " 24 00
1 Hereford " " " (841 lb.) @ 5 " " 42 05
1 Ayrshire, under 6 months, grade heifer 12 00
1 Angus " " " steer 6 00
1 Galloway " " " " 7 00
1 Scrub " " steer, weight (485 lb.) @ 2½ cts. 12 12

Total value of grades $1,894 40

SHEEP.

Cotswolds:

1 Stock ram	$ 40 00
4 " ewes @ $15.00	60 00
2 Ewe lambs @ $3.00	6 00
1 Ram "	3 00
	$109 00

Leicesters:

5 Stock ewes @ $12.00	$ 60 00
2 Ram lambs @ $10.00	20 00
4 Ewe lambs @ $10.00	40 00
	$120 00

Oxford Downs:

4 Stock ewes @ $18.00	$ 72 00
2 Ewe lambs " $14.00	28 00
	$100 00

Shropshire Downs:

1 Stock ram (imp)	$120 00
5 Stock ewes @ $25.00	125 00
2 Ewe lambs " 15.00	30 00
	$275 00

South Downs:

1 Stock ram (imp)	$90 00
4 " ewes " @ $25.00	100 00
1 Ram lamb	18 00
	$208 00

Horned Dorset:

1 Stock ram	$ 20 00
2 " ewes @ $20.00	40 00
	$60 00

Grades:

121 Lambs (weight 12,100 lbs.) @ 5cts	$605 00
Total value of sheep	$1,477 00

SWINE.

Berkshires:

1 Stock boar (imp)	$100 00
1 " sow	40 00
1 " "	25 00
1 " " (imp)	75 00
1 " "	50 00
1 Young boar	15 00
1 " sow	6 00
1 " "	6 00
1 " "	6 00
Total value	$323 00

Improved Yorkshires :

1	Stock boar (imp)	
1	" sow "	$75 00
1	" " "	85 00
1	" " "	85 00
1	" " "	85 00
1	" " "	85 00
1	" " "	85 00
1	Young boar, imp. in dam	85 00
8	" pigs @ $8.00	15 00
		64 00
	Total value	$664 00

Grades :

1	Stock sow	
3	Small pigs @ $2 00	$15 00
11	" " " 5.00	6 00
8	" " " 3.50	55 00
		28 00
	Total value	$104 00

VALUE OF STOCK ON FARM AT PRESENT.

Horses	
Cattle	$2,035 00
Sheep	6,980 97
Swine	1,477 00
	1,091 00
Total value	$11,583 97

The following is an inventory of tools and implements :—

Sleighs :

3	Set sleighs @ $20,00	
1	Long "	$60 00
Waggons :		7 00
4	Waggons @ $20.00	
1	Farm truck	80 00
3	Carts @ $8.00	50 00
Miscellaneous :		24 00
1	Binder	
2	Mowers $40.00 and $25.00	70 00
1	Hay rake	65 00
2	" " @ $22.00	7 00
1	" tedder	44 00
1	St. George cultivator	4 00
2	Land rollers @ $14.00	17 00
5	Tolton jointer plows @ $12.00	28 00
1	Gale sp. tooth harrow	60 00
1	" "	38 00
1	Eagle sulky "	4 00
1	" spring tooth "	20 00
2	Gang plows (Norwich) @ $12.00	28 00
2	" " (Teeswater) " $15.00	24 00
1	Corban harrow	30 00
1	12-hoe graindrill (Noxen)	18 00
1	9 " " " "	65 00
		27 00

Miscellaneous—Continued.

2 Sets iron harrows @ $7.50	15 00
2 " " " " $5.50	11 00
1 Root seed sower	28 00
2 Double mould plows @ $9.00	18 00
2 Sod plows @ $9.00	18 00
1 Sub-soil plow	10 00
4 Horse hoes @ $10.00	40 00

Implements:

2 Pea harvesters @ $12.00	24 00
1 Potato plow	2 50
1 Farm cutter	30 00
1 Rood scraper	7 00
1 Farm engine	450 00
1 Grain chopper	25 00
1 Thresher	260 00
1 Cutting box	35 00
2 Fanning mills @ $23.50	47 00
2 Root slicers " $14.00	28 00
1 Farm buggy	60 00
1 Democrat waggon	80 00
1 Office stove	10 00
Small tools	85 30
Total	$2,053 80

Your obedient. servant,

JOHNSTON E. STORY,
Farm Foreman.

REPORT OF THE ASSISTANT SUPERINTENDENT OF EXPERIMENTS.

To Professor Thomas Shaw:

Sir,—I have the honor of herewith submitting the report of the agricultural experiments conducted at this institution during the year 1890. My report including the summary of the readings of the meteorological observations, lysimeters, soil thermometers, drainage waters, etc., and also the chemical analysis of forty-one samples of fodder corn and two samples of ensilage all of which was done in duplicate, during the end of the last and the beginning of the present year, has been handed to Prof. James for the report of the chemical department.

We have been favored with a large measure of success in both the field and live stock experiments, during the year just closing and I wish to express my earnest desire that the results of these practical experiments which have been very carefully conducted might in some way reach the home of every Ontario farmer.

The experiments in the field were even more extensive than last year there being upwards of six hundred plots, averaging from one-hundredth to one acre in size and containing grain, potato, root, forage and grass crops. These made upwards of fifty acres devoted specially to experimental purposes during the present year, and there were also several fields upon the farm devoted to experiments of a more general character.

The season has, on the whole, been favorable for our work, but owing to the excessive wet weather in the earlier part of the summer, I was compelled to drop a few of the root experiments which I had planned for this year.

A number of meteorological instruments placed in one of the experimental fields, and which were read three times daily, show a weather record of much value in connection with our experimental work upon the field plots.

The amount of rain which fell during the five months (May 1st to Sept. 30th) as compared with that for the same period of the three previous years, was as follows :—

	1887. inches.	1888. inches.	1889. inches.	1890. inches.
May	1.58	1.08	3.59	2.18
June	2.36	2.92	4.25	5.31
July	.61	2.21	2.67	1.44
August	2.71	2.16	1.92	1.74
September	1.52	1.55	1.04	.72
Total	8.78	9.92	13.47	11.39

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

	1887.	1888.	1889.	1890.
May	60.49	50.98	52.3	50.7
June	65.02	64.36	59.8	65.4
July	72.87	67.22	67.8	68.2
August	65.58	66.56	64.4	62.8
September	55.83	54.96	58.3	55.4
Average	63.96	60.78	60.5	60.5

There has been a regular system of live stock experiments conducted throughout the year, as a week has not elapsed during the past twelve months without having two or more experiments under way. At the present time there are fully as many tests being carried on as can possibly be handled to advantage, with the room at our disposal.

In all our experimental work it is very evident that there is a growing appreciation in the work accomplished, and the farmers of Ontario are finding out more and more that it is our highest aim to assist them in the real practice of their farm operations by bringing before them the honest results of experiments of a thoroughly practical nature. Accordingly as there is a high appreciation by the farmers of the work done ; as there is a true harmony existing between this institution and the farming community ; and as we, at this experiment station, are honest and faithful in the discharge of the many duties devolving upon us, the greatest good can be expected to follow.

I greatly admire the action you have taken in the greater development of the experimental work of this institution, and specially do I admire your stand in regard to having the experiments so repeated that from them conclusions of great practical value can be shown.

In my report, throughout, I have endeavored to give as concise and at the same time as clear a statement as possible of the various experiments with their results, and will leave the summaries as last year for you to embody in your report.

The following list shows the experiments which have been conducted this year and also the order in which they are considered in the report :—

I.— Field Plot Experiments.

1. *Cereals.*

(*a*) Cereals on small plots.

1. Barleys, tests of varieties.
2. Barleys, different dates of seeding.
3. Peas, tests of varieties.
4. Spring wheat, tests of varieties.
5. Spring wheat, different dates of seeding.
6. Fall wheat, tests of varieties.
7. Oats, tests of varieties.
8. Oats, different dates of seeding.

(*b*) Cereals on large plots.

9. Barleys, tests of varities.
10. Spring wheat, tests of varities.
11. Oats, tests of varieties.

2. *Potatoes and Roots.*

12. Potatoes, tests of varieties.
13. Turnips, tests of varieties.
14. Mangels, tests of varieties.
15. Carrots, tests of varieties.

3. *Forage Crops.*

(*c*) Rape.

16. Rape, grown upon four kinds of soil.
17. Ridged against flat surface in rape cultivation.
18. Fertilisers with rape.
19. Thinning rape to different widths.

(*d*) Permanent pasture grasses.

20. Grasses grown singly.
21. Grasses grown in mixtures.

4. *Co-operative Experiments.*

22. Fertilisers with oats.
23. Corn cultivation.

II.—Live Stock Experiments.

24. Corn ensilage for making beef.
25. Fattening lambs.
26. Corn ensilage and roots as food factors in swine feeding.
27. Feeding swine on grain and meal.
28. Green fodder as a factor in swine feeding.
29. Soiling cows in summer.
30. Grade steers of different breeds.
31. Stable confinement in rearing cattle.
32. Berkshire *versus* Improved Yorkshire as pork producers.

I.—FIELD PLOT EXPERIMENTS.

The experimental plots during the past year have occupied parts of a number of fields over the farm, as some portions are better adapted for experiments of one kind and other portions for experiments of another kind. In cases where we have repeated experiments upon the same land for a number of years, great care has been taken to keep the soil in good condition and in some instances the plots have been run crosswise of those of the previous years and thus we have been avoiding the liability of using to the detriment of the experiment, soil which has become uneven by means of crops of varying growths.

1. Cereals.

The tests of different varieties of cereals during the year just closing, has been more extensive than those of previous years as upwards of three hundred varieties have been grown, which number consisted of imported as well as Ontario grains. The imported varieties were mostly the first and second crop from seed obtained from different parts of Europe, Asia, Africa, Australia, New Zealand and the United States. Among those grains which have been imported, we find some exceedingly promising varieties after two years testing, for among the barleys, wheats and oats are varieties which, in point of yield, considerably surpass those which have been grown in Ontario during a number of years.

We aim to have all of our grains sown in two different places on the farm each year, and the most promising varieties are often sown upon three, four, or even five different plots. Our regular system is : (1) to have the varieties of the same grain always once and sometimes twice or even thrice upon plots of exactly the same size, from which yields per acre are calculated. (2) To have the varieties in single rows with 200 grains in each row. (3) To have some of the most promising varieties in larger plots varying in size from one-fourth to one acre.

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

These tests were made to ascertain the relative value of different varieties of grain for Ontario farming and the advantages and disadvantages of different dates of sowing grain.

The plots varied from one-hundredth to one-fiftieth of an acre in size, and were measured off to the fraction of an inch. Stakes were driven at the four corners of each plot, and paths about thirty inches wide were left between each two plots. The grain for the various plots was weighed, bagged and labelled in the barn, and as soon as the land was ready, all the varieties of the same kind of grain were sown the same day, if at all possible. A line was stretched around each separate plot and the grain sown broadcast inside this line. A light narrow harrow was used to cover the grain, and the plots were all rolled when the ground was not sticky. After the grain came up a line was again run around each plot, and every plant which chanced to be outside of the line was cut off, thus making the plots not only very accurate for the experiment but also very neat in appearance. When the grain was ready for harvesting, one man did the whole of the cutting with a cradle, taking in order the different varieties as they were first matured.

In the experimental barn is situated a new separator, small in size and specially fitted for threshing grains of an experimental nature. This machine is driven by a tread power which runs charmingly, and is certainly well adapted for our requirements. In the mow, the floor of which is just beside and a little elevated from the feed table of the separator, was this summer placed a scale with a platform, six feet wide by twelve feet long, made specially for receiving the produce from the plots to be weighed. These scales are very sensitive, and will weigh accurately anything from one-half a pound to thirty-five hundred weight. The grain from the plots is drawn to the side of the barn and pitched upon the floor of the mow, then upon the scales to be weighed, and from the scales to the separator. The mow is quite roomy, and as the cracks in the floor have been puttied and painted, thorough sweeping can be accomplished after each plot has been removed. The four double doors at equal distances from each other along the back of the mow allow of a number of plots being stored away in the barn without danger of mixing.

With our present arrangements, we are enabled to have going on at the same time, the cutting, drawing, weighing, threshing and fanning of the grain as is often found absolutely necessary in properly caring for the crops and making the experiments of the greatest value. During the present year, the separator was running nearly every day from morning till night for about four weeks. At the same time, the grains were being harvested and threshed, collections were being made from the single rows (to prevent injury to the plots) for presenting at the leading exhibitions over Ontario.

(1) Barleys—Test of Varieties.

In range I of the old experiment field formerly known as field 14 of the farm were sown sixty varieties of barley, nearly all of which formed the second trial of the

samples imported two years ago, but a number of the Canadian kinds were also in the list. The yields of barley during the past year was 14.7 greater than that of the average of the varieties of 1889. The soil on which they were grown was a clay loam, which had a crop of barley in 1889 and was manured with farmyard manure last autumn at the rate of fifteen tons per acre. The plots were all exactly the same shape and size, and contained one-fiftieth of an acre each. Seeding took place on April 19th, with seed at the rate of two bushels per acre.

TABLE No. 1 shows the characteristics of fifty-four varieties of barley.

Variety.	Where obtained by O.A.C.	When obtained by O. A. C.	Years grown at O. A. C.	Date of maturity.	Length of plant.	Two or six-rowed variety.	Number of grains per ounce.
					In.		
Cape	New Zealand	1889	1	Aug. 1st.	39	6	611
Chevalier	"	1889	1	" 8th.	40	2	677
Cheyne	Germany	1888	2	" 6th.	33	2	670
Emperor	"	1888	2	" 6th.	34	2	720
Golden Drop	"	1888	2	" 5th.	36	2	646
Hallett's Pedigree	"	1888	2	" 6th.	37	2	630
Oderbrucher	"	1888	2	" 1st.	39	6	743
Phœnix	"	1888	2	" 4th.	41	2	626
Diamond	"	1888	2	" 5th.	43	2	690
Scholey's Chevalier	"	1888	2	" 7th.	37	2	697
Probsteier	"	1888	2	" 4th.	41	2	632
Invel	"	1888	2	" 7th.	39	2	657
Italian Rice	"	1888	2	" 2nd.	28	2	600
Bestehorn	"	1888	2	" 2nd.	40	2	696
Three-rowed	"	1888	2	" 7th.	31	6	736
Golden Melon	"	1888	2	" 7th.	38	2	715
Dutch	"	1888	2	" 5th.	39	2	717
Australian	"	1888	2	" 4th.	40	2	657
Improved Imperial	"	1888	2	" 6th.	42	6	1005
Kalina	Sweden	1888	2	" 4th.	40	2	615
Guymalaya	"	1888	2	" 1st.	39	6	945
Pfanen	"	1888	2	" 3rd.	38	2	549
Kinnakulla	"	1888	2	" 2nd.	37	2	610
Very Early Lapland	Russia	1888	2	July 23rd.	29	6	813
Mandschurei	"	1888	2	" 31st.	40	6	755
Annats	Scotland	1888	2	Aug. 7th.	34	2	703
Chevalier	"	1888	2	" 7th.	38	2	726
Perfection White	England	1888	2	" 9th.	37	2	722
Golden Drop	"	1888	2	" 7th.	41	2	827
Thanet	"	1888	2	" 8th.	42	2	780
Improved Golden Melon	"	1888	2	" 8th.	39	2	770
Early Minting	"	1888	2	" 6th.	.....	2	708
Improved Cheyne	"	1888	2	" 5th.	42	2	747
Improved Beardless	"	1888	2	" 7th.	41	2	735
Selected Chevalier	"	1888	2	" 7th.	41	2	758
Empress	"	1888	2	" 6th.	39	2	790
Imperial	France	1888	2	" 4th.	40	2	717
Large Skinned	"	1888	2	" 6th.	38	2	478
Two-rowed Italian	"	1888	2	" 7th.	40	2	557
Chevalier	"	1888	2	" 4th.	35	2	667
Early Black	"	1888	2	July 31st.	32	6	591
Chevalier	"	1888	2	Aug. 6th.	40	2	657
Two-rowed spreading or fan	"	1888	2	" 4th.	31	2	573
Peerless White	Ontario (Dom. Exp. Farm)	1889	2	" 7th.	37	2	750
English Malting	" " "	1889	2	" 7th.	38	2	668
Beardless	" " "	1889	2	" 6th.	39	2	750
Carter's Prize Prolific	" " "	1889	2	" 6th.	39	2	683
Skinless	Australia	1886	4	July 21st.	34	6	997
Italian	Italy	1888	2	" —	41	2	649
Scotch Improved	Ontario	.....	Several.	" 31st.	40	6	805
Black Hulless	"	.....	"	" —	36	6	633
Mensury	"	.....	"	" 31st.	46	6	786
Common Six-rowed	"	.....	"	" 31st.	33	6	819
Hungarian	Hungary	1888	2	" 4th.	.....	6	930

TABLE No. 11 shows the yields from fifty-four varieties of barley 1889 and 1890.

Variety.	Weight of grain per measured bushel.	Yield of		Yield of grain per acre, bushel per weight—48 lb.			Yield of straw per acre—tons.			Comparative order of grain yield for 1890.
		Grain per plot.	Straw per plot.	1889.	1890.	Average	1889.	1890.	Average	
	lb.	lb.	lb.							
Cape	51	47½	54	.....	51.3	.....	.....	1.35	.....	4
Chevalier	54⅜	41½	66½	.....	44.3	.....	.....	1.66	.....	13
Cheyne	53½	47	65	47.9	49.0	48.5	2.73	1.62	2.18	8
Emperor	53	25⅜	59½	36.5	26.8	31.7	2.38	1.40	1.89	46
Golden Drop	53½	38⅜	57½	40.6	42.2	41.4	2.20	1.48	1.84	18
Hallett's Pedigree	53⅜	46½	54½	34.4	48.2	41.3	1.69	1.35	1.52	10
Oderbrücher	54¼	43⅝	62⅜	44.3	47.2	45.8	1 29	1.55	1.42	11
Phœnix	53	32½	61	46.9	33.9	40.4	1.98	1.52	1.75	36
Diamond	52¾	25½	37	.....	26.6	.....	.....	.92	.....	47
Scholey's Chevalier	53	31½	45½	34.4	32.6	33.5	1.74	1.13	1.44	38
Probsteier	52	32½	63½	37.5	33.9	35.7	1.80	1.55	1.68	36
Invel	51½	30	44	22.9	31.3	27.1	1.46	1.10	1.28	40
Italian Rice	50	32	54	45.8	35.1	40.5	1.73	1.35	1.54	34
Bestehorn	52	42	67½	29.1	43.8	36.5	1.64	1.68	1.66	14
Three-rowed	61 1-5	23½	38	26.0	24.5	25.3	1.45	.95	1.15	50
Golden Melon	52⅖	25½	37½	31.3	26.3	28.8	1.30	.93	1.12	48
Dutch	44	29½	70½	20.8	30.5	25.7	1.15	1.75	1.45	42
Australian	52½	33⅜	49½	....	35.2	.....	.....	1.23	.....	33
Improved Imperial	47⅖	36½	60⅜	28.1	37.8	33	1.59	1.51	1.55	28
Kalina	52⅝	39½	64½	35.4	40.9	38.2	1.45	1.60	1.53	22
Guymalaya	61	36	58	34.4	37.5	36	1.58	1.45	1.52	29
Pfaner	52	28	41½	28.1	29·2	28.7	1.61	1.03	1.32	44
Kinnakulla	48⅜	25½	44⅜	24.5	26.3	25.4	1.66	1.11	1.36	48
Very Early Lapland	48	15½	33½	.....	15.9	.....	.....	.83	.....	53
Maudschurei	51¼	49⅜	51⅜	42.7	51.9	47.3	2.10	1.29	1.70	3
Annats	52	28⅜	43½	22.9	29.7	26.3	1.30	1.08	1.90	43
Chevalier	53⅜	27½	42⅜	24.0	28.4	26.2	1.20	1.06	1.13	45
Perfection White	52	34⅜	53⅜	18.8	36.2	27.5	1.11	1.34	1.23	30
Golden Drop	51¼	40⅜	65½	28.6	42.4	35·5	1.58	1.63	1.61	17
Thanet	50½	48½	66⅜	26.0	50.5	38.3	1.36	1.66	1.51	6
Improved Golden Melon	51½	41⅜	54½	34.4	43.5	39	1.61	1.31	1.46	15
Early Minting	51½	41½	61½	.....	43.2	.....	.....	1.53	.....	16
Improved Cheyne	52½	46½	72⅜	29.6	50.2	39 9	1.68	1.81	1.75	7
Improved Beardless	50½	37½	61⅜	27.6	38.6	33.1	.....	1.54	.....	26
Selected Chevalier	50½	50½	54½	33.3	52.6	43	2.14	1.36	1.75	2
Empress	51¼	45½	76½	43.7	47.1	45.4	1.94	1.90	1.92	12
Imperial	52¼	40½	66⅜	39.6	41.9	40.8	1.90	1.66	1.78	19
Large Skinned	63	21	39½	36.5	21.9	29.2	1.75	.87	1.31	31
Two-rowed Italian	52½	22½	75½	39.6	23.4	31.5	2.08	1.88	1.98	51
Chevalier	52⅜	51½	62	39.6	55.4	47.5	1.78	1.55	1.67	1
Early Black	51	47	78½	40.6	49.0	44.8	1.25	1.96	1.61	8
Chevalier	54½	39½	62½	.....	41.2	.....	.....	1.56	.....	21
Two-rowed Spreading	49½	21¼	.....	36.5	32.6	34.6	1.50	.....	.....	38
Peerless White	53	34½	49½	29.6	36.2	32.9	1.60	1.23	1.42	30
English Malting	52⅜	34	49½	25.5	35.4	30.5	1.71	1.23	1.47	32
Beardless	52⅛	33	51	21.9	34.4	28.2	1.38	1.27	1.33	35
Carter's Prize Prolific	52	34⅜	54⅜	26.6	38.0	32.3	1.59	1.36	1.48	26
Skinless	60½	8½	.....	29.9	8.9	19.4	.68	.....	.....	54
Italian	51⅜	37½	65⅜	5.7	38.8	22.3	2.41	1.64	2.03	24
Scotch Improved	52	39½	49½	47.9	40.9	44.4	1.30	1.24	1.27	22
Black Hulless	63⅜	30	50	...	31.3	.....	.....	1.25	.....	40
Mensury	51½	37¼	49⅜	...	38.8	.....	.....	1.24	.....	24
Common Six-rowed	54½	40	55½	41.7	41.7	41.7	1.19	1.38	1.29	20
Hungarian	62¼	49	63	8.3	51.0	29·7	....	1.57	.....	5

(2) Barley—Different Dates of Seeding.

Barley was sown at three different dates, to ascertain some facts regarding the relative yields from different dates of seeding the present year. The plots were one-hundredth of an acre in size and were in duplicate in each case. Soil was a clay loam, manured in the winter of 1889. The barley sown was the Maudschuri which was put in at the rate of two bushels per acre. Pressure of work prevented seeding earlier than May 1st, but it is important to notice that the same variety seeded in the plots for testing varieties on April 18th gave a yield of 51.9 bush per acre. In an experiment in testing different dates of seeding barley in 1889, it was found that the yield from seeding on May 5th was 65.3 per cent. less than on April 15th, and that on June 7th it was 59.1 per cent. less than on May 5.

Table No. III shows the yields of barley from three dates of seeding.

Dates of seeding.	Separate plots.	Duplicate tests for each date of seeding.			Average of yields for each date of feeding.		
		Weight per measured bush.	Straw per acre, tons.	Grain per acre, standard bushels by weight.	Weight per measured bush.	Straw per acre, tons.	Grain per acre, standard bushels by weight.
May 1st	A	48¾	.91	31.8	49.88	1.02	37.3
	B	51.0	1.13	42.8			
May 9th	A	45½	.98	26.4	46.25	1.04	31.2
	B	47.0	1.11	35.9			
May 17th	A	42.0	.80	18.8	41.88	.77	18.0
	B	41¾	.74	17.2			

(3) Peas—Different Varieties.

There has been tested during the present year twenty varieties of peas, but owing to the very wet weather at the earlier part of the season the yields are somewhat smaller than usual. The yield per acre of our varieties of last year was 32.9 bushels and for 1890 the yield was only 21.6 bushels per acre. Seven varieties situated in another portion of the field and somewhat later than those reported upon were so injured by the wet that no reliable conclusions could be drawn and the peas were not harvested separately. The soil upon which the twenty varieties were grown was a clay loam, manured last winter, at rate of fifteen loads per acre of farm yard manure. The seeding took place on April 24th, and the rate of seeding each variety is shown in the following table. The results are arranged in two parts in the tables. The first table gives the characteristics of the varieties and the second the figures regarding the sizes, weights, etc, of the peas of different kinds and the yields per acre :

Table No. IV shows the source and general characteristics of twenty varieties of peas.

Variety.	When and where obtained by O.A.C.		Years grown at O.A.C.	Quantity of seed sown p. a.	Date of		Average.		Width of pod.	Length of a row of ten peas touching each other.	Color of peas.	Outside character of peas.
	Country.	Year.			Seeding.	Maturing.	Length of vine.	Length of pod.				
Sweet Jessie	England			bus.								

TABLE No. IV shows the source and general characteristics of twenty varieties of peas.

Variety.	When and where obtained by O.A.C.		Years grown at O.A.C.	Quantity of seed sown per a.	Date of		Average.		Width of pod.	Length of a row of ten peas touching each other.	Color of peas.	Outside character of peas.
	Country.	Year.			Seeding.	Maturing.	Length of vine.	Length of pod.				
				bus.			inches.	inches.	inches.	inches.		
Sweet Jessie	England	1888	2	2½	April 24	Aug. 11	42	2	½	3½	Light brown.	Slightly indented.
Early Britain	"	1888	2	2½	" 24	" 11	60	2¾	5/8	3	Brown.	Somewhat indented.
Perfection White	"	1888	2	3	" 24	" 9	36	2½	¾	3⅜	White.	Outline rather irregular.
Earliest of all Blue	"	1888	2	2	" 24	July	30	2	½	2½	Blue.	Smooth.
Glory	"	1888	2	3	" 24	Aug. 12	33	2¾	3-5	3¾	Light blue.	Rough and irregular outline
Early Racehorse	"	1888	2	2	" 24	" 10	52 5-6	2½	7-16	2½	White.	Smooth.
Hero of Reading	"	1888	2	3	" 24	" 10	42	2¾	5/8	3⅜	Blue.	Medium.
Selected Maple	"	1888	2	2	" 24	July 27	36	.....	½	2⅜	Dappled brown.	Indented.
Veitches Perfection	"	1888	2	2	" 24	Aug. 12	25	3	5/8	3½	Light blue.	Crinkled very much.
Princess Royal	"	1888	2	3	" 24	" 9	36	3	¾	3½	White.	Nearly smooth.
Brown	New Zealand	1889	1	3	" 24	" 11	36	2¼	5/8	3	Brown.	Slightly indented.
Blue	"	1889	1	3	" 24	" 5	48	2¾	5/8	3	Blue.	Slightly indented.
Field	"	1889	1	2	" 24	" 7	58	2¼	½	2¾	White.	Smooth.
White Wonder	"	1889	1	2½	" 24	" 5	26	2¼	½	3⅛	White.	Smooth.
Mummy	Ontario	1889	1	3	" 24	" 11	38	2	½	3	White.	Smooth.
Black-eyed Marrowfat	"	.....	Several.	3	" 24	" 11	61	2¾	5/8	3⅝	White (black eye.)	Smooth.
White-eyed Marrowfat	"	.....	"	3	" 24	" 11	49	2½	½	3⅜	White.	Smooth.
Grass	"	.....	"	2	" 24	Sept. 10	31	1½	½	2⅛	White.	Rough and angular.
Multipliers	"	.....	"	2	" 24	.....	65	2 3-5	½	2⅞	White.	Smooth.
Prussian Blue	"	.....	"	2½	" 24	.....	64	2½	½	2¾	Blue.	Smooth.

TABLE No. v shows the comparative results of twenty varieties of peas.

Variety.	Peas per pod.	Peas per ounce.	Grain per measured bushel.	Yield of straw per acre.	Yield of grain per acre (60 lb. per bush).	Comparative order of grain yield per acre, 1890.
	No.	No.	lb.	Tons.		
Sweet Jessie	4½	103	62¾	.82	31.16	1
Early Britain	3⅛	110	60	.57	28.37	4
Perfection White	3½	86	61	1.22	14.88	16
Earliest of all Blue	4 1-10	154	64	.42	10.46	18
Glory	4	82	62½	.98	26.04	7
Early Racehorse	5	144	64¼	1.06	29.29	2
Hero of Reading	4⅓	93	63	.89	26.27	6
Selected Maple	5¼	156	64½	.72	20.00	14
Veitches Perfection	4	81	58	.67	10.46	18
Princess Royal	4	80	63½	.57	13.02	17
Brown	4 1-7	105	60¼	.95	23.25	12
Blue	6	100	65½	1.11	18.14	15
Field	4 13-20	122	64½	.89	25.34	8
White Wonder	3	138	64⅜	.80	27.67	5
Mummy	3	106	65¾	1.26	28.60	3
Black-eyed Marrowfat	4⅜	92	62	1.04	23.72	11
White-eyed Marrowfat	4	77	63¼	.93	21.16	13
Grass	3	212	66	1.51	5.12	20
Multipliers	4⅜	188	62½	1.44	25.34	8
Prussian Blue	4½	132	64	1.25	24.65	10

(4) SPRING WHEATS—TESTING OF VARIETIES.

There are three tables of spring wheats; the first being the results of eleven varieties which have been grown in Ontario for a number of years; the second being a report of the second crop from imported seed; and the third gives the results of the crop from imported seed two years old. Owing to 1889 being a very unfavorable season for spring wheats, and as some of the grains were late in getting here and therefore not ready for early seeding, we have taken the original seed of thirty varieties and given them a fair trial the present year. The following varieties were discarded at the end of 1889 as being totally unsuited for our climate: Crystal Rock, Sebastopol, Azima, Danubian, Dantzic White, Red Chaff White, Champion White, Selected Talavera White, Improved Red Nursery, Malaga White, Grand Cianco, Square Head, Egyptian, Spelz (Switzerland), and Early Japan.

The spring wheats of the first two tables were sown on April 25, and those of the last table were sown on April 26, upon plots one-hundredth of an acre in size. Soil of those of the first two tables was a clay loam, and that occupied by those of the third table was clay loam with a large percentage of vegetable mould. The grain was sown at the rate of two bushels to the acre.

TABLE No. VI shows the comparative results of eleven varieties of spring wheat, the seed of which was obtained in Ontario:

Variety.	Date of Maturity.	Length of plant.	Amount of rust. (1 to 10 being the standard adopted).	Weight of grain per measured bushel.	Yield of straw per acre.	Yield of grain per acre (bush. 60 lbs.).	Comparative order of grain yield per acre, 1890.
		Inch.			Tons.		
Red Fyfe	August 12	47	3	59½	1.95	15.83	5
Ladoga	" 5	42	2	56½	1.33	12.5	9
Wild Goose	" 12	52	1¾	62¾	2.27	12.9	8
Red Fern	" 11	48	¾	60	1.76	21.9	3
White Fyfe	" 14	50	3	60	1.39	26.9	1
White Russian	" 11	44	3	57¼	1.91	22.1	2
Colorado	" 6	52	3	61	1.07	15.8	6
Triumph	" 5	42	3	60	1.01	16.	4
Green Mountain	" 10	41	3	56½	1.32	12.5	9
Colorado	" 6	50	3	59¾	1.17	15.8	6
Lost Nation	" 14	38	4	56	1.00	8.8	11

TABLE NO. VII shows the comparative results of spring wheats, most of which are the second year's testing of imported varieties.

Variety.	Where seed was originally obtained.	Date of maturity.	Length of plant.	Amount of rust. 1-10.	Weight of grain per measured bushel.	Yield of straw per acre. (Tons.			Yield of grain per acre. (Bushels by weight, 60 lb.)			Comparative yield of grain, 1889 and 1890.
						1889.	1890.	Average	1889.	1890.	Average	
Pringle's Champion	Germany	August 12	43	¼	59½	1.4	1.9	1.6	15	21.2	18.1	2
Holben's Improved	"	" 14	42	1½	58½	.5	1.7	1.1	11.7	20.4	16.1	4
Summer	"	" 9	38	1½	58¼	1.5	1.5	1.5	10.0	17.5	13.8	5
Saxonka	Russia	" 11	42		57¼	.....	1.0	.....	11.7	10.6	11.2	9
Odessa Ghirka	"	" 12	43	2	60	1.4	1.5	1.5	8.3	15.8	12.1	6
Konisburg	"	" 11	44	½	62⅜	1.4	1.5	1.5	10.9	12.2	11.6	8
Dantzic	"	" 13	42	1	58½	.....	1.4	.....	8.3	12.5	10.4	10
Ordinary March	France	" 8	39	3	51¼	1.2	.9	1.1	6.7	7.1	6.9	13
Red Bearded March	"	" 6	36	2	57	1.3	.9	1.1	10.0	10.8	10.4	10
Herison Bearded	"		44	¼	64	1.5	1.9	1.7	18.3	27.2	22.1	1
Bearded Red	"	" 6	41	.....	58	.8	1.2	1.0	6.7	13.3	10.0	12
Ladoga	Ontario (Dominion Experimental Farm)	" 5	38	1	56½	.....	1.0	.....	8.3	15.8	12.1	6
Bart Trimenia	Greece	" 10	42	¼	64	1.0	1.6	1.3	6.7	26.3	16.5	3

TABLE NO. VI

Variety.												
Chidham White												
King Bartigen												
Fern or April												
Nenhert												
Triticum Spelta												
Poland												
April Bearded Red												
Lonzelle White												
Large Flag												
French Summer												
Hickling's March W												
Ordinary Bearded M												
March de Brie												
Rousselin												
Paros												
Voto												
Grecian												
Missogen												
Atalank												
Sorentino												
Neapel												
Square Head												
Red Wheat												
Mountain												
Banter												
Medeah												
Algiers												
African												
March White												
Egyptian												

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TABLE No. VIII shows the comparative resuits cf thirty varieties of imported spring wheat.

Variety.	Where seed was obtained.	Date of maturity.	Bearded or bald.	Length of plant.	Length of head.	Amount of rust.	Weight of grain per measured bushel.	Yield of straw per acre.	Yield of grain per acre, bushels by weight (60 lbs.)	Comparative order of grain yield, 1890.
				in.	in.	1-10	lb.	Tons.		
Chidham White	Germany	Aug. 12	Bald	40	2 3/4	2 1/2	52.3	1.17	10	15
King Bartigen	"	" 11	Bearded	57	2 1/2	1 1/2	56	.91	9.6	16
Fern or April	"	" 14	Bald	38	2 3/4	4	.....	1.08	2.9	30
Nenhert	"	" 12	"	43	3	3	49.5	1.25	6.7	21
Triticum Spelta	"	" 9	Bearded	46	3 1/2	4	35	.73	18.8	1
Poland	Russia	" 11	" ..	44	4 1/4	2	51	1.25	8.9	20
April Bearded Red	England	" 11	" ..	47	3 1/2	2 1/2	50.8	1.72	9.2	18
Lonzelle White	France	" 14	Bald	38	2 3/4	2 1/2	47	1.45	5.0	25
Large Flag	"	" 9	"	29	2 1/2	5	51.2	.66	6.3	23
French Summer	"	" 9	"	34	2 3/4	3	52.8	1.09	10.2	13
Hickling's March White	"	" 11	"	41	2 1/2	2	43.9	1.16	3.8	28
Ordinary Bearded March	"	" 10	Bearded	40	2 3/4	1 1/2	57.5	1.52	17.5	2
March de Brie	"	" 11	Bald	41	3	3 1/2	53	1.66	11.3	12
Rousselin	"	" 12	"	40	2 1/2	1/2	.....	1.01	2.1	31
Paros	Greece	" 11	Bearded	43	2 3/4	1	57.5	1.26	13.8	6
Voto	"	" 11	" ..	45	2 1/2	1	58.0	1.36	12.9	8
Grecian	Russia	" 10	" ..	42	2 1/2	3/4	59.9	1.28	13.8	6
Missogen	Greece	" 11	" ..	40	2 3/4	1/2	58.9	1.27	14.2	5
Atalank	"	" 11	" ..	44	2 1/2	1	57.5	1.23	12.1	10
Sorentino	Italy	" 10	.....	47	2	1	60	1.12	15.0	3
Neapel	"	" 11	Bearded	38	2	5	51.5	1.28	9.6	16
Square Head	Sicily	" 9	Bald	34	1 1/2	7	49.5	.95	5.0	25
Red Wheat	"	" 12	"	34	1 1/2	7	.....	.87	6.7	21
Mountain	Hungary	" 12	"	27	2 1/4	2	58.8	.67	9.2	18
Banter	"	" 14	Bearded	33	2 3/4	2	55	.88	4.6	27
Medeah	Africa	" 9	" ..	47	2 1/4	2 1/4	62.5	.62	15.0	3
Algiers	"	" 10	" ..	43	2 1/4	1	58.3	1.16	12.1	10
African	"	" 10	Bald	37	2 1/4	9	.....	.65	3.3	29
March White	California	" 5	"	41	2	2	56	.89	10.2	13
Egyptian	Egypt	" 18	Bearded	47	2 3/4	5	15	1.50	5.8	24

(5) SPRING WHEAT DIFFERENT DATES OF SEEDING.

The spring wheat used for this test was the Red Fyfe. The seedings took place just eight days apart, upon plots one-hundredth of an acre in size. The plots for each seeding were in duplicate as may be seen by the table. The soil consisted of a clay loam with a slight bearing to vegetable mould. Grain was sown broadcast at the rate of two bushels per acre. Unfortunate for the experiment, No. B. plot of May 17th, seeding is not reported upon owing to some mistake in handling the produce. The same variety of wheat seeded in another place on April 25th, upon soil very similar to that upon which the test was conducted gave a yield at the rate of 15.83 bushels per acre, being nearly one-half as much again as that seeded on May 1st.

TABLE No. IX shows the yield of spring wheat from three dates of seeding.

Dates of Seeding.	Separate Plots.	Duplicate tests for each date of seeding.			Average of yields for each date of seeding.		
		Weight per measured.	Straw per acre.	Grain per acre bus. by weight (60 lbs.)	Weight per measured.	Straw per acre.	Grain per acre bus. by weight. (60 lbs.)
		bus.	tons.		bus.	tons.	
May 1st	A	57.5	1.4	11.7	57 4	1.35	10.65
	B	57.3	1.3	9.6			
May 9th	A	57.	1.0	7.1	56.5	1.15	6.25
	B	56.	1.3	5.4			
May 17th	A	56.	1.4	5.4	*56.0	1.4	5.4
	B	.....	.....	.....			

* Only one plot with spring wheat seeded on May 17th. B. unfortunately destroyed.

(6) FALL WHEATS—TEST OF VARIETIES.

There were eighteen varieties of fall wheats tested of which the seed was obtained in Ontario, and thirty-one varieties of which the seed was imported from foreign countries. Twelve of the imported varieties proved to be total failures, while some others are quite promising. The winter was very severe upon fall wheats, and especially upon those which were grown in this climate for the first time. The plots were situated in field No. 17 of the farm upon the side hill sloping to the south-west. Each plot was one-hundredth of an acre in size, consisting of clay loam and was manured in the fall of 1889. The seeding was done upon September 10th, except six varieties of the Canadian sorts which were not sown until later, owing to delay on part of seedsmen. Grain was sown at the rate of two bushels per acre.

TABLE No. X shows the results of the tests with eighteen varieties of fall wheats from Ontario seed.

Variety.	Date of seeding.	Date of maturing.	Strength of straw.	Amount of rust.	Bearded or bald.	Color of grain.	Weight of grain per measured bushel.	Yield of straw per acre.	Yield of grain per acre, bushels by weight (60 lbs.)	Comparative order of grain yields, 1890.
				1-10			lb.	tons		
Golden Drop	Sept. 10	July 25	Medium	2	Bald	Golden	61.2	2.34	32.5	5
Surprise	" 10	" 19	Strong	1½	"	White	58.7	2.83	29.6	12
Manchester	" 10	" 23	Medium	5	"	Amber	61.0	2.41	30.4	11
Bonnell or Landreth	" 10	" 25	Strong	1	"	White	61.0	2.51	32.1	7
Seneca or Clawson	" 10	" 25	"	1	"	"	59.0	1.74	25.4	15
Rogers	" 10	" 27	"	2	"	Amber	60.8	2.74	34.6	3
Hybrid Mediterranean	" 10	" 21	Weak	3¼	Bearded	"	60.2	2.35	32.1	7
Martin Amber	" 10	" 27	Strong	2	Bald	"	62.5	2.03	32.5	5
Standard	" 10	" 24	"	3	"	White	59.3	2.13	31.7	10
Red Velvet Chaff	" 10	" 23	"	2	"	Red	61.0	2.48	35.8	2
Lancaster	" 10	" 20	Weak	2	Bearded	"	61.8	3.33	33.3	4
Early Red Clawson	" 10	" 22	Strong	2	Bald	"	58.0	2.51	32.1	7
Volunteer	" 12	" 19	Medium	3	Bearded	"	58.5	3.18	36.3	1
Golden Cross	" 19	" 20	Strong	3	"	"	58.0	2.56	27.9	14
New Monarch	" 19	" 27	"	3	Bald	"	56.7	1.88	20.0	16
Red Lion	" 19	" 23	"	2	Bearded	"	60.0	2.20	29.2	13
Democrat	" 27	" 28	"	4	"	Amber	56.5	2.18	20.0	16
Garfield or Natural Cross	Oct. 7	" 28	"	2	Bald	White	57.0	1.65	15.8	18

TABLE No. XI shows the leading characteristics of nineteen varieties of fall wheat, the seed of which was imported.

Variety.	Country from which seed was obtained	Power of withstanding the severe winter.	Date of maturity.	Length of straw.	Strength of straw.	Amount of rust.	Length of head.	Color of chaff.	Bearded or bald.
				in.		1-10	in.		
Galizien Summer	Germany.	Good -medium .	July 25.		Strong .	1		White .	Bald
Dividend	" .	" .	" 30.	56	" ..	5	3½	Red....	"
White Square Head	" .	Medium.....	" 30.	51	" .	4	2¼	White .	"
One Grain Speltz	" .	Good.....	Aug. 5	37	" ..	0	2	" ..	Bearded
Russian Odessa	Russia .	Medium.....	July 30.		Weak .	4		.....	Bald
Herefordshire	England .	"	Aug. 1	50	Strong .	4	3¼	Red....	"
Spalding Red	" ..	Poor	" 2	43	" ..	2	2¼	"	"
Kessingland Red	" ..	"	" 4	41	" ..	4	3½	White .	"
Golden Drop Red	" ..	"	" 2	41	" ..	2	3	Red....	"
Square Head	" ..	"	" 4	39	" ..	3	2¼	White .	"
Lammas	" ..	"	" 2	50	" ..	4	3½	Red....	"
Champion Prize White	" ..	"	" 1	38	" ..	4	3	White .	"
Browick Red	" ..	"	" 3	48	" ..	4	3½	Red....	"
Lamed Hybrid	France ...	Good—medium .	July 30.	50	" ..	4	3½	White .	"
Dattell's Hybrid	" ..	Medium.....	" 31.	42	" ..	4	3	"	"
Saumur	" ..	"	" 31.	49	" ..	3½	2¾	"	"
White Petanelle	" ..	Medium—poor .	Aug. 1	54	" ..	5	3½	White .	"
Rietti	" ..	Poor	July 30.	48	" ..	3	3¼	" ..	Bearded
Red Inversible	" ..	"	Aug. 1	47	"	½	4½	Medium	"
					Medium	4	2½	Red....	Bald

TABLE No. XII shows the results of yields, etc., of nineteen varieties of fall wheat from imported seed.

Variety.	Color of grain.	Quality of grain.	Weight of grain per measured bus.	Yield of straw per acre.	Yield of grain per acre bus. by weight. (60 lb.)	Comparative order of grain yield.
			lb.	tons.		
Galezien Summer	Red....	Excellent	62⅜	2.05	32.50	1
Dividend	"	Shrunken	53	2.57	23.33	5
White Square Head	White-red	"	57½	2.22	32.08	2
One Grain Speltz	.....	Enclosed in chaff .	40½	1.92	47.33	Enclosed in chaff.
Russian Odessa	.....	.....	60⅜	2.05	28.33	3
Herefordshire	White....	Medium.....	57½	1.75	23.33	5
Spalding Red	Red	Good.....	58½	1.33	17.08	12
Kissingland Red	"	Poor	52⅜	.60	5.00	18
Golden Drop Red	"	Medium.....	59¼	1.37	21.25	7
Square Head	"	"	56	1.15	15.83	13
Lammus	.....	.....	58½	1.75	20.00	8
Champion Prize White	.....	.....	57	.51	12.08	16
Browick Red	Red.....	Shrunken	55½	1.35	10.83	17
Lamed Hybrid	"	Medium.....	59	1.79	26.25	4
Dattell's Hybrid	White....	Excellent	60	1.37	20.00	8
Saumur	Red.....	Shrunken	57½	1.37	14.16	14
White Petanelle	White ...	Medium.....	58	1.48	17.91	11
Rietti	Red.....	Good.....	59½	1.27	19.13	10
Red Inversible	"	"	59¼	1.31	13.75	15

(7) OATS, TESTING OF VARIETIES.

There were ninety-three varieties of oats tested upon the experimental plots during the year 1890. The results are in two tables; the first giving the characteristics of the growth and behavior of the various kinds; and the second table giving the yields for 1889 as well as for 1890.

The plots were one-hundredth of an acre in size, and situated in the first and second ranges of field number three on the farm. The soil was clay loam and was manured with farmyard manure at the rate of fifteen loads per acre during last winter. Seeding took place on April 22nd, and each plot was sown at the rate of two and a quarter bushels per acre.

TABLE No. XIII shows the characteristics of ninety-three varieties of Oats.

Variety.	Where obtained by O.A.C.	When obtained by O. A. C.	Years grown at O.A.C.	Date of maturity.	Length of plant, inches.	Character of head.	Amount of rust, 0 least, 10 most.	Colour of grain.	Number of kernels in one gram.	Percentage of hull in grain, 1890 crop	Percentage of kernel in grain, 1890 crop.
American Welcome	Germany	1888	2	July 4th		Spreading		White	37	31.2	68.8
California White	do	1888	2	" 11	55	Mane	2	"	50	33.0	67.0
Oderbrücher	do	1888	2	" 6	47	Spreading	1	"	41	33.5	66.5
Thürigen	do	1888	2	" 11	51	"	4	Yellow	49	40.0	60.0
Danebrog	do	1888	2	" 9	48	"	2	White	41½	30.0	70.0
Hopetown	do	1888	2	" 10	54	"	2	"	54	32.0	68.0
Yellow August	do	1888	2	" 12	51	"	3	Yellow	56½	30.0	70.0
Longfellow	do	1888	2	" 9	62	"	2	White	39½	33.5	67.0
Probsteier	do	1888	2	" 6	50	"	2	"	44	30.8	69 2
Waterloo	do	1888	2	" 7	45	"	3	"	43	33.3	66,7
White Canadian	do	1888	2	" 10	46	"	3	"	40	29.8	70.2
Improved Besthorn	do	1888	2	" 9	41	"	3	Yellow	45	30.6	69.4
Nubian Black	do	1888	2	" 10	40	Mane	2	Black	40	33.9	66.1
August White	do	1888	2	" 9	48	Spreading	1½	White	44	29.8	70.2
Georgien	do	1888	2	" 9	42	"	1	"	50	28.0	72.0
Providence	Sweden	1888	2	" 9	38	"	1	"	57½	31.8	68.2
Rosedale	Ontario	1890	1	" 8	45	Mane	2	"	42	34.5	65.5
Scotch Potato	Russia	1888	2	" 10	34	Spreading	2	"	59	35.2	64.8
White Poland	do	1888	2	" 7	46	"	½	"	51	31.4	68.6
Podolischer	do	1888	2	" 4	56	"	2	"	43	38.0	62.0
Egyptian	Ontario		Several.	" 7	56	"	2	"	45	26.1	63.9
Pringle's Progress	do	1889	1	" 4	48	"	1	"	39	35.0	65.0
Siberian	Russia	1888	2	" 9	54	"	1	"	44	28.3	71.7
White Tartarian	do	1888	2	" 11	54	Mane	2	"	44	34 8	65.2
Berwick White	Scotland	1888	2	" 8	46	Spreading	2	"	55	32.0	68.0
Victoria White	do	1888	2	" 4	57	"	1½	"	43	33.6	66.4
Dun	do	1888	2	" 10	46	"	1	Dun	55	32.0	68.0
Black Tartarian	do	1888	2	" 11	42	Mane	4	Black	40	34.1	65.9
Hamilton	do	1888	2	" 10	44	Spreading	2	White	60	34.9	65.1
Bertrum Prolific	do	1888	2	" 10	40	"	2½	"	60	34.1	65.9
White Tartarian	do	1888	2	" 15	44	Mane	3½	"	58	34.1	65.9
Black Poland	do	1888	2	" 11	44	"	3½	Black	41	35.1	64.9
Birlie	do	1888	2	" 9	42	Spreading	2	White	58	30.7	69.3
Angus	do	1888	2	" 10	46	"	2	"	60	32.6	67.4
Longfellow	do	1888	2	" 7	42	"	2½	"	56	33.5	66.5
Hopetown	do	1888	2	" 11	52	"	3½	"	60	32.5	67.5
Potato	do	1888	2	" 10	34	"	2	"	62	38.1	61.9
Flying Scotchman	England	1888	2	" 3	59	"	1	"	43	36 5	63.5
Selected Winter	do	1888	2	" 12	51	"	2	Dun	50	36.3	63.7
Improved White Tartarian	do	1888	2	" 14	54	Mane	3	White	60	33.7	66.3
Dutch Bren	do	1888	2	" 3	51	Spreading	1	"	48	39.4	60.6
White Tartarian	New Zealand	1889	1	" 8	52	Spreading	3	"	47	34.1	65.9
Improved Black Tartarian	England	1888	2	" 10	52	Mane	3½	Black	49	36.3	63.7
Early Racehorse	do	1888	2	" 3	56	Spreading	2½	White	47	38.8	61.2
Victoria Prize White	do	1888	2	" 5	54	"	1½	"	45	38.8	64.5
Improved Waterloo White	do	1888	2	" 9	48	"	3	"	51	37.8	62.2
Early Blossom	do	1888	2	" 5	54	"	5	"	48	38.4	61.6
Yellow Flanders	France	1888	2	" 11	57	"	5	Yellow	55	31.3	68.8
Brie Black	do	1888	2	" 14	47	"	3	Black	63	36.9	63.1
Egyptian	Ontario		Several.	" 9	55	"	2	White	48	33.3	64.7
White Abundance	France	1888	2	" 7	52	"					
Black Red Crown	do	1888	2	" 11			2½	"			
Georgia White											

Hopetown	do	1888	2	" 11	52	"	3½	"	60	32.5	67.5
Potato	do	1888	2	" 10	34	"	2	"	62	38.1	61.9
Flying Scotchman	England	1888	2	" 3	59	"	1	"	43	36 5	63.5
Selected Winter	do	1888	2	" 12	51	"	2	Dun	50	36.3	63.7
Improved White Tartarian	do	1888	2	" 14	54	Mane	3	White	60	33.7	66.3
Dutch Bren	do	1888	2	" 3	51	Spreading	1	"	48	39.4	60.6

White Tartarian	New Zealand	1889	1	" 8	52	Spreading	3	"	47	34.1	65.9
Improved Black Tartarian	England	1888	2	" 10	52	Mane	3½	Black	49	36.3	63.7
Early Racehorse	do	1888	2	" 3	56	Spreading	2½	White	47	38.8	61.2
Victoria Prize White	do	1888	2	" 5	54	"	1½	"	45	38.8	64.5
Improved Waterloo White	do	1888	2	" 9	48	"	3	"	51	37.8	62.2
Early Blossom	do	1888	2	" 5	54	"	5	"	48	38.4	61.6
Yellow Flanders	France	1888	2	" 11	57	"	5	Yellow	55	31.3	68.8
Brie Black	do	1888	2	" 14	47	"	3	Black	63	36.9	63.1
Egyptian	Ontario	.....	Several.	" 9	55	"	2	White	48	33.3	64.7
White Abundance	France	1888	2	" 7	52	"	2½	"	46	28.7	71.3
Black Red Crown	do	1888	2	" 11	43	"	2½	Black (pale)	57	30.9	69.2
Georgia White	do	1888	2	" 7	40	"	2½	White	48	35.1	64.9
White Hungarian	do	1888	2	" 14	53	Mane	2½	"	60	32.1	67.5
Poland White	do	1888	2	" 7	54	Spreading	1	"	41	28.7	71.3
Yellow Gigantic	do	1888	2	" 15	48	.....	3	Yellow	58	36.6	63.4
Colommiers	do	1888	2	" 14	50	Spreading	2½	Black	61	36.8	63.2
Red spot	do	1888	2	" 5	38	"	.....	Dun	139	36.8	63.3
Joanette Black	do	1888	2	" 9	38	"	1	Black (pale)	51	27.0	73.0
Round or Branching Black	do	1888	2	" 10	46	"	2	"	61	38.1	61.9
Potato	New Zealand	1889	1	" 3	61	"	.....	White	50	39.3	60.7
Chenailles Black	France	1888	2	" 8	45	"	1	Black	55	26.0	74.0
Black Hungarian	do	1888	2	" 13	49	Mane	2	"	43	34.5	65.5
Dunn	New Zealand	1889	1	" 15	52	Spreading	1½	Dun	60	37.8	62.2
Black Etampes	France	1888	2	" 9	38	"	1	Black	41	26.8	73.2
Houdan Black	do	1888	2	" 9	44	"	2	" (pale)	66	28.9	71.2
Siberian	do	1888	2	" 2	50	"	1½	White	51	30.0	70.0
Triumph	Australia	1886	4	" 15	48	"	3½	"	62	51.0	49.0
White	do	1886	4	" 2	50	"	1½	"	44	40.7	59.3
Carter's Prize Cluster	Ontario	.....	Several.	" 3	53	"	2	"	43	37.3	62.7
Flanders White	France	1888	2	" 10	52	"	3½	"	47	36.3	67.4
Hopetown	Ontario	.....	Several.	" 9	44	"	3	"	42	33.6	66.4
Egyptian	do	.....	"	" 7	54	Mane	2	"	46	37.6	62.4
Racehorse	do	.....	"	" 3	50	Spreading	2	"	45	37.6	62.4
Black Tartarian	do	.....	"	" 9	43	Mane	3½	"	50	36.1	63.9
Banner	do	1890	1	" 8	53	Spreading	2	"	48	35.2	64.8
Bavarian	do	1889	2	" 8	51	"	3	"	51	37.2	62.8
White Australian	do	.....	Several.	" 14	49	Mane	3	"	48	31.8	68.2
Rennie's Prize White	do	.....	"	" 2	52	Spreading	2	"	47	39.9	60.1
Acclimatized Black Tartarian	do	.....	"	" 11	52	Mane	3	Black	44	39.8	60.2
Pedigreed Black Tartarian	do	1888	2	" 10	53	"	3	"	47	38.1	61.9
Black Champion	do	.....	Several.	" 11	55	"	2½	"	52	36.5	63.5
Improved Scotch	do	.....	"	" 9	52	Spreading	2	White	51	37.9	62.1
Cluster or Triumph	do	.....	"	" 4	54	"	2½	"	51	41.5	58.5
Welcome	do	.....	"	" 4	56	"	2	"	49	41.4	58.6
Early Calder	do	.....	"	" 7	49	"	2	"	57	37.7	62.3
Hungarian Black	Hungary	1888	2	" 9	40	Mane	2	Black	49	40.9	59.1
Port Adelaide	Australia	1888	2	" 6	54	Spreading	2	White	43	39.9	60.1
Australian White	do	1888	2	" 6	47	"	2½	"	47	31.5	68.5
Prolific Black	California	1888	2	" 7	51	Mane	3	Black	54	39.0	61.0
Danish	New Zealand	1888	2	" 7	39	Spreading	3	White	46	37.9	62.1
White Wonder	Ontario	1889	1	" 1	50	"	2	"	40	37.9	63.1

TABLE No. XIV shows the yield for ninety-three varieties of Oats for 1889 and 1890.

Variety.	Weight of grain per measured bushel.	Yield of—		Yield of grain per acre. Bushels by weight (34 lb.)			Yield of straw per acre. Tons.			Comparative order of grain yield, 2 years.
		Grain per plot.	Straw per plot.	1889.	1890.	Average.	1889.	1890.	Average.	
		lb.	lb.							
American Welcome	40⅛	15½	49½	50.	45.6	47.8	2.2	2.5	2.4	38
California White Prolific	32	15	47	47.1	44.1	45.6	3.1	2.4	2.8	45
Oderbrucher	31½	19⅜	39¼	75.0	58.1	66.6	2.6	2.0	2.3	4
Thuringen	31½	13½	55	32.1	39.7	35.9	3.9	2.8	3.4	65
Danebrog	32	18	42	75.0	52.9	64.0	3.2	2.1	2.7	5
Hopetown	33½	12¾	60¼	23.5	37.5	30.5	.....	3.0	3.0	78
Yellow August	29½	14	57	45.6	41.2	43.4	3.9	2.9	3.4	49
Longfellow	31½	9	56	25.	26.5	25.8	4.0	2.8	3.4	84
Probsteier	33	18½	44½	69.1	54.4	61.8	2.9	2.2	2.6	8
Waterloo	31½	19¼	44⅜	64.7	56.6	60.7	3.1	2.2	2.7	11
White Canadian	33½	19½	54½	63.2	57.3	60.6	3.1	2.7	2.9	13
Improved Besthorne	32¼	18	40	70.6	52.9	61.8	1.7	2.0	1.9	8
Nubian Black	32	17½	44½	48.5	51.5	50	3.3	2.2	2.8	32
August White	40½	14⅜	45¼	41.2	43.4	42.3	3.8	2.3	3.1	51
Georgian	33⅝	19⅜	43½	63.2	58.1	60.7	3.6	2.2	2.9	11
Providence	35½	13¾	40⅜	36.8	39.0	38.0	3.3	2.0	2.7	61
Rosedale	38½	18½	45½	26.5	54.4	40.5	3.9	2.3	3.1	56
Scotch potato	34¼	8½	27¼	26.5	25.7	26.1	3.2	1.4	2.3	83
White Poland	34½	13⅜	35⅝	44.1	39.0	41.6	3.4	1.8	2.6	54
Podolischer	39¼	16¾	49½	32.4	49.3	40.9	2.9	2.5	2.7	55
Egyptian	37½	20	46½	57.4	58.8	58.1	3.7	2.3	3.0	16
Pringle's Progress	28½	21½	48	60.3	63.2	61.8	3.0	2.4	2.7	8
Siberian	40	15¼	36⅜	73.5	44.9	59.2	3.3	1.8	2.6	15
White Tartarian	35⅜	18½	43⅝	60.3	54.4	57.4	3.8	2.2	3.0	19
Berwick White	36	12	39	44.1	35.3	39.7	3.5	2.0	2.8	58
Victoria White	42½	17¼	42¾	55.9	50.7	53.3	2.8	2.1	2.5	25
Dunn	32	13	56	32.4	38.2	35.3	4.4	2.8	3.6	67
Black Tartarian	34½	18	42	52.9	52.9	52.9	3.9	2.1	3.0	26
Hamilton	36	12¼	44⅜	30.9	36.0	33.5	3.6	2.2	2.9	71
Bertrum Prolific	35½	13½	45⅝	39.8	39.0	39.5	3.6	2.3	2.5	59
White Tartarian	30½	15¼	56⅜	42 6	44.9	48.8	4.5	2.8	3.7	33
Black Poland	35¼	17¼	44½	54.4	50.7	52.4	2.8	2.4	2.5	28
Birlie	38	14¼	48⅜	25.0	41.9	33.5	2.6	2.4	2.5	71
Angus	35½	15½	54⅜	22.1	44.9	33.5	2.3	2.7	2.5	71
Longfellow	35	14½	49⅜	29.4	41.9	35.5	3.5	2.5	3.0	66
Hopetown	33½	12½	65½	22.5	36.8	29.7	3.5	3.3	3.4	81
Potato	31½	10¼	41⅝	20.6	30.2	25.4	2.8	2.1	2.9	86
Flying Scotchman	39	18	47	63.2	52.9	58	2.4	2.4	2.4	18
Selected Winter	32½	10½	45¼	22.1	30.2	26.2	2.3	2.3	2.3	32
Improved White Tartarian	29½	12½	62	23.5	36.8	30.2	3.1	3.1	3.1	79
Dutch Bren	36⅝	16	45	47.1	47.1	47.1	2.2	2.3	2.3	41
White Tartarian	29½	13⅜	46¼	32.4	40.4	36.4	.....	2.3	.....	64
Improved Black Tartarian	30	13	44½	35.3	38.2	36.8	2.2	2.2	2.2	63
Early Racehorse	40½	12⅜	39⅞	32.4	37.5	35.0	1.6	2.0	1.8	68
Victoria Prize White	41	15	37½	47.1	44.1	45.6	1.8	1.9	1.8	45
Improved Waterloo White	29½	15¼	44⅝	51.5	44.9	48.2	2.0	2.2	2.1	35
Early Blossom	36½	15¾	57¾	60.3	44.9	52.6	2.0	2.9	2.5	26
Yellow Flanders	29⅝	10½	55	33.8	30.9	32.3	3.2	2.8	3.0	75
Brie Black	29½	13¼	64½	36.8	39.	37.9	3.4	3.2	3.3	62
Egyptian	38¼	19¼	46¾	55.9	56.6	56.3	2.7	2.3	2.5	19
White Abundance	35	19	55	61.8	55.9	58.8	.....	.....	.....	.....
Black Red Crown	31½	141	691	.....	.....	.....	.....	.....	.....	.....
Georgia White										

Improved White Tartarian	32½	10¼	45¼	22.1	30.2	26.2	2.3	2.3	2.4	2.3	18
Dutch Bren	29½	12½	62	23.5	36.8	30.2	3.1	3.1	2.3	3.1	32
White Tartarian	36½	16	45	47.1	47.1	47.1	2.2	2.3	2.3	3.1	79
	29½	13¾	46¼	32.4	40.4	36.4	.....	2.3	.....	2.3	41
											64
Improved Black Tartarian	30	13	44⅛	35.3	38.2	36.8	2.2	2.2	2.2	2.2	63
Early Racehorse	40½	12⅜	39¼	32.4	37.5	35.0	1.6	2.0	1.8	1.8	68
Victoria Prize White	41	15	37½	47.1	44.1	45.6	1.8	1.9	1.8	2.1	45
Improved Waterloo White	29½	15¼	44⅝	51.5	44.9	48.2	2.0	2.2	2.1	2.5	35
Early Blossom	36½	15¾	57½	60.3	44.9	52.6	2.0	2.9	2.5	3.0	26
Yellow Flanders	29⅝	10½	55	33.8	30.9	32.3	3.2	2.8	3.0	3.3	75
Brie Black	29½	13¼	64¼	36.8	39.	37.9	3.4	3.2	3.3	2.5	62
Egyptian	38¼	19¼	46½	55.9	56.6	56.3	2.7	2.3	2.5	2.6	19
White Abundance	35	19	55	61.8	55.9	58.8	2.4	2.8	2.6	3.2	17
Black Red Crown	31½	14½	68½	41.2	42.7	41.9	3.0	3.4	3.2	3.2	52
Georgia White	34½	17¼	76⅝	61.8	50.7	56.3	2.6	3.8	3.2	2.8	19
White Hungarian	32½	13	60	47.1	38.2	42.7	2.7	3.0	2.8	2.0	50
Poland White	42½	15¼	42⅝	64.7	44.9	54.8	1.9	2.1	2.9	2.9	22
Yellow Gigantic	27½	16½	60⅞	54.4	48.5	51.5	2.7	3.0	3.4	3.4	31
Coalommiers	29½	13¾	68¼	38.2	39.0	38 6	3.4	3.4	2.5	2.5	60
Red Spot	27½	9	48	35.3	26.5	30.9	2.5	2.4	2.7	2.7	77
Joanette Black	34½	21⅓	60⅜	80.9	62.5	71.7	2.4	3.0	2.6	2.6	1
Round or Branching Black	28½	10⅝	51⅝	25.3	32.0	33.7	2.7	2.6	2.4	2.5	70
Potato	38	14 1-5	47 3-10	54.4	41.8	48.1	2.7	2.4	2.9	.....	37
Chenailles Black	34⅝	18	57	80.9	52.9	66.9	.....	3.0	2.8	2.8	3
Black Hungarian	33½	16	59	45.6	47.1	46 3	2.7	2.6	2.5	2.5	43
Dun	30½	11	52	63.2	32.4	47.8	2.4	2.3	2.5	2.5	38
Black Etampes	36½	21¼	46⅜	66.2	68.4	62.3	2.6	2.7	2.0	2.0	7
Houdan Black	34⅜	26	54	61.8	76.5	69.1	1.3	2.1	2.1	2.1	2
Siberian	34⅜	20¾	42¼	66.2	61.0	63.6	2.1	2.3	2.3	2.3	6
Triumph	27	9	45	20.6	26.5	23.5	2.3	2.3	2.2	2.2	88
White	40½	12	43	52.9	35.3	44.1	2.2	2.2	1.8	2.0	47
Carter's Prize Cluster	40½	13	35	50.0	38.2	44.1	2.3	2.2	1.9	2.3	47
Flander's White	34½	13½	38	25.0	39.7	32.4	2.8	3.3	2.1	2.7	74
Hopetown	33½	14	41⅛	42.6	41.2	41.9	3.3	3.0	3.6	3.3	52
Egyptian	36¾	21¼	72⅜	57.4	62.5	60.0	3.0	2.5	1.5	2.0	14
Racehorse	40	11	29	48.4	32.4	40.4	2.5	2.7	1.4	2.0	57
Black Tartarian	32¼	12⅛	27⅜	55.9	35.7	45.8	2.7	.....	2.3	.....	44
Banner	31¾	18	45	.....	52.9	.....	.....	2.9	2.8	2.6	26*
Bavarian	33	15½	46⅜	72.1	44.9	54.0	2.9	2.8	2.4	2.6	47*
White Australian	32½	14¾	48½	64.7	43.4	46.4	2.8	2.6	2.2	2.6	22
Rennie's Prize White	39	12	43½	57.4	35.3	53.7	2.6	2.5	2.3	2.4	42
Acclimatised Black Tartarian	30½	15½	46	61.8	45.6	48.2	2.5	2.5	2.4	2.4	24
Pedigreed Black Tartarian	31¼	15⅝	48¼	50.0	46.3	52.2	2.5	2.7	2.4	2.5	35
Black Champion	38½	16½	47½	55.9	48.5	25.0	2.7	3.2	2.3	2.6	29
Improved Scotch	30	9¼	46⅝	22.1	27.2	49.6	3.2	2.5	2.2	2.7	87
Cluster or Triumph	37	13¼	43⅝	60.3	39.0	47.8	2.5	2.4	2.1	2.3	33
Welcome	37	11	41	63.2	32.4	51.8	2.4	2.7	2.1	2.2	38
Early Calder	29½	13⅜	41¼	63.2	40.4	30.2	2.4	2.4	1.5	2 4	30
Hungarian Black	31½	13½	30⅞	20.6	39.7	31.3	2.3	2.5	1.9	2.0	79
Port Adelaide	39½	12⅝	30¼	25.0	37.5	25.7	2.5	2.4	2.2	2.1	76
Australian White	37¼	10½	42½	20.6	30.9	33.8	2.4	.....	1.2	2.3	85
Prolific Black	30½	14½	44½	25.0	42.7	.....	.....	.....	1.6	.....	69
Danish	31¾	12¼	23⅝	.....	36.0	.....	.....	.....	.....	.....	65*
White Wonder	41⅝	14¼	31¼	.....	41.9	.....	.....	.....	.....	.....	52*

* Only one year's testing.

(8) Oats, Different Dates of Seeding.

Six plots of Bavarian oats were seeded on three different dates, two plots being seeded each time. The soil was quite uniform on the whole range, consisting of clay loam with some vegetable mould and was manured at the rate of fourteen loads to the acre in the winter of 1889. Each plot was one hundredth of an acre in size, and grain was sown broadcast at the rate of two and one quarter bushels per acre. On April 22 the Bavarian oats were sown upon a soil of clay loam, also manured last winter but situated in another field. From this plot a yield at the rate of 44.9 bushels per acre was obtained.

Table No. xv shows the yields of oats at three dates of seeding.

Dates of seeding.	Separate plots.	Duplicate tests for each date of seeding.			Average of yields for each date of seeding.		
		Weight per measured bushel.	Straw per acre, tons.	Grain per acre, bus. by weight (34 lb.)	Weight per measured bushel	Straw per acre, tons.	Grain per acre, bus. by weight. (34 lb.)
		lb.			lb.		
May 1st.	A	29.0	1.89	34.6	30.5	2.07	30.9
	B	31.9	2.24	27.2			
May 9th.	A	24.0	1.93	25.0	24.5	1.73	25.0
	B	25.0	1.53	25.0			
May 17th.	A	21.0	1.68	19.1	21.5	1.66	19.1
	B	22.0	1.63	19.1			

(b) Cereals on Large Plots.

Over twenty varieties of grains were grown upon plots varying from one-third to one acre in size. These consisted of some of the most noted Canadian varieties but principally of the most promising of the 1889 crop from imported seed. The plots were made in field No. 9 of the farm, consisting of twenty acres. One half of this field received a good coating of farmyard manure in 1888 and the whole field was in corn during 1889. The manured part showed a very marked advantage in the corn crop over that part which was unmanured. During the present year the grain plots were run uniformly, so that each plot would contain one-half of the manured and one-half of that which had received no manure. The crops upon the two parts were very different in growth, that upon the manured part being taller in growth and producing more grain of a better quality. All plots were of the same length, being about forty rods long, and a path thirty inches wide was left between each two plots.

Three acres of pease, namely, the Mummy, Multipliers and Centennial were so affected by the wet weather in the early part of summer that the experiment proved unreliable for ascertaining the relative yields.

Could all these larger plots of grain have been sown about ten days earlier, we have no doubts there would have been a much larger yield, judging from the results of our smaller plots.

A description of these grains can in nearly every case be found in the tables of the smaller plots, and we will here simply give the yields per acre.

(9) Barleys, Tests of Varieties.

There are seven varieties of barley to report upon from the large plots. The land upon which these were grown, was a clay loam with a considerable amount of vegetable matter. The land was about as uniform as could be chosen for plots of such large size. The soil is so uneven over the greater part of this farm that it is very difficult to select parts which is as even as is desired for experiments. Especially when

the plots are of such a large character. The difficulty of irregularity in soil can be more fully overcome in the smaller plots where sections can be selected of a much more even nature throughout.

The first five varieties were upon plots of one-third of acre each, and the two last varieties were upon acre plots. The soil of the acre plots was lower lying than that of the other plots, and consisted of a greater quantity of vegetable matter.

TABLE No. XVI shows the yields of barley per acre, from plots one-third of an acre and one acre in size.

Variety.	Yield per acre (bush. by weight, 48 lb.).
Improved Scotch	30
Italian Rice	21 4-5
Phœnix	30
Kalina	26
Oderbrucher	36½
Common 6-rowed	39
Carter's Prize Prolific	31½

(10) SPRING WHEATS, TESTS OF VARIETIES.

There were three varieties of spring wheat tested upon acre plots, but through some cause two of these varieties were missed from the tests of the smaller plots. The soil on which these tests were made, was perhaps as uniform as any section on the farm of the same area. The difference between the part which had received manure in 1888 and that which received none was great in case of the spring wheats, the advantage being much in favor of the manured part. Could these parts have been harvested and threshed separately, it would be of much value to have the comparative figures, but pressure of work made it impossible for us to accomplish this work satisfactorily. After being well cleaned, the first two named wheats gave a yield per bushel of 62 lbs. each, and the latter 61 lbs.

TABLE No. XVII shows the yield on each acre.

Variety.	Yield per acre.
Red Fern	17⅓
Rio Grande	11⅜
Manitoulin	15⅓

(11) OATS, TESTS OF VARIETIES.

The oat plots were in the central part of the field and were fairly uniform throughout. There are thirteen varieties upon which to report. These were the last that were sown in the field, and were about eight days later in being put in than those on the small plots, and we observe in our tests of different dates of seeding that the same varieties put in eight days after the first seeding on April 22, gave a yield of 31 per cent less, a fact which should be taken into consideration in comparing yields of the small and large plots.

The first ten varieties were put in plots of one-third acre each and the last three in plots of one acre each.

TABLE No. XVIII shows the yields of oats per acre of 13 varieties.

Variety.	Yield per acre (bush. by weight, 34 lb.).
Black Etampes	47.1
White Abundance	33.4
Flying Scotchman	23.5
Waterloo	38.7
Probsteier	41.3
Improved Besthorn	29.3
White Tartarian	39.1
Siberian	33.4
White Poland	49.2
Danebrog	39.3
Bavarian	41.0
American Banner	45.4
White Bonanza	29.6

2. POTATOES AND ROOTS.

Upwards of one hundred varieties of potatoes and roots have been tested upon small plots during the past summer. The seed of these varieties was mostly obtained from the Canadian seedsmen and the varieties are principally those which have been grown more or less over Ontario. The plots were situated on the south-westerly slope of field 17 of the farm. This field was under grass and pastured by sheep in the summer of 1889, and was plowed lightly in August of the same year and afterwards harrowed crosswise with the Corbin disc harrow. This was again plowed before winter set in. In the spring of the present year this land received a good coating of farmyard manure, and was again plowed and afterwards harrowed and drilled up for the potatoes and roots.

(12) POTATOES, TEST OF VARIETIES.

There were twenty-eight varieties of potatoes grown upon plots one twenty-seventh of an acre in size. These plots were about twelve rods long and there were three rows in each plot. Thirty inches were allowed between each two consecutive rows and between each two consecutive plots. The land which is a clay loam had been in sod the previous year. It was plowed in the autumn, top dressed with farmyard manure at the rate of 14 loadsper acre in the spring, and again plowed. Surface cultivation then took place and the potatoes dropped into drills made with the plow. The seed potatoes were cut into pieces containing two eyes each, but owing to heavy rains was of necessity left about five days before being planted after cutting was done. The seeding took place on and as soon as the plants were nicely up, the ground was lightly harrowed. Horse hoeing took place occasionally during the growing period, and two applications of Paris green in water were made upon the tops to destroy the bugs. The potatoes were carefully taken up with a potato digger in the autumn and weighed. The crop was not large, which was perhaps principally owing to the very wet weather in the early summer.

A small sample of each variety was sent to yourself, to Mr. Forsyth, the gardener, and to myself, to test the different varieties as to their relative value for table use. These tests were all made independently of each other and reported upon as may be seen in the table. The samples sent to yourself were taken from the crop of the large plots, while those sent to Mr. Forsyth and myself were taken from small single rows in another field the soil of which was also a clay loam but of rather a lighter nature.

TABLE No. XIX shows the yields and table quality of twenty-eight varieties of Potatoes.

Varieties. (In same order in which table quality was tested).	Table Quality.								Yield per acre,	Comparative order of yield.
	Flavor.			Mealiness.				Ripening.		
	By Professor of Agriculture.	By Foreman of Horticulture Dep.	By Assistant Supt. Experimental Dept.	By Professor of Agriculture.	By Foreman of Horticulture Dept.	By Assistant Supt. Experimental Dept.	General appearance on plate.	Remarks.		
Early Rose										

TABLE NO. XIX shows the yields and table quality of twenty-eight varieties of Potatoes.

Varieties. (In same order in which table quality was tested).	Table Quality. Flavor. By Professor of Agriculture.	By Foreman of Horticulture Dep.	By Assistant Supt. Experimental Dept.	Mealiness. By Professor of Agriculture.	By Foreman of Horticulture Dept.	By Assistant Supt. Experimental Dept.	General appearance on plate.	Remarks.	Ripening.	Yield per acre, bus.	Comparative order of yield.
Early Puritan	Good	Good	Good	Good	Good	Medium	Fairly good	Somewhat above average in qualities.	Early	139⅓	4
Crown Jewel	Medium	"	Very good	"	Medium	Good	Medium	Above average in qualities.	"	70⅔	20
Summit	"	Very good	Medium	"	Good	Medium	Whitish	Slightly above medium quality.	Late	137	6
Convoy	Very good	"	Very good	"	"	Good	"	Very fine Potato. This variety was grown in the garden.			
London	Good	"	Poor	"	Medium	Medium	Reddish white	Medium qualities.	Early	135⅓	7
Rose's New Invincible	"	Poor	"	Medium	Poor	Poor	Yellowish	Poor.	Medium	78	17
The Daisy	Medium	Very good	Very good	Good	Good	Good	Fairly White	An excellent table potato.	Early	157⅓	3
Clark's No. 1	"	Very good	Good	"	"	"	Medium	Good potato.	Medium	139⅓	5
Green Mountain	Very good	Very good	Medium	"	"	Medium	Darkish tinge	Slightly above average qualities.	"	79½	16
Early Maine	Good	Good	Good	Poor	Medium	Good	Whitish	Good table variety.	Early	135⅓	7
Stray Beauty	Good	Poor	Poor	Poor	Poor	Medium	Yellowish	Poor table variety.	"	49	24
Empire State	"	Good	Good	Good	Medium	Medium to good	Whitish	An excellent table potato.	"	162	1
Beauty of Hebron	Very good	Very good	Very good	"	Good	Good	White	Extra qualities.	"	99	12
White Elephant	"	Medium	Medium	"	Medium	Medium	Fairly white	Medium qualities.	Late	67	23
Early Sunrise	Good	Good	"	"	Medium	"	"	Fair qualities.	Early	69⅓	22
Rural Blush	Medium	Medium	Poor	"	"	Poor	Reddish cast	Generally poor.	Late	102⅔	11
Halton's Seedling	Very good	"	Good	Good	"	Good	Medium	Good qualities.	Early	94⅔	13
Dakota Red	Good	Poor	Medium	Medium	Poor	Poor	Very solid	Poor potato.	Medium	77⅔	19
Early Ohio	Very good	Medium	"	Good	Poor	Medium	Fairly white	Medium qualities.	Early	45⅔	25
Rosy Morn	Medium	"	Poor	Poor	Good	Poor	Greenish cast	Rather poor potato.	"	77⅔	18
Thorburn	Good	Very good	Very good	Good	"	Good	Whitish	Excel't table potato.	Late	162	1
Rural New Yorker	Very good	Medium	"	"	"	"	Medium	Excel't table potato.	Early	129	9
Minister	Medium	Good	Very poor	"	"	Medium	Fair	Course texture.	Late	70⅔	21
Pootaluck	"	Medium	Medium	Medium	Medium	"	Fairly light with a yellowish tinge	Medium qualities.	Medium	106⅔	10
Late Rose	Very good	Good	Good	Good	"	"	Whitish	Fair qualities.	"	94⅓	14
Sweet St. Vernal	Good	Medium	Poor	"	"	Good	Medium	Medium qualities.	Late	87⅔	15
Lady's Finger										25⅓	27
Mrs. Foraker									Medium		

(13) Turnips, Test of Varieties.

There were in all forty-eight varieties of turnips, or rather forty-eight tests, as in a few instances the same variety appears from seed of different places. The rows were a little over eight rods long, and there were two rows of each variety. The rows were twenty-eight inches apart, and the turnips thinned to about fourteen inches in the row, or as near that distance as could be well done. Owing to the wet weather in June the turnips were not sown until the last week.

In the first table is given the results from the yellow and white fleshed turnips, and in the last table from the Swede turnips.

Table No. xx shows the characteristics and yields per acre of 16 varieties of yellow and white fleshed turnips.

Variety.	Color of flesh.	Amount of tops.	Shape of roots.	Uniformity.	Number of turnips per acre.	Average weight per root.	Yield per acre.	Comparative order of yield.
						lb.	tons.	
Pearce's Invincible	Yellow	Medium	Globe	Good	9,307	2.26	10.54	16
Purple Top Mammoth	White	"	"	Medium	13,530	3.36	15.83	9
Golden Ball	Yellow	Small	"	"	8,364	2.60	10.89	15
White Globe	White	Large	"	Good	6,847	4.56	15.62	11
Mammoth White	"	"	Elongated	"	6,068	6.64	20.15	3
Grey Stone	"	Medium	Globe	"	11,275	3.45	19.48	5
Green Top Aberdeen	Yellow	"	Elongated	Medium	8,364	3.06	12.81	14
Purple Top Aberdeen	"	Large	Globe	Poor	11,603	2.51	14.58	12
Early Six Weeks	White	Medium	Elongated	Medium	8,528	3.90	16.66	8
Waite's Eclipse Hybrid	Yellow	Large	"	Poor	10,947	2.86	15.64	10
Flat White Dutch	White	Small	Flat	"	8,323	3.50	14.58	12
White Stone or Snowball	"	Large	"	Good	8,487	4.52	19.20	6
Orange Jelly	Yellow	Medium	Globe	Medium	9,348	4.10	19.16	7
Red Top Strap Leaf	White	Small	Flat	"	9,266	4.46	20.68	2
Pomeranian White Globe	"	Large	Elongated	"	8,610	4.59	19.80	4
Red Globe Norfolk	"	"	Flat	Good	7,790	6.81	26.52	

TABLE No. XXI shows the characteristics and yields per acre of 32 varieties of Swede Turnips.

Variety.	Quantity of tops.	Neck of roots.	Uniformity of roots.	Number of roots per acre estimated from small plots.	Average weight per root.	Yield per acre.	Comparative order of yield.
					lb.	tons.	
Bangholm	Medium..	Medium..	Good.....	15354	.96	7.34	30
Laing's Swede	Small	" ..	Medium..	15826	.80	6.29	31
Green Top	Large	Short	" ..	15641	1.33	10.44	27
Skirvings	Small	"	Good.. ..	13653	1.81	12.38	24
Marquis of Lorne	Medium..	Long.....	Medium..	14555	1.43	10.39	28
Sutton's Champion	Large ...	Medium..	Good.....	15211	1.48	11.36	25
East Lothian	"	" ..	" ...	15149	1.70	12.85	22
Scottish Champion	"	Short	"	15190	1.67	12.65	23
White Swede	"	"	Medium..	8302	2.23	14.30	18
Marshall	" ..	Long.....	" ..	13919	2.13	14.82	15
Prize Winner	Small	"	Poor	18142	1.23	11.15	26
Hagard's Improved	Large ...	Short	Good.....	17753	1.68	14.95	14
Purple Top	Medium..	Long.....	" ..	18839	1.49	14.04	20
Drummond's Improved	" ..	Medium..	"	18921	1.49	14.10	19
Laidlaw's Improved	Small	" ..	"	19286	1.57	14.31	17
P. W. & Co. Improved Prize	Large ...	Short	Poor	17896	1.61	14.41	16
Carter's Imperial	"	Medium..	Good.....	18819	1.79	16.81	11
Elephant (Steele)	"	Long.....	"	16482	2.23	18.35	6
" (Bruce)	" ...	"	"	10251	2.52	12.92	21
Fetticairn	"	Short	"	16441	2.54	20.91	2
Marshall	Small	Medium..	"	17671	1.45	12.81	22
Rennie's Prize Purple Top	Medium..	Long.....	Poor	16851	1.87	15.79	13
Simmer's Champion	Large ...	Medium..	"	19311	1.72	16.54	12
Carter's Elephant (Simmer's)	"	Long.....	Good.....	18532	2.26	20.98	1
Royal Norfolk	"	"	"	18880	2.14	20.19	3
Hall's Westbury	"	"	Medium..	18901	2.01	19.00	4
Marquis of Lorne	Small	"	Poor	16605	2.07	16.97	10
Steel Bros. Highland Prize	Large ...	"	Good.....	19639	1.76	17.26	9
Hazard's Swede Turnip	Medium..	Medium..	"	17794	2.10	18.72	5
Homefield	Large ...	Long.....	"	18532	1.90	17.55	8
Green Top	Small	Medium..	"	17117	2.06	17.65	7
Purple Top	Large ...	" ..	"	7667	2.64	10.13	

(14) Mangels, Test of Varieties.

Twenty-nine varieties of mangels were grown upon the plots during the summer of 189-. Each plot consisted of one forty-first of an acre, the rows were twenty-eight rods apart and the mangels thinned to fourteen inches in the row. Quite full notes were taken of the growth of these roots, but owing to a misfortune we are unable to present them, and consequently only include in the table the estimated number of mangels per acre as determined from the number of mangels on the plot of one forty-first of an acre, the average weight per mangel and the yield per acre in tons.

Table No. xxii shows the average size of roots and yields per acre of 29 varieties of mangels.

Variety.	Number of mangels per acre.	Average weight per mangel.	Yield per acre.	Comparative order of yield.
		lb.	tons.	
Champion Yellow Winter	14842	1.40	10.35	20
Yellow Intermediate	11644	2.44	14.23	2
Mammoth Red Intermediate	13858	1.64	11.38	16
Imperial	17876	1.41	12.58	9
Long Yellow	13735	1.33	9.12	26
Long Red	14386	1.59	11.30	17
Norbitan Giant	16482	1.68	13.81	4
Gate Post	13571	1.72	11.66	14
Yellow Globe	13284	1.64	10.87	19
Maulen Orange	15539	1.51	11.77	13
New Giant	14596	2.00	14.62	1
Mammoth Long Red	15580	1.53	11.93	12
Carter's Golden Intermediate	9471	2.06	9.76	24
Lane's Improved	15662	1.72	13.49	5
Wane's Tankard	11767	1.12	6.58	28
P. W. & Co. Mammoth Long Red	14514	1.67	12.14	11
Yellow Globe	15539	1.62	12.61	8
Beck's Champion Yellow Globe	12792	1.69	10.30	21
Pearce's Clan Giant	16031	1.75	14.04	3
Red Globe	15375	1.62	12.42	10
Fisher Hobb's Yellow Globe	16072	1.64	13.20	6
Carter's Warden Prize Globe	12382	1.61	9.98	23
P. W. & Co. Golden Flesh Tankard	13038	1.32	8.61	27
Red Tankard	14063	.92	6.50	29
Giant Half Long	14309	1.84	13.14	7
Giant Yellow Globe	21894	1.46	10.95	18
Dudgeon's White Sugar Beet	11972	1.60	9.65	25
Bruce's White Sugar Beet	17302	1.18	10.21	22
White Sugar Beet	15088	1.52	11.46	15

(15) Carrots, Test of Varieties.

Eleven varieties of field carrots were tested by having four rows, twenty-eight inches apart and eight rods long of each variety. The plants were thinned to from three to four inches apart in the row. Seven varieties were tested in 1889 and it is seen the Giant Short White or White Vosges has taken the lead each year.

Table No. xxiii shows the characteristics and yields of 11 varieties of carrots.

Variety.	Amount of tops.	Color of root.	Uniformity of roots.	Average length of carrot.	Average diameter of carrot.	Easy or hard to remove	Average weight per	Yield	Comparative

TABLE No. XXIII shows the characteristics and yields of 11 varieties of carrots.

Variety.	Amount of tops.	Color of root.	Uniformity of roots.	Average length of carrot.	Average diameter of carrot.	Easy or hard to remove from soil.	Average weight per carrot.	Yield per acre.	Comparative order of yield.
				inches.	inches.		lb.	tons.	
Yellow Belgian	Medium	Light orange.	Medium	13½	1 5-9	Hard	.64	12.65	9
White Belgian	Large	White	Poor	12½	2	Medium	.67	16.64	3
Red Altringham	Small	Deep orange.	Medium	9	2	Medium-hard	.32	8.93	11
Intermediate	"	"	Good	8¾	2¼	Medium-easy	.47	14.43	7
Long Orange	Large	"	"	13¾	2¼	Hard	.43	11.87	10
White Green Top Orthe	Medium	White	Medium	13⅛	2½	Medium	.74	16.53	4
Danvers Orange	Small	Deep orange.	Good	6¾	3	Medium-easy	.56	15.70	5
P. W. & Co. Giant Wiltshire White	Large	White	Medium	12¼	2¼	Hard	1.01	13.12	8
Peerless Orange Giant	Small	Light orange.	Good	10¼	2 4-5	Medium-easy	1.05	14.89	6
Mitchell's Perfected	Large	Deep orange.	"	9⅛	1⅞	Medium	.59	17.02	2
Giant Short or White Vosges	"	White	"	10	3¼	Easy	.85	17.78	1

3. Forage Crops.

These experiments have been mostly confined to rape tests during the past season, although a few plots were sown to lucerne in the spring of the present year. An experiment in corn cultivation will be given under the heading "Co-operative Experiments."

(c) Rape Experiments.

Until the year 1889 almost no experiments were ever conducted in connection with rape cultivation in Ontario. Owing to the growing importance of this crop for feeding lambs in the autumn and early winter, a number of experiments have been conducted upon the experimental plots for the past two years.

In harvesting the rape knives were used and the plants were cut off on a level with the ground, and consequently the yield will be lighter than last year when the roots and tops were weighed together.

(16) Influence of Salt with Rape on Four Kinds of Soil.

About seven years ago a plot was formed in the central part of the experimental field for the purpose of testing four kinds of soil under as near the same conditions as could be obtained. The whole plot is eight rods long by two rods wide, and is divided into four portions, each being two rods square. The soil is well supplied with tile drains. One end of the plot is a natural muck. The surface soil of the two central plots was removed to a depth of two feet and then one was filled with clay of a rather heavy nature and the other with marl intermixed with loam, while the remaining portion, being naturally a good clay loam, was left untouched.

In the spring of 1888, each portion was divided into two equal parts, and boards placed edgeways in the ground at the division and extended from one end of the plot to the other.

The accompanying diagram will illustrate the position of the soils and the divisions:

SALT.	SALT.	SALT.	SALT.
LOAM.	MARL.	CLAY.	MUCK.
NO SALT.	NO SALT.	NO SALT.	NO SALT.

The treatment of the plot throughout was similar until the spring of 1888, when salt was applied at the rate of 400 lb. per acre on the soils of one side of the division through the centre, while the remaining half of each soil was left without salt. Barley was sown upon the whole plot and results presented in the College Report of 1888. In the spring of 1889 salt was again applied at the rate of 400 lb. per acre upon the same portions as in 1888 and oats sown over the whole plot.

In the summer of the present year rape was sown upon these plots in drills twenty-two inches apart. No addition of salt was made and the result of the rape experiment shows the influence of salt in the second year's crop after application. The rape was thinned to about five inches apart in rows.

The results of crops for the last three years are given in the table, as they are very interesting and also of much practical value.

TABLE No. XXIV shows the results of crops grown upon four kinds of soil, with and without the application of salt, for the past three years.

	Salt or no salt.	1888. Yield of barley.		1889. Yield of oats.		1890. Yield of rape.	Yield per acre.		
		Grain, per plot.	Straw, per plot.	Grain, per plot.	Straw, per plot.	Rape, per plot.	1888. Barley.	1889. Oats.	1890. Rape.
		lb.	lb.	lb.	lb.	lb.	bus.	bus.	tons.
Loam	Salt	21¼	23¾	23½	58	236	35½	55⅕	9.45
	No salt	21	21⅕	22¼	50	164	35	52⅕	6.56
Marl	Salt	11¼	36¼	16¼	68¼	168	18¾	38¼	6.72
	No salt	10½	31½	15½	41	98	17½	36½	3.92
Clay	Salt	16¾	15¼	20½	57½	70	28	48¼	2.81
	No salt	12¼	17¾	17½	45	60	20½	41⅛	2.40
Muck	Salt	11¼	15¼	.....	.....	119	18¾	.....	4.77
	No salt	7	20	.....	.....	107	11⅞	.....	4.28

(17) RAPE UPON FLAT AGAINST RIDGED LAND.

Twelve plots of rape were grown upon land, one-half of which had been previously drilled up and one-half of which had been left level. Seed was sown at the rate of four lb. per acre, and after coming up the young growth was treated as follows:—Two plots in each half were left untouched; two plots in each half were thinned so that the rape plants stood on an average of four inches apart; and the remaining two plots upon each half were thinned so that the plants were six and one-half inches apart. The rows were twenty-two inches apart, and the same cultivation was given the various plots throughout the season.

TABLE No. XXV shows the average of duplicate results from growing rape upon ridged and flat soil, with planting thick and thin.

Cultivation.	Thinnings.			Average yield per acre. lb.
	¾ inch apart.	Thinned to 4 in. in row.	Thinned to 6½ in. in row.	
	Yield per acre. lb.	Yield per acre. lb.	Yield per acre. lb.	
Ridged land	9855	7245	8460	8520
Level land	12105	10530	7650	10095

(18 FERTILISERS UPON RAPE.

Twenty-four plots were grown with rape and salt superphosphate, dried blood and scrap, sodium nitrate and fresh wood ashes were applied in varying quantities, and both to the plant and to the soil, but as the conclusions might be somewhat misleading as the tests were not made in duplicate, it seems best to merely present the average of the four plots

with each fertiliser, and also the average of the four plots with no manure. The fertilisers were applied when the plants were about one-third grown, and the crops were cut off even with ground in harvesting and carefully weighed.

TABLE No. XXVI shows the yields of rape per acre in lbs. from the application of fertilisers.

Fertiliser.	Quantity of fertiliser per acre.	Yield of rape per acre estimated from average of 4 plots in each case.	Fertiliser.	Quantity of fertiliser per acre.	Yield of rape per acre estimated from average of 4 plots in each case.
	lb.	lb.		lb.	lb.
Salt	300	17370	Sodium nitrate	150	20025
Superphosphate	300	16223	Fresh wood ashes	750	16223
Dried blood and scrap	300	18068	No fertiliser		16088

(19) RAPE THINNED TO DIFFERENT DISTANCES WHEN GROWING.

Twelve plots were sown with rape in ridges twenty-two inches apart, and with seed at the rate of four pounds to the acre. These twelve plots were divided into six sets, with two plots in each set. The rape on each of the plots in No. 1 set was thinned so that the plants averaged fifteen inches in the row; No. 2 set, twelve inches in the row; No. 3 set, nine inches in the row; No. 4 set, six inches in the row; and No. 5 set was left unthinned. The thinning did not take place until the plants were about one-third grown, and perhaps had it been done earlier in the season each plant might have made greater development by having more room.

TABLE No. XXVII shows results from different thinnings.

Distances apart of plants in row.	Yield of rape per acre in pounds. Estimated from plot.		
	Test No. 1.	Test No. 2.	Average.
15 inches	5250	5760	5505
12 "	6000	6900	6450
9 "	6540	8100	7320
6 "	10200	10680	10440
Unthinned, seed at 4 lbs. per acre	27633	27120	27376.5

(d) Permanent Pasture Grasses.

A number of grasses have been grown upon the experimental plots for a number of years, both singly and as mixtures. The object in Ontario should be to pasture as much stock on land devoted to pasture each year as possible, with the partial soiling and ensilage systems, which are coming in use so much at the present time, a smaller area of pasture land is needed than formerly, but this should be of the best that can be obtained.

A considerable portion of the seeding on this farm is now done with a mixture of grasses and clovers, even when intended to stand for only two or three years. The grasses which would stand well here might do well in many other localities over Ontario. We will very briefly notice some of the English grasses as grown by us a number of years and observe their hardiness of each.

(20) Grasses grown singly.

Grasses were sown singly upon plots one-twentieth of an acre in size in the spring of 1883. The soil was a mild clay loam with a considerable quantity of vegetable matter. The crop has been mostly cut with the horse mower for hay, but has also been pastured off by sheep. Some of the grasses have completely disappeared while others are holding out remarkably well.

Table No. xxviii shows the results of the eighth season's test of grasses sown singly upon plots.

——	Durability for eight years.	Remarks.
Meadow Foxtail	Holding well	Earliest of all the grasses.
Timothy	Disappeared	Gone in about three years.
Perennial Rye	"	" " " "
Italian Rye	"	" " two "
Wood Meadow Grass	Holding well	Close matting of fine grass.
Rough stalked meadow grass	" "	" " " "
Various leafed Fescue	" "	Grows to about 23 inches, a little bunching.
Sheep's Fescue	" "	" " 20 " fine wiry leaf.
Hard Fescue	" "	" " 18 " very thick mat.
Fine leafed Fescue	Medium	" " 12 " very bunchy.
Large leafed Fescue	Nearly gone	Strong plants growing here and there.
Tall Fescue	Medium	Grows to about 36 inches, few heads.
Red Fescue	Holding well	" " 11 " short and thick.
Sweet Vernal	Disappeared	Gone in second year.
Crested Dog's Tail	"	" " "

(21.) Grasses Grown in Mixtures.

A number of plots have been sown with mixtures for the last eight years, there being one, two or more plots put in nearly every year. From several years' observations the following varieties are the most reliable for this locality:

Meadow Foxtail,
Orchard Grass,
Kentucky Blue,
Meadow Fescue,
Tall Oat,
Wood Meadow Grass.

A number of the fescues are also very hardy, but are much finer in growth. The first four varieties named, along with red and alsike clovers, would make an excellent pasture for three or four years or more, and if the crop were carefully handled would make a large amount of good hay. We took this year 3.86 tons of fine hay from two acres of grass land seeded with a mixture in 1886 and which has been pastured very heavily since that time.

It is found to be the best to seed in the spring of the year, as some of the young and tender grasses are liable to become destroyed during the first winter, unless they get a good rooting the year before.

4. Co-operative Experiments.

During the past few years some very interesting and valuable experiments have been conducted over the province by members of the Ontario Agricultural and Experimental Union and other leading agriculturists. The principal object has been to obtain a better practical knowledge of some of the most easily procured Canadian fertilisers. The Union has forwarded from the experimental department of the institution material for the tests, free of charge, to those desirous of undertaking the experiments, and the very enthusiastic manner in which this work has been taken hold of by college associates and others has almost surpassed our expectations. The number of experiments has become greater each season, and the number of those carrying on the tests has increased about eight fold during the last three years. It has been my aim from the very commencement of this co-operative work in 1886 to give all the assistance and encouragement possible to this line of work, knowing the great advantage of these experiments to those who conduct them, and also to the whole farming community. With a soil and climate so varied as we have over the province of Ontario it is very evident that experiments conducted with fertilisers, newly-imported cereals, different modes of cultivating corn, etc., are much limited in their value as close guides for the majority of farmers of Ontario. I have been looking forward for the past three years with the expectation that in the near future this all important co-operative experimental work would be placed upon a more elaborate system of operation; that there would not be individuals engaged at this work alone, which they have been doing at their own expense, but that there may be a number of branch experiment stations over this agricultural country. Surely there need be no greater evidence of the need of branch stations than the enthusiastic manner in which the members of the Experimental Union have been engaged at these co-operative experiments. This plan of branch station work is being carried into effect in several of the American states with much success, and who can doubt but it would meet with equal success in our own land and be of inestimable value to the farmers of Ontario.

The following is the front page of a circular sent to experimenters over Ontario during the past spring. Instructions and blank forms for the experiments made up the remaining part of the circular.

Ontario Agricultural and Experimental Union.

Guelph, March 1st, 1890.

Dear Sir,—Experiments carefully carried on have done much towards improving the methods of farming. With this fact in view the Ontario Agricultural and Experimental Union has been carrying on co-operative experiments from year to year, which have been gradually growing in importance and value. Those proposed for this year's work should

be appreciated by every farmer. If you can give the small amount of time and careful attention required to carry on one or more of these tests, you will be amply repaid for the trouble taken by yourself by the conclusions arrived at on your own farm. You will also have the benefit of the results of similar experiments conducted in different parts of the province, all of which, when carefully carried out, will be presented at the annual meeting of the Association, and afterwards entered in the annual Report of the Union, a copy of which will be sent to each experimenter.

The experiments for this year are as follows :

(1) A continuation of the test with superphosphate, dried blood and scrap, farmyard manure, and no manure, with oats, applied without additional fertiliser.

(2) New plots with superphosphate, dry blood and scrap, farmyard manure, and no manure with oats.

(3) Application of sodium nitrate to either spring wheat or fall wheat, to be applied in the spring at the rate of 200 lbs. per acre.

(4) Testing new varieties of cereals.

(5) Diffierent modes of cultivating corn similar to 1889.

(6) The growing of lucerne.

Full particulars for carrying out the above experiments are contained in this circular.

Fertilisers and seeds required for the tests will be sent free of charge to your nearest express office.

The materials for Nos. II., III., V. and VI. being expensive, only a limited number of these can be sent out. Those applying first will of course have the preference.

If you are in a position to carry on one or more of these experiments, kindly let us know by the 25th instant which test or tests you prefer, mentioning your nearest express office, so that the materials shall reach you in time.

Kindly forward all communications regarding experiments to C. A. Zavitz, O. A. College, Guelph, by October 20th, 1890.

Yours sincerly,

AGRICULTURAL COMMITTEE.

The material and instructions for the different experiments and the blank forms on which to return reports were sent from here during the spring of the year just closing, partly at the expense of the Experimental Union and partly at the expense of the Experimental Department of this institution, The following is the number of plots for which material was sent to those experimenting.

Experiment	No.	I.	No additional fertiliser required.
"	"	II.	48 plots.
"	"	III.	34 "
"	"	IV.	170 "
"	"	V.	44 "
"	"	VI.	58 "

The greater number of the results from the summer's work are now received, and when they are all to hand, will be summarized and presented at the annual meeting of the Association in February next.

We feel it not only a duty but also a pleasure to here give a list of those ex-students and other farmers who have taken hold of this work during the past season. Experimental work of this kind takes considerable thought and care, and some extra labor to carry it on properly, and we think much credit is due to those who have sent in good reports in the past. The reports of the present season give indications of surpassing

all those of the previous years. From letters received we are led to believe that much advantage has been derived by the experimenters themselves in obtaining a better knowledge of their own soil and its requirements, and the results of all the experiments when summarized will be made to add valuable matter to the collected reports of the Union of the four previous years, as presented in the annual report of the association.

The following is a list of experimenters for 1890 :—

Names of experimenters.	Counties.	Names of experimenters.	Counties.
Alexander, R. C	Middlesex.	Lett, R.	Renfrew.
August, William	Dufferin.	Lick, E.	Ontario.
Ballantyne, W. W	Perth.	Marsh, G. F.	Grey.
Birdsall, F.	Hastings.	Mattice, G. L.	Stormont.
Birdsall, W. G.	"	McKay, J. E.	Bruce.
Birdsall, William	"	McMartin, D. A.	Stormont.
Bowman, C. D.	Waterloo.	McNiven, W. J	Bruce.
Bristow, G. B	Grey.	Monteith, N.	Perth.
Brown, P. J	Digby.	Morgan, R	Middlesex.
Brown, R. M.	Grey.	Moyer, D.	Lincoln.
Burwash, H. A.	Bruce.	Mowbray, William	Lambton.
Buchanan, William	Huron.	Muir, J. B.	Bruce.
		Muma, J	Middlesex.
Cameron J. M.	Hastings.		
Carruthers, P.	Haldimand.	Nancekivell, W	Oxford.
Christy, G. V.	Prince Edward.		
Clapp, W.	"	Pike, L.	York.
Cousineau, J. B.	Ontario.		
Cuppage, J.	Simcoe.	Quinn, William	Victoria.
Dawson, H.	Wellington.	Raynor, T.	Prince Edward.
Drummond, J. M.	Peterborough.	Redmond, J.	Peterborough.
		Reed, D.	Wentworth.
Farlinger, F. E.	Dundas.	Rendall, William	Grey.
Flemming, F. A.	York.		
		Shuh, F.	Ontario.
Goldthrop, W. M.	Muskoka.	Sherriff, G. G.	Russell.
Grant, R. S.	Haldimand.	Smith, E. P.	Durham.
Grey, J.	Peel.	Smith, J. D.	"
Guest, J.	Simcoe.	Snyder, G. A.	Lincoln.
		Sprague, J. A.	Prince Edward.
Hartman, W.	Grey.	Stone, J. B.	Northumberl'd.
Henry, J.	Simcoe.		
Hodge, G. F.	Ontario.	Varcoe, J. A. S.	Huron.
Hunter, J	Lambton.		
		Walker, E.	Muskoka.
Job, J. R.	Wentworth.	Walker, S.	Huron.
Jeffs. H. B.	Simcoe.		
		Zavitz, E. M.	Middlesex.
Kennedy, J.	Lincoln.	Zavitz, William	"
Kitchen, B. E.	Norfolk.		

As the details and summaries of the union experiments as conducted during 1889 and presented at the last annual meeting of the association are enclosed in the thirteenth annual report of the association, which is embodied in the latter part of this volume, but little will be given here of the results. Two experiments conducted the present year by the experimental department, and which are not recorded elsewhere, will be here given

(22) Superphosphate, Dried Blood and Scrap, Farmyard Manure, and no Manure with Oats.

Instructions for No. II. Experiment as sent to each Experimenter.

(1) Select a piece of ground of same nature throughout, and representative as far as possible of the land of the neighborhood. Avoid naturally rich soils or those which have

had recent applications of manure or special cultivation. Keep clear of wet spots, trees, fences and buildings. Give cultivation to experimental plots similar to that of your larger fields. *An advantage would be gained if the plots could be chosen in such a position that they could remain for experiment another year.*

(2) Mark off four plots of one-fortieth of an acre each, leaving a clean path two feet wide between the plots. Two rods square is a convenient shape.

(3) Submit all plots to same treatment, and sow one-fourth of grain sent on each Aim at seeding one inch deep.

(4) Apply the superphosphate sent to plot No. I.; the dried blood and scrap sent to No. II.; the farmyard manure to No. III., and leave No. IV without any manure. The fertilizers to be sown at the time of seeding.

(5) Keep plots at all times clear from trespassing by poultry, etc.

(6) Aim at sowing 700 lb. farmyard manure on No. III. plot (14 tons per acre.)

(7) If it is your wish to carry on this experiment, please inform the Secretary, as named on front page, naming your nearest express office, and there will be sent to you, expressage prepaid, 7½ lb. ... .oats; 10 lb. superphosphate for plot No. I., and 10 lbs. of dried blood and scrap for plot No. II.

(8) Fill out blank form and return according to directions on front page. NOTE.—The price of the superphosphate is about $30 per ton, and the dried blood and scrap $40 per ton.

TABLE No. XXIX shows results of Fertiliser test upon Experimental plots, 1890.

Fertiliser.	Yield of straw, tons per acre.	Yield of grain, bus. per acre.
Superphosphate, 400 lb. per acre..	.830	15.29
Dried blood and scrap, 400 lb. per acre.....	.990	15.29
Farmyard manure, 14 tons per acre.....	1.243	15.44
No manure.....	.685	11.78

(23) DIFFERENT MODES OF CORN CULTIVATION.

Instructions for No. V. Experiment, as sent to each Experimenter.

(1) Select a piece of ground of same nature throughout, under same conditions, and representative as far as possible of the land of the neighborhood. Avoid naturally wet spots, and keep clear of trees, fences, and buildings. Prepare the ground as you would a large field for the same crop.

(2) Mark out four plots of one-tenth of an acre each, allowing a clean path between the plots. Four rods square is a convenient shape for each plot.

(3) Sow the corn received in the following manner:

No. I plot—Drills of equal distance apart (as near 3½ feet as possible) with seed averaging two grains to the foot.

No. II plot—Drills of same distance apart as No. I, with seed averaging 12 grains to the foot.

No. III plot—Broadcast or close drills with seed averaging one-half bushel per acre (2.8 lbs. per plot.)

No. IV plot—Same as No. III with seed averaging three bushels per acre (16.8 lbs. per plot.)

(4) Aim at having the seeding all done in one day, and not later than 15th day of June. NOTE.—Shallow planting for early seeding, and deeper planting if late enough for soil to be warm.

(5) Give plots I and II the same amount of after cultivation, as often as you think they need it, but avoid mounding the rows; shallow cultivation is preferred.

(6) Cut each crop at the time when its condition corresponds to the roasting condition of field corn, or when the ears are in the glazed state.

(7) Weigh produce from the plots when under as equal conditions as possible. NOTE.—If you can observe the comparative results from the feeding of the different lots please send information under head of "Conclusions" in blank form.

(8) Fill out accompanying blank form and return according to directions on front page.

TABLE No. XXX shows the result of Corn test upon Experimental plots, 1890.

Seeding and cultivation of crop.	Yield per acre, tons.
Wide drills, 2 grains per foot	16.87
Wide drills, 12 grains per foot	15.60
Broadcast or close drill, 2.8 lbs. per plot (one-half bushel per acre)	10.37
Broadcast or close drill, 16.8 lbs. per plot (three bushels per acre)	19.32

II.—LIVE STOCK EXPERIMENTS.

(24) CORN ENSILAGE AS A FOOD FOR MAKING BEEF.

An experiment on the fattening of steers with ensilage and meal; ensilage, hay and meal; and roots, hay and meal, was conducted in the early part of the present year.

Six grade steers, which had been bought by the farm department on October 19th, 1889, were used for the experiment. They were all slightly over three years old when the experiment was commenced. From the time the animals reached the farm until the test started they were kept under the same treatment and food until the last week, when they were divided into three groups, of two animals in each group, and fed their respective rations as a preparation for the experiment.

TABLE No. XXXI shows the breeding of the animals in each group and the quantity of food which we purposed to give each animal of each group, as nearly as the peculiarities of the several animals would allow.

	Group I.		Group II.		Group III.	
Breeding.	1	2	1	2	1	2
	S. H. grade.	S. H. grade.	S. H. grade.	S. H. grade.	Pure S. H.	S. H. grade with touch of Ayrshire blood.
Daily average quantity of food per animal aimed at in the experiment.	Ensilage, all that would be eaten. Meal, 12 lbs.		Ensilage, 45 lbs. Hay, all that would be eaten cleanly. Meal, 12 lbs.		Roots, 45 lbs. Hay, all that would be eaten cleanly. Meal, 12 lbs.	

The experiment proper was commenced on Dec. 31st, 1889, with the two animals of each group in a double stall. Feeding took place at 5 a. m., 11 a. m. and 5 p. m., and watering at 8 a. m., 1 p. m. and 4 p. m. Grooming was done five times weekly. The stable in which the animals were kept was comfortably warm, there being almost no frost present throughout the experiment.

The following notes are upon the character of food given :—

Ensilage.—The ensilage was made from fodder corn, and was of excellent quality for the first seven weeks after which time it was not as good owing to the corn being more immature when put in the silo.

Roots.—The roots consisted of turnips which were pulped, and mixed with the other feed.

Hay.—The hay consisted of timothy and clover in about equal parts. The hay was only medium in quality.

Meal.—The meal consisted of equal parts by weight of peas, barley and oats.

The different constituents of the feeding ration were all mixed together before feeding, and everything excepting bedding and water was weighed before being put before animals and the refuse left over if any was again weighed, before more feed was given.

The experiment commenced on Dec. 31st, 1889, and closed on April 29th, 1890, thus making in all 119 days.

TABLE No. XXXII shows the weight of each animal during each week of the experiment.

Dates.	Group I.		Group II.		Group III.	
	Steer No. 1.	Steer No. 2.	Steer No. 3.	Steer No. 4.	Steer No. 5.	Steer No. 6.
December 31st	1,515	1,327	1,469	1,393	1,477	1,341
1st week	1,533	1,328	1,477	1,390	1,485	1,371
2nd "	1,517	1,331	1,504	1,375	1,527	1,401
3rd "	1,536	1,343	1,484	1,411	1,488	1,369
4th "	1,559	1,352	1,512	1,412	1,523	1,400
5th "	1,584	1,369	1,531	1,434	1,547	1,418
6th "	1,591	1,377	1,540	1,443	1,539	1,420
7th "	1,613	1,405	1,561	1,457	1,581	1,432
8th "	1,627	1,391	1,578	1,479	1,591	1,449
9th "	1,642	1,420	1,577	1,498	1,605	1,478
10th "	1,669	1,431	1,617	1,514	1,610	1,475
11th "	1,671	1,429	1,614	1,529	1,618	1,489
12th "	1,671	1,433	1,622	1,541	1,645	1,494
13th "	1,697	1,446	1,634	1,543	1,642	1,506
14th "	1,701	1,461	1,644	1,565	1,649	1,507
15th "	1,718	1,487	1,664	1,586	1,651	1,483
16th "	1,759	1,515	1,680	1,600	1,675	1,510
17th "	1,762	1,520	1,691	1,613	1,696	1,526
Total increase per animal, 119 days	247	193	222	220	219	185
Total increase per group, 119 days.	440		442		404	
Average daily increase per group, 119 days	1.847		1.857		1.697	

The food was all eaten up cleanly except the ensilage of which there was an average of 18 lb. left for each animal of the first group, and an average of 13½ lb. for each animal of the second group. This, however, was given to other animals not under experiment, and was nearly all eaten by them.

TABLE No. XXXIII shows the amount of each kind of food given to each animal for the separate weeks of the experiment.

Weeks of experiment.	Group I.				Group II.						Group III.					
	Steer No. 1.		Steer No. 2.		Steer No. 3.			Steer No. 4.			Steer No. 5.			Steer No. 6.		
	Meal.	Ensilage.	Meal.	Ensilage.	Meal.	Ensilage.	Hay.	Meal.	Ensilage.	Hay.	Meal.	Roots.	Hay.	Meal.	Roots.	Hay.
1st week	84	525	84	525	84	315	63	84	175	63	84	315	84	84	315	84
2nd "	84	525	84	525	84	315	63	84	175	63	84	315	84	84	315	84
3rd "	84	588	84	525	84	315	63	84	315	63	84	315	84	84	315	84
4th "	84	588	84	525	84	315	63	84	315	63	84	315	84	84	315	84
5th "	91	588	91	525	91	315	84	91	315	84	91	315	98	91	315	98
6th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
7th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
8th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
9th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
10th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
11th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
12th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
13th "	91	588	91	525	91	315	84	91	315	84	91	315	126	91	315	98
14th "	91	588	91	525	91	252	84	91	252	84	91	210	105	91	210	84
15th "	91	588	91	525	91	252	84	91	252	84	91	210	105	91	210	84
16th "	91	588	91	525	91	252	84	91	252	84	91	210	105	91	210	84
17th "	91	588	91	525	91	252	84	91	252	84	91	210	91	91	210	84
Total food given to animals, 119 days	1,519	9,970	1,519	8,925	1,519	5,103	1,344	1,519	4,823	1,344	1,519	4,935	1,848	1,519	4,935	1,554
Average daily food given to each animal, 119 days	12.7	83.8	12.7	75	12.7	42.9	11.3	12.7	40.5	11.3	12.7	4 5	15.5	12.7	41.5	13.1

TABLE No. XXXIV shows the average amount of daily food given to each animal.

Feed.	Group I.	Group II.	Group III.
Meal	12.7	12.7	12.7
Corn Ensilage	79.4	41.7	.....
Roots	.....	.....	41.5
Hay	.....	11.3	14.3

The estimated value of steers on December 31st, 1889, was 57.50 or 4¼ cts. per lb. The value of feed for the period was meal, ⅞ cents per pound; corn ensilage, $2.50 per ton; roots, 8 cents per bushel; and hay, $6.50 per ton. These valuations were taken from Guelph market prices with exception of corn ensilage and roots.

TABLE No. XXXV shows the average increase in the weight of the animals of each group.

	Group I.	Group II.	Group III.
Average weight at commencement	1421	1431	1409
Average weight at close	1641	1652	1611
Average total gain	220	221	202
Average daily gain	1.847	1.857	1.697

The steers were sold on May 16th, at 5¾ cents per pound live weight, after the animals were lying in the yard all night without food, and weighed at 8 a.m. the following morning.

Weight before fasting	10,149	lb.
" after 12 hours fast in yard	9,763	"
Loss in weight	386	"

(25) FATTENING LAMBS.

An experiment in which forty-eight lambs were fed for two months upon rape in the field and for two months upon dry fodder in the shed, was commenced on October 10th, 1889, and closed on February 10th, 1890. The lambs were purchased just before the experiment was commenced and were weighed on October 10th.

TABLE No. XXXVI shows where the lambs were obtained, the number in each lot, price paid, the weights of the different lots on October 10th and the cost per hundred.

Lambs bought October, 1889, from	Number of lambs.	Price paid per head.	Total cost.	Total weight.	Cost per hundred.
		$ c.	$ c.	lb.	$ c.
Auld	20	3 95	79 00	1,920	4.11 11-24
Jerow	7	4 00	28 00	658	4.25 13-22
Anstie	8	3 37½	27 00	687	3.93 3-22
Rennie	13	3 90	50 70	1,347	3.76 7-18

The lambs were nearly all Coltswold and Oxford-Down grades, but a few Leicester and Shropshire grades were among the number. The rape field contained eight acres, and the lambs were unable to eat more than about one-half of the crop when they had to be removed on December 3rd on account of severe weather.

Weight of 48 lambs on October 10th	4,612	lb.
" 48 " December 10th	5,476	"
Gain of 48 lambs in the 62 days of the experiment	864	"

The lambs were kept in the shed from December 10th, 1889, until February 10th, 1890, and all the food given them was very carefully weighed and noted except the hay, which could not well be done. They received of sliced turnips 85 bushels and of whole oats 31 1-10 bushels. During the last part of the experiment one lamb was found lying on its back dead.

Weight of 48 lambs on December 10th, 1889	5,476	lb.
" 47 " February 10th, 1890	6,020	"
Gain of 48 lambs for 59 days (less a 140 lbs., lamb which died).	544	"

The price received for the lambs on March 14th and 22nd was $5\frac{3}{4}$ cts. per lb. Thus the results would be as follows :—

Cost of 48 lambs on October 9th, 1889	$184 70
Price realised for 47 lambs on March 14th and 22nd	370 30
Total gain	185 60

(26). Corn Ensilage and Roots as Food factors in Swine Feeding.

An experiment was conducted with store pigs averaging 204.5 lb. each, for the purpose of gleaning some information as to the value of corn ensilage and of roots as factors in the economical feeding of swine. The experiment was commenced on January 10th, 1889, and closed on March 28th, 1890, making in all a duration of 77 days.

Table No. xxxvii shows the division of the animals into groups and the quantities of food which were to be fed as far as circumstances would allow.

Animals in experiment.	Number of each group.	Animals in each group.	Class of Animals	Amount of feed eaten by animals in each group.
9	1	1	Barrow	All the meal they would eat without waste.
		2	Small sow.	
		3	Large sow.	
	2	1	Barrow	One-third as much meal as was given to group No. 1, mixed with all the sliced turnips they would eat.
		2	Small sow.	
		3	Large sow.	
	3	1	Barrow	One-third as much meal as was given to group No. 1, mixed with all the corn ensilage they would eat.
		2	Small ow.	
		3.	Large sow.	

The animals were from three litters, there being a representative from each litter in each group. Two weeks were allowed after the pigs were placed in their respective pens and the feeding ration of the experiment was first given, as a preparatory period. The meal consisted of one part wheat middlings, one part each of oats and peas ground, and two parts of pea meal, all mixed together. The meal was always mixed with water in the trough at time of feeding. The roots consisted of sliced turnips, which were sprinkled with the meal before being fed. The ensilage was made from fodder corn, and was of very good quality, considering the corn had been somewhat immature when cut. The meal was also mixed with the ensilage before given to the pigs.

TABLE No. XXXVIII shows the weight of each group of animals at the commencement and at the close of the preparatory period.

Group.	Weight at commencement.	Weight at close.	Average gain or loss.
1	618.5	655.5	37
2	583.5	595.5	12
3	602.5	590.5	-12*

*The pigs in No. 3 group did not eat the ensilage well at the commencement.

TABLE No. XXXIX shows the average amount of food given per day to each group of animals throughout the experiment.

Group.	Meal.	Roots.	Ensilage.
1	16½ lb.	5½ lb.	5½ lb.
2	.....	60 "	.....
3	.....	.....	35 lb.

The feed of each group was eaten up without waste except the ensilage of group No. 3 which was only partly eaten, but was all picked over and chewed up.

TABLE No. XL show the weekly weights of each animal throughout the experiment.

	Group I. (Meal.)			Group II. (Meal and roots.)			Group III. (Meal and ensilage).		
	Barrow.	Small sow.	Large sow.	Barrow.	Small sow.	Large sow.	Barrow.	Small sow.	Large sow.
January 10th	251	212.5	192	203	200	192.5	201½	212½	176½
1st week	265	217	199	216	210	204	206	215½	182
2nd "	273.5	231	207	218.5	214	206	209	219	186
3rd "	282	233	215	221	216	206	212	221	187
4th "	290	251	226	227	221	211	213	224	189
5th "	300	261	234	227	232	214	217	224	193
6th "	300	268	238	237	226	215	219	225	194
7th "	312	279	249	245	234	228	223	230	199
8th "	319	273	250	248	237	223	225	226	199
9th "	331	287	262	252	236	224	224	227	195
10th "	341	300	271	260	243	231	229	230	203
11th "	347	306	273	263	246	226	232	229	210
Total weight at close of experiment	926.5			736.5			671		
Total increase during the experiment	270.5			139.5			80.5		
Daily average increase	1.170			.604			.348		

The experiment proper was closed on March 28th, at which time the animals of group I. were sold for 5¼ cents per pound, live weight. The other six pigs were fed for 41 days longer upon a ration of meal similar to the one given before, of which an average of 22 lb. was eaten daily by each group. The daily increase for this period was as follows :—Animals in group No. II 1.58 lb. and animals in group No. III 1.95 The six pigs were sold on May 9th at 5¼ cents per pound live weight.

(27) Feeding Swine on Grain and Meal.

. An experiment was conducted with pigs, averaging about 50 lb. each, to test the value of a meal mixture composed of ground peas two parts, ground oats one part, ground barley one part and wheat middlings one part ; against a ration of peas and barley in equal quantity ground, and peas and barley in equal quantity whole. The experiment was commenced January 17th, and ended May 31st. The respective rations were given to the groups one week before the experiment started for a preparation period, previous to which time they had been fed similarly for twenty-nine days.

Table No. xli shows the arrangement into groups and some features relating to both the animals and the food given.

Groups.	Breed.	Date of farrowing.	Class of animal.	Food rations.	Preparation of food.	Manner of giving water.
		1889.				
I.	3 Berkshire grades	Oct. 4	2 barrows. 1 sow	Peas, 2 parts. Oats, 1 part	Ground grain	Meal and water mixed.
	1 Pure Berkshire	Sept. 13	1 sow	Barley, 1 part. Wht. middlings, 1 part.		
II.	3 Berkshire grades	Oct. 4	2 barrows. 1 sow	Peas, 1 part	Ground grain	Meal and water mixed.
	1 Pure Berkshire	Sept. 13	1 sow	barley, 1 part		
III.	3 Berkshire grades	Oct. 4	2 barrows. 1 sow	Peas, 1 part	Whole grain	Whole grain and water given separately.
	1 Pure Berkshire	Sept. 13	1 sow	Barley, 1 part		

Feeding took place three times daily, and at the following hours : 8 a.m., 1 p.m. and 5 p.m. Each group was fed all it would eat without waste. In mild weather the pigs were allowed in the yards for exercise every three or four days.

Table No. xlii shows the amount of food eaten by each group during the 134 days of the experiment.

Periods.	Days.	Food eaten by each group.		
		Group I.	Group II.	Group III.
January 17th to February 14th	28	227	197½	178
February 14th to February 21st	7	83	66	61
February 21st to March 31st	28	287	222	236½
March 31st to April 18th	28	352	268½	261
April 18th to May 16th	28	456	221	331
May 16th to May 31st	15	244	126	200
Total	134	1,649	1,101	1,267½

The animals in group I. kept good health throughout, while those in group II. were not so thrifty. B animal of this group became so stiffened by April 25th that it had to receive a change of diet, of a much lighter character. Animals C and B of the third group became slightly stiffened in limbs during the last two weeks of the experiment.

TABLE No. XLIII shows the weight of each animal at different periods throughout the experiment.

Dates of weighings.	Number of days.	Group I.				Group II.				Group III.			
		A.	B.	C.	D.	A.	B.	C.	D.	A.	B.	C.	D.
1890.		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lbs.	lb.	lb.	lb.
January 17th....	.....	69½	47	67½	47	69½	51½	51½	36	73	62½	51	38
January 24th....	7 days.	72	50	76	50	85	57	56½	40	74	67	52	41
February 14th ..	21 "	87	64	98	66	110	72	69	46	94	85	59	50
February 21st ..	7 "	94	67½	105½	74	118	77	73½	46½	97½	91½	60½	54
March 21st.....	28 "	112	83	129	98	138	96	81	55	128	125	82	82
April 18th	28 "	128	101	163	132	167	122	94	77	137	137	85	84
May 16th	28 "	138	118	193	167	183	119	101	88	147	164	92	98
May 31st.....	15 "	145	128	210	183½	196	133	106	99	155	161	96	108

NOTE—A, represents thoroughbred sow ; B, grade sow ; C, grade barrow ; D, grade barrow.

TABLE No. XLIV shows the daily averages of the food eaten, and increase live weight of the average animal of each group.

Group.	Amount of meal eaten daily by average animal.	Increased live weight of the average animal.
I.....	3.07	1.35
II.....	2.27	.49
III.....	2.36	.21

On May 31st the pigs in Group I. were sold for 5¼ cents per pound. On July 23rd the thoroughbred sow of Group II. was sold for $25.00, and on September 11th the remaining pigs were sold at rate of 5 cents per pound.

(28) GREEN FODDER AS A FOOD FOR SWINE.

On June 7th, 1890, an experiment was commenced with swine to ascertain the value of green fodder as a help in cheapening the cost of producing pork.

Nine animals were used in the experiment, which were divided into three groups, with three animals in each group. The three lots were very evenly divided as regards age, breeding and class of animals, as may be clearly seen from the following table:

TABLE No. XLV shows the classification and character of the animals used in the experiment.

Group.	Date when experiment commenced.	Date of experiment closing.	Animals per group.	Litters represented in group.	Breeding.	Date of farrowing.	Class of animal.
I	June 7	Oct. 8	3	1	Berkshire, pure..	Sept. 11	Sow.
				2	Berkshire, grade.	Dec. 1	Barrow.
				3	Berkshire, grade.	Nov. 25	Barrow.
II	June 7	Oct. 8	3	1	Berkshire, pure..	Sept. 11	Barrow.
				2	Berkshire, grade.	Dec. 1	Barrow.
				3	Berkshire, grade.	Nov. 25	Sow.
III	June 7	Oct. 8	3	1	Berkshire, pure..	Sept. 11	Barrow.
				2	Berkshire, grade.	Dec. 1	Sow.
				3	Berkshire, grade.	Nov. 25	Barrow

The experiment proper continued from June 7th until October 8th, 1890, being a period of 123 days. The feeding took place three times daily, as follows: 8 a.m., 1 p.m. and 5 p.m. Previous to June 7th the animals of each group received their respective rations, and from this period of preparation an idea of the amount of food which each group would eat up cleanly was ascertained. No. I. group received all the meal they would eat, without waste, while No. 2 group received about three-quarters the amount of meal and in addition a quantity of green fodder, while No. III. group ate about one-third as much meal as No. I. and twice the weight of green fodder consumed by No. II. group. When any change in the quantity of food given took place, it was always made at the end of some one period, each period being two weeks long. The meal in every case was composed of peas 2 parts; barley 1 part; oats 1 part, and wheat middlings 1 part, while the green fodder from one time to another was composed of clover, oats, millet and corn, according to season.

The following table shows the amount of food eaten by each group at periods of fourteen days each throughout the experiment, and also the average eaten per day by each group, and by the average animal of each group.

TABLE No. XLVI shows the amounts of food eaten throughout the experiment.

Date.	Number of days.	Group I.	Group II.		Group III.	
		Meal.	Meal.	Green fodder.	Meal.	Green fodder.
June 7th to June 21st	14	168	126	42	56	112
June 21st to July 5th	14	168	126	70	56	140
July 5th to July 19th	14	168	126	84	56	168
July 19th to August 2nd	14	168	126	84	56	168
August 2nd to August 16th	14	168	126	84	56	168
August 16th to August 30th	14	168	126	84	56	168
August 30th to September 13	14	168	126	84	56	168
September 13th to September 27th	14	168	126	84	56	168
September 27th to October 8th	11	176	132	66	66	132
Total, June 7th to October 8th	123	1520	1140	682	514	1392
Average per day	1	12.36	9.27	5.55	4.18	11.32
Average of each animal per day	1	4.12	3.09	1.85	1.39	3.77

At every fourteen days during the experiment, the animals were weighed separately and the weights of each recorded. The table below besides giving the weights at each period, gives the increase of live weight of each animal, the total increase of each group, and the average increase of the three animals in the separate lots.

TABLE No. XLVII shows the weights of the different animals during the testing.

Date.	Number of days between weighings.	Group I.			Group II.			Group III.		
		Thoroughbred Berkshire.	Grade Berkshire.	Grade Berkshire.	Thoroughbred Berkshire.	Grade Berkshire.	Grade Berkshire.	Thoroughbred Berkshire.	Grade Berkshire.	Grade Berkshire.
June 7th		199	115	139	164	104	174	193	103	146
June 21st	14	215	130	152	169	114	186	196	109	148
July 5th	14	228	137	162	176	121	197	195	114	151
July 19th	14	242	145	177	170	133	209	195	116	153
August 2nd	14	250	159	185	189	142	225	193	118	158
August 16th	14	269	169	198	186	151	240	195	116	153
August 30th	14	277	184	200	199	165	253	195	129	160
September 13th	14	280	190	204	194	170	260	200	131	170
September 27th	14	296	196	219	200	175	263	196	128	165
October 8th	11	304	207	234	207	183	274	200	130	171
Increase of each animal	123	105	92	95	43	79	100	7	27	25
Increase of each group	123	292			222			59		
Increase of average animal of each group	123	97.3			74			19.7		

On October 8th, the experiment proper was closed. The pigs in No. I. group were fat and looking well, those in No. II. were also about prime; but not as fat as those of No. I. group, while those of lot III. were not nearly prime; but were what may be classed as good store pigs;

The thoroughbred Berkshire of group I. was sold on October 7th, for breeding purposes, and brought $25. The other eight were fed until November 17th, when they were sold for $4\frac{1}{10}$ cents per pound, live weight.

(29.) Soiling Cows.

After a week of preparation, two cows were entered upon an experiment to determine how much land would be required to produce sufficient food for them during the summer season. The experiment was started on June 10th, and closed September 26th, making in all 108 days. No special preparation was made to grow the largest yields of produce upon the land, but fodder was cut from the ordinary farm fields near the barns, and the area of the patches used was carefully measured and recorded. The fodder consisted of, permanent pasture, clover (first growth), lucerne, peas and oats and clover (second growth), and was fed in the order named. The cows were kept in the main stable where they had comfortable quarters, both standing in a double stall. The cows had been some time in milk, and one calved soon after the experiment closed, and in consequence of this the only results that will be here considered is the area of land required to keep the two cows for 108 days upon green fodder.

Table No. xlviii shows the areas of ground from which the fodder was taken.

Growths.	Crops.	Area of each crop.	Area of first and second growth.	Total area.
		acre.	acre.	
First growth	Permanent pasture	.3275	.7952	1.559
	Red clover	.2322		
	Lucerne	.0500		
	Peas and oats	.1855		
Second growth	Lucerne	.0500	.7638	
	Red clover	.7138		

This shows an area of 1.559 acres required to produce sufficient food for two animals from June 10th to September 26th, or for one animal it would require .78 acre.

(30) Feeding of Steers of Different Breeds.

During the past year an experiment has been commenced to test the comparative merits for beef production, early maturity, etc. of the grades of the principal breeds of cattle in Ontario. It is expected to continue this experiment for a number of years by using three sets of animals with from one to two years intervening between the commencement of the different sets. Each set will be continued for two and a-half or three years, and careful records kept throughout the entire time.

In the early part of this year grade calves of the Galloway, Shorthorn, Aberdeen Angus Poll, Hereford, Devon, and Holstein breeds were procured from different breeders over Ontario. A representative of what is called the "Native" or "Scrub" type was obtained from Quebec, to have in the comparative test with the grades. A second grade short-horn animal was entered in the contest and was given skimmed instead of new milk for the first six months.

The animals were all received at the O. E. farm when under fifteen days old except the Galloway which was fifty-three days old when arriving for the experiment, but previous to this time he had been running with the dam.

Table No. xlix shows particulars regarding eight grade calves which were entered upon experiment.

Grade.	Source of obtaining animal.	Sire.	Dam as described by the owners.	Date at which each animal arrived at	Age in days of each animal when

TABLE No. XLIX shows particulars regarding eight grade calves which were entered upon experiment.

Grade.	Source of obtaining animal.	Sire.	Dam as described by the owners.	Date at which each animal arrived at Ontario Experimental Farm.	Age in days of each animal when arriving at Ont. Expt. Farm.
				1889.	
Galloway	Mr. Keough, Owen Sound, Ont.	Rajah of Brooke (3970)	A light roan, $\frac{1}{8}$ short horn and $\frac{7}{8}$ Canadian	December 26th	53
				1890.	
Short Horn	Mr. Ballantyne, Stratford, Ont.	Methlick Hero=2723=(imp.)	A high grade short horn	January 11th	14
Aberdeen A. Poll	Messrs. Hay and Patton, New Lowell, Ontario	Runnyme 2nd, 5220	A common Canadian two-year old heifer	" 9th	8
Hereford	Mr. J. O. Clifford, Oshawa, Ont.	King Hal, owned by Mr. Drew	A good common cow	" 9th	4
Devon	Mr. Robertson, Eden Mills, Ont.	Bull, owned by Mr. Rudd	A short horn grade	" 14th	6
Holtstein	Mr. A. C. Hallman, New Dundee, Ontario	African Prince (H. F. H. B.) 1270	A common cow	February 22nd	5
Short Horn (fed on skim milk)	Ontario Experimental Farm, Guelph, Ontario	Macduff	A short horn grade	April 1st	0
Scrub	Quebec	A native bull of the rangey type	A three-year old native	April 23rd	7

The following shows the character of food used in the experiment up to the end of the first nine months:

Milk { Whole, with a very little skimmed which was reckoned as equal to one-half the quantity of whole milk.

Hay { Timothy, about one-half.
Clover, about one-half.

Meal { Peas, one-fourth by weight.
Oats, " "
Bran, " "
Small wheat, " "

Green Fodder { Clover,
Peas and oats.

The milk was fed from the pail until each animal was six months old after which time the milk was withheld. The hay was of medium quality, and was cut finely before being fed. Each animal received all the hay he would eat without waste. The meal consisted of the above mentioned grains ground together, and was fed dry until green fodder was given, at which time it was mixed with the fodder. The green fodder was cut up and fed in quantities that would be eaten up cleanly, and was fed after being mixed with the meal.

TABLE No. L shows some notes taken on the grade steers at the end of the first six months after birth of each.

Breeding.	Color of animal.	Build of animal.	Flesh.	Handling qualities.	General appetite.
Galloway grade.....	Black with very little white.	Short in the leg and blocky.	Inclined to deep and even flesh.	Good	Good.
Shorthorn "	Solid red.....	Slightly leggy for S. H. type.	Fleshed well....	"	Medium.
Aberdeen A. Poll grade	Solid black.....	Not robustly developed.	"	Medium to good.	Poor to medium.
Hereford grade.....	Typical Hereford color.	Short in legs and heavy in body.	"	Good	Good.
Devon "	Red with white spot on shoulder.	Neat, squarely built frame.	"	"	"
Holstein "	Typical Holstein in color.	Large, with a tendency to coarseness of bone.	Below average in fleshiness.	"	"
Shorthorn " (fed on skim milk).	Red and white.. ...	Large but well built.	Medium flesh. ..	"	"
Native or scrub.....	Light red.....	Narrow in body, flat ribbed and long in legs.	Poorly fleshed..	"	Poor.

TABLE No. LI shows the amount of food eaten for the first six months of the test by the animals under experiment.

Animals.	Date of birth.	Food eaten by each animal in first three months. lb	Food eaten by each animal in second three months.	Food eaten by each animal for whole milk period (six months).

TABLE No. LI shows the amount of food eaten for the first six months of the test by the animals under experiment.

Animals.	Date of birth	Food eaten by each animal in first three months. lb.			Food eaten by each animal in second three months. lb.				Food eaten by each animal for whole milk period (six months). lb.			
		Milk.*	Hay.	Meal.	Milk.	Hay.	Meal.	Green fodder.	Milk.	Hay.	Meal.	Green fodder.
Galloway grade	Nov. 3, 1889	770.9	8	36½	755.0	207½	245	20	1525.9	215.5	281.5	20
Shorthorn "	Dec. 28, "	1888.8	3	5	2494.8	104	191½	68	4383.6	107.0	196.5	68
Aberdeen A. Poll grade	Jan. 1, 1890	1637.0	8	17	2545.2	105	178½	57	4182.2	113.0	195.5	57
Hereford grade	" 5, "	1745.5	12½	24½	2408.4	127½	219	66	4154.0	140.0	243.5	66
Devon "	" 8, "	1387.5	8	6½	2224.0	104	128	70½	3611.4	112.0	134.5	70.5
Holstein "	Feb. 17, "	2057.8	9	12	2418.0	101	178½	125½	4475.5	110.0	190.5	125.5
Shorthorn grade (fed on skim milk)	Apr. 1, "	2018.5	4½	3½	2673.0	171	184½	212	4691.5	175.5	188.0	212.0
Native	" 16, "	1387.7	1½	1½	2374.0	70	92	148	3761.7	71.5	92.5	148.0

*Quantity of milk taken before each animal reached the farm was estimated by allowing the same daily amount during that period as during the other portion of the first three months.

TABLE No. LII shows the weights of each animal taken when six months old.

Animals.	Weight of each animal when six months old. lb.
Galloway grade	457
Shorthorn "	530
Aberdeen A. Poll grade	485
Hereford grade	545
Devon "	434
Holstein "	537
Shorthorn grade (fed on skim milk)	454
Scrub	386

(31) STABLE CONFINEMENT IN REARING CATTLE.

To get some actual results from the practice of rearing cattle without exercise an experiment was conducted during the last summer with an Ayrshire grade heifer, in which test the animal was confined in a box-stall from the time it was four days old until it reached the age of 194 days, at which time it became stiffened in the limbs so badly it had to be removed.

The animal used was from a pure bred Ayrshire bull and a grade Shorthorn cow, and was calved on May 20th, 1890. The box-stall in which the animal was kept was in the central part of the large stock stable under the main barn, and was 11 ft. 6 in. long by 8 ft. 4 in. wide. The wall was tightly boarded, 5 ft. high on all sides, above which there was an entire opening to the main stable.

For the first two weeks of the experiment the calf got all whole milk, for the second two weeks a mixture of whole and skimmed milk in equal quantity, after which time the milk given was all skimmed. When the animal was five months old the milk was stopped, and the meal, hay and roots was continued.

TABLE No. LIII shows the amount of food eaten during the confinement in the box-stall.

Food.	Quantity eaten (pounds).
Milk	2411
Meal (mixture)	473
Hay (timothy and clover)	195½
Roots (mangels)	538
Green Fodder (corn and millet)	103½

The following is the weight of the animal at different periods :—

May 20th	28 pounds.	August 20th	236 pounds.
June 20th	130 "	October 20th	390 "
July 20th	184 "	November 20th	455 "

During the experiment up to the latter part of November the heifer had a good appetite and was in good health, but at that time she began to get weak in the limbs, and by November 30th she was stiff on all limbs and unable to stand without great difficulty. On December 1st she was taken out of the stall and left in the yard a little while, and by means of some exercise each day a marked improvement was soon seen, and by December 5th she was able to run while in the yard. In two week's time of stall tying and daily exercise she gave appearance of again possessing good health and having full use of her legs.

(32) Berkshire versus Improved Yorkshire.

It is unsafe to draw conclusions from experiments in breed competition until a sufficient number has been conducted to overcome, to a large extent, the individual peculiarities of animals. It is with the hope that an opportunity may be afforded for several tests between the pure bred Berkshire and the pure bred Improved Yorkshire breeds of pigs that one has been conducted along that line during the past autumn. One animal of each breed was selected, as a larger number could not at that time be procured.

The Berkshire was a pure bred male animal and was farrowed on June 18 in a litter of nine. He was third or fourth best animal in the litter.

The Improved Yorkshire was also a pure bred male animal and was farrowed on July 4 in a litter of nine also, and was taken from the sow just at the time the experiment was commenced.

The experiment began on August 19th and continued until December 19th. Each animal had good health throughout with the exception that the Improved Yorkshire was slightly troubled with rheumatism for a while towards the end of the test but had recovered before the close.

Table No. liv shows the amount of food given to each animal during the experiment.

Months.	Berkshire		Improved Yorkshire.	
	Milk.	Meal.	Milk.	Meal.
1 (Aug. 19—Sept. 19.	99 lb.	19½ lb.	99 lb.	19½ lb.
2 (Sept. 19—Oct. 19)	120 "	67 "	120 "	62 "
3 (Oct. 19—Nov. 19)	4 "	135 "	4 "	120 "
4 (Nov. 19—Dec. 19)	Roots. 29 lb.	110 "	Roots. 29 lb.	100 "

From this we see the amount of food consumed by each animal was as follows :

	Milk. lb.	Meal. lb.	Roots. lb.
Berkshire	223	331⅓	29
Improved Yorkshire	223	301½	29

Table No. lv shows the weights of the animals at different periods.

Dates of weighing.	Berkshire.	Improved Yorkshire.
August 19th		
September 19th	25 lb.	25½ lb.
October 19th	61 "	60 "
November 19th	104½ "	102 "
December 19th	140 "	134½ "
	167½ "	155 "

The Berkshire throughout the test ate thirty lb. more meal than the Improved Yorkshire and made an increase of twelve and one-half lb. over the latter. The animals are now being used for breeding purposes.

CONCLUSION.

In conclusion I wish to speak of the grain exhibit which, by your direction, I placed at the Midland Fair, Kingston; Industrial Exhibition, Toronto; Western Fair, London; and Walkerton Fair, held at Walkerton during the autumn of 1890.

This exhibit contained 328 varieties of cereal grains, of which 56 were fall wheats, 64 were barleys, 85 spring wheats, 95 oats and 28 peas. Nearly all of these were shown in the ear, and they represent the growth of the first and second years since importation, viz., the years 1889 and 1890, but they included 30 new varieties of imported winter wheats and some other kinds of grains obtained from New Zealand, tried for the first time on the farm.

Grain was shown in sample jars representing the seed as imported from various countries in Europe, Asia, Africa, New Zealand and Australia. Of these grains there were 237 varieties. There were also 66 samples of corn, all of which have been tested upon the farm by the Dairy Department, and a large number of varieties of other kinds of grain grown during 1890, in so far as they could be got ready in time for exhibition.

The facilities for experimental work have been considerably increased during the past year in the purchasing of a small separator and tread power for the experimental threshing, and also the large scales for weighing the produce from each plot. There are two features which I wish to speak about as being of the utmost importance to the real practical bearing and greater development of the experimental work at this institution for the best interests of the farmers of Ontario.

(1) That an experiment station building be erected upon the college grounds where work could be accomplished during the winter months in preparing grains and fertilisers for the coming season's experimental work and for distributing over the province; where samples of all the different varieties could be collected for close examination by ourselves and for inspection by others; and where the reports could all be prepared with the different products close to hand for reference, etc.

(2) That there be a number of branch experiment stations established throughout Ontario. In a province with such a variation in both soil and climate as is possessed by Ontario, it is quite evident that tests carried on at the station at Guelph with fertilisers, imported grains, varieties of fruit, etc., etc., cannot form close guides for the farmers in very many localities. These branch stations, with the station at Guelph as their centre, need not be very elaborate or expensive, and would form centers for experimental work n the different localities.

I would ask that you do your utmost in presenting to the Government of Ontario the advantages of these two may I say real necessities, as I am of the firm opinion that the results accruing therefrom would be of inestimable value to the farmers of Ontario.

Respectfully submitted,

C. A. ZAVITZ.
Assistant Director.

PART VIII.

REPORT OF

ASSISTANT IN DAIRY DEPARTMENT.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, ONT., December 31st, 1890.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present herewith my report upon the work done during the year 1890, in the Dairy Department. It will be most convenient to consider it under the following divisions:

1. Creamery management.
2. Feeding experiments with hogs.
3. Fodder corn and the silo.
4. Winter dairying.

1.—CREAMERY MANAGEMENT.

For parts of seven seasons the Ontario Creamery has now been in operation. Its success has been varied. The season determines to a large extent the measure of success; that of 1889 was a very dry one, the supply of cream fell away so much it was deemed advisable to close the factory the middle of August, while that of 1890 was a more favorable one in many respects. The continued wet weather in the spring and early summer, while damaging to the corn field, was beneficial to the pastures by starting a luxuriant growth which, aided by the summer showers, kept fresh much longer than usual. During September, however, the pastures were not so good and the cream fell away so much that two routes had to be gathered only twice a week instead of four times to keep down expenses.

Before commencing operations for the season the appearance of the inside of the creamery was much improved by a coat of paint. The churns, vats and other furniture were put in good shape and painted. The engine was taken to pieces, overhauled and put in good working order. The next thing to receive attention was the cold storage room. This is a necessary adjunct to a creamery and especially so where the butter remains in store until the fall. It is then imperative to have a cool, dry room of uniform temperature in which to keep the butter; if these conditions are not obtained a serious loss in the quality of the butter is the result. The cold storage room, when first built, was cooled by a current of cold air entering near the floor from a passage which ran along the bottom and up the side of the adjoining ice-house; an opening in the ceiling giving vent to the warm air. This was found to be insufficient to keep the temperature as was desired. Accordingly, a shelf arrangement of galvanized iron was made at one side of

the room to hold ice. In this way the room was cooled very successfully, but the drip from the melting ice kept the floor wet, and the dampness caused the tubs to mould on the outside. The floor settled making a place for the water to gather. Such was the state of affairs when work was started on it this spring. The shelf arrangement and ceiling were taken out, the floor levelled with cement and a new floor put in. It was proposed to put in a galvanized iron ceiling, resting on and dipping in between joists, with room above to put in ice. It was effected in this way:—joists 3 x 12 were set in place on rests securely spiked along the sides of the room; the rest on one side was an inch lower than the one on the other side, this gave a fall on the joists to one side. Over the joists was now placed the galvanized iron in the form of troughs between the joists. The object of having them in this form was to give more cooling surface below. They were about ten inches deep, closed at both ends, but there was an opening in the bottom of the trough at the lower end; this opening was to let the water formed from the melting ice escape, and opened into a flat trough underneath at right angles and connected with the main drain from the building. All the troughs opened at their lower end into this flat one. The iron was securely nailed down to the joists and to the sides of the building; all the joints were then soldered and everything made tight so that there would be no leakage. Slats were placed on top to prevent the blocks of ice injuring the iron. As the air in the storage room came in contact with the cool surface of iron it would be chilled, then sink and warmer air take its place. In this way the temperature would be kept down. As the warm air came in contact with the cold surface the moisture in it would be deposited on the iron, to prevent this dripping on the floor small troughs were swung close under the large ones to catch it and empty it into the cross-trough at the end. Thus the room was kept dry and cool; no difficulty was met with in keeping the temperature at about 50° Fahr. the whole season. The saving in ice over the old way of cooling was considerable, to say nothing about the convenience of the new plan, as a door was cut into the ice-house from the chamber above the storage room, and about fifteen blocks of ice put in once a week would give us the temperature required without any further trouble.

Early in the spring a few weeks were spent in visiting the former patrons and others in the interests of the creamery. A public meeting was then called in the city at which the report of last year was read and an outline of the proposed work, etc., for the present year presented, and a committee of management were appointed to look after the creamery in the interest of the patrons.

The cream only was gathered, the skim milk being left for use on the farms. The patrons used what is known as the shot-gun pail, a narrow pail about twenty inches deep, the patrons doing their own skimming. The gatherers carried a pail 12 inches in diameter in which all the cream was measured by a steel rule. An inch deep in this pail makes what is called a creamery inch. Credit was given each patron for the inches and eighths inches of cream he had. The cream was gathered three times a week from each patron, each gatherer having two roads, going on the same road alternate days. A sample of each patron's cream was taken every time the gatherer obtained cream from him, this was put in a numbered tube, the number marked in the gatherer's book opposite the patron's name, and the tube taken to the factory. At the factory the tubes brought in that day were warmed if necessary and allowed to stand to sour until the following morning, when they were churned in an oil test churn. In this way the churnable fat or butter-making value of each sample was determined. The variation in the quality of the different samples of cream was from nine ounces to twenty ounces of butter per inch of cream. We have thus been able to distribute the proceeds of butter sales among the patrons according to quantity and quality of the cream furnished.

The creamery has been used to a certain extent for instruction of students in the practice of butter-making. We had a young man with us the most of the summer learning to make butter besides a number of students who spent from a day or two to two weeks in the factory.

The college creamery does not afford its patrons any special advantages over what may be realised from any joint stock or private concern in any part of the province.

Those who furnish cream are paid for it at the price realised from sales of the butter manufactured, after all expenses for cream gathering, management, labor, furnishings, tubs, fuel, ice, salt, etc., etc., have been deducted. Strict economy is practised and all outlays and expenses kept as low as possible. Notwithstanding this, the cost of making per pound of butter is high. The cost of gathering the cream depends so much on the distance to be travelled for the quantity collected that the number of patrons and cows within a given area largely determines the rate per pound. For the ground covered, the number of patrons and the quantity of cream supplied is unnecessarily small. This may be accounted for to some extent by reason of the area required for supplying milk to the city of Guelph and the important thoroughbred stock interests of the country around Guelph have prevented a large number of the best farmers in the vicinity from sparing any cream for butter-making. Hence our patronage is almost wholly from farmers living from two to nine miles from the college. Another difficulty we have to contend with arises in this way. The butter market of Guelph is a good one and the withdrawal of so much butter from the market as effected by the creamery improves it for those who do not patronise the creamery; consequently, our patrons are tempted after July by the increased price to make up and market their own butter direct. The committee deemed it advisable to make an effort to prevent patrons quitting the creamery before it was closed down for the season.

The following circular was sent to every patron (only one refused to sign it) and to their credit be it said we did not have to enforce it. One or two did quit before the season was over, yet it was because they did not have any cream to spare beyond what they required for their own use.

Notice to Patrons.

The committee appointed by the patrons, and made responsible for the management of the Ontario Creamery for the present season, has decided to pay on account 16 cents per pound of butter from the beginning; but, as this price is more than the market warrants in the early part of the season, this payment of 16 cents per pound, is made to each patron with the understanding that he will continue to send his cream to the creamery till the end of the season, and that in case he fails to do so, for any reason which is not satisfactory to the committee, he shall forfeit 10 days cream and his share in any surplus which may be at the end of the season.

Further, the patrons are requested to see that the gatherers in every case stir the cream thoroughly, and take the exact full of the small dipper as a sample for testing; and if any patron observes anything that he disapproves of, or in case he is dissatisfied for any reason whatever, he will oblige by at once making the matter known to some member of the undersigned committee.

We may simply add that every effort will be made to manage the creamery in such a way as will be satisfactory to the patrons.

(Signed), Duncan Macfarlane, Aberfoyle,
Duncan Gilchrist, Arkell,
Jas. Lennie, Guelph,
Alex. McIntosh, Mosboro',
John Crosby, Marden.

Ontario Agricultural College,
Guelph, May 15th, 1890.

N. B.—Patrons are particularly requested—

1. To see that the udders of their cows are brushed, or rubbed with a damp cloth before milking.

2. To see that the cows are not milked in stables or other places where there are any strong or offensive smells.

3. To see that the milk is not at any time allowed to stand where there are bad smells, but is carefully strained into thoroughly scoured and well aired cans as quickly as possible after it is drawn from the cows.

4. To see that the cans receiving the milk are promptly placed in the coldest water that can be got, and that the water be changed twice in case no ice is used. Otherwise, some of the cream will be left in the milk.

The agreement between the committee and the patrons at the beginning of the season was to the effect that they should receive after the end of each month a cash advance on the cream supplied, at the rate of 16 cents, per pound of butter made. After providing for these prices, and paying all expenses out of receipts from the sale of butter and buttermilk, there is a balance of $207.35 on hand for distribution among them.

A summary of the season's business is herewith presented—

Receipts.	$ c.	Disbursements.	$ c.
Sales of butter	5,908 75	Patrons for cream	4,479 26
Sales of buttermilk	216 44	Labor	294 57
		Cream gathering	654 00
		Salt, tubs, fuel, ice, repairs, sundries, etc.	490 01
		Balance on hand	207 35
	6,125 19		6,125 19

Butter manufactured	29,252	pounds
Average price per pound of butter	20.20	cents
Number of patrons	85	
Number of days in operation	110	
Routes travelled by cream waggons	4	

Length of routes ranged from 18 to 25 miles.

Cost of cream gathering	2.24		cents per pound of butter.
Cost of labor	1.01		" " "
Cost of furnishings	1.67		" " "
Total	——	4.92	" " "
Cr. Receipts from sales of buttermilk		.74	" " "
Net cost for collecting cream and manufacturing		—— 4.18	" " "

The cost per pound is still much higher than it should be, although every reasonable effort was made to reduce the rate. It is very high when compared with that of many of our leading creameries. Salt of Canadian manufacture was used at the rate of about an ounce to the pound of butter, and the butter packed in tin lined tubs.

2.—FEEDING EXPERIMENTS WITH HOGS.

The progres of ideas as connected with farm practices is far more rapid than farmers get credit for as the work goes along We have only to look back over a few years of time to learn that great changes in methods and practices have taken place, and have settled down into the position of common practice. This change has been very marked in some lines of farm practices ; but none more so than in the business of growing and

fattening pork. It is more plainly illustrated in the west with their larger operations, though the change has taken place here as well as there. It was but a few years ago that it was the general understanding, that a hog must be a year old or more before he was ready to be fitted for the butcher or consumer, that heavy weights with a lot of fat must be obtained. The demand for that kind of meat has passed; a lighter hog with more lean meat, long sides and good quarters is wanted.

It has been shown that a pound of growth could be made on less food, and at far less cost on a growing beefing animal than on an old one, that, in fact, it was a law of growth that the younger the animal, the greater the growth per day, and the less food called for per day. This is just as true of a hog as of a cattle beast, and growers were not slow to take advantage of it, for, in feeding as in all other lines of farming, the factor of profit holds the leading position and all progress is rightfully following its lead.

The growing of pork is rapidly on the increase in Ontario; this is as it should be for there is money in making pork of the proper quality. We have no animal that makes so good a use of the food fed it as the despised grunter. They digest a larger percentage of their food than any other animal; they also require less food to support life, respond most readily to good treatment and in every way are the most profitable, when rightly managed, of our farm stock. Although great changes have taken place in the growing and fattening of our hogs—there is another change that should be made, that is, in the time of marketing. Hitherto, the general time of marketing has been late in the fall or early winter. A study of the prices for pork during the last few years reveals the fact that the highest prices are paid for pork during the summer months, the highest price generally being given in August, for pork of the right quality. Our farmers should endeavor to supply the demand during these months when our packers buy largely of American pork. Canadian fed hogs bring higher prices than the American ones, because they make better pork. The demand for them is always so brisk during the summer months that sales are easily effected at good prices. As we fatten hogs for profit, or if we don't we should, this is a matter we should take into consideration, it is the little gains like this that make up the sum of our yearly profits, they are, therefore, worthy our most earnest attention. As young pigs cannot be made to attain the most profitable weights under six months, it would not be easy for many of our farmers to furnish pigs for the early part of the season; but those farmers who have warm pens could do it from late autumn litters, and many of them could obtain much higher prices for their pork than they do at present, if they would have litters in February and March. They could then get their pork on the market before the market becomes glutted in the fall.

Experiments in Feeding.

Every animal requires a certain amount of food to sustain life, this may be called the food of support, or a maintenance ration. It goes to produce heat, repair waste tissue, and to do the necessary functional work of the body, it is to keep the animal from losing flesh, at the same time it is not so great as to cause any increase in weight. Any gain in weight an animal makes comes from food over and above that required to sustain life, hence we see why liberal feeding always pays. This maintenance ration increases as an animal increases in weight; we have thus to feed heavier as the animal grows older, to get a corresponding gain. During the past season experiments in feeding hogs were carried on to ascertain, if possible, the increased rate or amount of food required as the animals grew and were carried to heavy weights.

The following conditions, etc., apply to all the pig experiments recorded. The building was of stone, cool in summer and warm in winter, fairly well ventilated, windows darkened in the hot weather to keep out flies, for pigs like comfort and peace. A small yard at the rear of each pen gave an opportunity for fresh air and exercise. Feeding was done three times a day, regularly. The feed in all cases mixed in the trough, with water or milk as the case might be, immediately before the pigs had access to it; they had a liberal supply of salt; all feed was weighed; once a week the pigs were weighed and a record kept of each.

I. *Pens Nos. 1 and 2.*—In August last year eight pigs of the same litter, a Yorkshire cross, were divided as evenly as possible into two pens of four each. The object being to feed them on middlings, salt and water, to find the increase of food required to put on a pound of flesh as they gained in weight. The pigs weighed about 40 lb. each on an average when they entered on the experiment. Both pens continued until the pigs weighed an average of about 140 lb. each. Pen No. 1, was then put on the rape ensilage for six weeks, when this was done they were continued on middlings until the close of the experiment, a suitable allowance of time was made for change of feed. Pen No. 2 was fed middlings continuously and both pens were carried on until they had attained an average weight of nearly 300 lb.

The following table shows the weight of each pen at the beginning and end of the different periods into which it has been divided. It also shows the gain made, feed consumed, the amount required to make a pound of flesh, and percentages of increase.

TABLE I.

Pen Nos. 1 and 2.

Increasing in weight from	No. of pen.	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Middlings consumed.	Middlings consumed per pound of increase.	Average of pens 1 and 2.	Increased percentage of food required per pound of gain.
40 to 95 lb ..	1	158 lb ..	385 lb ..	227 lb ..	436 lb	1.92 lb ..	2.095 lbs	
	2	170 " ..	360 " ..	190 " ..	433 "	2.27 " ..		
95 to 140 lb ..	1	385 " ..	545 " ..	160 " ..	521 "	3.25 " ..	3.255 "	55.37
	2	360 " ..	520 " ..	160 " ..	522 "	3.26 " ..		
140 to 175 lb ..	1	555 " ..	685 " ..	130 " ..	Middlings, 211 lbs	Middlings, 1.62 lbs ..	4.73 "	45.31
					Rape, 2,018 lbs ..	Bape, 15.53 " ..		
	2	520 " ..	701 " ..	181 " ..	1,856 " ..	4.73 " ..		
175 to 250 lb ..	1	708 " ..	972 " ..	264 " ..	1,153 " ..	4.36 " ..	4.16 "	
	2	701 " ..	990 " ..	289 " ..	1,146 " ..	3.96 " ..		
250 to 300 lb ..	1	972 " ..	1,163 " ..	191 " ..	775 " ..	4.05 " ..	3.90 "	
	2	990 " ..	1,190 " ..	200 " ..	750 " ..	3.75 " ..		

The rape saved very well in the silo coming out nice and fresh, the pigs took to it readily and did very well on it. According to this experiment 5 lb. of rape ensilage was equal to 1 lb. of middlings in producing a pound of gain in live weight. In another experiment carried on at the same time, and given in last year's report, page 187, it took 5.12 lb. of the rape ensilage to equal one pound of the middlings. The value of rape as a food for hogs should not be overlooked in these days of rape growing.

In looking over these results we see a steady increase in the amount of food required to put on a pound of flesh as the pigs grow older and heavier; after they had attained a weight of two hundred pounds it decreased somewhat. We find a similar increase and decrease in the other experiments, in the food required for a pound of flesh. We also notice that the most feed was required to put on a pound of flesh when the pigs were making a gain from 150 lb. to 200 lb. The feed required to increase the weight of the

pigs one pound, from 95 to 140 lb. was on an average 55.37 per cent. greater than that from 40 to 95 ; and from 140 to 175 lb. 45.31 per cent greater than from 95 to 140 lb., also, that it required 90.45 per cent. more feed to put on one pound of the second hundred than the first hundred pounds. The food required for increasing the live weight above 200 lbs. is not so great, yet much greater than for weights nearer the 100 lbs. Heavy weights and a great amount of fat are not wanted.

In the month of April 19 hogs were purchased and divided into three lots as equally as possible, so as to have three pens well balanced for experimental work. A different kind of food was fed each pen and notes on their respective gains made.

II. *Pen No. 3.—Feed, Middlings.*—A few weeks preparatory feeding was given them. They got about as much skim milk and buttermilk to drink as if water had been given them, this was discontinued at the end of the first feeding period, and from that until the close of the experiment they got water only to drink. For the sake of seeing more plainly the rate of increase in the feed the feeding period has been divided into four parts. The weights come as near the even numbers as it is possible to get them.

TABLE II.

Pen 3—Six Hogs..

Increasing in weight from	Weights at beginning of feeding period.	Weights at end of feeding period.	Gain.	Middlings consumed.	Middlings consumed per pound of increase.	Increased percentage of food required per pound gain.
50 lb. to 78 lb.	328 lb	468 lb	140 lb.	315 lb	2.25 lb	
78 " to 105 " ..	468 "	629 "	161 "	573 "	3.36 "	49.33
105 " to 153 " ..	629 "	930 "	291 "	1,643 "	5.64 "	67.85
153 " to 197 " ..	920 "	1,180 "	260 "	1,161 "	4.46 "	

The amount of food required to make the gain of one pound from 78 lb. to 105 lb. was 49.33 per cent. greater than that required in making the same gain from 50 lb. to 78 lb. while the increase in the amount of food required to make the gain of one pound from 105 lbs. to 153 lb. over that from 78 lb. to 105 lb. was 67.85 per cent., or 150.66 per cent. more than from 50 lb. to 78 lb. To make the gain of one pound from 105 lbs. to 153 lbs. required 101.4 per cent. more feed than that required to make the same gain below 105 lbs.

In increasing from 50 lb. to 105 lb. it required on an average 2.805 lbs. of middlings to put on a pound gain of live weight, while the average from 50 lbs. to 197 lb. was 4.33 lbs. to put on a pound gain.

III. *Pen No. 4, Five Pigs.—Feed, Bran.*—After a short preparatory feeding on middlings and milk, they were put on bran, as much as they would eat, with what skim milk and buttermilk they would drink, the milk was continued through the experiment, towards the close however it diminished somewhat.

The object of this experiment was to show the value of bran as a feed for hogs, where there was a liberal supply of skim milk. Hitherto bran has not been considered a very suitable food for pigs.

TABLE III.

Pen 4—Five Hogs.

Increasing in weight from	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Weight of bran consumed.	Amount of bran per pound of gain.	Increased percentage of food required per period of gain.
50 lb. to 74 lb ..	250 lb	371 lb	121 lb.	322 lb	2.66 lb	
74 " to 103 " ..	371 "	517 "	146 "	424 "	2.90 "	9.02
103 " to 147 " ..	517 "	734 "	217 "	809 "	3.72 "	28.27
147 " to 162 " ..	734 "	808 "	64 "	392 "	6.12 "	64.51
50 " to 147 " ..	Average.....	.....	.....	....	3.21 "	

The pigs were not continued long on the fourth period, as it was plainly seen they had got about as far as it was profitable to feed the bran. They were a thrifty looking lot of pigs and grew heavier frames than their mates of the same litter that were fed on middlings and pea meal; they were not fat but had a good covering of flesh, two weeks fattening on corn meal made them ready for market. The gain on the corn meal was very rapid it required 3.22 lb. of meal to put on a pound of flesh.

This one experiment goes to show, that bran is a good food for pigs, in conjunction with a supply of milk, that they can be carried to a weight of over one hundred pounds very cheaply. They would require to be finished off on some other food. The hog grown this way will be more nearly what the packers want than the one grown on richer food, and kept fat from the start.

IV. *Pen No. 5, Eight Pigs.—Feed, Pea Meal.*—These pigs did not have much preparatory feeding, but were put on the pea meal a week or so after they were weaned; they had all the pea meal they could eat, and all the milk they cared for until the end of the second feeding period, when they weighed about 78 pounds apiece, after that they got no more, only water to drink. Though they had all they could eat, there was not one of them went off their feed or feet.

TABLE IV.

Pen 5—Eight Hogs.

Increasing in weight from	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Pea meal consumed.	Pea meal consumed per pound gain.	Increased percentage of food required per pound gain.
34 lb. to 50 lb ..	272 lb	406 lb	134 lb .	202 lb	1.50 lb	
50 " to 78 " ..	406 "	625 "	219 "	396 "	1.80 "	20.00
78 " to 115 " ..	625 "	925 "	300 "	969 "	3.23 "	79.44
115 " to 149 " ..	925 "	1,195 "	270 "	907 "	3.36 " . ..	4.00
149 " to 194 " ..	1,195 "	1,556 "	361 "	1,613 "	4.46 "	32.73
194 " to 230 " ..	1,556 "	1,840 "	284 "	971 "	3.42 "	
34 " to 230 " ..	Average..				3.23 "	
34 " to 115 " ..	"				2.18 "	
115 " to 230 " ..	"				3.74 "	71.55

The rapid increase in the amount of feed required to put on one pound of gain in the third feeding period may be accounted for to some extent by the supply of milk being discontinued at the end of the second feeding period. It required 71.55 per cent more feed to put on one pound gain between 115 lb. and 230 lb. than it did from 34 lb. up to 115 lb.

In all these experiments we notice a steady increase, as the animals get older and heavier, of the amount of food required to lay on one pound of fleah. This appears to be greatest, in most cases about the time they attain a weight of two hundred pounds, after that it diminishes somewhat. Young pigs are the cheapest to feed and should be turned off about the time they attain a weight of one hundred and fifty pounds, live weight, as the least amount of food as a rule will then be required to produce a pound of flesh.

3.—FODDER CORN AND THE SILO.

The system of providing feed by means of the silo has been in practical operation in Ontario for a number of years, and is reaching an age which should enable it to speak for itself. Nearly every farming section of the Province now has one or more silos in it or near it; this makes it possible for those who have not decided to build one, but are considering it, to become thoroughly acquainted with its workings before they undertake to build one for themselves. They are, therefore, not called upon to exercise the same amount of faith in this new departure in feeding that was required of those who built the first ones and had to follow the directions blindly.

Many of those who have tried them have not been as sucessful as they would like, but they do not lay the cause of failure to the silo, rather to some mistake of their own, either in faulty construction or improper methods of harvesting and filling that could be easily remedied the next time the silo was filled. The objections come mainly from those who have had no experience with them, and have had nothing whatever to do with one. We have yet to hear of a person who has a silo complaining that it was not a success. Experience has taught us how we may avoid many of the objections urged against the silo in its early history, as for instance, that of scouring and giving a bad odor to milk from animals fed on it. These have been largely overcome by taking the corn at a proper stage of maturity and a better manner of feeding it, for it must be remembered that no food when fed alone will give entire satisfaction; ensilage is not a complete food in itself, though it may perhaps come the nearest to it if the corn has been well matured.

Among our most advanced silo advocates the question now is not so much, Does it pay to build a silo? as it is, "How can we perfect the silo?" or "How can we get better results from the silo?" A great deal has been learned about it, but there is a great deal we do not yet understand about it. There is work here for our experimental stations to solve for us.

It is admitted by all intelligent cattle feeders that some succulent food is needed during the winter to keep the animal system in good order, where much dry concentrated food is fed. Such a food we find in ensilage, as it comes the nearest to grass of any food we have to feed during the winter, it is especially valuable in the dairy as a winter food, as its effect on the animal system is such that the butter made from it has much more of the nature of grass butter than that made from dry concentrated feed, The idea that ensilage taints the milk has been exploded. Spoiled ensilage will taint the milk in the same way that any foul food will, but good sweet ensilage will not taint the milk. If the milk has a taint supposed to be from the ensilage, and the ensilage is good, it would be well to look around for some cause for it other than the ensilage. If the milk is allowed to stand around the stable where the ensilage is fed it will soon smell of it; it should be removed from the stable as soon as drawn.

Since silage makes such a good substitute for grass, why not feed it all the year? It requires at present on the large majority of farms from five to six acres to keep one animal

the year round. In almost any part of Ontario ten to fifteen tons of corn can be obtained to the acre, ten tons of ensilage will with some grain, feed an animal the year round or in other words we can keep one animal on one acre instead of it requiring five or six to do it. This may be putting it high, but there is nothing to hinder many or all of our farmers doubling the amount of stock which they keep. We are crying about hard times; we look to our legislators to help us, and sit idly by instead of trying to help ourselves. We will not succeed that way, we must help ourselves to success. One way of doing this is by growing more corn, and feeding more animals. It is not necessary we grow all corn, there should be sufficient ensilage to feed until fall sown rye would be ready to cut in the spring, or failing that until clover would be large enough to cut; this might last with another green crop sown in the spring until the new corn crop would be ready to cut. The excess of these crops may be made into hay or put in the silo and fed in the fall if preferred. Rye, clover, oats and peas, etc., can all be saved most successfully in the silo, so that variety can be given the animals the whole time. Soiling is a practice the farmers of Ontario will have to adopt sooner or later to make the most of their land. A simple calculation will convince most men that they can winter an animal cheaper than they can pasture it during the summer. Then why not give up pasturing so much. An acre of grass cut and taken to the animals will feed more than if they had free access to it themselves, as they would lie on it and tramp it down so that a large proportion of it would be wasted, not to say anything about that lost through their droppings falling on it or of the loss of the droppings themselves. The great bugbear about soiling is the amount of work it makes. It certainly means more work but does it not also mean larger returns? Too many farmers try to do a little soiling just to see how it will do, but they find the work so heavy they give it up in despair; why is this? Because they have been trying to do the extra work with the usual amount of help after they have done their day's work; extra work needs extra hands to do it, if they would try it that way they would find that it was a much better way, and the increased returns would soon more than pay for all the extra work, and leave a handsome profit besides.

Growing the corn crop.—The field set apart for growing the corn this year was the one known as No. 12. It consists of about eighteen acres, the newest and at the same time the wettest field on the farm. Only some two or three crops have been taken off it since it was brought under cultivation, hence it was thought that an excellent crop of corn would be obtained without manuring the field. It had been underdrained before it was broken up, but in several low places the drains had not been put down deep enough, for the plow had turned out the tiles; the water did not drain away from these places readily; about four acres of this was not sown with corn, it was too wet and did not get dry enough to work until the end of July.

The field was plowed in the fall and worked up with the disc harrow and spring tooth cultivator in the spring. The open winter before and the heavy spring rains left the ground hard and sad, it required more work to get a good seed bed. In the lower parts of the field the soil was a vegetable mould the rest a clay loam, all the cradle knolls had not been worked down; this proved disastrous for the corn as it was drowned out in the hollows, while that on the knolls did not do as well as it should have done; altogether the field was not a very satisfactory one for experimental work for the season we had, had it been a dry one no doubt a good crop of corn would have been realised.

Planting.—The first of the corn was sown the 28th of May, and it was all sown by the 31st. This was as early as we could do anything with the land; the spring was wet and the land so low. A common force feed seed drill was used for planting; all the spouts but two were closed, by regulating the feed the corn could be dropped at the desired rate. It was nearly all sown in drills three feet apart. Some for experimental purposes was sown at three and a half and four feet apart, different rates of seeding to determine what rate would give best returns, as one grain every six inches, eight inches and twelve inches; the different rates of seeding were continued in drills at different widths. Of the many varieties tried last year only forty-six were deemed of sufficient

value to try again this year. These were sown in drills across the field, one row of each kind, three feet apart, and the same number of grains to the foot as evenly as possible.

As part of the field was too wet to plant, land equivalent to that part was obtained in two other places, the ground prepared and sown the 9th of June, wet weather preventing sowing earlier.

After the corn was sown and about ready to come through the ground, the heavy rains flooded the field and much of it was drowned out. Six acres was so badly destroyed that it was ploughed up and sown again June 26th. It came on quickly making a good growth; the ground was cleaner and easier worked than the early sown land, but being on the low part of the field was badly frozen by an early frost the 1st of September and had to be cut before it had attained respectable growth. The blanks in the corn were all replanted June the 25th and 26th.

Cultivation.—As soon as the corn was nicely through the ground it was harrowed. Then the horse hoe was used almost continuously all summer. This kept down the weeds in between the rows, kept the ground loose and the continued stirring would tend to preserve the moisture in the land during the hot weather.

Manure—This is a point which may be taken up here as well as anywhere else. The value of a good coating of manure to a field intended to grow corn can hardly be estimated. The field this year had no manure, as a result the growth was uneven, even if it was a new field and in fairly good heart. Last year the same thing was noticed, the part of the field that was manured gave a good even stand of corn, while the unmanured portion was very uneven. The corn plant is one of the largest air-feeding plants we have, and weight for weight with other crops, is perhaps not so exhaustive on the land as they are, but the enormous yields of corn so frequently obtained make it after all an exhaustive crop. Its mass of roots indicates it to be a gross feeder, while the slow, poor growth it makes on unmanured ground, indicates that it has not the same powers of elaborating its food from the soil that other plants have, or if it has, the season is too short to elaborate the quantity necessary to make the growth we like to see, hence to get the best results with a corn crop, the field should receive a good coating of manure, this will insure a good, even stand of corn, because the roots will have an abundance of food ready for them to work upon, the growth of roots will be much greater, and the growth above ground will be correspondingly great. For experimental purposes, the ground should be manured, the growth then will be even for comparison, whereas on unmanured ground, the growth would be so uneven, definite results could not be counted upon. Where different varieties are being tested side by side, the ground should be manured to allow them to do the best they can. The best corn this year was a piece of about two and one-half acres, manured heavily for potatoes the year before, sown late, the 9th of June, its average height was eleven feet: there was a good development of ears; two average rows were weighed and shewed a weight of over twenty-two tons to the acre. A portion in another field was weighed to estimate the weight for the British Farmer Delegates and showed a weight of over twenty-five tons to the acre.

Results.—Some of the experiments planned and started were destroyed altogether or rendered useless by so much of the crop being drowned out or plowed up. In replanting the different varieties, it was found that some of them had suffered more than others, hence strictly accurate results cannot be obtained from this year's work, as the corn replanted did not come on evenly, and in a number of experiments the amonnt of corn sown a second time was so large as to render it worthless as an experiment. The cradle knolls, as already mentioned, proved another source of failure.

The second sowing of corn, or rather that which was planted among the other corn, was badly frozen, while the corn around it was not touched. A striking illustration of this was seen in a single stalk of corn growing on the six acres that had been plowed up. In some way or other it had escaped destruction and had attained a fair growth, the later sown corn around it was frozen almost to the ground, while it was untouched. This was evidently due to the larger percentage of moisture in the later grown plant, while the older plant, being more mature, with less moisture, was not affected in the

same way by the frost. It was noticed in some of the last standing corn that the late sown corn amongst it was touched with the frost fully two weeks before the first sown corn showed any signs of the effects of the frost.

Table I. gives the results of experiments with different quantities of seed per acre in drills, the same width apart, and with drills different widths apart. It was tried with the Mammoth Southern Sweet, the Red Cob and the Giant Prolific Sweet Ensilage corns and the Pearce's Prolific field corn. The first three were a failure on account of the replanting, only the last one gave reliable results as it was not affected in the same way by the wet weather. Three hundred feet of two rows of each lot were weighed and the weight per acre computed from this.

TABLE I.

Kind of corn.	Lot.	Date of planting.	Width of drills.	Seed per acre.	Maturity.	Yield per acre.
Pearce's Prolific	4	May 31st	3 feet	35 lb.	Roasting	21,998 lb.
" "	5	"	3 "	29 "	"	21,090 "
" "	6	"	3 "	20 "	"	22,207 "
" "	7	"	3½ "	18 "	"	26,451 "
" "	8	"	4 "	15 "	"	27,612 "

The average height of the corn was about six feet, at the time of cutting the grain in the ears was quite hard and nearly ready to cut for field curing. Every stalk carried an ear and many of them two good sized ears.

Lots 7 and 8 had a greater leaf development than the others, the leaves were also of a much darker green, showing a stronger growth. There were also a greater number of suckers, stronger and heavier stocks and a larger percentage carrying two ears.

In this corn we had quality, the quantity was also good. Last year the same kind of corn attained a weight of 16 tons to the acre. The growing period was about 100 days.

Table II. shows a comparison of the different varieties of corn grown side by side in single rows to discover the comparative degrees of maturity attained in 100 days growth, and also for a comparison of the yields per acre. Three hundred feet of each row was weighed and the weight per acre computed from these weights. The stages of growth were termed "Tasselling," "Silking," "Blossoming," "Out of Bloom," "Early Milk," "Late Milk" and "Ensilage." The number of ears on ten average stalks is also given.

TABLE II.

Variety of Corn.	1890. Average height attained.	1890. No. of ears to every 10 stalks.	1890. Stage of maturity or growth reached.	1890. Green, weights per acre in pounds.	1889. Stage of growth reached.	1889. Green, weights per acre in pounds.
Chester Co. Mammoth	8 feet.	.....	Out of bloom	35,458 lb.	Early milk .	22,823 lb.
Calico Dent	7½ "	8	Early milk	32,210 "	Out of bloom	30,508 "
Mammouth S. Sweet	9 "	....	Silking	29,548 "	Silking.....	33,810 "
Wisconsin Yellow Dent	8 "	10	Late milk	29,513 "	Early milk .	37.149 "
Cranberry White Dent	8 "	6	Early milk	28,484 "	" .	36,508 "
Leaming Dent	8½ "	7	"	27,472 "	" .	28,333 "
Red Cob Ensilage	9 "	.....	Silking	26,301 "	Silking.....	30,900 "
Giant Prolific Sweet Ensilage	9 "	.....	"	25,982 "	"	25,230 "
Thoroughbred Flint	7½ "	6	Late milk	25,662 "	.....	.....
Hickory King	9 "	.....	Silking	25,448 "	Silking.....	40,530 lb.
Sheeps Tooth	8 "	.....	Early milk	25,183 "	"	41,220 "
South-Western	8 "	.....	"	25,183 "	Blossoming.	37,140 "
Woodworth's Yellow Dent	8 "	.....	"	25,183 "	Early milk .	29,087 "
Asylum Sweet	4½ "	9	Late milk	24,383 "	" .	30,810 "
Edmund's Premium Dent	8½ "	6	Early milk	24,330 "	" .	34,481 "
Sibley's Pride of the North	8 "	8	" ...	23,798 "	" .	34,530 "
Wisconsin White Flint	7½ "	8	"	23,691 "	" .	37,468 "
Compton's Early	6 "	9	Late milk	23,639 "	" .	32,490 "
North Star Yellow Dent	8 "	10	Ensilage	23,107 "	" .	29,522 "
King Phillip	7 "	10	Late milk	22,946 "	Late milk ..	31,987 "
White Flint	6½ "	10	Ensilage	22,749 "	Early milk .	30,343 "
Champion White	8 "	9	"	22,679 "	.....	.....
Wisconsin White Dent	8 "	.....	Out of bloom ...	22,308 "	Early milk .	33,205 lb.
Red Glazed	6 "	9	Early milk	21,615 "	.....	.....
White Western	8 "	10	Ensilage	21,562 "	.....	.....
Giant White Southern	8 "	.....	Silking	21,562 "	.....	.....
Horse Tooth	8 "	.....	"	21,296 "	Blossoming.	33,379 lb.
Golden Dewdrop	7 "	8	Early milk	21,082 "	Early milk .	30,585 "
Longfellow	7 "	9	Ensilage	20,977 "	" .	29,754 "
Angel of Midnight	6½ "	8	Late milk	20,071 "	" .	33,150 "
Pride of the North	7½ "	8	"	19,166 "	Late milk ..	31,504 "
Stabler's 2nd Early	4 "	8	"	18,737 "	.....	.....
100 day Corn	7 "	.....	"	18,686 "	Early milk .	23,775 lb.
Egyptian Sweet	5 "	9	"	18,367 "	Blossoming.	37,300 "
Early Adams or Burtington	7 "	5	Early milk	18,267 "	Late milk ..	27,347 "
Hickox Sweet	4⅓ "	10	Late milk	17,953 "	Out of bloom	26,280 "
Pearce's Prolific	5 "	2	Early milk	17,950 "	Late milk ..	32,828 "
Parish White Dent	8½ "	9	Late milk	17,462 "	Silking. ...	33,666 "
Smut Nose	5 "	.....	Silking	16,611 "	.....	.....
Tuscarora	6 "	10	Ensilage	16,291 "	Early milk .	23,954 lb.
Evergreen Sweet	4½ "	10	Early milk	15,758 "	Silking.....	26,115 "
Self-Husking	6 "	2	"	14,854 "	Late milk ..	25,260 "
Canada Yellow	7 "	10	Ensilage	14,800 "	Early milk .	28,170 "
Old Colony	4 "	10	"	13,682 "	" .	19,285 "
		8	Early milk	11,606 "		

The Growth of Corn.—During the month of August nearly 600 measurements were taken of growing leaves and tassels of the corn. The object being to ascertain, if possible, the rapidity of the growth of the leaves and of the stalk when shooting the tassel.

For measuring the growth of the tassel plants were selected in which the tassel was just showing itself among the leaves, measurements were then taken of this as it grew until it had attained its growth. The leaves were taken in a similar way; they were taken just as they commenced to unfold themselves from the centre roll and to spread out. All the measurements were made from August 13th to 29th, at the same hour in the day and in the same order. The averages per day given in the following table are obtained from the daily measurements taken during this time. The maximum and minimum growths are also given.

TABLE III.

Number.	Average growth per day as obtained from the daily measurements.		Maximum growth.		Minimum growth.	
	Leaf.	Tassel.	Leaf.	Tassel.	Leaf.	Tassel.
	inches.	inches.	inches.	inches.	inches.	inches.
1	2.03	2.03	3.37	4.37	1.00	.50
2	1.93	2.00	4.50	4.00	.50	.50
3	1.76	1.83	2.37	3.00	1.00	1.00
4	2.21	2.38	3.50	3.00	.50	1.50
5	3.00	3.22	3.33	3.75	2.50	3.00
6	2.33	2.64	3.12	3.16	1.00	2.00
7	2.1	2.32	2.50	3.16	1.00	1.00
8	2.15	2.30	.25	4.00	.50	.50
9	1.76	1.60	3.00	3.00	1.00	1.00
10	2.42	2.50	3.33	3.50	1.00	1.25
11	1.86	2.60	5.00	6.00	.00	.00
12	1.33	1.53	2.00	2.50	.00	.50
13	1.61	1.88	2.66	3.50	1.00	2.00
14	2.08	2.20	2.50	3.00	1.00	.50
15	1.22	1.77	2.66	3.50	.25	.50
16	1.86	1.93	3.00	3.00	1.00	1.00
17	1.80	1.55	3.50	2.50	.00	.50
18	1.86	1.90	2.50	2.66	1.20	.50
19	1.86	1.93	3.00	3.00	.50	.50
20	1.96	1.66	2.25	3.00	1.00	1.00
21	1.30	1.57	2.00	2.50	.50	.50
22	1.83	.....	2.50	.....	.50	.....
23	1.41	2.17	3.50	3.25	.25	.50
24	2.30	.....	2.00	.....	.50	.....
25	1.76	.....	3.00	.....	1.00	.....
26	1.73	2.06	2.50	3.00	1.00	.50
27	1.80	1.83	2.37	2.37	1.00	1.00
28	2.10	2.13	3.00	3.00	.00	.50
Average	1.92	2.03	2.97	3.27	.69	.89

Conclusions.—All other things being equal, the rapidity of growth depends on the weather. This was noticed very markedly, a fine hot day always resulted in a very rapid growth, as high as three inches in the 24 hours and in one or two cases as high as five inches. If the day was cold the growth was very slow, in some cases none at all. The growth during the night was *nil.*

Filling the Silo.—This was commenced the 15th of September. The corn was cut with an ordinary reaping hook and allowed to wilt for about a day. Platform waggons, as described in Bulletin XLII. of the college, were used for drawing it to the silo. Here it was cut in two-inch lengths and elevated into the silo by a Smalley ensilage cutter and carrier. The power was furnished by the farm engine. The filling was somewhat irregular, as the farm needed the engine certain days in the week for cutting feed, etc., hence we would fill for a day or perhaps two days in one silo, then move the machine to the other silo and set up while the farm was using the engine; cutting would be done here for a similar period when we would move to the other silo again. A man was kept in the silo constantly to tramp and level, special pains were taken to have the corners well tramped. Though the silos were thus filled rapidly no trouble was experienced in getting the required temperature for sweet ensilage. The corn being in the right state for putting in the silo the heat worked up through it very quickly. If the corn is in the right state when put in the silo there is no need for any delay in filling, it can proceed until the silo is full. Care should be taken in levelling a silo that the anxiety to have the sides firm and solid so that it will keep well does not lead you to forget to keep the centre the fullest. There will be more settling there than at the sides, and if not kept full when it settles will have a tendency to draw the silage away from the outsides towards the centre, and much waste may be caused thereby.

A covering of cut straw about one foot deep was put on the top of the silo at the new barn. On the silo at the dairy barn about one-third of it was covered in the same way, another third covered with uncut straw and the remaining third left uncovered. So far as appearances go and what testing has been done, the results are in favor of that covered with the cut straw immediately after the filling of the silo has been completed.

In the rapid development of the silo we have jumped from heavy weighting to no weighting at all. We may have traveled too fast, and may have to go back over some of the ground. I think there would be less waste on the top of our silos if some pressure were added; the top is so loose that it is very difficult to prevent considerable waste. A weight would tend to press this loose top down and thus exclude the air from penetrating so far into the corn. The bottom of the silo gets pressed sufficiently, the top does not. We would not suggest heavy pressure of any kind only after the silo was full and ready to close up.

Shrinkage in the Silo.—The silo is a most successful way of saving green feed; it is thought that this saving is effected without any loss in the feeding value of the food ensiled and without any shrinkage in weight. In saving corn in the shock in the field there is a loss in the weight and in feeding value. Some authorities put this loss as high as twenty per cent. and that we have a loss also in the silo of from ten to fifteen per cent of the feeding value. An experiment was conducted in connection with the silo, this fall, to ascertain if possible the real loss there may be in weight and feeding value. A box was made of wire netting, with the meshes small enough that no corn could get out or any get into it, yet not so close that when it was buried in the silo it would not be subjected to the same conditions as the rest of the contents of the silo. This box was filled with cut corn the same as was going into the silo at the time, closed up and buried in the silo A sample of the corn was taken for analysis, that we might know the composition of the corn that went into the silo. Some time after the silo was opened the box was uncovered, it was taken out and contents weighed; when compared with the green weight that went in it was found that there was a shrinkage of 6.73 per cent. in weight. A sample was taken for analysis; the comparison of the analysis of these two samples will show what loss there may be in feeding value So far these two samples have not been analyzed. We are thus not in a position to say what the

total loss may be. The contents of the box were to all appearances as well preserved as the corn around it. In June a similar test was made with green rye; there was a little over 5 per cent. shrinkage in weight in this test.

Cost of Growing the Crop of Corn.—An account was kept of all the work and expense connected with growing the crop of corn and saving it in the silo. On account of the exceedingly wet weather in the spring, the expense of working up the land was increased somewhat, as some of it was worked up more than once. The six acres that was plowed up and re-sown added to the expense, and the crop it returned was so very small it greatly increased the rate per ton of the cost. Including all the experimental work, the cost of growing the corn came to a trifle over $2 a ton. Deducting the experimental work and allowing as good a yield on the six acres as was obtained on the rest of the field the cost was about $1.50 per ton.

4.—WINTER DAIRYING

The business of a farmer is to produce food; he may think it is to make money or to raise profitable crops that he can turn into money. But, are not all his crops food for either man or beast, or to be used in ministering to the comfort of man. The food of the land is supplied from the farm in one form or other. If the farmers' crops are good we find a prosperous year throughout the land; if, however, his crops are poor we find the reverse the case, truly he is the backbone of the country. Holding this honorable position is it not his duty, nay is it not demanded of him that he have a definite object in view in his work, and that he have his plans so laid that he may produce the largest amount of food possible from his land, that there may be happy and prosperous times throughout the length and breadth of the land. How many of our farmers are doing this? How many have a definite line of work laid out and are following it closely? Are not the large majority farming at hap-hazards, going in for one thing one year and something else the next, as changeable as the season, catching at every bauble that gives the appearance of good returns, but by the time he is ready to enjoy the returns, the bauble disappears and he is left lamenting.

Every farmer should carefully consider what line of farming his farm is best adapted to or what perhaps is of more importance the line of farming he likes best, that affords a sure and reasonable return for his outlay. Then let him make a specialty of this, develop it for all it is worth, stick to it year after year. If his choice has been reasonably made with a view to the demands of the market, he will find himself much further ahead at the end of ten years than if he had drifted about with no aim in view. It is a prevalent idea that it requires some extra ability to handle a specialty—it is not so, every man has a liking for a certain class of work; all the details of that work he masters easily—because he loves it—he thus soon becomes an expert at that species of work; but if he were doing a dozen different kinds of work would he bring them all to the same perfection he would the one? In the one case he must know *something* about a dozen different kinds of work, in the other he knows *all* about one kind. Which takes the most ability? We see this exemplified in all our large manufacturing establishments, it is all "piece work," one man does one thing and only one thing, he soon becomes so expert he can turn out double the usual quantity, etc. This is concentration of energy on one thing Our farming should take more of the nature of "piece work." "Specialty" is written all through manufacturing life. farm operations must partake more and more of that nature.

To a large majority of our farmers winter-dairying, as a specialty, offers sure and reasonably profitable returns for their labors. It will give them an aim, and without an aim nothing will be accomplished. As the specialist in the machine shop will have the latest labor-saving device, the handiest and best instruments for doing delicate work quickly and

well, so the specialist on the farm must be up to the times in his line of work, his machines must be of the latest improved pattern and his tools of the best. His cows are his machines, artifical machines you may call them if you like. Most of the cows through the country milk only during the summer and dry up as soon as the cold weather comes on in the fall, this is as nature made them. There is nothing artificial about them, the only arts they seem to be perfect in is giving as little milk as possible and boarding on the farmer six months in the year. The artificial cow is largely the product of man's mind, her latent abilities have been developed, feed, breed, care and attention have made her what she is. We can greatly improve the product from our present stock in much the same way. First the cow must calve in the fall, instead of the spring, the milking period will thereby be very much lengthened, and she will be milking at a time when the farmer will have time to look after her; he will not be so busy that he will not have time to see whether she gets sufficient water to drink or that the pasture is so scorched that there is nothing to eat. This brings us to the second change, feed, shelter and attention. A noted breeder once said, "You feed a common cow like a Jersey and you will think you have a Jersey," and he might just as well have added that if you feed a Jersey like many men do the common cow, soon all you will have left of her will be her hide, because she has not been trained to stand hard fare and starvation. Some men may tell us our cows are tender, they are fed and petted too much, stables are too warm. They would like to see a cow that was *tough* and could *rough* it a little. But all this toughness and ability to rough it is at the expense of her milk returns. Motherhood, the origin of the milking period, is in every way opposed to roughing it, it is a tender period; then again, the organs concerned in producing milk are very delicate, the third most sensitive organs of the body and most intimately connected with the nervous system. They should therefore have warm quarters, plenty of wholesome food, with the best of care and attention —feed her like you would a Jersey. It is possible in this way to nearly double the returns from your cows. It is the result of thought and skill applied to the cow to develop her latent powers. The heifer progeny of these cows, if sired by a bull of a milking strain, will be a great improvement on their mothers. "Train up a child in the way he should go," is certainly good advice for the human family. It is just as good advice to say "Train up a heifer calf in the way she should go when she becomes a cow." Now, if she is intended for a dairy cow, she should go first in the way of consuming the best milk producing foods, and second, of converting these foods into the largest possible quantity of milk—rich in butter fat—the fat being the chief valuable part of milk. Then feed your calf just such foods in order to train her organs of digestion and assimilation so that when she enters upon the real business of her life she will be able to convert as much as possible of these foods into rich milk. Feed the calf liberally so as to promote rapid growth and development, but avoid feeding her so as to make her unnecessarily fat. For in this there is danger in forming a beef tendency and habit, so that she will even take on the beef form to a certain extent more than she otherwise would, and quite likely to divert too much of her foods into the wrong channel for a dairyman when she becomes a cow. The other side of this feeding question is just as true. If the calf's stomach is injured by improper feeding the effects of it will last through her life. A habit will be formed of making a poor use of the food fed, such a cow will be an unprofitable one for a dairyman to keep.

Having the animal he wants or the artificial machine, he must have something to feed it. His cheapest feed he will find to be ensilage and soiling crops. His animals will not be suffered to scrape out a living on sunburnt pastures, but will be protected from the scorching rays of the sun, with an abundance of succulent feed before them. During the summer he will grow a lot of fodder corn for the silo that he may have feed enough to keep twice as many animals through winter as he used to do, thus furnishing work for his hired man the whole year. He will feed with his ensilage a ration of grain that his cows may produce abundance of milk which will be rich in butter fat. He will thus have products to sell when they bring the highest price on the market, for butter during the winter always brings a half more than during the summer months.

In handling the product of his cows he will ever be mindful to see that it does not

lose any value in his hands. His object will be to produce as much food as possible, and send it out in such a form that he may gain a name for his article. He will thus be helping on the whole land to prosperity, and as he sees his animals growing and developing into superior animals he himself will likewise grow and be a better man from the exercise of thought, study and the close attention to business necessary to success. He will be a more obliging neighbor, a kinder husband and father and a better christian in consequence of having exercised the care, patience and kindness necessary to rear a good dairy herd of cows.

The Dairy Herd.—At the beginning of the year the herd consisted of fourteen cows. Of these three had been milking since the last of June and one from the first of October, 1889, the other ten were bought around Harriston and brought to the dairy about the end of November. One of them came in about that time, two or three more before the end of the year and the rest, all but one, before the end of February. The exception was one which proved not to be with calf, she was afterwards fatted and sold to the butcher. So the herd really consisted of thirteen milking cows, four of them not giving much as they had been milking some time. In February one of our best milkers lost her milk through inflammation of the udder, hence from that time our number was only twelve. The majority of them proved good milkers. Each milking was weighed by itself and a record kept. In this way we know what the cows are doing. This test for the year found some of the cows wanting in quantity, as four of them were under 4,000 lb. a year. It was decided to sell them and fill their places with others. The best cow gave nearly 9,500 lb. of milk for the year. Several others gave between 7,000 and 8,000 lb.

They were fed corn ensilage morning and night, a few pounds of hay at noon. The ration for the day was 50 lb. corn ensilage, 5 lb. hay and 6 lb. meal. This food cost twelve cents a day. The cows were kept in the stable the whole time. They were not turned out to pasture until the end of May.

Ensilage as a soiling food.—All the ensilage was not fed up by the time the cows were turned out. What was left was covered and saved with but very little waste until August when it was uncovered and fed. It was found to be in as good condition as when we quit feeding from it in May. The cows ate it readily. The pastures were pretty bare so they lived on the ensilage entirely. The feed was the same as in the winter. During the day the cows had the run of a small field where there was plenty of water and shade. During the night they were in another field nearer the stable, but the pasture was no better.

Results.—Before they were fed the ensilage the cows were oeginning to fail on account of the short pasture, and had they continued on the pasture the failure in milk would have been serious, as there was no fresh pasture to be obtained at the time. The flow of milk was sustained and even increased, for at the close of a month's feeding they were giving a trifle more than at the start.

Handling the milk.—The milk was set in deep pails in ice water to raise the cream. Skimming was done with a conical skimmer. The cream kept sweet until ready to ripen for churning, which took place every afternoon. It was found we got the best results when the cream was churned at a temperature of from 66° to 68° Fahr. A Daisy churn was used. Butter was salted at the rate of about one ounce to the pound of butter. Most of the butter was marketed in Toronto. A student was sent to the dairy every afternoon for instruction, and every facility afforded him to learn the most approved methods of handling the milk, cream and butter, as well as the care of dairy stock. During the summer the cream was sent to the creamery.

I have the honor to be, Sir

Your obedient servant,

GEORGE HARCOURT.

ELEVENTH ANNUAL MEETING

OF THE

AGRICULTURAL AND EXPERIMENTAL UNION.

The eleventh annual meeting of the Ontario Agricultural and Experimental Union was held in the lecture hall of the Agricultural College, Guelph, on Thursday and Friday February 6th and 7th, 1890.

Mr. J. A. Craig, B.S.A., President of the Union, occupied the chair, and after the roll was called the minutes of the previous meeting were read and approved.

Mr. N. Monteith, Secretary-Treasurer (*pro tem.*) then presented the following financial report, which was signed by the Auditors and approved by the Associaton :

TREASURER'S REPORT.

Receipts.	$ c.	Disbursements.	$ c.
To amount on hand from last year.....	64 92	By grain experiments, fertilizers, etc	67 35
" government grant.....	200 00	" bee "	15 00
" extra membership fees on 1889 account.	12 50	" postage, telegram	19 12
" membership fees on 1890 account.....	22 50	" printing, reports and stationery.....	64 00
		" editing reports.....	35 00
		" expenses of com. to Toronto.....	5 00
		" cattle experiments, circulars, etc.....	2 05
		" balance	92 40
	299 92		299 92

THE PRESIDENT'S ADDRESS.

J. A. Craig, B.S.A., Toronto, Editor *Canadian Live Stock and Farm Journal*, then read his annual address, as follows :—

GENTLEMEN—It devolves upon me as a pleasant duty to welcome you all to our annual reunion, and this I do with all the heartiness and cordiality at my command. To our visitors we extend the free hand of friendship and invite them to reason with us on the burning questions of our agriculture, to the graduates and associates we give fraternal greetings, trusting that the old fond days of student felicity may once more be experienced unalloyed, whileto the students and professors we offer glad welcome to our consultations, hoping that the outcome of all our efforts may be reflected in some degree in our after work as well as strengthen and upbuild to a greater height of power the institution we all love to think upon, talk about, and glory in. It is one of the soundest economical truths of the age that the broad grindstone will sharpen the axe quickest, and so in touch with this, we, as a society, seek to sharpen our wits by the breadth of mind esulting from the presence of many.

A decade has swept rapidly by since this society of ours launched out on its course with the laudable and extended work before it of binding the alumni of this college together for her and their good as well as to endeavor to raise our agriculture to the status of a skilled art and sound science, and if I correctly draw conclusions from the past, and if I peer not too optimistically into the future, the years to come will be pregnant with greater results and fraught with close unity. Our caption implies that we are a union, but it fails to express to the uninformed mind the great truth round which all others swirl that we either as students, ex-students, graduates or friends of the Ontario Agricultural College, are bound together as a unit to extend the usefulness of our alma mater. Fealty to our college and her cause is the cementing material that holds together the foundation and superstructure of this union, and this allowed to weaken through oversight presages the collapse of the whole structure. The connection between our society and the college deserves a first place and the highest honor in our estimation when considering the elements that have contributed to the success of our union. It has appeared to me that in the past this desired unity of all for the good of the one, though at all times apparent, yet has never been accredited with the importance that is due it and the fruits of this are to be seen in the number of the college alumni that annually gather here. Our weakness, and it is well that we should know it, is that we cannot bring out the number of ex-students, associates and graduates that should attend ; this statement is grounded on the fact that there are hundreds of such throughout Ontario. Why is this? It may be a matter of dollars and cents with those far away, but it cannot be so with those near at hand. It seems to me that not considering their presence according to its true value there never has been a very strong bid made for their attendance. As a means of in part remedying this condition of affairs we should in our programme, give greater prominence to the discussion of collegiate matters, and through this means keep up the interest in the college in the minds of all the alumni. For some time past I dotingly mused on the pleasure I would have in broaching to you the subject of a college paper, but I am happier now in spending words that otherwise would have been used in advocating this measure, to give cheering encouragement and express warm gratitude to the active and able movers in this important matter. As the review greatly strengthens the bond of union between friends outside the college walls with those within its campus, so must it serve to make this union of ours stronger in every way. The scheme that I would have advanced would be to make it not only an organ of the O. A. C. Literary Society but of the Experimental Union as well, and it is still an opinion of mine that such a step might well be taken yet. As we are all aware there has always been a great delay in issuing our reports, and this has been the fault of the printer and not of the compiler. Being an organ of the society the results of the experiments and doings of this meeting would be made known through its pages long before it would reach the anxious experimenters through the usual tedious course. It would devolve upon the Union to bear some of the expenses of publication of the Review but that would not be considerable. This suggestion I commit to your charge. I have thought that in our brief sojourn here we do not extend our acquaintances among the students as we should. We are not here to merely criticise each other coldly from a distance and drop comments as to the evolution of the Ontario Agricultural College graduate, but we are here to know of each other and co-operate with each other in helping along our good cause. Means should be considered such perhaps as the adding of a committee on reception to our list to make our meetings more genial in that respect, and further also provide, as far as possible, for the accommodation of visiting alumni in the college. It dampens their ardor and tempers their zeal to seek the modest inns of Guelph, and I am sure that I voice the opinion of every graduate here when I say that they would willingly pay double the hotel charges to be allowed to make their home in the college while here. Repose this duty in the charge of the students and thus bind them up with the interests of the union as much as possible.

The most practical phase of our work is that of experimentation and in respect to this it seems to me better to urge a thorough development of the various lines of experiment we now have in hand rather than weaken our forces by branching off into anything

new. It has been said by Coleridge that experience is like the stern lights of a ship which illumines only the track it passes over, and we may extend this simile by saying that experiment is the brilliant headlight that illumines the path before. Agriculture has long suffered for the want of experimenters to solve the many perplexing questions of practical import that are continually cropping up, but that day is past and now we find farmers and scientists, though long estranged, brought into close contact, with benefit to both, through the medium of experimental stations and associations such as ours. That the results of experiments carefully conducted and bearing on the practice of the farm are appreciated, is reflected in the energetic efforts that are being made in the establishment of stations in all countries. In our own Ontario and the older Provinces of our Dominion the bottom has been completely knocked out of grain farming, and moreover it is a bottom that will require the best knowledge and finest skill to restore. Be it our work to do this through the medium of our experiments.

The data we are constantly collecting through our fertilizer and grain experiments that deserves emphasis by repetition, is that each experimenter determines the best fertilizer and grain for his own soil and conditions, that no experiment station can do for him. It was a timely suggestion that was made by my predecessor in regard to experiments in respect to our live stock industry, and I am pleased to know that his suggestion has been acted upon. This is a field for our Union worthy of it, for there is now in Ontario a strong reaction going on in favor of this interest, and it means that in a few short years Ontario will be the stockman's paradise of this continent, and as the interest grows the value and appreciation of our experiments will become greater.

In conclusion let me say our footpath through the labyrinth is already blazed for us, and all that we need is hearty co-operation, generous enthusiasm, and universal encouragement, and under such conditions the objects that gave birth to this society must gradually evolve into accomplished realities. Many of us rest too long after we hoe our row, but this should not be; for this Union to make permanent progress in the work before it, must ever have your interest, your best efforts, and the benefit of your counsel.

Having these, optimistic though I may be, I cannot with any degree of surety mark the limit of usefulness of this Union not only in keeping us shoulder to shoulder in the ranks of college defenders, but in elevating to a higher position in the industrial, intellectual, and social world, that industry with which we are all proud of being inseparably connected.

It was moved, seconded and carried that Messrs. Sinclair, George Harcourt and Cowan be a committee to consider the points in the President's address and report at a future sitting of this meeting.

THE MINERAL EXHAUSTION OF SOILS.

A paper on this subject, as indicated by the composition of wheat grain, prepared by A. E. Shuttleworth, of McGill College, Montreal, was read by Mr. C. A. Zavitz. When asked by your committee to prepare a paper for this meeting, knowing it would be impossible to attend, it seemed to me advisable that only members from among those attending the convention should contribute papers. This I thought advisable because your time should be most profitably occupied, and, as written articles are not clear always in every detail, no one should be more helpful during their discussion than the author himself. However, even under these disadvantages, the committee have extended to me the privilege of noting a few observations for your discussion; and a feeling of obligation to the Ontario Agricultural and Experimental Union, and an interest in the work it is laboring to advance, move me to comply with your request.

Before entering upon the subject matter of my paper permit me to make a few remarks about this society's position. The greatest recommendation it can offer is that it

aims to be useful. Such a purpose wisely directed always results in much success. In degree of time, this Union, is just entering its second decade ; while in degree of useful results, it is only commencing. Do not misunderstand me. Time has not passed in vain for the difficulties of experimental work are such that, before the best working system is established, certain experience must have been gained, and before desirable results are obtained, a system must be established. Much of this experience has been gained, and you are prepared now to complete the establishment of a "sound workable system." Why emphasise the sound workable system? Because the varied climatic influences and the soil variations make it inevitable that, in order to arrive at definite and applicable conclusions, experiments must be continued for a great number of years and in a variety of localities. The establishment of this kind of work under these necessarily associated conditions requires careful scientific and practical direction at the outset ; and it must be pursued patiently and regularly. There may be many papers and sufficient discussion at these annual meetings since these are the easier and more popular part of our task. But the real difficult and foundation work is in performing the experiments leading to additional light that, year by year, will be added to the table of results. Its difficulty lies in the constant attention, the patience, the perseverance and the exactness involved in successfully conducting an experiment ; and it may be regarded as the fundamental work because experiments, successfully conducted, afford practical facts. These practical facts gathered from varied and numerous conditions can be profitably discussed, arranged and recorded as useful information. But, on the other hand, carelessly conducted experiments are not only unprofitable, but they are also positively injurious by misleading and wasting the time of those who may unfortunately read or discuss them. Therefore, be careful that those conducting your experiments are in these different ways qualified ; and encourage such to continue by a proper appreciation of their work.

In preparing this paper for you, I do not profess to advance or discuss what hitherto may be unknown to you, but rather to bring to your notice a few observations and facts that may lead to more light upon the conduct of partially mineral exhausted soils.

Even with a soil, naturally as fertile as the loams and clay-loams of Ontario are, exhaustion or weakening of its productive power accompanies or follows continuous cropping under what, probably at this age of scientific agriculture, may be spoken of as injudicious cultivation. Illustrations of this are afforded us from localities where grain production has been conducted since their earliest occupation, and where this has been the only or principal branch of agriculture followed. Districts in which the improvement and increase of live stock are only secondary or almost neglected. Such for instance as are designated by the name "wheat and horse districts." In many of these districts mineral exhaustion of soil exists to an alarming extent, and its effect has and is creating a great deal of restlessness among the farmers. It is perfectly obvious to all thoughtful men, practical as well as scientific, that hard cropping under bad management must in time lead to exhaustion in the soil. The nature and the manner in which it is indicated will depend upon various existing conditions of soil and soil treatment. With these I only delay in so far as they bear upon the observations to be presented in this paper.

A soil, consisting of clay-loam, has been under cultivation since 1835, and subjected to a rotation of cropping as follows :—Breaking up from sod, pease are grown, followed consecutively by oats ; turnips, with fifteen tons farm-yard manure per acre ; wheat or barley, seeded ; hay two years ; and pasture one. Occasionally, and of late years more frequently, the turnip crop was substituted by a fallow in view of cleaning. The manure applied was such as is made from the ordinary stock of a farm where hay and roots are fed, but little coarse grain, bran, oil cake, etc. This manure was applied in sufficient quantities to the above soil, and which soil now possesses an accumulation of organic matter. No mineral manures except gypsum occasionally have been used. Under this management, this soil continues to produce abundant crops of straw, hay, etc. ; but for the last ten or twelve years it has failed in one important respect. It does not produce anything like so good a quality of wheat-grain as previously. Even under most favorable climatic conditions the grain is deficient in plumpness—weight per measured bushel—and in flour producing quality. In season for instances when the yield of spring wheat

exceeds twenty bushels per acre and, generally speaking, is fairly plump, the grain will not produce a good quality of flour, *i.e.*, flour from which can be made a light and palatable bread. Yet the soil in good seasons produces increasing quantities of course grain, straw and hay.

These matters are the more intesesting because they are personal observations of facts existing under natural conditions. But one cannot regard such a condition of soil interesting in itself, but only as it reveals more clearly nature's laws, and, by indicating what greater evils may follow, leads to studies and practices enabling the soil to continue productive and profitable.

In view of this, these few observations have been made and their studies pursued as far as time and other duties have permitted. In ascertaining the cause of a revealed fact, other facts, resulting from parallel natural conditions should be included in the study. This has been done as far as opportunity afforded; and comparatively with this poor wheat, the product of the above soil, a sample from practically similar clay-loam, but which has been cultivated only ten years, is studied. By so doing, one is carried back forty-five years into the soil's natural capabilities. This similar clay loam from which the other sample of wheat is grown is situated on the same farm, subjected to similar climatic, conditions and under similar management. But, while the former has been under cultivation for fifty-five years, the latter has been cultivated only ten years, having been cleared and broken up in 1880. Upon these two soils spring wheat of the same kind was sown in 1889, harvested, threshed and examined separately. In round numbers the yield from the former or old soil was a little over twenty bushels per acre, and that from the new soil a little over twenty-five. The straw on the old soil was probably more abundant and decidedly more inclined to crinkle and develop rust. But the grain of the new soil was brighter and plumper. Of these wheats I made rather careful examination in view of obtaining what might assist in ascertaining something of the old soil's exhaustion. In comparing the composition of these two samples of wheat for brevity and clearness, the one grown on the new soil may be called No. 1, and the other No. 2.

Spring Wheat.	Yield per acre.	Weight per bushel.	Weight of 100 berries.	Per cent. of total ash.	Per cent. of nitrogen.	Per cent. of phosphoric acid (in ash).
No. 1 (new soil)	25 bush....	60.5 lb	4.45 grams.	1.98	1.989	51.93
No. 2 (old soil)	20 bush....	58 lb	3.05 grams.	1.96	1.980	46.47

By examining No. 2 comparatively with No. 1, something may be learned regarding the nature of the defect in this old soil. To the most casual observer, although the two samples are the same variety of wheat grown from the same seed, etc., a marked distinction in plumpness and brightness would be observable. Regarding their weight No. 1, or that grown on the new soil, was decidedly heavier. By weight per measured bushel, No. 1 stood 60.5 lb. and No. 2 only 58 lb.; and upon a delicate chemical balance 100 berries of No. 1 weighed 4.45 grams, while the same number of No. 2 weighed only 3.05 grams. These weights are the average of several examples; and by them alone, according to English authority, No. 1 being the heavier, possesses higher qualities in other respects. Passing on to their composition, there is regarding total ash a percentage of 1.98 in No. 1, and 1.96 in No. 2. This cannot be called a marked difference, however, it indicates a tendency to a lower ash percentage in wheat No. 2 grown where nitrogenous matter is in excess, and mineral matter is deficient. At Rothamsted where the average for a number of years is given, the wheat grain grown upon soil made highly nitrogenous by the repeated application of ammonium salts, but no mineral manures, contained 1.82 per cent. of total ash. While the wheat grown during

the same period upon a soil in which the nitrogenous and mineral constituents were proportional contained 1.91 per cent. of total ash, likewise, pointing to the fact that a highly nitrogenous but minerally exhausted soil produces a product of lower ash percentage.

Although probably less distinct is the difference in the nitrogen percentage of these two samples of wheat, however, the examination is even more interesting; and a reference to it will be profitable. A very careful and prolonged nitrogen analysis was made, but the results at first seemed contradictory to what one would expect. The nitrogen in each is almost the same, No. 1 containing 1.989 per cent., and No. 2, 1.980 per cent. It may be well to observe that No. 2, the one a little lower in nitrogen, was grown on the old soil which, as stated before, is rich in nitrogenous manures. It seems more probable at first thought that this soil should yield grain also rich in nitrogen, being itself rich in nitrogenous manures. But after examining the ash constituents and finding that No. 2 ash was particularly low in certain of them. I compared these facts with the tables of the Rothamsted experiments. Their results go to show that mineral exhaustion may accompany excessive nitrogenous accumulation in soils, while the wheat grain product shows in a marked degree a deficiency in nitrogen. Their facts are, so far confirmed in these observations, a soil rich in organic matter producing a wheat-grain product lower in weight, in percentage of total ash and nitrogen, than the same variety of product grown upon a new soil and one evenly balanced in the elements of manure.

These facts appear to indicate mineral exhaustion in wheat producing elements in the older soil; and this opinion is strengthened after comparing notes upon the percentage of phosphoric acid. In mineral exhaustion, especially when accompanied by accumulating quantities of nitrogenous manures, deficiency in the ash constituents of phosphoric acid is of all other constituents the most marked. The analysis of these ash products show No. 1 to contain 51.93 per cent., a high average, and No. 2 to contain 46.47 per cent., much below the average, pointing unmistakably to the conclusion that the old soil is becoming exhausted in available mineral elements. With further development of the nature of this soil's exhaustion in available mineral matter greater light may be obtained. Even with these few facts lessons can be learned. For by comparing two similar products produced under similar climatic conditions, but the one upon a soil—though a clay-loam as the other—that has been farmed for almost fifty-five years, we have found a condition bearing out authoritative statements, the result of years of close and patient agricultural investigation. A condition also that appears reasonable, and that can be easily comprehended by practical farmers. A soil that with the lapse of time, and under what hitherto has been considered good management, is capable of producing crops of greatly increased bulk though in composition and maturity of grain deficiency. A deficiency that is more than theoretically interesting for it is practically unprofitable. The other soil that has been cultivated only ten years, but, otherwise, under similar conditions, produces in the same variety a plumpness and a quantity that is entirely satisfactory.

What are we to learn from these facts? We have repeatedly heard it said, "Make plenty of farm-yard manure and your land will never suffer." But this statement is too broad and undefined to be a universal guide to the farmer; for quality of manure has everything to do in determining its useful effect. Time will not permit here a consideration of what this quality should be, and besides that is pretty well known. In concluding it may be remarked that to a practical mind these few observations on mineral exhaustion of soil, indicated by the composition of wheat grain, may suggest inquiry and thought, thereby avoiding the unpleasant loss of time and means in learning by bitter experience what may be foreseen by observation. Moreover this single example illustrates a very general evil in Ontario which in time, if it should continue and extend, will mean a great loss to our Province.

The PRESIDENT—We should feel very thankful for Mr. Shuttleworth's paper as it indicates many practical points brought out.

Mr. SINCLAIR—Will purchasing wood ashes be the cheapest method of increasing ash material in old soil?

Mr. ZAVITZ—That would be a cheap method of supplying a part of the ash constituents to the soil, especially the potash. The experiments conducted by this Association have shown poor results from fresh wood ashes when applied in the spring to cereal crops. The fertilizer tests for two years now over Ontario show those used to have given the greatest increase in yields in the following order, commencing at the best: Superphosphate, farmyard manure, salt, ground apatite and fresh wood ashes, while no fertilizer came lowest.

The PRESIDENT—Wood ashes are very beneficial in gardens, especially as top dressing for onions.

Mr. ZAVITZ—Cereal crops are not usually benefited much by potash manures. Wood ashes usually have the greatest influence upon turnip, clover and other leguminons crops.

Mr SINCLAIR—In my experience I have found ashes give good results with the oat crop, and also in the orchard.

Mr. ZAVITZ—Did you have any oats which did not have ashes applied?

Mr. SINCLAIR—Yes, and these were not so heavy and stood up better than those which had ashes applied, and which were much lodged. I have no definite figures to show the different yields from the crops.

Mr. SLEIGHTHOLM—How many bushels of ashes did you apply.

Mr. SINCLAIR—About 25 bushels per acre, and not so heavy in orchard.

Mr. HUTT—Was there any perceptible difference where the ashes were applied in the orchard?

Mr. SINCLAIR—Ashes were applied in spring. I think the fruit was better and there was a larger crop where ashes were applied.

QUESTION DRAWER.

Q. How do the feeding values of bean, shorts and wheat screenings compare in feeding value?

The PRESIDENT—I think it would pay to sell grain and buy these substitutes, if bran can be bought for $10 and shorts for $14 per ton.

Mr. SINCLAIR—In my experience I have found it best to sell some and buy some, so as to have portions of both.

Mr. DEAN—A great deal depends upon what there are to feed. If milch cows, I would buy bran.

The PRESIDENT—Dairymen are favoring feeding pea meal very much, and many strongly favor feeding meal when cows are upon pasture.

Mr. SLEIGHTHOLM—I think it would be profitable to buy bran and shorts as a change in food, but in my opinion $12 a ton is quite high enough to pay. I consider bran a very beneficial food.

President MILLS—The mixture which Mr. John McMillan, of Huron, is using this winter is as follows: Two parts pease, 2 parts barley and 1 part bran. Of this mixture he feeds about 3 lb. per day, with some ensilage and cut straw and hay in fitting steers of 1,200 to 1,400 lb. each for finishing on the grass. This ration costs from 9½ to 10c. per day. Mr. McMillan sometimes substitutes roots for ensilage. He soiled thirty head last year and likes the system so well that he intends soiling twice the number next summer. In making estimates he always reckons the manure to counterbalance the labor.

Mr. HUTT—Does he keep his animals in the stable all the time.

President MILLS—He gives exercise to his animals, as they are then better able to stand the sea voyage, but for home use he would not give exercise. He ventilates the stables when the animals are out.

Q. What kinds of soil are most benefited by lime?

A. E. RENNIE—I have had a good deal of experience in lime on very heavy soils, and it has a very beneficial effect in making it more friable, although the section in which it was used contained a considerable quantity of limestone.

Mr. HUTT—Prof. Storer says that lime acts upon the nitrogenous matters in the soils and has a tendency to impoverish soils.

President MILLS—I think if the supply of humus is kept up there will be good effect.

Q. Can we undertake live stock experiments, and should there be any remuneration for the work?

The PRESIDENT—I feel that we should let the Experiment Stations lead in this matter, and let us follow and glean the results. They have appliances that we cannot have, and can carry on this work much better than we are able to. We should verify experiments of the stations, rather than undertake much new work.

Q. When and in what form can nitrogenous manures be procured?

The PRESIDENT—I think that the best place for procuring nitrogenous manure is in the barnyard.

Mr. ZAVITZ—I expect this question has special reference to commercial fertilizers. A number of nitrogenous fertilizers can be obtained from the Ontario fertilizer companies. Sodium nitrate is one of the strongest and most readily soluble of this class of manures, and can be obtained at Smith's Falls for about $60 per ton. Ammonium sulphate is another fertilizer used considerably. There are fertilizers made from refuse of pork factories, and from wood waste which contain a good quantity of ammonia and are being tried in some parts.

Q. Can the farmers' institutes be carried on over Ontario, without taking so much of the time from the college professors?

The PRESIDENT—This is a vital question and should be thoroughly discussed here. The primary object of the institutes was to give encouragement to the local talent, but the local men have not taken hold of the institutes as they should.

Mr. BOWES—I think the professors are the ones to come out and give us information.

The PRESIDENT—I consider the farmers are relying far too much upon the professors. It is detrimental to the college and is also very hard upon the professors.

Mr. RENNIE—It is one of the best possible advertisements for the professors to go out and get a personal acquaintance with the farmers. The professors prepare themselves sufficiently for the work, but if they are taken too much from the college now, there should be other arrangements made as the institute work is continually increasing. I think far too much is expected from the college professors.

Mr. SINCLAIR—I consider that the professors are doing a work over Ontario that cannot be done in any other way. I think it is the best thing that can be done to both the college and to the farming community.

Mr. BOWES—Surely the increasing demand for the college men is the strongest point possible in having them go out.

Mr. DEAN—From the students' standpoint I would suggest that more of the ex-students should take these places; all they want is encouragement. If the farmer wants to be developed he must take hold of these matters himself.

Mr. MARSH—I think both the professors and ex-students should be sent out; they would carry weight with them, and the college would be better known among the farmers.

The PRESIDENT—We should interest ourselves in this matter. As an ex-student I would not like to have the professors lose their hold on the institutes.

Mr. ROBINSON—I agree with Mr. Dean, that too much work is put on the professors; leave the local men to swim also.

President MILLS—I have had the most of the thinking to do in this institute work since 1884. We felt there were many mistaken ideas among the farming community, regarding the college and the work done by the students. Michigan had institutes which were assisted by the professors. It was our previous custom to have two weeks vacation at Christmas and two weeks again at Easter, and after talks with the Hon. A. M. Ross, we decided to drop out the Easter two weeks and have the four weeks at Christmas—three of which could be devoted to institute work. I have no objection, personally, to dropping the work, but I feel it has been of a great deal of advantage to both the farmers and the professors, in the past. I would at the same time have no objection to severing the pro-

fessors from the institute work, but would never consent to have the professors go and come at various times during the winter. There are certain times that the institute lecturing could be done. Before Christmas there would be two weeks, and after New Years there could not be more than about four weeks. This would allow of three sets, comprising 27 institutes. We give the professors three weeks to go out at New Years, and the professors ought not to go out at any other time. I have invariably advised the professors not to go during the college sessions. If the professors go at all they must go at Christmas. How could their places be best supplied by others? I take the ground that we want to get the best men for the institutes. I know three men in Ontario away from the college whom the farmers will accept. They want a professor. The best men should be sent, and the first place should be given to the ex-student, when they prove themselves well capable for the work. The question finally comes to this: Shall we have the institutes as they now are, or sever our connections with them? In reference to the matter of having shorter Christmas holidays and letting the students home two weeks earlier in the summer, I think there is undue value put upon the two weeks in June, as it is between seeding and haying, and next to January there is no month less urgent than the month of June. In Michigan the holidays are from September to April. I would be a wonderfully relieved man if you could see your way clear to run the institutes to good advantage without the assistance of the college staff.

The PRESIDENT—There seems only two ways open to us; first to keep the institutes as they are now held in January, or second, to sever the connection of the professors from the institutes, and I would very much favor the former.

REPORT ON THE PRESIDENT'S ADDRESS.

The committee appointed to consider the President's address made the following report, which was adopted:

We, the committee appointed to consider the points taken up in the President's address, and summarize the parts which it was considered best to bring again before the meeting for their action, beg to submit the following:

(1.) That the Association devise some plan to induce a greater number of ex-students to attend the annual union meetings.

(2.) That a reception committee be appointed from among the students each year.

(3.) That *O. A. C. Review* be made an organ of the union also, and that a committee of three be appointed to meet the paper staff, and ascertain what arrangements can be done.

(4.) That there be a greater development of live stock experiments, by having not too broad a field, but a definite line of work.

BARNS FOR ONTARIO.

By J. B. BOWES, PINKERTON.

"A thing of beauty is a joy forever."

A barn of beauty to the farmers of Ontario in their present pinched condition is one that will give the greatest return for money invested

A barn should be durable, convenient and safe, should be one that has stables underneath for horses, cattle, swine and poultry, also root-house, or silo, or both. The great objects to be desired in having stabling underneath are warmth, economy of labor, and, where practicable, one roof covering two buildings.

To build a barn it is not necessary to have square timber, as planks spiked together is all that is required for the frame.

Building a barn high is no barrier since rack-lifters, hay-forks and slings have come into use The height of a barn can be determined by the amount of fodder required in the stable, and the safe resistance to eighty-five mile an hourwinds.

The dimensions of a barn that I would consider of sufficient accommodation on one hundred acres of cleared land, are as follows:

One sixty feet square, with either end or side drive, and with twenty-four posts on the sides, with the roof at an angle of 45° all the way to the peak ; four bed sills to support centre of frames ; four bents, twenty feet apart ; barn floor fourteen feet wide, twelve feet high ; the feed passages of stable at right angles with the barn floor ; girts every six feet, two main and four purline plates, I would consider a first-class plan of a stable. I have seen several stables spoiled, as far as the comfort of the cattle were concerned, by the space between the gutter and the manger being very short. Too short a space compels a beast to lie with a portion of the body hanging over the gutter, and in many cases I have seen the animals lie almost half way over. Especially with cows does this condition of affairs produce the greatest amount of dirt, to say nothing of the uncomfortable position. The posts to support the superstructure are in the mangers, where they are least in the way. The size of manger depends upon the kind of fodder. A convenient size for all purposes is one eighteen inches deep, sixteen inches at the bottom, and twenty at the top. The length of floor for cows of twelve hundred weight should be seven and one-half feet from passage boards to gutter. A steer can do with much less. The different rows should be made to suit the size of animals that are to occupy them. The slope on the floor if made of blocks should be at least one-half inch to the foot, cows and heifers will do with less. Stalls for two twelve hundred pounds cattle are sufficiently wide at six feet three inches clear of sides.

The silo is next the wall in the centre mow, and occupies part of the room generally alloted to roots. It is six feet wide, by eighteen feet long, and thirty-two feet high, as it extends from the floor of the stable to the main plate, and is divided off perpendicularly into three bins, six feet square, the corn to be elevated into these bins by means of the hay-fork, or slings with car on a track extending from the centre of barn floor to the silo bin, about thirty feet high. A box with a trip bottom is about the best thing to use. Those three bins will hold sufficient silage for thirty-six head of cattle for ninety-six days. I consider that this silo can be emptied from the bottom ; that the immense weight will make it follow down as it is taken out, although it seems to be the experience that it will not settle. The best plan so far is to take a board or two off of the outside casing at the bottom, and fling the silage down between the inside and outside casings, portions of inside casing to be taken off as the silage is taken out.

The watering of stock without letting them out of the stall and having water in front of them at all times can be accomplished by having a metal or other cup in the corner of the manger large enough for the animal's nose, the height of water in the cup being regulated by a float valve in some part of the stable shutting off the supply. Water will rise to its own level, and the water in the cups will not rise higher than the float valve box, as the beast drinks the water flows in till it again finds its own level The chief supply of water must be higher than the top of water in float valve or regulating box.

I find from practical experience that swine can be kept in the same stable as the cattle, and produce no bad smell, if cleaned out regularly and given a fair amount of bedding. By the arrangement of passages of stable you can get from any part of root-house or silo to any place in the feed passages without opening a door.

My object in having the roof of the barn at an angle of 45°, or half pitch, all the way to the peak is to allow the hay-fork more room. By having a roof at that angle you can almost fill the barn without touching a fork full. The only real objection there is to a high barn is found when we come to thresh, it is almost impossible to get the straw up as high as the grain was formerly.

The PRESIDENT—I think it is almost universally adopted to take silage out of the top of the silo, and this is best done by means of a chute similar to the one in the silo here.

Mr. SINCLAIR—What floor have you in your stables ?

Mr. BOWES—I am in favor of cedar block floor. I use it all the time. Where the cattle stand I prefer blocks, but planks where the wheelbarrow runs

President MILLS—Do you pour on pitch ?

Mr. BOWES—No ; I do not, the floor is ratherdamp.

President MILLS—Have you used a track to fill the silo
Mr. BOWES—No.
President MILLS—Is it too expensive?
Mr. BOWES—No; I consider it a very cheap construction.
President MILLS—How are your stables ventilated, Mr. Ballantyne?
Mr. BALLANTYNE—By shafts, running from the edge.

THE SCIENTIFIC PRINCIPLES UNDERLYING THE MAKING AND FEEDING OF CORN ENSILAGE.

BY C. C. JAMES, M.A., PROFESSOR OF CHEMISTRY, O. A. COLLEGE.

The making of corn ensilage began in America about fifteen years ago, its development belongs to the last ten. To-day the growing of corn, the production of ensilage, and the feeding of it to stock are among the most extensive and most numerous of the experiments carried out at the experimental stations of Massachusetts, Maryland, Connecticut, New Jersey, New York, Ohio, Kansas, Missouri, Minnesota, Wisconsin, and Ontario, and it is upon the results of these that the present address is based. From the multitude of opinions and results I have carefully endeavored to separate the hypothetical from the actual, and to draw reliable conclusions based upon a wide range of experiments.

I shall divide my subject into three parts; the corn put into the silo, the process of making ensilage, the use of the ensilage thus produced.

Out of nothing nothing comes. Good ensilage can be made only from corn of good quality. What comes out of the silo depends upon what goes into the silo.

Circumstances affecting the quality of the corn are:

1. Variety of corn.
2. Nature of soil, method of preparation, fertilizers used.
3. Method of growing corn, whether broad casted or drilled, cultivated or uncultivated.
4. Season.
5. Stage of maturity at time of cutting.

The chemist is concerned principally with Nos. 3 and 5.

3. *Method of Growing.*—The general conclusion of experiments at all stations, based on chemical analysis and actual feeding tests, is that the best ensilage is produced from corn that has been drilled and not broad casted. Every stalk of corn should be grown so that it has plenty of soil room in which to develop its roots, plenty of rich soil to draw nourishment from, plenty of air-breathing space, and plenty of sunlight falling directly upon all of its leaves. The immaturity of closely growing corn depends more upon its lack of sunlight than upon any other cause.

Prof. Roberts (Cornell experimental station, New York, 1888) valued as follows:

One acre of	hay	$18 00
"	broad casted corn	19 72
"	drilled corn	35 74

4. *State of Maturity.*—This is controlled greatly by method of growing. Prof. Roberts, following out his experiments as cited above, says:—"From the above facts it will be seen that the real feeding value of the corn increased 166 per cent. after it had tasselled out, and 80 per cent. after it had nearly reached the roasting ear stage. This being so the greatest care should be taken to select those varieties of corn intended for ensilage that will fully mature before frost, in the localities where it is proposed to grow them."

Bulletin 9, 1889, Missouri experimental station, discusses the life-history of corn and contains this among many important statements, "The considerable increase between September 10th and September 17th (amounting to 24 per cent. of the total weight) indicates clearly that a crop of corn should remain in the field as long as possible, the weather permitting, to reach its greatest perfection."

Mass. Report for 1885 says, (p. 53) "One ton of green fodder corn in tassel contained in one case 307.2 lb. of dry vegetable matter; whilst in the case of the seed just beginning to glaze 463.8 lb. of dry vegetable matter are found in one ton,—a difference of 156.6 lb. in favor of the more matured state of the growth."

Mass. Report for 1886, "The ensilage of a more matured fodder corn has a higher feeding value pound for pound, compared with that cut at an earlier stage of growth."

Other experiments might be referred to, the general conclusion is that for *quantity and quality* of corn and ensilage the plants should be grown in drills and allowed to grow until the kernels begin to glaze. So long as a plant is increasing in height there will be little sugar or starch accumulated in its stalks or leaves, its compounds will be principally in a state of translocation, in a soluble form liable to easy change.

In 1884 Dr. A. Voelker, F.R.S., addressed the Royal Agricultural Society as follows:—"I feel compelled, however, to say at once that a careful and critical study of the literature of the subject, and attentive perusal of most of the original publications on ensilage in England, America and the Continent, have shewn me how scanty and imperfect is our knowledge of the complicated processes of fermentation and of similar chemical and physical changes to which succulent green food is liable under various conditions of temperature, the total or partial exclusion of atmospheric air or its free admission."

The same can be repeated with equal truthfulness in the year 1890. The changes taking place in the silo are principally changes that are classed as fermentations, and the latest English, French and German investigations of fermentations leave us in much uncertainty as to their nature and conditions. From the conflicting opinions and the varying results I have selected a few results that are the unmistakable outcome of a large range of experiment and experience.

1. *Loss.*—There is a loss of valuable plant material due to the chemical changes taking place in the silo. It will vary from a very small per cent. to one-half of the dry material of the corn. The loss will depend upon the condition of the corn placed in the silo and the fermentation taking place. The substances lost or used up will be in the following order:—Sugar, starch, fibre, nitrogenous compounds. The distinction of these constituents will be accompanied by the production of acids (carbonic, lactic, butyric, acetic, etc.), so that the acidity of silage is a fair test of the loss sustained, and the production of as sweet a sample as possible is both advantageous and economical.

2. *Production of Acid.*—We have just stated that this is carried on at the expense of the most valuable portions of the corn. The difference between sweet and sour silage is one of degree of acid, varying in sweet ensilage from .02 per cent. to .50 per cent. of acid to 2.0 per cent. or over in sour ensilage.

Now let us look at some of the conditions controlling acid production, for in understanding them and following out their conclusions lies the difference between sweet and sour, good and poor ensilage.

(*a*) *Water.*—Ordinary fermentations are carried on in solutions, in presence of water. Matured grains, straw, well-cured hay, succulent foods thoroughly dried, manure deprived of all of its moisture will not ferment. Even concentrated solutions ferment but slowly. It would seem that when the plant is young and succulent when the amount of water rises much above 75 per cent. that the cells are in their most favorable water condition for fermentation. Water is not only a favorable medium in which the fermenting cells develop most vigorously, but is also demanded for many of the chemical changes, many fermentations being processes of hydration. To retard acid formation therefore, save loss of food, and make sweet ensilage the material put in should not be too succulent.

Conclusion.—For sweet silage use well-manured, or partially dried and wilted corn.

The amount of water in the corn depends upon the state of maturity, the method of growing and the treatment at harvesting.

CORNELL EXPERIMENTAL STATION, DECEMBER, 1888.

Period.	Date of Cutting.	Per cent. Water.
I	July 24	89.34
II	Aug. 8	83.57
III	Sept. 3	73.93

"It will at once be seen that the most marked difference in the compositionrof the fodder cut at the different periods consists in the constant and rapid decrease in the amount of water."—(Prof. Roberts.)

MASSACHUSETTS EXPERIMENTAL STATION REPORT, 1885, p. 52.

FODDER CORN AT DIFFERENT STAGES.

—	July 22.	July 29.	Aug. 5.	Aug. 3.	Aug. 27.	Sept. 3.
Water	88.61	85.76	84.64	82.08	81.15	76.81
Solids	11.39	14.24	15.36	17.92	18.85	23.19

The crowding of corn together also has the effect of retarding growth and maturity, and, in most cases, of increasing the water per cent.

ONTARIO EXPERIMENTAL DAIRY DEPARTMENT, 1888.

Drilled corn, 81.32 p. c. water broad casted corn, 83.61 p. c. water.

In favorable weather wilting upon the ground will have the effect of reducing the water per cent. and also of effecting changes (as many advance) similar to hay making or curing.

(*b*) *Condition of Maturity.*—"The marked increase of nitrogen free extract (members of the starch family) as the corn matures, and the progressive decrease of acid in the ensilage, show how greatly the corn improves as it approaches ripening. The relatively large amount of water and crude fibre in the young plant justifies the epithets 'slush' and 'swill' as applied to the ensilage from such material." (Michigan Experimental Station Report, 1889). This statement accompanies a table of analyses of ensilage from which the following is taken :

No. 1, Aug.	25, wilted two days, then ensiled,	1.10	per cent.	acid.
" 2, "	27, put in fresh,	1.62	"	"
" 3, Sept.	1, wilted two days,	0.95	"	"
" 4, "	3, put in fresh,	0.91	"	"
" 5, "	8, wilted two days,	0.87	"	"
" 6, "	10, put in fresh,	0.80	"	"
" 7, "	13, put in fresh,	0.81	"	"
September 14, killing frost.				

Prof. Henry, of Wisconsin, says, "In regard to making the so-called sweet ensilage the main point appears to be to have the corn well ripened, ready for early cutting and shocking. Corn ripened so that the grain begins to dent will make sweet ensilage even if the silo is filled in a single day."

The more matured a plant, the more fixed, less changeable are its constituents, *i. e.*, the constituents of a young plant will suffer change or decomposition more rapidly than those of the same plant more matured.

(*c*) *Temperature.*—Mr. George Fry, of England, in his work "Sweet Ensilage," laid great stress on the necessity of raising the ensilage to 122° F., thereby to stop the various ferments. The most favorable temperature for the development and working of the various ferments is about 95° F., and most of them cease at 122° F., but some continue active to 140° F. Fry says that excess of water in succulent food prevents this rise of temperature and that sour ensilage thereby results, as the ferments are not then destroyed.

In opposition to Fry, Prof. Alvord, of Maryland Experimental Station, says, "Temperatures 110° to 140° F. are most favorable for their development and activity, and it requires at least 185° F. to destroy them, while fermenting ensilage does not often exceed 140° F., and no authentic record of 150° F. can be found."

Along the same line Prof. Johnson, of Michigan, says, "I am of opinion, however, that positive evidence to sustain this theory is almost if not entirely wanting. Enough careful work has not been done to demonstrate it beyond question."

Amid conflict of opinions I think that, taking the conclusions of scientific experts as our guidance, we are warranted in the conclusion that though we cannot expect to raise the ensilage to such a temperature as to cause all ferments absolutely to cease work, nevertheless we can retard greatly their action and control somewhat the souring of the ensilage. There is along this line room for investigation on the part of our interested young agriculturalists of a scientific turn of mind.

(*d*) *Method of Filling.*—Whether slowly or rapidly, whether wilted or unwilted, this will be partly controlled by the weather, but there seems to be something of more controlling influence back of this. The effect of the method will perhaps have more effect on the aroma or flavor of ensilage than upon its acid production.

(*e*) *Exclusion of Oxygen.*—Presence of air is of course necessary for the beginning of many of the fermentations, but, once commenced, absence of air will not necessarily destroy them. The exclusion of the air is of most importance in the case of ensiling young and succulent fodder.

3. *Effect on Protein.*—This is the muscle and flesh forming portion of the plant, hence the effect on it is worth considering. Michigan Experimental Station, Bulletin 49, May, 1889, states, "A small loss of crude protein is common in the silo, but the change from albuminoid to amide condition of the nitrogen compounds is the most striking feature of ensiling. These two facts point to a loss of value in ensilage as compared with the fresh corn stalks, or even the dry material when it has been rapidly and perfectly cured."

The same conclusion was arrived at by Dr. Voelcker in '86-'87, and reported upon to the Royal Agricultural Society of England, Report XLVI, p. 403. Silage was made from grass and compared with hay from the same. "The total loss due to fermentation, evaporation, etc., in making the silage was 7.29 per cent. on fresh grass, of this 3.25 per cent. consisted of water. The loss of total nitrogen when, as here, no drainage is allowed to flow away, is very slight; but the nitrogenous bodies have undergone considerable change from the albuminoid to the non-albuminoid condition. The woody fibre, as indeed the whole of the fibre, has been diminished, insoluble albuminoids are lessened, and the soluble albuminoids increased. In the hay the nitrogen has undergone but little change."

Put in silo 151 lb. (n. compounds), 123 lb. alb'd, 28 lb. amides.

In silage 155 lb. (n. compounds), 73 lb. alb'd, 82 lb. amides.

The most extensive tables of analyses of American fodders are those compiled by Dr. Jenkins of Connecticut. The table below gives his average of 59 samples of ensilage and the maximum and minimum amounts of the various constituents. To his table I

have added 41 analyses, gathered lately from a wide range of reliable sources, and give the average of 100 samples that I thus obtained :—

——	Water.	Crude Protein.	Fat.	Soluble carbo-hydrates.	Crude Fibre.	Ash.
Maximum	87.00	2.80	1.80	22.30	10.00	
Minimum	64.40	0.70	0.20	5.10	3.00	
Average, 59 samples	80.28	1.52	0.70	10.49	5.70	1.31
" 100 "	79.83	1.56	0.73	10.62	5.94	1.29

Water.—The water varies from 64.4 to 87.0 per cent. From our investigations it appears that the best, the sweetest, and the greatest amount of ensilage will be produced when the amount of water lies near 75 per cent., between that and 80 per cent.

Crude Protein.—In food analyses, this of course includes the less valuable amides, which are not flesh and muscle formers, but heat producers. The following table gives a few analyses separating the true protein from the amides or non-protein. I have said before that in the silo true protein will be changed to amides to a certain extent ; this, in addition to the amides always existing in young growing plants, will give us a high per cent. of non-protein :

——	Total crude protein.	True protein.	Amides or non-protein.	Per cent. of true protein.	Per cent. of non-protein.
New York, 1886	0.85	0.50	0.35	58.83	41.17
" "	0.85	0.45	0.40	52.95	47.05
" "	1.08	0.75	0.33	69.45	30.55
" "	1.17	0.73	0.44	62.40	37.60
Wisconsin, 1888	1.92	0.99	0.93	51.58	48.42
Dr. Voelcker, 1884	1.12	0.68	0.44	61.10	38.90
Pennsylvania, 1889	2.15	1.43	0.72	66.52	33.48
" "	2.35	1.75	0 60	74.47	25.53
" "	2.43	1.98	0.45	81.48	18.52
" "	2.34	1.60	0.74	68.42	31.58
Michigan, 11 analyses, 1889	1.32	0.82	0.50	62.12	37.88
Average	.....	.....	.....	63.36	36.64

German investigators have found non-protein in considerable quantities in roots, potatoes, malt sprouts, and fodder plants of all kinds, the average in the last case being about 30 per cent. In four analyses of malt sprouts Kellner found an average of 27.40 per cent. (Armsby). The average so far found in corn ensilage is in excess of that usually found in the freshly gathered plants, and this large quantity of non-protein, to a certain extent, takes from the value of the ensilage and demands a liberal addition of nitrogenous foods to it to make complete rations.

Fat.—There is little or no true fat in corn ensilage, unless it be made from corn well matured. The fat represented in our tables is ether extract more properly and consists largely of chlorophyll, waxy matters and acids. The amount of fat, therefore, may be considered as of little or no value.

Much difficulty meets us here; there are few determinations with wide differences. I give the digestion co-efficients available:

——	Moser. (Germany.)	Armsby. (Pennsylv'a)	Woll. (Wisconsin.)	Sturtevant (New York.)
Protein	73	41	78	49
Fat	75	86	53	90
Carbohydrates	67	66	56	67
Fibre	72	60	74	69

Reference to the reports of work done at some U. S. stations, especially at Wisconsin and Pennsylvania during the past two years, clearly shows that there is good work to be done in determining the exact feeding value of corn ensilage in comparison with corn fodder. Some contend that ensiling lowers the digestibility of some portions of the food, fibre for instance. The variability of results arising from variety of methods adopted to determine this leaves the question as yet to be settled.

——	Water.	Protein.	Fat.	Soluble carbo-hydrates	Fibre.	Ash.	Nutri-tive ratio.
Colostrum	71.7	20.7	3.4	2.5		1.8	1:0.5
Whole milk	87.0	4.0	3.7	4.6		0.7	1:3.3
Grass	75.0	3.0	0.8	13.1	6.0	2.1	1:7.0
Corn ensilage	79.8	1.6	0.7	10.6	6.0	1.3	1:11.0

Nature's feeding is from colostrum to whole milk to green grass. By consulting our table we see that corn ensilage is alone not sufficient to take the place of either whole milk or good pasture grass, that the great lack is in nitrogenous constituents, flesh and muscle formers, and that the use of ensilage in a ration demands the addition of foods containing protein and fat, such as good hay, grain, bran, cake, in such proportions as must be regulated by the circumstsnces of the feeder and market prices. Let us now contrast the ensilage with the German feeding standard for milk production, which is the best established of the standards. Though these standards cannot be closely followed in this country, they will serve to show the great lack in the ensilage for milk production which must be supplied as above stated. I take the highest digestible co efficients (Moser's)

——	Organic sub-stance.	Digestible Substances.			Nutri-tive ratio.
		Protein.	Carbo-hydrates	Fat.	Total.
German standard for milk	24.0	2.5	12.5	0.4	15.4	1:5.4
120 lb. of corn ensilage	24.2	1.4	13.7	0.5	15.6	1:10.1

Thus it would require 120 lb. of ensilage per 1,000 lb. live weight, daily, to give organic substance equal to that demanded by the German standard. The two noticeable features are, the lack of protein and the great mass of ensilage. The general conclusion of the American experiments is that in profitable feeding the daily allowance will not exceed 50 lb.

In conclusion, let me state requirements met by the ensilage :—1st. It is succulent and palatable. 2nd. It gives bulk for ruminants. 3rd. It contains heat and force producing constituents. 4. It may contribute somewhat towards fat production. 5th. It should, pound for pound, a little more than take the place of roots. 6th. It is regulating and tonic in its effects upon the animal system.

CHEMISTRY OF DAIRY PRODUCTS.

By A. E. Rennie, of Hamilton.

In examining the composition of blood and milk the large amount of water they contain, is at once noticeable, there being in the maximum only 15 per cent of solids.

Empires like milkmen have risen to greatness, in proportion to their water privileges. In the case of the milk dealer, however, it is often in the inverse ratio, in relation to true greatness.

What would Egypt, Greece or Italy have been without the grand water highways which surrounded and penetrated them? The mighty rivers and the great lakes of Canada were the cause of her rapid immigration and advancement.

Men follow, nature leads.

Man found water a more convenient freight bearer than land, and therefore used it as a travelling route.

He found water a good heat conveyer, and therefore boasts of the hotwater system of heating.

Long before the first ocean grey hound crossed the intervening water, the pioneer voyageur ran a rapid, or a Roman galley left the Tiber, nature used water as a freighting medium.

Stratified rock exemplifies how materials were disintegrated, floated, precipitated in ages past.

The rounded boulders in our fields shows us that all things need recreation.

The Scotchman can point back to these monuments of glacial action, as proof that curling is the most ancient of games, nature having introduced the sport in ages past.

The avenues of the work of water are not to be found in this organic world only but are exhibited in the water vascular system of the lowest echinoderm and the circulatory system of the highest vertebrate.

The whole organism is a sea port town, and like a double track railway there are separate ways for incoming and outgoing cargoes.

At the lacteal vessels the blood is freighted with dissolved nutritive substances from the food. At the "long port" the little blue incoming boats discharge their heat giving material, and take in oxygen, thus becoming red vessel outward bound. Every hundred volumes of blood carries twenty-two volumes of oxygen.

Look at the circulation of the blood: Can any engineer propose or put in execution a process of heating better than this old plan.

Don't brag of the discovery of the hot water system of heating, it is as old as the vertebrates.

Water of the blood and milk depends for its purity upon the source from which it is obtained. If water is obtained from fermented, or putrid food, it will contain germs that will originate fermentation. I canvas not your opinion, gentlemen, whether you are

pessimists, and believe life is degenerating, or whether you believe in the survival of the fittest and that the organic mechanism is still making upward strides; but simply state that if you expect a cow to act as a successful garbage filter; you have overestimated cow nature, for the milk product will contain the ferments of putrefaction and disease.

The person who is not political economist enough to believe in division of labor, to the extent, that the man who delivers milk and the man who collects garbage from his yard should not be one and the same man, has missed his calling in life, for he should travel and see the world. Yes! See the world with Barnum.

A dairy farm drew water from a certain pond; within 22 paces of the same pond at a higher level a ditch ran in which a sewer from a village discharged its contents. The result was that diphtheria broke out in the village, the attacks and fatal cases being in the families of the customers of this dairy farmer.

A bad epidemic of sore throat was clearly traced to the prevalence of this disease among cows in 1883 in Dover, England. Four hundred cases of sore throat occurred in a week among the customers who received milk from the diseased source. Authentic evidence shows that water from a diseased origin is dangerous.

The fat of milk is complicated as to its constituents being composed of a mixture of a number of hard and soft fats. The specific gravity of this fat at 100° F. is from .912 to .914 the melting point being 96.4° F. The specific gravity and melting point of milk fat changes to some extent according to the nature of the food the animal consumes while producing the milk. Some believe that in the elaboration of milk, the fat is given off from the gland follicles by a process of budding. I don't say it laughs and grows fat. Half such an undertaking is enough.

It was naturally supposed that the fat in milk was derived from the fat of the animal's food; but investigation has proved that the fat in the milk exceeded the fat in the food.

Opinion is likely to run to extremes; the prevailing idea at the present time, being that the fat of the food is used up in producing force and heat, and is therefore not identical with the fat in milk.

Fat stored up in the body receives its character from the food producing it. Pigs fed on oily nuts, mast, etc., exemplifying this fact, the flesh being oily and unfirm. Experimenters have come to the conclusion that a high per cent. of oil in food depresses the activity of the milk gland. This might be due to too great a change in the food, the animal showing different results if educated up to the extreme change. It is a well-known fact that the emulsification of fat in the body is produced by the bile; and that a too rapid increase of fat in the food is liable to be followed by an excessive secretion of bile, causing biliousness. The consequence of this being that the system would be disturbed, and the production of milk interfered with to some degree. The fact that northern cows cannot stand being fed on the crude cotton seed, while southern cows can eat it in considerable quantities, may be due to the amount of oil it contains, its high per cent. of albuminoids, or the medicinal effect of the cotton plant itself.

The melting point of butter from milk of cows fed on cotton seed is remarkably high, while cotton seed oil solidifies only when cooled near the freezing point of water. This would indicate that the fat in the milk was due to the albuminoids of the cotton seed and not to the oil it contained.

The size of the globules of emulsified fat has an important bearing upon the creaming of milk. The large globules of the Jersey and Guernsey allow the milk of these breeds to show at their best, the per cent. of churning butter being large, on account of the ease with which the large butter globules rise through the milk. The Ayrshire and Holstein breeds are at a disadvantage, on account of the butter globules being small. This milk requires more skill to extract as butter as large a per cent. of the fat present in the milk.

When we commence to study milk under this heading we are struck with the wonderful provision nature has made for the development of off-spring. Starting from the blood, we note the great changes exhibited between it and the colostrum (or first milk), and between this and normal milk. In the colostrum, there is ten times more fat than there is in the blood serum. The young animal requiring heat producing food

to keep up the temperature of the body. In normal milk there is an increase of twenty-two times as much fat as in the blood, that being twice as much as in the colostrum. The calf on account of its active life requiring a force producing food. This is where nature and the boy that took the calf to the market disagreed. The calf was on one end of the rope and the boy on the other. The calf would go ahead at a rate that made the boy think it was competing with an express train, then it suddenly stopped and the boy sat down as suddenly. The boy thought the animal had too much energy and certainly didn't need food to produce it.

Mr. E. Smith of N. Y., who has written on food, says "that ten grains of butter burnt in the body, produces heat sufficient to raise 18.68 lbs. of water 1 ° F."

Prof. Atwater says, "that if 1-28 of an ounce of fat is consumed in the body, it will (if it be transformed into mechanical energy such as the steam-engine or the muscles use to do their work), furnish as much as would raise one ton fourteen and two-tenths feet, or 14 2-10 tons one foot. Mr. Zavitz suggests that the fat must have been strong."

The fat in milk does not saturate the other solids. If such was the case, the fat would prevent the solids being acted upon to any advantage by the juices of digestion; but the facts are just opposite, for the fat is presented in the milk in the form of an emulsion, ready to be passed into the circulation.

There is less than five per cent. of sugar and extractives in the blood. In colostrum there is 1.34 per cent. which realized three times as much as in the blood; and normal milk contains ten times as much sugar as the blood. The reason of this increase is to supply heat and force giving material equal to the demand in calf life, occasioned by its prominent characteristic, namely—activity.

Milk is the only known substance that contains sugar in the form of lactose.

Milk sugar is remarkable for its grittiness, its lack of sweetness, and its power of resisting the attack of certain ferments among which is the *butyric facillus.*

The effect of milk sugar to the dairyman is of great moment, indeed, it is the high-way of friend and foe.

Ferments may be conveniently divided into two classes:—1st. *Pathogenic* (disease producing) and, 2nd. *Non-pathogenic.*

In speaking of the *non-pathogenic* ferments, it is convenient to divide them into two classes, those that develop in a neutral or alkaline solution and those that require an acid medium in which to increase.

It is known that there are from 30 to 40 *non-pathogenic* species of *bacteria* that grow, and produce certain changes in milk and cream.

It is a common practice in farm life, to subdue weeds by crowding them out, by keeping the land covered by some economic crop. Buckwheat is often used for the purpose indicated above, because it covers the ground with a luxuriant growth, and because its roots seem to have an antagonistic effect on other plant life. The dairyman in producing butter and cheese uses certain ferments for a similar use. The ferment that produces the ordinary souring in milk, is called "*Bacillus acide lactici.*" It is the most commonly known of all the ferments in milk and cream. It produces its action by attacking the milk sugar and converting it into *lactic acid.* It multiplies best in a neutral or slightly alkaline solution. Its growth is slow in a dilute acid solution and is prevented entirely when the acid is increased to .8 per cent. On account of the above fact only a portion of the sugar in milk can be changed to acid. To the unskilful butter and cheese-maker, the *lactic* ferment is the personification of all evils; while to the scientific and painstaking it is a friend at all times. The *butyric bacillus* is the dread of the butter-maker, for to it is attributed the condition prevalent in 10c. butter. This ferment cannot increase the presence of free *lactic acid.* The cheese-maker knowing that the ferments which produce this effect known as "ripening" in cheese increase but slowly in the presence of *lactic acid,* manipulates the curd in such a way that it will retain just the proper amount of acid. The consequence being that there is a very gradual change due to certain ferments that have the power of making the *albuminoids* more soluble, and consequently more digestible. If the cheese-maker is unskilled and allows too great a development of *lactic acid,* before he draws off the whey the curd will be hard and

dense, digestive fermentation impossible ; and the resulting cheese will be heavy, wanting that porosity and rich cheesy smell that characterises marketable cheese.

The ash of milk is composed of phosophates of iron, potash, lime and magnesia ; and chlorides of soda, potash and lime. The coagulating action of rennet on casein, will only take place when the neutral phosphates are present. The ash in colostrum is nearly double that in normal milk. This being necessary to satisfy the needs of the calf whose bony tissues need ash constituents.

There are three main classes of albuminoids in milk, albumen, casein and fibrin.

The albumen in normal milk is about one-fifth of the casein present. In the colostrum it is increased to the extent that it reaches 60 per cent. of the total solids present. Albumen will not coagulate under the action of rennet or acid, but is coagulated by heat. It is closely identified with blood albumen ; there is less of it in the blood than in normal milk, however. Nature seems to increase it in the colostrum for the purpose of medicine and on account of its fine division to give the juices of the stomach a better chance of action during the period of its first secretion of digestive juices.

The viscosity of milk is largely due to the albumen, and nature has produced it for the very reason that dairymen wishes to get rid of it.

Nature has for its object the presentation of milk in a form that could be best acted upon by the digestive system, therefore milk was made viscose to prevent the fat globules from clustering, and by massing interfere with the easy digestion of the other solids, and also necessitate a secretion of bile to again emulsify this fat before it passes into the blood.

The dairyman on the other hand wishes the fat to cohere and thus become larger in its globules so that the creaming will be more rapid. There is a point for discussion here, therefore the cheese or butter maker does not want fibrin in the milk, the butter maker for the reason about creaming. The cheese-maker would appear to want it to keep as much fat as possible held on the solids of milk, but another fact comes in here. The albumen would coagulate with rennet, but on coagulating with heat it produces difficulties in cheese manufacture and even after manufactured it leaves the cheese so open to the attack of ferments, that the cheese changes rapidly and is anything but what would be termed "of good shipping quality."

Casein, by the best authorities, is said to be manufactured from the albumen of the blood. The reason for coming to this conclusion, is that when by disease or excitement the body is thrown out of its normal condition, the casein is greatly diminished in the milk and albumen predominates.

Albuminoids in the form of casein are present in no other substance than milk.

Casein of human milk coagulates in a very fine state, producing much surface to the attack of the juices of digestion. The casein of cow's milk coagulates in mass, holding the globules mechanically. The smaller the globules of fat the easier they can be held by the curd, and the fewer of them will escape from it, so that Holstein and Ayrshire milk is well adapted for cheese making. The casein holds the phosphate of lime in true combination. The late Prof. Arnold held that if the curd was left too long before the whey was withdrawn, the phosphate became separated from the casein. The cheese losing in weight and food value that valuable ash constituent.

It is the opinion of the best authorities that fibrin does not exist in the normal blood previous to its being shed, but is the result of the union of fibriogen and paraglobulin.

These compounds may, with proper management, be precipitated from the blood without union. The coagulation of blood is due to the formation of fibrin, which encloses the blood corpuscles in its net work of threads.

Blood contains 2.2 to 2.8 parts of fibrin in the 1,000.

Coagulation is promoted by—

1. Exposure to air.
2. An increase of temperature slightly higher than the living body.
3. Contact with foreign substance.
4. Agitation.
5. Addition of minute quantities of common or other neutral salt.

Coagulation is delayed by —

1. Cold.

2. Certain chemical reagents in sufficient quantity. Among these are common salt, caustic alkalies, magnesium sulphate (epsom salts), potassium nitrate (saltpetre).

Dr. S. M. Babcock of the Wisconsin Agricultural Experimental Station, has made some very valuable investigation in regard to fibrin.

In Bulletin No. 18, it is stated that milk contains fibrin to the extent of about 1-500 of that in blood, or two or three parts in every ten thousand of milk, the fat in the whole milk.

Cream 99.3 per cent. fat of milk. Skim-milk 7 per cent. fat of milk.

If the milk is not quickly chilled with ice water fibrin will form rapidly, so that in thirty minutes the milk be in such a condition on account of the formation of fibrin, that if it then be immersed in ice water at 40° F. it will only yield up fat as follows :—

Cream 91.2 per cent. fat of whole milk.

Skim-milk 8.8 per cent. fat of whole milk.

Contrasting this with the other method of rapid milk setting, *there is a loss of 8.1 per cent. of fat.*

This necessitates a loss of 8.1 per cent. of the butter made by the farmer, resulting in *a loss of 8.1 per cent of cash for* butter that could have made.

When there is such a cry "that farming does not pay," it is worth while to use better methods of work. In this one case for the butter.

It is contended that fibrin in milk is in the form of a network of interlacing particles, as in blood, and that the creaming of milk is retarded by the fat globules being caught in the fibrin, an impediment in the rising of the fat being caused to such an extent that almost all the fibrin is carried up into the cream layer ; the result of the above being that the cream raising is slow and a quantity of small fat globules never reach the top.

This fact is exemplified by experiments and in practice from Prof. Henry's investigation (Wisconsin exp. station), and from results of daily practice in actual dairy work it is shown that if normal milk in gun shot cans be immersed in ice water at 40° F. directly after it is milked (say while at 90° F.) the result attained shows that the farmer has a chance to increase his output in butter 8 per cent. Business men consider 8 per cent. a very good interest.

Experimental stations and such unions as this, gentlemen, have the high honor of investigating and bringing forward improved methods, and I believe the present depression in farm life is not to be looked upon with despair. It is "a dark cloud with a silver lining," which will force the ignorant, careless and timid to strike out for more knowledge. The institutions of agricultural education will be recognised in their true merit, and the farmers of Canada will press for more and more research in regard to the unknown in the field and the dairy. The conclusion of the whole matter being that the Canadian farmers will supply Canadian markets, and cope successfully in supplying the foreign, especially the British market.

HORTICULTURAL EXPERIMENTS.

The following report is a synopsis of the experiments in potato culture for 1889, showing in a concise way the results obtained by the different persons who undertook the work. The committee deemed it advisable to leave out No. 3, small, eyes cut out but one, and No. 4 medium, cut in two, as there was a loss of time in preparing the former, and an extravagance in bulk of seed. The following circular was sent to experimenters, together with a blank form for report :—

GUELPH, April 5th, 1889.

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. We shall be pleased if you will conduct these experiments and report result

No. 1. planting large whole potatoes.
" 2. " small uncut potatoes
" 3. " medium potatoes, fresh cut, 2 eyes.
" 4. " " " old cut, (5 days), 2 eyes.
" 5. " " " cut, with 1 eye.
" 6. " " " seed ends.
" 7. " " " fresh cut, 2 eyes, cultivated flat.

Nos. 1 and 2 to be planted 20 inches apart in rows. Nos. 3, 4 and 5 to be planted 8 inches apart in rows. Plant that variety which does best with you. Potatoes to be planted on 6 adjoining rows, where land is uniform. Give same manure and cultivation as rest of the field. Each row to be 7 rods long. In digging be careful to weigh accurately, and forward results as soon as possible to

N. J. CLINTON, Windsor, Ont.

Report at earliest convenience if you will undertake the work.

ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION.

	Answers.	No. of Row	Weight of crop lb.	No. of lbs. small potatoes under 1½ inches in diameter.
Give date of planting.....				
" date of digging				
" Crop in 1888.....				
" Crop in 1887.....				
" Weather				
" Variety.....				
" Surface Soil.....				
" Subsoil..				
" Distance between rows.				

What is your usual way of preparing seed for planting?.....
How do you cultivate your potatoes?.....
Name.....P. O.....

The following are a few conclusions we can draw from this and the preceding report for 1888 :—

1. That there is not any advantage in keeping potatoes cut for seed any length of time before planting, for in both cases the returns are less than from the fresh planted seed.

2. The planting of the large whole potato 20 inches apart in rows gave better results then when planted 12 inches apart.

3. A person not having time to cut his potatoes will not lose anything by planting them whole, especially large and medium sized potatoes, for they gave returns of 43.2 bushels more of large or marketable potatoes than any of the six rows and 29.6 bushels more potatoes than any of the six rows after the seed was deducted from the total yield, No. 6 being the next highest.

4. No. 4 gave second greatest yield of marketable potatoes out of six rows, No. 6 second, No. 2 3rd, and No. 5 4th.

REMARKS.

The additional experiment No. 7 was added on after the plan of the experiments was printed and only three tried it, and as two of the three experiments gave the heaviest returns it would not be fair to deal with it among the averages, but only as the three individual experiments. One reported the sample as extra large.

The light yield as compared with that of 1888 was largely owing to the early wet season followed up by a long spell of dry weather in most localities during the season.

J. HOYES PANTON,
ELMER LICK,
N. J. CLINTON. } Committee.

Result of Potato Experiments for 1889.

Experimenters.	Variety of Potato	Large wh .			Small un- ut.			Fresh cut, 2 eyes.			Old cut (5 days) 2 eyes.			Cut with 1 eye.			Seed ends.			Two eyes, (fresh cut) flat cultivation.			Average seven kinds.		
		1.			2.			3.			4.			5.			6.			7.			—		
		Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.	Lar. lb.	Sm. lb.	Tot. lb.
J. H. Esplin	Early Rose	65	30	95	42	26	68	39	20	59	28	7	35	43	14	57	32	21	53	....	....	....	41.5	19.6	61.1
Elmer Lick	White Elephant	34½	17½	52	29½	12	41½	31	11	42	31	14	45	23½	9	32½	14½	9	23½	32	7	39	28	11.3	39.3
Isaac French	....	155	20	175	115	15	130	73	9	82	68	12	80	87	14	101	83	17	100	91	21	112	96	15.4	111.4
Edgar M. Zavitz	White Elephant	52	18	70	47½	7	54½	45	5	50	43	6	49	....	....	....	....	....	....	....	....	....	46.8	9	55.8
George G. Sherriff	Early Rose	44	6	50	54	8	62	62	7	69	29	4	33	40	5	45	76	12	88	....	....	....	50.8	7	57 8
R. C. King	Late Rose	38	25	63	18¾	16½	35¼	13¾	21½	35¼	18¾	29½	48¼	19¼	19¼	38½	21½	25	46½	....	....	....	21.6	22.7	44.3
Jas. Forsyth	Beauty of H ron	192½	9½	202	72	13	85	173	12	185	96	9	105	108½	8½	117	128½	10½	139	114	9	123	126.3	10.2	136.3
Average yield one row (7 rods)	....	83	18	101	54	13.9	67.9	62.3	12.2	74.6	44.8	11.6	56.4	53.5	11.6	65.1	59.2	15.7	74.9	79	12.3	91.3	58.7	13.6	72.3
Average seed used per acre	 1889	Bush. 33.2			Bush. 8.7			Bush. 14.4			Bush. 14.4			Bush. 8.2			Bush. 8.2			Bush. 14.4			Bush. 14.5		
	 1888	55.5			14.4			14.4			14.4			8.2			8.2			.....			19.1		
Average yield per acre	 1889	212.1			142.8			156.7			118.4			136.7			157.5			190.7			159.3		
	 1888	263.9			216.0			213.9			209.1			197.3			207.4			.....			220.6		
Net yield per acre (less seed)	 1889	178.9			134.1			142.3			104.0			128.5			149.3			176.3			144.8		
	 1888	208.4			201.6			199.5			194.7			189.1			199.2			.....			201.5		

SECOND DAY'S PROCEEDINGS.

The nominating committee presented their report, and the Association elected the officers for 1890-91, which were as follows.

OFFICERS FOR 1890-91,

Hon. President, Prof. T. Shaw, O. A. College, Guelph.
President, T. G. Raynor, B. S. A., Rosehall, Prince Edward County.
Vice-President, J. J. Sinclair, Ridgetown, Kent County.
Corresponding-Secretary, G. A. Brodie, Bethesda, York County.
Secretary-Treasure, A. Shantz, Waterloo, Waterloo County.
Editor, C. A. Zavitz, B. S. A., O. A. College, Guelph.
Auditors—J. A. Craig, B. S. A., Toronto; H. H. Dean, O. A. College, Guelph.

District Secretaries.

District No. 1, comprising Stormont, Dundas, Russell, Glengary, Prescott, Cornwall, Carelton and Grenville, W. E. Serson, Antrim.

District No. 2, Lanark, Renfrew, Leeds, Frontenac, Lennox, Addington, Hastings and Prince Edward, T. Raynor, Rosehall.

District No. 3, Nipissing, Parry Sound, Muskoka, Haliburton, Peterborough, Northumberland, Durham, Victoria and Ontario, G. B. Brodie, Bethesda.

District No. 4, Simcoe, York, Peel, Dufferin, Grey, Wellington and Halton, H. B. Jeffs, Bondhead.

District No. 5, Wentworth, Lincoln, Welland and Haldimand, H. L. Hutt, South End.

District No. 6, Waterloo, Oxford, Brant and Norfok, A. Shantz, Waterloo.

District No. 7, Huron, Perth and Bruce, N. Monteith, Fairview.

District No. 8, Middlesex and Elgin, W. A. McCallum, Ailsa Craig.

District No. 9, Essex and Kent, N. J. Clinton, Windsor.

District No. 10, Lambton, A. E. Wark, Wanstead.

Committee on Experiments.

Agricultural—Profs. James, Shaw and Robertson, Messrs. C. A. Zavitz, J. Harcourt E. A. Rennie, N. Monteith, W. A. McCallum, and H. L. Hutt.

Horticulture—Prof. Panton, N. J. Clinton and E. Lick.

Agriculture—R. F. Holtermann and A. E. Rennie.

Dairying—Prof. Robertson, G. Harcourt and A. E. Rennie.

Live Stock—A. E. Wark, F. G. Sleightholm, J. J. Sinclair, H. H. Dean and Geo. Harcourt.

AGRICULTURAL EXPERIMENTS.

Mr. C. A. Zavitz, Secretary, submitted the following report of the Committee on Agricultural Experiments:—

During the past four years a Committee has been appointed annually by the Ontario Agricultural and Experimental Union for the purpose of making proper arrangements for the conducting of Agricultural Experiments over Ontario. This work has been very

carefully done each year by the committee appointed and only those experiments chosen which were considered to be of real practical value to those conduct.ng them, and at the same time to be of such a nature that the results would, when collected together, and printed in the annual report of the Union, afford much useful information. The tests so far have been with grains, fertilizers and corn, and during the past season there has been four distinct experiments conducted over the Province. The carrying on of this work is not now confined to the ex-students of the college alone, but a number of other leading farmers over Ontario have also joined the ranks, and both the number of experiments and of experimenters is increasing annually. Much interest and enthusiasm is manifested in these experiments, and we think a valuable work is being done.

After the names and addresses of those members of the Union and others who were desirous of conducting one or more of the proposed experiments were obtained, materia was sent in sufficient quantities to carry on the tests free of charge to the experimenters. Sheets containing full instructions regarding the detail management of the plots, and blank forms to be filled out and returned to the secretarie at the end of the season, were sent at the same time as the material for the tests. The following is a concise report of the experimental work done the past season.

Two Sets of Plots were fertilised in 1887, and hence this season's crop shows the influence of the fertilisers over third year's growth.

THIRD CROP AFTER APPLICATION OF FERTILISERS.

Fertilisers.	Ontario Experimental Farm, Wellington County.			J. B. Muir, Bruce County.			Average of two lists.	
	Oats.			Barley.			Oats and Barley.	
	Date of maturing.	Yield of straw per acre.	Yield of grain per acre.	Date of maturing.	Yield of straw per acre.	Yield of grain per acre.	Yield of straw per acre.	Yield of grain per acre.
		tons.	bus.		tons.	bus.	tons.	bus.
Salt, 10 lb. per plot (400 lb. per acre)	Aug. 11	.86	66.8	Aug. 10	.54	9.2	.70	38.0
Superphosphate, 10 lb. per plot (400 lb. per acre)	13	.76	89.6	14	.68	8.3	.72	49.0
Ground Apatite, 10 lb. per plot (400 lb. per acre)	11	.79	82.6	14	.71	8.8	.75	45.7
Farmyard manure, 700 lb. per plot (14 tons per acre)	15	.99	118.42	14	.84	12.9	·92	65.7
No Manure	14	.92	87.3	14	.68	8.3	.80	47.8

		Fertiliser.	Date of maturity.		Straw per acre (tons) estimated from 1-40 acre plots.			Grain per acre, bush. estimated from 1-40 ac. plots.			Nature of Soil.	Previous cropping.	Name of Experimenter.	County.
			1888.	1889.	1888.	1889.	Av.	1888.	1889.	Av.				
Black Tartarian Oats.	1	Salt, 400 lb. p. ac.	....	Aug. 15	Undeterm'd	2.02	.....	.....	51.8	..			Elmer Lick.	Ontario.
	2	Superphosphate, 400 lb. p. ac	.....	" 15	.....	1.71	.....	.....	60.6	.....				
	3	Ground apatite, 400 "	.....	" 15	.....	1.80	.....	.....	58.8	.....				
	4	Freshwood ashes, 400 "	.....	" 15	.....	1.76	.....	.....	61.8	.....				
	5	Farm-y'd manure, 14 tons p. a.	.....	" 15	.....	1.51	.....	.....	52.6	.....				
	6	No manure	.....	" 15	.....	1.60	.....	.....	50.6	.....				
Black Tartarian Oats.	1	Salt, 400 lb. p. ac.	Aug. 10	Aug. last w'k	Undeterm'd	Undeterm'd	.....	18.8	44.7	31.8			Luke Gibbons	Ontario
	2	Superphosphate, 400 lb. p. ac.	" 10	"	.....	.....	.....	16.3	35.9	26.1				
	3	Ground apatite, 400 "	" 10	"	.....	.....	.....	12.3	35.6	24.0				
	4	Freshwood ashes, 400 "	" 10	"	.....	.....	.....	14.0	35.2	24.6				
	5	Farm-y'd manure, 14 tons p.a.	" 10	"	.....	.....	.....	17.5	42.4	30.0				
	6	No manure,	" 10	"	.....	.....	.....	15.3	36.5	25.9				
Black Tartarian Oats.	1	Salt, 400 lb. per acre	.....	Aug. 15	.....	1.16	....	.....	30.6	.....	Low lying.		Lewis P. Hubbs.	Pr. Edward.
	2	Superphosphate, 400 lb. p. ac.	.....	" 15	.....	1.20	.....	.....	23.5	.....				
	3	Ground apatite, 400 "	.....	" 15	.....	.98	.....	.....	20.0	.....				
	4	Freshwood ashes, 400 "	.....	" 15	.....	.94	.....	.....	21.2	.....				
	5	Farm-y'd manure, 14 tons p.a.	.....	" 15	.....	1.22	...	.....	35.3	.....				
	6	No manure	.....	" 15	.....	.96	.....	...	21.8	.....				
Barley 6-rowed.	1	Salt, 400 lb. per acre	Aug. 13	July 26	.99	.50	.75	28.80	16.7	22.8	Heavy clay, naturally well drained.	1884, fallow. 1885, fall wheat 1886, clover and timothy. 1887, timothy. 1888, experimented with oats.	R. E. King.	Haldimand.
	2	Superphosphate, 400 lb. p. ac.	" 13	" 26	.74	.45	.60	22.86	15.0	18.9				
	3	Ground apatite, 400 "	" 13	" 27	1.04	.40	.72	26.66	13.3	20.0				
	4	Freshwood ashes, 400 "	" 13	" 27	.69	.25	.47	19.83	8.3	14.1				
	5	Farm-y'd manure, 14 tons p. a.	" 13	" 26	1.15	.40	.78	31.11	13.3	22.2				
	6	No manure	" 13	" 27	.95	.25	.60	22.44	8.3	15.4				
Fall Wheat Democrat.	1	Salt, 400 lb. per acre	Aug. 13	Aug. 1	.52	.40	.46	18.66	12.0	15.3	Heavy clay loam.	1884, hay. 1885, hay. 1886, hay manured. 1887, timothy seed.	Martin Bellerby.	Grey.
	2	Superphosphate, 400 lb. p. ac.	" 13	" 1	.56	.4	.51	16.00	13.3	14.7				
	3	Ground apatite, 400 "	" 13	" 1	.56	.44	.50	16.66	12.7	14.7				
	4	Freshwood ashes, 400 "	" 13	" 1	.44	.54	.49	14.00	15.3	14.7				
	5	Farm-y'd manure, 14 tons p.a.	" 13	" 1	.42	.60	.51	14.00	16.7	15.4				
	6	No manure	" 13	" 1	.56	.50	.53	15.00	14.7	14.9				

1887.—

Number

Egyptian oats,
White Cluster
ments ....
Common 6-row
experiments
Red Fife wheat,

Average of 40 ex

1888.—Re

Number of se
with each

Oats, 13 ex
Wheat, 6
Barley, 8

Average....

1887.—Results of 27 Sets of Experiments showing the influence of the fertilisers immediately after application. The fertilisers were applied at same time as seeding was done and harrowed in lightly.

Number of sets of experiments with each kind of grain.	Salt.		Superphosphate.		Apatite.		Farmyard manure.		No manure.	
	Straw per acre.	Grain per acre	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Oats, 13 experiments	2844	1441	2806	1474	2716	1448	2612	1480	2502	1396
Wheat, 6 "	2250	900	2194	1020	2290	1007	2605	1116	2020	820
Barley, 8 "	2291	1432	2292	1295	2180	1239	2318	1399	2200	1240
Average	2570.8	1348.4	2540.4	1408.8	2480.8	1271.6	2525.6	1384.8	2321.2	1252.8

1888.—Results of 40 Sets of Experiments also showing action of fertilisers the first year.

Number of sets of experiments with each set of grain.	Salt.		Superphosphate.		Ground Apatite.		Fresh wood ashes.		Farmyard manure.		No manure.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Egyptian oats, 10 experiments.	2557	1427	2481	1487	2410	1428	2300	1298	2706	1576	2480	1294
White Cluster oats, 13 experiments	2064	1168	1979	1204	1711	1013	1912	1076	1946	1119	1806	983
Common 6-rowed barley, 12 experiments	2394	1758	2377	1769	2220	1656	2221	1588	2406	1698	2087	1512
Red Fife wheat, 5 experiments.	1371	916	1565	992	1495	868	1580	952	1755	1108	1580	896
Average of 40 experiments	2221	1393.2	2189	1432.0	2032	1307.6	2073	1274.4	2272	1412.8	2053	1221.6

1889.—Results of 5 Sets of Experiments showing action of fertilisers the second year after they were applied.

Number of sets of experiments with each set of grain.	Salt.		Superphosphate.		Ground Apatite.		Fresh wood ashes.		Farmyard manure.		No manure.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Black Tartarian oats, 3 experiments.	3180	1440	2910	1360	2780	1397	2700	1340	2725	1477	2560	1226
Common 6-rowed barley, 1 "	1000	800	900	720	800	640	500	400	800	640	500	400
Democrat Fall wheat, 1 "	800	720	920	800	880	760	108	920	1200	1000	1000	880
Average of 5 experiments	2040	1168	1910	1120	1810	1058	1745	1068	1863	1214	1655	992

The following table shows the concise results of three years' tests with salt, superphosphate, ground apatite, fresh wood ashes, farmyard manure, and no manure, and includes oats, barley and wheat crops. There are for 1887, 27 tests; 1888, 40 tests; 1889, 5 tests; making in all 72.

Fertilisers.	1887.		1888.		1889.		Average of all crops for three years, being 72 experiments.	
	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.	Straw per acre.	Grain per acre.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Salt, 10 lb. per plot (400 lb. per acre)	2570.8	1348.4	2221.0	1393.2	2040	1168	2340	1361
Superphosphate, 10 lb. per plot (400 lb. per acre)	2540.4	1408.8	2189.0	1432.0	1910	1120	2361	1402
Ground apatite, 10 lb. per plot (400 lb. per acre)	2480.8	1271.6	2032.0	1307.6	1810	1058	2185	1277
Fresh wood ashes, 10 lb. per plot (400 lb. per acre)	.....	.....	2073.0	1274.4	1745	1068	2036	1251
Farmyard manure, 700 lb. per plot (14 tons per acre)	2525.6	1384.8	2272.0	1412.8	1863	1214	2339	1388
No manure	2321.2	1252.8	2053.0	1221.6	1655	992	2126	1217

In all grain and fertiliser experiments the plots were one-fourth of an acre, and the results were reckoned out per acre from the size of plots.

The superphosphate used in these tests was obtained from Smith's Falls and cost $26 per ton, and the ground apatite or phosphate was procured at the same place at $12 per ton.

The analyses of these fertilisers were as follows :

	I. Apatite.	II. Superphosphate.
Water		5.885 per cent.
Soluble phosphoric acid	0.16 per cent.	10.489 "
Reverted " "	.... "	5.808 "
Insoluble " "	.... "	1.313 "
	27.848 "	
	27.848 per cent.	17.615 per cent.

The analyses of salt showed the following :

Sodium chloride, pure salt	89.42 per cent.
Calcium sulphate—gypsum	1.45 "
Calcium chloride	0.11 "
Magnesium chloride	2.01 "
Insoluble matter	0.18 "
Water	6.75 "
	99.92 per cent.

An analyses of an average sample of fresh wood ashes gave the following :

Water	2.07 per cent.
Insoluble matter	7.68 "
Potash	7.15 "
Phosphoric acid	1.89 "
Lime	37.33 "
Magnesia	3.02 "
Iron and alumina	1.53 "
	60.67 per cent.

EXPERIMENT No. II.

(1) Select a piece of ground of same nature throughout, under same conditions and representative as far as possible of the land of the neighborhood. Avoid naturally wet spots, and keep clear of trees, fences and buildings. Give cultivation to experimental plots similar to that of your larger fields. An advantage would be gained if the plots could be chosen in such a position that they could remain for experiments another year.

(2) Mark off four plots of one-fortieth of an acre each, leaving a clean path two feet wide between the plots. Two rods square is a convenient shape.

(3) Submit all plots to same treatment, and sow one-fourth of grain sent on each. Aim at seeding one inch deep.

(4) Apply the superphosphate sent to plot No. I ; the dried blood and scrap sent to No. II ; farmyard manure to No. III, and leave No. IV without any manure. The fertilisers to be sown at the time of seeding.

(5) Keep plots at all times clear from trespassing by poultry, etc.

(6) Aim at sowing 700 lb. farmyard manure on No. III plot (14 tons per acre).

(7) If it is your wish to carry on this experiment, please inform the Secretary, naming your nearest express office, and there will be sent to you, expressage prepaid, 7½ lb. oats ; 10 lb. superphosphate for plot No. I, and 10 lb. of dried blood and scrap for plot No. II.

Results of Experiment No. 2.

No. of Experiment.	Variety of grain.	No. of plot.	Fertiliser.	Date of Maturing.	Straw per acre.	Grain per acre.	Remarks.	Previous cropping.	Nature of soil.	Name of Experimenter.	County.
					tons	bus.					
I.	Egyptian oats.	1	Superphosphate	Aug. 26	1.09	45.9	Oats from no manure plot had less weight per bushel than each of the other three by two lb.	1886, sod. 1887, peas. 1888, wheat.	Clay loam.	Enos Walker.	Muskoka.
		2	Dried blood and scrap...	26	1.07	45.3					
		3	Farmyard manure	30	1.16	49.4					
		4	No manure.....	31	.77	37.1					
II.	Egyptian oats.	1	Superphosphate	Aug. 15	1.53	46.5	The plumpest grain was from No. 3 plot.	1886, 1887 and 1888, oats.	Medium loam.	C. P. Bowman.	Waterloo.
		2	Dried blood and scrap...	" 15	1.50	35.2					
		3	Farmyard manure	" 15	1.94	48.2					
		4	No manure.....	" 15	1.40	35.3					
III.	Egyptian oats.	1	Superphosphate	Aug. 24	1.10	23.5	Crop on no manure plot was most affected by rust and was weakest in straw. Grain from No. 2 plot plumpest of all.	Sod.	Sandy loam.	Donald McLaren.	Lanark.
		2	Dried blood and scrap...	" 26	1.20	24.4					
		3	Farmyard manure	" 22	1.14	18.8					
		4	No manure.....	" 24	1.00	17.6					
IV.	Egyptian oats.	1	Superphosphate	Sept. 7	1.42	23.5		1888, Potatoes.	Sandy loam.	William Quinn.	Muskoka.
		2	Dried blood and scrap...	" 7	1.56	27.1					
		3	Farmyard manure	" 7	1.31	27.1					
		4	No manure.....	" 7	1.56	25.9					
V.	Black Tartarian oats.	1	Superphosphate	Aug. 24	1.00	41.2	No. 2 plot withstood the dry weather best. Grain from No. 2 plot plumpest, and straw from No. 2 plot heaviest and brightest of all the plots	1888, Peas. No manure for twelve years.	Sandy loam.	H. N. Alexander.	Middlesex.
		2	Dried blood and scrap...	" 20	1.24	44.7					
		3	Farmyard manure ...	" 20	1.08	42.3					
		4	No manure.....	" 30	.78	34.7					
VI.	Egyptian oats.	1	Superphosphate	Aug. 28	1.58	36.5	Grain from No. 1 plot was two lb. heavier and that of No. 4 plot two lb. lighter than that from the other plots.	1887, sod. 1888, peas.	Clay loam.	George Binnie.	Grey.
		2	Dried blood and scrap...	" 28	1.48	40.0					
		3	Farmyard manure	" 28	2.41	55.6					
		4	No manure.....	" 28	1.15	32.5					
VII.	Egyptian oats.	1	Superphosphate	Aug. 11	2.02	66.8	The crops on No. 2 and 3 plots were lodged more than those on Nos. 1 and 4.	1886, fallow. 1887, spring wheat. 1888, oats.	Clay loam.	Ont. Expt. Farm.	Wellington.
		2	Dried blood and scrap...	" 12	2.33	69.1					
		3	Farmyard manure	" 15	2.46	66.5					
		4	No manure.....	" 13	1.91	60.0					

The average results of this Experiment were as follows :—

Fertiliser.	Straw, per acre.	Grain, per acre.	Fertiliser.	Straw, per acre.	Grain, per acre.
	Tons.	Bush.		Tons.	Bush.
Superphosphate..... 400 lb. per acre.	1.39	40.55	Farmyard manure..... 14 tons per acre.	1.64	43.99
Dried blood and scraps... 400 lb. per acre.	1.48	40.82	No manure.....	1.22	34.73

Experiment No. III.

(1) Select a piece of ground of same nature throughout, under same conditions, and representative as far as possible of the land of the neighborhood. Avoid naturally wet spots, and keep clear of trees, fences and buildings. Prepare the ground as you would a large field for the same crop.

(2) Mark out four plots of one-tenth of an acre each, allowing a clean path between the plots. Four rods square is a convenient shape for each plot.

(3) Sow the same kind of corn (M. S. S. Corn) on each plot as follows :—

No. I plot—Drills of equal distance apart (as near 3½ feet as possible) with seed averaging two grains to the foot.

No. II plot—Drills of same distance apart as No. I, with seed averaging twelve grains to the foot.

No. III plot—Broadcast or close drills with seed averaging one-half bushel per acre (2.8 lb. per plot).

No. IV plot—Same as No. III with seed averaging three bushels per acre (16.8 lb. per plot).

(4) Aim at having the seeding all done in one day, and not later than 15th day of June. Note—Shal low planting for early seeding, and deeper planting if late enough for soil to be warm.

(5) Give plots I and II the same amount of after cultivation, as often as you think they need it, but avoid mounding the rows ; shallow cultivation is preferred.

(6) Purchase 40 lb. of M. S. S. Corn from your seedsman and send the account to the Secretary, C. A. Zavitz, as early as possible, and the money will be sent you until the limited funds of the Committee are exhausted. This will save much unnecessary expense of expressage. If you cannot obtain the corn apply to the Secretary, mentioning your express office, and it will be forwarded to you.

(7) Cut each crop at the time when its condition corresponds to the roasting condition of field corn, or when in the glazed state.

(8) Weigh produce from the plots when under as equal conditions as possible. Note—If you can observe the comparative results from the feeding of the different lots please send information under head of "Remarks" in blank form.

(9) Fill out the accompaning blank form and return.

The following is the average for the three experiments in fodder corn :—

	Seed and cultivation.	Percentage of stalks having ears.	Yield per acre. (Estimated from plots 1-10 acre.)
			Tons.
1	Drills (2 grains per foot)	51.7	8.8
2	Drills (12 grains per foot)	1.7	10.0
3	Broadcast or close drills (½ bus. per acre)	13.7	7.41
4	Broadcast or close drills (3 bus. per acre)	.....	9.8

Results of three experiments in growing fodder corn.

	No. of plot.	Seeding and cultivation of crops.	When sown.	Distance apart of rows.	Average depth of planting.	Dates of cultivating and hoeing.	No. of stalks grown per 100 feet.	Depth of cultivating.	Weight of produce.	Percentage of stalks having ears.	Nature of soil.	Previous cropping.	Name of Experimenter.	County.
							About		lb.	About				
I	1	Drills—2 grains per foot.....	May 24.	40 inch.	1 inch..	After each rain.....	100	2 inch	736	100	Sandy loam.	Sod pasture.	E. M. Zavitz.	Middlesex.
	2	Drills—12 grains per foot.....	" 24.	40 "	1 " ..	" "	400	2 "	1,112	5				
	3	Broadcast or close drill—2.8 lb. per plot ($\frac{1}{2}$ bus. per acre).	" 24.	8 "	1 " ..	.....	100	None.	1,240	..				
	4	Broadcast or close drill—16.8 lb. per plot (3 bush per acre).	" 24.	8 "	1 " .	.....	500	None.	1,000	.....				

REMARKS.—Some of the stalks in No. 1 had two ears on. A number in plot 3 had nibbins, but no full ears.
CONCLUSIONS.—On light soil I believe in planting thin as it stands up better and is more easily harvested in drills, about four feet apart. I believe what is minus n quantity will be more than made up in quality.

	1	Drills—2 grains per foot.....	June 12	30 inch.	About 3 inch.	Harrowed June 22; cultivated July 6; drills hoed July 9; cultivated July 19.	110	3 inch	2,160	50	Clay loam.	Oats, peas, sod.	Geo. Binnie.	Grey.
II	2	Drills—12 grains per foot.....	" 12	30 "	3 "	Similar to No 1.....	650	3 "	2,450	None.				
	3	Broadcast or close drill—2.8 lb. per plot ($\frac{1}{2}$ bus. per acre).	" 12	.. ..	.....	.....	.....	.....	1,005	30				
	4	Broadcast or close drill—16.8 lb. per plot (3 bus. per acre).	" 12	.....	.....	.....	.....	.....	2,180	alm'st none.				

REMARKS.—Owing to the cold, wet spring, much of the seed did not grow.

	1	Drills—2 grains per foot.....	May 18.	42 inch.	1 inch..	Horse cultivating July 2-23; hand hoeings July 16, Aug. 15.....	97.9	2 inch	2,344	5	Clay loam.	1884 roots, 1885 barley, 1886 clover, 1887 oats, 1888 green fodder.	O.A.C. Experimental Department.	Wellington.
III	2	Drills—12 grains per foot.....	" 18.	42 "	1 " ..	Same as No. 1.....	592.5	2 "	2,413	.....				
	3	Broadcast or close drill—2.8 lb. per plot ($\frac{1}{2}$ bus. per acre).	" 18.	.....	1 " ..	.....	.....	None.	2,201	11				
	4	Broadcast or close drill—16.8 lb. per plot (3 bus. per acre)	" 18.	.....	1 " ..	.....	.....	"	2,677	.....				

REMARKS.—At the time of cutting many of the leaves of No. IV plot had turned yellow, while on Nos. I and III the leaves were green and thrifty looking.
CONCLUSION.—Owing to only about one-half of the seed germinating, this experiment is considerably modified thereby.

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Experiment No. IV.

From the Southern States, where Kaffir corn is extensively grown, we obtain the following informa-
tion: It stands dry weather well. Where corn will suffer from drouth, this plant will simply stop and
wait for rain, and then go on and make its full yield. In the way of dry fodder it makes enormous returns.
It will grow on any land suitable for corn, and even on land too poor for that crop. Its seed weighs 50 lbs.
to the bushel.

This one—Kaffir corn—is the earliest of the five varieties of non-saccharine sorghums. It grows from
four to five feet high, making a straight, upright growth, having a stocky stem with numereus wide leaves.
The stalks keep green and are brittle and juicy, not hardening like other samples of sorghum, making
excellent fodder, either green or dried, which is highly relished by cattle and horses. The seed heads form
at the top of each stalk, and as soon as these show the grain well the joints next below the top send up
shoots which yield the second seed heads. If the crop is wanted mainly for fodder it is recommended to
cut down the whole stock when the first seed heads come into bloom, at which stage it cures admirably and
makes most excellent forage.

The pound of seed sent to you is sufficient to plant one-quarter of an acre of ground. The first week in
June is recommended as the best time for planting. The land need not be very rich, but should receive
similar cultivation to that for an ordinary corn crop. The rows should be three feet apart, with from 3 to
4 seeds per foot. The cultivatings or hoeings between the rows should be the same as for common corn.
The proper time to cut the fodder is when the first seed heads come into bloom.

The Kaffir corn was recently received from S. Carolina for the Dairy Department. A portion has been
handed over to the Experimental Union for distribution. We think this valuable fodder plant may do well
in your section, and that it would be to your interest to give it a trial.

The Kaffir corn has not proved a very marked success in our climate, the average results of six experiments being as follows: Weight per plot 1,665.5 lb., or 16,655 lb. per acre, being 8.3 tons of the green fodder.

CORN AND HOGS AS SOURCE OF PROFIT IN FARMING.

By Byron Robinson of Wheatley, Ont.

The territory in Ontario, with the climate suited for the growing of corn, is very limited, but the crop can be grown in almost every part of the province for fodder for soiling purposes during summer and autumn, or for storing in the silo, or lastly for drying for winter use. But in Essex corn is one of our best grain crops. We prepare our ground about the second week in May. After having the ground plowed in the fall, we cultivate and harrow well in the spring and then mark out in rows four feet apart both ways, plant with a hand-planter, and in about two weeks the corn will be up and ready for the horse-hoe and will need about the same culture as any other hoe crop. When ripe, which will be inside of one hundred days after planting, cut, put in shocks with from eight to ten hills square in a shock. A good average crop of corn will yield one hundred bushels of ears per acre, and the fodder will be as good as a light crop of hay, and will pay rent and taxes on the land. The cost of growing an acre of corn after using the fodder as above mentioned. will be as follows:

Plowing ground	$2 00
Cultivating and harrowing	60
Marking	20
Planting	20
Horse-hoeing, three times both ways	4 50
Cutting	1 00
Husking	4 00
Cribbing	50
Total	$13 00

At this rate the corn would cost exactly 13 cents per bushel of ears. We find by experiment that it takes twenty bushels of corn in the ear to make one hundred lb. weight of pork, which, after allowing the manure for attending the pigs, will cost $2.60 per hun-

dred, and we are safe in counting $5 per hundred dressed pork. This leaves a profit of $2.40 per hundred, or $12.00 profit on growing one acre of corn and feeding the produce to hogs.

Farmers in the corn belt, owning from twenty-five to fifty acres of land can make greater profits in raising hogs than can be made with any other stock, as they require less grass land.

The grain would be fed to the hogs, and the fodder when saved will suffice to winter the necessary cows.

If what is taken from the land be returned in the shape of manure, corn can be grown on the same ground for any number of years without any fear of impoverishing the soil. Corn has been grown for twenty years in succession on the same land with us without manure, the last crop being as good as the first. But farmers in possession of larger tracts with considerable quantities of natural grass-lands, can do better by feeding corn to cattle on pasture. Our conclusions have not been arrived at by theory, but by practice.

The breeding and management of swine constitutes one of the most important branches of agriculture in the south-western parts of Ontario, and none but the best breeds should be allowed on the farms. A single pair of any of the improved breeds would increase in three years sufficient to stock the largest farm. The boar could also be used to forty or sixty other sows. After making up your mind to any one particular breed, grade or cross, stick to it and you will be sure to succeed better than by mixing, and in any case do not breed the same sow to two boars of different breeds. After the breed is secured, then there should be the best of feeding and care daily from the time they are born until they are slaughtered, or sold at live weight as the case may be. As a rule a sow should not be allowed to farrow under the age of fifteen months, and the boar is not fit for continued service until he is eighteen months old. A sow will breed three litters a year, but in our opinion two is plenty ; one in spring and the other in the fall. And in fact, some of our best breeders are advising but one litter a year, and that to be dropped in the spring, as they may be fed in the summer with mostly green fodder and pasture, only giving grain at night, When a sow is to farrow in cold weather, provide a good warm pen, but allow her and the little pigs to have free access to fresh earth daily. We have lost pigs by keeping them confined too close, but never lost one when the above method was carried out. When the weather is warm let the sow shift for herself. After a sow has farrowed give her warm drink for three days, and feed sparingly on soft food and under no circumstances feed as to make the young pigs unduly fat. When they are from three to four weeks old, geld, and in about sixteen days they will be old enough to wean. The period for feeding pigs, being from weaning to selling time, should have the greatest of care. The market no longer requires the hog of four hundred lb., and experiments show that it takes five per cent. more food to make one pound of growth on one hundred and fifty lb. pig than it does on a fifty lb. one. It is therefore evident that the greater profit will be realised by pushing the young pigs along as fast as possible. Our method for feeding in summer is to let the hogs run in yards that have been sown with clover or with grass. We feed all the grain food we can, such as clover, oats, peas, pig-weeds and sweet corn. When the pigs are first weaned skimmed or butter-milk is excellent food, but when that cannot be obtained a little linseed or oat-meal and shorts mixed with kitchen swill will answer, later on give as much mixed grain, shorts, bran, etc., as they will eat, and we always finish with corn, as pork finished on corn always brings the highest price. In winter, follow as near as possible the above rule as regards feeding, try and replace green fodder with something else such as roots. In all cases give plenty of fresh water no matter how sloppy the food may be. Give a little sulphur occasionally, and plenty charcoal ashes, salt and fresh earth. Keep pens and especially bed, clean and dry. We would advise selling by live weight, as the day is not far distant when no hog will be slaughtered on the farm, and sold by dress weight, and the sooner that day comes the better for both the hog raiser and the packer.

Mr. BRODIE—Would you advise selling pork by live weight or dressed?

Mr. ROBINSON—I would advise to feed during summer and sell live weight in the fall.

Mr. SHORE.—Do you harrow corn in your section?

Mr. ROBINSON—Yes, I have practiced this a good deal, and can recommend the system very highly, but the corn should not be harrowed when more than 1½ inches high. I would advise having hills four feet each way. This is for raising the grain that I am speaking.

Mr. SHORE—How can you get enough manure with hogs?

Mr. ROBINSON—We do not need much manure in Kent.

Mr. ——— How many grains do you put in each hill?

Mr. ROBINSON—We like four stalks, but put six grains in the hills. I [illegible] planting in a double hill.

Mr. SINCLAIR—Instead of leaving the female until twelve months and the male until fifteenth months, I would prefer using the sows at eight months and the boars at twelve months of age.

Mr. ROBINSON—I believe the sows should mature before breeding. I am of the opinion that a cross from a Berkshire boar and Yorkshire sow would make a fine animal.

Mr. HOBSON—Why is the Yorkshire white preferred by the shippers?

Mr. CLARK—The demands of the hog market have varied very much during the past few years. Formerly, a very fat hog was required, but what is called for now is a pig weighing from 150 to 180 or 200 lb., with the pork well streaked. I think the main reason for recommending the Yorkshire is because at that age they produce the desired kind of pork, and spring litters will produce the required material in the fall.

Mr. SINCLAIR—I also think it is the superior side meat of the Yorkshire that is desired—the meat being streaked and the side long. I would advise crossing a Yorkshire sire and a Berkshire sow and the desired hog will be produced, and you will get an early matured pig.

Mr. CLARK—Another advantage of Yorkshires is the fact that they are white.

Mr. SHORE—Farmers in England grow hogs very rapidly and sell before getting very fat, and I think we should not grow ours too fat.

Mr. HARCOURT—I notice in the Wisconsin report that there is a great deal of stress put on the way of feeding to produce pork of the right quality.

Captain HOOD—I very strongly advocate crossing a Berkshire boar with a Yorkshire sow.

THE FARMER'S SON BEFORE AND AFTER A COURSE AT COLLEGE.

By J. B. MUIR, NORTH BRUCE.

The title of my essay is one in which the most of us have a personal interest, as the great majority of those present are farmers's sons with or without the advantage of a two year's course at the O. A. C.

But that use of the term, farmer's son, is too comprehensive for our purpose, and we must limit it to the particular sons who are making agriculture their professsion. If we acquaint ourselves with the early history and training of the average farmer's son of to-day, we shall generally find a moral, careful, and hard-working young man. One who in common with his parents is striving to the best of his ability to raise remunerative crops and earn an honest living.

To do this he has for his principal guides past experience and observation, interspersed with hints from agricultural papers and journals. These, when properly mixed with good common sense, are no mean guides, and in the past have carried many of our farmers in safety to comparative ease and plenty. But in this age of competition, ex-

hausted soils and uncertain seasons, the guides mentioned are often insufficient and we find many farmers young as well as old, straying gradually and surely into bankruptcy. Sometimes this is the result of bad management; at others it is produced by unforseen circumstances; but more frequently it is due to ignorance pure and simple, as to the nature and treatment of the soil, stock, and crops with which we have to deal.

Hence we find that the intelligent thinking class amongst the farmers are availing themselves of every opportunity for increasing their knowledge, both theoretically and practically, in agricultural lines. In like manner, also, the sons of quite a number of the better class of farmers are taking the two year course at the Ontario Agricultural College to prepare themselves for meeting the difficulties incident to farm life. In all this, experience is teaching us that in order to be successful we must have more knowledge, more of other men's ideas stored up within us ready for us when required. To be an intelligent man, or a graduate of the Ontario Agricultural College, does not necessarily make us successful. It is only when the knowledge we possess is rightly applied and persevered in that success will crown our efforts.

We have already stated that knowledge is not success; it is rather that by which the road to success is made easy. The farmer's son, before taking the Ontario Agricultural College course of study, finds the road uneven and hard to follow; but after taking the full course, he finds it graded and carefully marked out. He has now for his guides the experience and practice of the ablest men in his profession, while the leading truths and principles in agricultural science are at his disposal. He has, as it were, a part of nature's laws revealed to him; while his duty to nature has been more clearly defined. Instead of following on blindly in the practice of his ancestors, he is able to press forward intelligently into the front ranks and make agriculture a success.

Instead of being a slave and a drudge in his profession he rises above this, and takes his chief pleasure and delight in subduing nature and her difficulties, under his control. Instead of grinding out every trace of natural fertility in the soil, his aim is to keep it constantly renewed and increasing from year to year. Instead of simply keeping and half starving the poorest class of stock he strives to keep the most and best of any in the neighborhood. Instead of sending off the best of the manure to grow sea-weed in the Atlantic Ocean, it is carefully saved at home and set at growing corn and other cereals.

These are a few of the distinguishing features between the farmer's son before and after a two year course at the O.A.C. But these are not all, we find a great improvement in the social position of the farmer's son after graduating successfully. His is now a position of honour in the farmers' councils, institutes, agricultural societies and the like, and even in church and state affairs his influence is greatly advanced. His mode of farming is carefully watched and if successful copied more or less by his neighbors. His advice is also frequently asked for, and in this way he finds his sphere of usefulness greatly increased.

But there is yet another aspect of this question, of even greater importance than any we have yet mentioned. The course of training prescribed and followed at the O.A.C. is one especially fitted for developing the mind. It embraces many subjects, and ranges through so many fields in nature, that an appetite for knowledge must be stimulated in the minds of the most indifferent. To satisfy this there is a great variety of choice literature over which the cultivated mind delights to roam. This desire to read and improve the mind is one of the few pleasures of which we never grow weary, and one in which the Ontario Agricultural College graduate has the advantage. The life of the average farmer's son is one of physical labor in which there is little time to cultivate a taste for reading or other intellectual improvement. His education, though it may be the best the public school can supply, is not broad enough, nor advanced enough, to stimulate a desire for knowledge, especially agricultural knowledge, of which he stands most in need. Much of his early training is lost from not being able to connect the ideas conveyed in the lessons with future usefulness. The foundation of his early training is not broad enough to enable him to understand even the simplest works on agricultural science, which all require more or less knowledge in chemistry. This branch of science so mysterious and yet so simple, is the key to agricultural knowledge, and the average farmer's son is almost ignorant of its existence.

The science course at the Ontario Agricultural College opens up an entirely new field to the student of nature, and an intelligent farmer must study her closely, both for pleasure and profit, to be successful. Consequently, the Ontario Agricultural College graduates have a great advantage in this respect over those whose education is limited to a public school. But it may be maintained by some that a careful course of reading would supply all the pleasures obtainable from having an educated mind. But this is not the case, we must come in contact with well trained men that the truths read may be impressed and retained, and no amount of reading will compensate for a deficiency of practical proof and experience. Truths read and lessons taught are fully appreciated only when taught and explained by practical men.

But the question which interests us as graduates and ex-students is not, what are the advantages of the Ontario Agricultural College course of study, but are we rightly employing and improving the advantages we feel we have gained by our two years of practical study? Are we doing what we should to build up and maintain the reputation of our college, that others may be induced to go there and be benefited? Are we, as individuals, striving to do the best for ourselves and our country according to the instruction given us? Our position is evidently in the front ranks, leading the agricultural thought and practice of our fair Province; let us, therefore, be alive to the position we hold, and show, by practical proof, that we and our college are able and fitted to lead ourselves, and farmers generally, to success, in this age of agricultural depression. Much good work has been already done, but there is yet a great deal of progressive, intellectual labor required before the science of agriculture is understood by the vast majority of those who cultivate the soil. At present they are uncertain whether the training given at the Ontario Agricultural College is practical or not; let it be the aim of each one of us to show by practical proof and experiment that it is practical, and that we are better, wiser, and more successful farmers after taking the two year course of study at the Ontario Agricultural College.

THE NEED AND USES OF EXPERIMENTAL WORK IN DAIRYING.

By Prof. James W. Robertson, Dairy Commissioner, Ottawa.

Following is a synopsis of an address by Prof. Robertson:

Improved methods of agriculture have grown out of experimental work, pursued with more or less intelligence aud care since the times of Adam and his remarkable son, whose jealousy and envy at Abel's success seems to have become the possession or possessors of some of his craft, by whom every effort to do things in any other way than according to their preconceived notions, is taken as a personal rebuke and cause for dislike to this day. An increosed knowledge of the laws that govern the changes in nature, which farming seeks to bring about and control, has come from crude and intermittent experiments, as well as from the well-planned, skilfully-conducted and continuously-pursued investigations, which have been made at the experiment stations so liberally devised and supported by governments on this continent during recent years. In time to come, experimental work in dairying should not be confined to the government experiment stations.

The Ontario Experimental Union may, with advantage, take up some branches of it, with the certainty of giving valuable service, enlightenment and encouragement to the farmers of the province. The need of further investigation, through experment, has increased rather than diminished.

The purpose of all intelligent effort in farming, is the creation of wealth and the making of profits for the persons who are engaged in that occupation.

In exchange for the products of the fields and animals the farmer obtains what may be called here gross receipts. The gross receipts may include cash, goods received in trade or exchange, house-rent, board, lodging, the use of horses for pleasure and work,

etc. A large proportion of the gross receipts of most men, except farmers, must go out as expenditure for those things which the farmer gets from his products over and above the cash which he handles. A small cash income does not always mean a small income, nor does a large sum as gross receipts always indicate a large profit. The measure of profit is the difference between receipts and expenditure. All experimental work that helps to show how expenditure or cost may be reduced, without lessening the quantity or degrading the quality of the products in dairying, is legitimate work worthy of your union.

Investigation may be directed profitably by one or more members, towards the discovery of how far and in what ways expenditure or cost of production can be lessened under the following heads :—

I. *The use of feed of cheaper sorts.*—Can corn be produced at a cost of $1.75 per ton on the ordinary farm? How much of it will produce as much milk as one ton of hay? How does the cost of soiling compare with that of pasturing for milk production in different districts of the Province? Are roots as economical for a succulent food as corn or other ensilage?

II. *The mixing of feeds into the best combinations.*—Is the nutritive ratio theory sound, when acceptability of flavor is ignored?

III. *Providing and preserving fodders and grain in the most acceptable condition of flavor.*—What is the worth of a ton of hay that has been exposed in the feeding passage for a day and mussed over, compared with a ton of hay of equal quality fresh from a compact mow? Does digestibility of feed depend in any degree upon its palatability?

IV. *A reduction in the quantity of feed offered to cattle.*—When a cow eats too much rich feed, an immediate consequence is a lessened flow of milk of impoverished quality. Are many cows spoiled by over-feeding?

V. *A lessening of the cost of labor and expense in producing, manufacturing and marketing.*—Is there any advantage in carrying on dairying in winter in respect to the labor available on the farm during that season? Can butter and cheese be made as economically in small lots in private dairies as in co-operative factories? Can dairy goods for the home market be sold best direct into the consumer's homes from the producers? Will it pay the producer to sell always, when perishable goods are in the best condition, regardless of the current or prospective price?

I have used a great many interrogation points. In trying to answer the enquiries every honest investigator will learn much and to some extent become a teacher to instruct and stimulate others.

The tendency to devote one's whole attention to the receipts as the source whence may be obtained an increased profit is a common weakness of judgment, when a business calculation is being made, The reduction of expenditure or cost of production is a more controllable factor in profit-making, and still there are safe and economical ways in which receipts can be legitimately and certainly augmented. Practical enquiry may seek to learn from experimental investigation, to what extent that may be accomplished under the following heads :

I *Enlargement of the capacity of the animal.*—May not the capacity of every dairy cow be enlarged, until she gives annually as many pounds of solids in her milk as her live weight?

II. *Improvement in the quality of the product.*—How far can the quality of milk as to its per cent. of solids be varied by feed and treatment of the animal? How far does the quality and the kind of feed influence and affect the flavor of animal products. The quality of all food products not only modifies the market price, but gives stability or uncertainty to the demand in degree as it is uniformly fine or irregular and inferior.

III. *Selling most of the product at a season of the year when prices rule highest.*—Is cheese-making in summer and butter-making in winter the best dairy practice for the farmer, under ordinary conditions in Ontario?

IV. *Marketing products in the best concentrated form.*—Will the labor and expens

of special preparation, in giving products an attractive appearance for the market, add more to their value than the extra cost involved? Will such a preparation help to secure a class of customers able and willing to pay the highest current prices?

V. *Making the most of by-products.*—Animal products from the dairy retain an average of less than 20 per cent. of the total nitrogen, phosphoric acid and potash in the feed consumed. The manure which contains the residue of these from the feed is the first by-product. Although it contains over 80 per cent. of the valuable constituents of the feed, it is not worth 80 per cent. of the original value. How can it be saved and used to yield the greatest value? Skim-milk, butter-milk and whey are by-products. In what combination can they be fed with most profit to calves, colts and swine?

The common dairy practice is a reproach to the business judgment of the farmer. Many cows are fed at an annual loss. They board on men who can ill afford to support indigent cows on the out-of-door relief plan. Single cows in some herds, like the Egyptian lean kine, in everything but appearance, swallow up the profits of two cows which are exercising the profit-making talent. Thoughtful experiment in any kind of a way, along the line indicated, cannot fail to convince any farmer of the possibility of realising some profit from dairying, and may stir him up to try for more while helping him to succeed in getting it. An experimenter generally becomes enthusiastic, enthusiasm is contagious and practical investigations keep it operative in beneficial ways.

Mr. HOBSON—Do you still advocate feeding twice daily?

Prof. ROBERTSON spoke much in favor of feeding twice daily.

Mr. ROBINSON—We used to feed four times a day, but on hearing Prof. Robertson advocate feeding twice daily, we have adopted the plan and like it well.

Prof. SHAW—How soon should corn be put into the silo after it is cut?

Prof. ROBERTSON—Every crop for the silo should be near maturity and allowed to wilt until it reaches about 73 per cent. water. I would cut it from one to two days before filling into silo. Sunlight upon plants after they are cut, seems to produce an aroma in the fodders which is much liked by stock, and gives a greater feeding value to the crop.

Mr. ZAVITZ—To what height would you recommend a silo to be built?

Prof. ROBERTSON—I would not recommend a silo over 20 feet except in special circumstances, and never more than 25 feet.

Mr. HOBSON—Would you recommend a plank floor to a silo?

Prof. ROBERTSON—I would prefer a clay floor.

Mr. ZAVITZ—How did the experiment with the different walls of the silo turn out this winter?

Prof. ROBERTSON—We have a silo built with all its sides differently constructed, which are about as follows: The studding was 2′x10″ on each side, and one wall was made by simply nailing one thickness of undressed lumber horizontally on the inside of the studding. Another was made by having the lumber tongued and grooved, and dressed on one side, and with tar paper between the lumber and the studs. The third had first inch lumber dressed on one side, then tar paper and inch lumber dressed on one side, and the other side was similar to No. 3 wall, but the lumber was tongued and grooved. The only silage that was at all spoiled was that in for about 3 or 4 inches along the side first described. I would recommend a covering of poles and straw over the silage. I will always go against painting the inside of a silo with tar, but petroleum is a good thing to preserve the wood.

BARLEY GROWING IN ONTARIO.

By Mr. T. G. Raynor, B.S.A., Rosehall.

Barley was grown as a cereal crop in very remote times. We learn from Ex. 9,31 that when Moses was pleading with Pharoah to let the Isrealites go, one of the plagues was a violent hailstorm which destroyed the barley crop then in the earing stages. In the time of our Saviour barley was used as a breadstuff, as is indicated in the narration of the miracle "The feeding of the five thousand." Of its value we find that in Rev. vi. 6, it was considered to be worth only one-third of what wheat was valued at.

Of its abuse we learn nothing until a much later date. Gambrinus, a legendary king, is regarded by the Germans as the inventor of beer. His memory is kept fresh by pictures of this supposed person, which are hung over the bars of many of the beer drinking dens, especially in Germany which is second to Great Britian in the manufacture and consumption of beer. It is estimated that the total yearly output of all the nations has now reached the enormous amount of 4,970,500,000 gallons.

Many years ago the farmers of Ontario found it profitable to grow barley for the export trade, the great bulk of it going to the United States. The acreage devoted to this crop increased from time to time as wheat growing in many parts became unprofitable, as a result largely from injudicious cropping of wheat after wheat, wheat after wheat, and wheat for a change. Very little was returned to the soil in the shape of manure, to supplement the plant food which was being manufactured in the soil and what came from the atmosphere. So that I find, taking the bureau of industries as my authority, that for the last seven years the average number of acres sown to barley is 757,525, yielding nearly 20,000,000 bushels, or an average of 26.1 bushels per acre. Compare with the other cereal crops grown, barley stands third in the amount of acres sown, and second in the yield per acre; more land being devoted to wheat and oats, but only the latter leading in the quanity per acre.

The yearly average export of barley for the eleven years 1868-87 has been 8,210,222 bushels, valued at $5,674,014, or 69 cents per bushel. From these figures we gain some idea of the importance of the barley industry to this Province in the past; and the present outlook would indicate that its importance as an export crop was altogether a thing of the past. However, the bright side of the picture may again turn to us before we anticipate it.

From observation we learn many things, and among them, that Ontario is specially adapted for the successful development of many important industries. Her water power climate, soil, and other natural resources are all conducive to this end. Examining more closely we find that Ontario has many local conditions favoring each separate industry. To illustrate, only four or five sections are really adapted for fruit culture, other sections for stock raising and dairying, and even the cereal crops are partial to local conditions, such as soil and climatic influences. Let us apply this to barley growing. Once more referring to the bureau of industries I find the counties bordering on the Bay of Quinte, lakes Ontario and Huron, Georgian Bay, with the inland counties of Victoria and Peterborough, to be the chief barley growing sections of the Province. Examining the soils of these counties we find a great deal of heavy and gravelly clay soils, with in some instances clay loams all of which produce the best samples of barley, at the same time bear in mind the fact, that all these districts are more or less influenced by the large bodies of fresh water lying adjacent to them.

Barley is grown chiefly for two purposes, viz., *malting and feeding*. As the great bulk is grown for the "brew of the world," one object should be to grow it suitable for that purpose. What the malster desires in brief, as I understand it, is a plump, bright, heavy barley, containing a large percentage of the carbohydrates, which will malt in the quickest possible time, and uniformly. Besides manufacturing beer from the malt, much of the bright barley, by distillation, goes to make the "pale ale" and "porter," which are delicate whistle wetters for the nabobs.

Land devoted to barley growing should be prepared in the *fall*, for spring seeding. Any preparation made for a wheat crop is quite as suitable for barley, as sowing a bare fallow, after a hoed crop, on clover sod plowed in the fall, or after a pea crop, where the land has been ganged, repeatedly stirred with the harrow and cultivator, and finally plowed with a single plow, throwing the furrow well up to the action of the frost, or simply ridging it. In spring, prepare the seed bed before sowing, getting it in as fine a state of tilth as possible, being careful not to work the seed bed to a greater depth than four inches (as barley is a shallow growing crop and requires its plant food at the surface.) If the land be in good condition and dry, drill; if very moist, broadcast; in either case be careful not to cover too deeply, one inch to one and one-half inches is plenty. Sow at a time, if possible, when the seed will germinate uniformly and continue to grow vigorously. From one to two bushels is the quantity sown per acre, varying with the kind of soil. I prefer one bushel, if drilled, or one bushel and a peck where broadcasted. I am of the opinion that in many parts of the country too much seed is used per acre, except, perhaps, where farmers have to provide for injurious insects. Manures for barley should be applied as a top-dressing, or merely worked into the surface soil. Top-dressing in winter with farmyard manure where barley is to be sown gives splendid results. If special fertilizers are used apply them at time of seeding. Nitrogenous and phosphatic manures are the best, especially the latter, as barley draws more heavily on nitrogen and phosphoric acid than on the potash and other ash constituents of the soil. Carrying out these conditions, with a favorable season, we may expect good results, but our work doesn't stop here. Harvesting is a critical point usually, more especially regarding the color, as barley is very susceptible to heavy dews or showers. Some one has said that there are only three days in which to cut barley: the day before it is ripe; the day it is ripe, and the day after it is ripe. I would advise to begin cutting the day before it is ripe, to get as much cut as possible on the day it is ripe, and finish the day after it is ripe. Ripe seeds malt quickest. There is often three and four days difference in the malting properties of barley, due for the most part to the different stages of maturity. Cutting with the self-binder has many advocates and many points in its favor. Unless it is entirely ripe, I think a better way is to swath it with a reaper, allow it time to cure, rake with a horse-rake into winrows, and if the weather be favorable house it. if not, cock it up. It is decidedly better to let barley sweat out in the mow than to thresh early and leave in large heaps. Barley, on the whole, I think is the easiest crop to handle on the farm, and can be grown with the least outlay. In fact it might be considered "the lazy man's crop."

The marketing of barley often gives the farmer more anxiety than all the trouble in growing it. Taking one year with another I believe the *early market* is the best, and by selling early it saves much uncalled for worry. But, says some one, we cannot afford to grow barley any more for 33c. to 43c. per bushel, and I must agree with the sentiment. Are there no means of making barley growing profitable, notwithstanding the keen competition of the Western States and our own great North-west? This competition doubtless has been *the* prominent factor, along with the over-production of the past year, in reducing the price. I will try to suggest a few ways out of our present difficulty.

As regards future prospects of Barley Growing in Ontario.

1. We must lower the cost of production and produce more per acre. This would mean less hired labor, the tilling less land and the enriching and cultivating better what land we do work.

2. Remove the restrictions at present existing on the export trade in barley. Where the price of an article is fixed in a foreign market, under a protective policy, the producer has to pay the duty when exporting his produce there, so that, the Ontario farmer marketing 500 bushels of barley with a duty of 10 cents per bushel on it, gets $50 less for his crop than he might have received had there been no tariff wall. I learn that during the years 1885-6, we exported from Ontario to the United States 20,178,877

bushels of barley, valued at $13,696,224. On this we paid as duty $2,017,887, or $1,008,943 for one year. The argument is self-evident. Down with the tariff!

3. Why could we not become the source of supply for American seedsmen? Our conditions are favorable for growing first-class seed, and northern seeds are preferable for southern climates.

4. What is there to hinder us growing two-rowed barley for the English market? Could not the governments of the day be influenced to import a considerable quantity for experimental purposes and see if our conditions are not favorable for growing barley of the right stamp for the English market?

Barley has always ranked pretty high as a grain for feeding purposes. If we have to turn our attention more to stock raising and dairying than we have in the past, there is no reason why barley should not play an important part in the rations prepared for such purposes. It is a good grain for horses, especially when used with cut straw or hay, and it is an excellent feed for growing and fattening hogs. Having a nutritive ratio of 1: 8.2 it is better to feed it in conjunction with other fodders of a more albuminous character. It should be cracked, not floured, for feeding purposes; and here is where many farmers make a great mistake in having the coarse grains ground too finely. It is better to allow nature to do most of the work. Even the straw has considerable feeding merits, especially where bulk is required, and even the *beards*, when boiled and fed with the *tea*, make a nourishing article of diet for calves.

I will not discuss here the moral aspect of barley growing, as "a great deal might be said on both sides;" but will respectfully submit these few thoughts for your consideration, hoping I have suggested enough to form the basis of a lively discussion.

CLOSING EXERCISES.

After moving a vote of thanks to the retiring officers of the association, to the representatives of the "Press" present at the different sessions, and to the visitors, many of whom had taken an active part in the various discussions, the Eleventh Annual Meeting of the Ontario Agricultural and Experimental Union was brought to a close at 5 p.m.