FIFTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

1889.

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ONTARIO AGRICULTURAL COLLEGE GUELPH.

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To the Honora

DEAR SIR
of the Ontario
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FIFTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM.

GUELPH, January 2nd, 1890.

To the Honorable CHARLES DRURY,
Minister of Agriculture :

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

In this Report we have reviewed briefly the work of the year 1889 under the following heads :—

I have the honor to be, sir,
Your obedient Servant,

JAMES MILLS,
President.

PART I.

REPORT OF THE PRESIDENT.

A year ago on the 26th of last November our farm buildings, with their contents, were destroyed by fire. This calamity caused us much trouble and inconvenience. We had to sell most of our cattle at such prices as we could get under very unfavorable circumstances, and were obliged to provide temporary stabling for our horses during the winter. It was not only the loss and inconvenience that were to be regretted, but the serious interference with the educational work of the institution. The students who were in attendance last winter had little or no opportunity for practical instruction in cattle feeding; no experiments were conducted in the live-stock department; and we had not the usual number and variety of animals for practical illustration in the live-stock class-room. Notwithstanding these disadvantages, we kept the students together and did what we could in various ways to make up for the lack of practical instruction in one or two departments.

During the latter half of the year things have been in much better shape for efficient and satisfactory work in all the outside departments.

The Experimental Department.

Our new experimental barn, with the necessary conveniences for experimental work, was completed early in the summer. A large number of varieties of wheat, oats, and barley, imported from Europe, were sown on our experimental plots; and under the management of Professor Shaw, with the efficient assistance of Mr. C. A. Zavitz, our Assistant Superintendent of Experiments, it is hoped that valuable results will be obtained from these tests—that some good varieties of cereals which are adapted to our changed conditions of soil and climate will be found and gradually distributed among the farmers of this Province. A number of experiments in cattle feeding have also been undertaken —breed against breed, food against food, and method against method. Careful tests are being made, and bulletins giving the results will be issued from time to time during the winter and spring.

The Farm Proper.

A special and determined effort has been made during the year to clean the farm of noxious weeds, which have given some trouble and have not added much to our reputation in the past; nearly a mile of substantial wire fence has been constructed; and a good deal of time has been spent in making a first-class (I might almost say a model) road between our farm proper and an additional fifty acres in the township of Puslinch. This road will be a convenience to ourselves and the public, and will add considerably to the value of the land on both sides. Our new farm buildings have been completed; and I think we may say that the barn, silo, horse stable, sheep house and bull shed which we now have are in many respects a marked improvement upon those which were destroyed a year ago. They look better and are much more convenient.

Live Stock.

We have not imported either sheep or cattle to take the place of those which were sold after the fire, but have endeavored to buy suitable animals at reasonable prices from Canadian breeders. Professor Shaw and John I. Hobson, Esq., were commissioned to purchase cattle of the beef breeds—Shorthorns, Herefords, Aberdeen-Angus Polls, Galloways, and Devons. They completed their work some time since, and the animals selected are now in our stables for experimental and educational work. In addition to these, Professor Shaw bought four Jerseys and two Ayrshires some months ago; and J. W. Robertson, our Professor of Dairy Husbandry, has recently selected two or three more Ayrshires and suitable samples of the Holstein breed.

The Dairy Department.

In the Dairy Department also, valuable work has been done during the past year. By direction of the Professor of Dairying, 70 samples of Indian corn were sown under different conditions. The intention was to make a number of experiments simultaneously; and the plot of ground chosen for the purpose was a large, low-lying field which was rather dirty, but otherwise in fair condition. Part of this field was ploughed in the fall, part in the spring, and the remainder in both fall and spring. Artificial fertilizers were applied to one part of the field, a good coat of farmyard manure to another, and a third part was left unmanured. Some of the seed was sown broadcast, some in drills, and some in hills. Some was sown early, some late and some at the ordinary time. Drills were made at different distances apart, and different quantities of seed were put in different drills. Thus, it will be seen, many practical points were involved, and Professor Robertson's report giving the results in Part VIII. of this volume will be an unusually interesting and valuable addition to dairy literature in this Province.

For the preservation of the corn spoken of above, a large silo has been constructed in one corner of the old barn, near the creamery; and the remainder of the same barn has been changed into a cow stable for winter-dairying.

The Horticultural Department.

There has been the usual amount of work in this department, but nothing specially noteworthy, except the grading and gravelling of some roads on the lawn. Owing to the size of the lawn and the number of other things to be looked after—the vegetable garden, the orchard, the raspberry grounds, the vinery, and the forest tree-clumps—the work in this department has become very heavy; and this year it has been work without much return, because the frost which came early in June was so severe that it left neither blossoms, fruit, nor fruit buds. Consequently we have grown no fruit this year. We are now buying all we use, and shall have to do so till next autumn.

Chemical and Botanical Laboratories.

The work in these two laboratories has been carried on with energy and earnestness throughout the year. It is however fully described by the Professors of Chemistry and Natural History in Parts III. and IV. of this report, and all I need say is that our students generally are taking greater interest than formerly in scientific and literary work. They are not neglecting the practical or bread-and-butter branches; but they seem more anxious to learn the scientific principles which underlie the best practice, and to acquire such a knowledge of their mother tongue as will enable them to express their thoughts correctly, clearly, and forcibly on such subjects as it may be their duty or privilege to discuss in the different spheres in which they may move when college days are past.

A College Paper Started.

For several years past our students have thought and talked about starting a college paper, but the shortness of our course of study has always been a serious obstacle in the way. During the first fourteen years of our history, our course was limited to two years; and as a consequence we had regularly a complete change of students every *biennium*. Under such a system it would of course be very difficult to conduct a college paper with any degree of efficiency. With editors and business managers constantly changing, there would not be much chance of success. In the session 1887-88, however, a third year was added to our course, and since that time the prospects for a college journal have been somewhat brighter. At length, in October last, the matter was taken up by our Literary Society, and in the month of November the first number of the "O. A. C. Review" appeared. The second number has since come to hand, and, all considered, I think it is a creditable production—one which exhibits good taste and a very fair share of journalistic ability.

A Very Sad Event.

In this report it is our painful duty to record the first death in our list of graduates —that of R. M. Soule, B. S. A., South End, Welland, Ontario. Having spent three years with us, Mr. Soule passed his final examinations in May last, and on the 8th of June received the degree of B. S. A from the University of Toronto. Twenty-four years of age, full of hope, and anxious to make some return for the advantages of a college education, he went back to his father's farm and had got nicely to work, when his life came suddenly to an end, and his parents were left to mourn the death of a dutiful and promising son. Mr. Soule was a general favorite at college, a good student, and a hard worker. His conduct and record were very satisfactory to the college staff, and his sorrowing parents have our sincere sympathy.

Students in Attendance.

The attendance during the past year has been quite satisfactory—a little larger than the year before. The total number on the roll is 134, more than 70 per cent. of whom are from this Province. Thirty-one counties of Ontario are represented, and the largest representation is from the counties of Grey, Leeds, Prince Edward, York, and Middlesex.

COLLEGE ROLL FOR 1889.

Third Year Students.

Name.	P. O. Address.	County, Etc.
Brodie, G. A	Bethesda	York, Ont.
Dean, H. H	Harley	Brant, Ont.
Gelling, J. A	Bridgewater	Nova Scotia.
*Harcourt, G	St. Ann's	Lincoln, Ont.
*Hutton, J. R	Welland	Welland, Ont.
*Lehmann, A	Orillia	Simcoe, Ont.
McCallum, W	Ailsa Craig	Middlesex, Ont.
McEvoy, T. A	London South	Middlesex, Ont.
Monteith, S. N	Fairview	Perth, Ont.
*Morgan, J. H. A	Kerwood	Middlesex, Ont.
Oraman, C. P	Bathurst	Lanark, Ont.
*Raynor, T	Rose Hall	Prince Edward, Ont.
Shanta, A	Waterloo	Waterloo, Ont.
Stover, W. J	Norwich	Oxford, Ont.
*Seule, R. M.	South End	Welland, Ont.
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*Obtained the degree of B.S.A. in June.

Associates Doing Special Work.

Name.	P. O. Address.	County, Etc.
Horrocks, T. J	Toronto	York, Ont.
Willans, N	Leeds	England.
Willans, T. B	Leeds	England.
—3		

Second Year Students.

Name.	P. O. Address.	County, Etc.
Asbury, E	Delaware	Middlesex, Ont.
Bayne, P. R. C	Calcutta	India.
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.
*Derbyshire, J. A	Brockville	Leeds, Ont.
Dolsen, W. H	Chatham	Kent, Ont.
Elliott, R	Seaforth	Huron, Ont.
Fairbairn, O. G	Brockville	Leeds, Ont.
Field, H	Cobourg	Northumberland, Ont.
Hadwen, G. H	Mons en Bareul, near Lille	France.
Harcourt, J	St. Ann's	Lincoln, Ont.
Hewgill, E. A	Heathcote	Grey, Ont.
Holliday, W. B	North Shields	England.
Hutt, H. L	South End	Welland, Ont.
*Linfield, F. B	Dunlop	Huron, Ont.
Macfarlane, T. W. R	Ottawa	Carleton, Ont.
Makinson, T. C	Harbor Grace	Newfoundland.
*Marsack, F	Turnbridge Wells	England.
*Marsack, H	Turnbridge Wells	England.

College Roll.—Second Year Students.—*Continued.*

Name.	P. O. Address.	County, Etc.
Mattice, W. A	Cornwall	Stormont, Ont.
McDonald, H. M	Lower South River	Nova Scotia.
McKergow, J. G	Montreal	Quebec.
*McClaren, P	McGarry	Lanark, Ont.
Monk, W. D	South March	Carleton, Ont.
Mulholland, F	Yorkville	York, Ont.
Noxon, H. S	Ingersoll	Oxford, Ont.
*Rendall, W	Camperdown	Grey, Ont.
*Rennie, E. A	Hamilton	Hamilton, Ont.
Shaw, P. G	Thornton Heath, Surrey	England.
Sleightholm, J. A. B	Humber	Peel, Ont.
Thomson, H. C	Hamilton	Hamilton, Ont.
*Tinney, T. H	Oakwood	Victoria, Ont.
Watson, G. C	Varney	Grey, Ont.
Webster, F. E	Creemore	Simcoe, Ont.
Wells, E	Chilliwhack	British Columbia.
Whitley, C. F	Enfield, Middlesex	England.
Wilson, F. G	Green River	Ontario.
Wood, W. D	Cornwall	Stormont, Ont.

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*Received an Associate Diploma in June

First Year Students.

Name.	P. O. Address.	County, Etc.
Alloway, E. L. U	Toronto	York, Ont.
Bate, E. H	Brighton	Northumberland, Ont.
Bealey, H. B	Ratcliffe Close	England.
Benyon, E. A. G	Bracknell, Surrey	England.
Bertram, H	Toronto	York, Ont.
Buscarlet, F. W	Lausanne	Switzerland
Burns, J. A. S	Halifax	Nova Scotia.
Cathcart, W	Liverpool	England.
Carlyle, W. L	Chesterville	Dundas, Ont.
Cochrane, J	Kilsyth	Grey, Ont.
Conn, W	Heathcote	Grey, Ont.
Cox, H	Rose Hall	Prince Edward, Ont.
Duke, E. W	Chelsea, London	England.
Dunne, H. R	Ottawa	Carleton, Ont.
Esterbrook, F	Bridgehampton, L. I	New York, U. S.
Faithfull, L. E	Marseilles	France.
Farlinger, F. E	Morrisburg	Dundas, Ont.
Gibson, D. Z	Willow Grove	Haldimand, Ont.
Golden, J. H	Amherstburg	Essex, Ont.
Graham, M. H	London, S. W	England.
Grange, G. J	Guelph	Wellington, Ont.
Grant, R. S	Byng	Haldimand, Ont.
Hall, E	Darlington, Durham	England.
Hall, W. P. B. H	Kingston	Frontenac, Ont.
Harris, J. C	Calne, Wilts	England.
Harrison, F. C	London	England.
Hunter, G. N	St. George	Brant, Ont.
Haight, W. L	Wellington	Prince Edward, Ont.
Jacob, N. F	Norwich	Oxford, Ont.
Johnston, P. B	Somenos	British Columbia.
Kitchen, B. E	Waterford	Norfolk, Ont.
Landsdowne, F. R. B	Clifton, Bristol	England.
Lewis, W. W	Brockville	Leeds, Ont.
McCrea, H. E	Brockville	Leeds, Ont.
McFaul, D	Wellington	Prince Edward, Ont.

COLLEGE ROLL.—FIRST YEAR STUDENTS.—*Continued.*

Name.	P. O. Address.	County, Etc.
McGarry, W. R	McGarry	Lanark, Ont.
McGoey, J. P	Ottawa	Carleton, Ont.
McMichael, J. H	Waterford	Norfolk, Ont.
Moody, A. A	Weston	York, Ont.
Murphy, A	Sidney	Cape Breton, N. S.
Milne, H. S	Brown's Corners	York, Ont.
Musgrave, R	Cowichan	British Columbia.
Newcomen, W. F	Epping, Essex	England.
Perry, E	Smithville	Lincoln, Ont.
Pownall, E. F	S. Kensington, London	England.
Preston, J. G	Forfar	Leeds, Ont.
Ransom, S	Sydenham	England.
Rorke, J. R	Heathcote	Grey, Ont.
Roper-Curzon, A. C	Norbiton Place, Surrey	England.
Roper-Curzon, S. D	Norbiton Place, Surrey	England.
Rowen, E	Holt	York, Ont.
Seymour, F. B	Toronto	York, Ont.
Scully, D	Downeyville	Victoria, Ont.
Smith, D	Montreal	Quebec.
Sparrow, J. C. H	Antrim	Carleton, Ont.
Spencer, W. A	Salmon Point	Prince Edward, Ont.
Stagg, J. C	Brockville	Leeds, Ont.
Start, F. E	Currie's Crossing	Oxford, Ont.
Thomas, E. F	Clifton, Bristol	England.
Thompson, A	Thornton	Simcoe, Ont.
Thompson, J. P	Uptergrove	Ontario.
Urquhart, W. H	Newbury	Middlesex, Ont.
Warner, W. A	Napanee	Lennox, Ont.
Weber, E	Hamburg	Germany.
White, E. F	Clarksburg	Grey, Ont.
White, J	Heathcote	Grey, Ont.
Wheaton, J. H	Thorndale	Middlesex, Ont.
Whitworth, E. J	Fenwick	Welland, Ont.
Wiancko, A. T	Sparrow Lake	Muskoka, Ont.
Wills, H. G	Toronto	York, Ont.
Wilkin, F. A	Calgary	Northwest Territories.
Wilkinson, J. J	Winterbourne	Waterloo, Ont,
Worthington, F. H	Brockville	Leeds, Ont.
Woolverton, E. L	Grimsby	Lincoln, Ont.
Young, J. L	Murray	Prince Edward, Ont.
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Total.....134.

ANALYSIS OF ROLL.

Counties, etc.	No. of Students.
Brant	3
British Columbia	3
Carleton	4
Cape Breton	1
Durdas	2
England	22
Essex	1
France	2
Frontenac	1
Germany	1
Grey	8
Haldimand	2
Hamilton	2
Huron	3

Counties, etc.	No. of Student
India	1
Kent	2
Lanark	3
Lincoln	4
Leeds	7
Lennox	1
Middlesex	6
Muskoka	1
Newfoundland	2
New York, U. S. A.	1
Norfolk	2
Northumberland	1
Northwest Territories	1
Nova Scotia	3

Analysis of Roll—*Continued.*

Counties, etc.	No. of Students.
Ontario (County)	2
Ottawa	1
Oxford	4
Peel	1
Perth	1
Prince Edward county	6
Quebec	2
Simcoe	3
Stormont	2
Switzerland	1
Toronto	4
Victoria	2
Waterloo	4
Welland	4
Wellington	1
York	6
Total	134

Religious Denominations.

Episcopalians	38	Christians	1
Presbyterians	33	Evangelical Reform	1
Methodists	30	Mennonites	1
Baptists	9	Plymouth Brethren	1
Congregationalists	9		
Roman Catholics	6	Total	134
Friends	5		

Age of Students.

3	16 years.	5	23 years.
19	17 "	7	24 "
30	18 "	5	25 "
22	19 "	7	26 "
13	20 "	1	27 "
8	21 "	3	28 "
11	22 "		

Average age.....20 years.

County Students.

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

Addington, Brant, Carleton, Cornwall, Dundas, Elgin, Essex, Grenville, Grey, Haldimand, Huron, Kent, Lambton, Lanark, Leeds, Lennox, Lincoln, Middlesex, Muskoka, Norfolk, Northumberland, Ontario, Peel, Prince Edward, Simcoe, Stormont, Victoria, Waterloo, Welland, 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. The syllabus of lectures given in Appendix 1 conveys some idea of the class-room work done during the year, and the class lists in Appendix 4 indicate the standing of each student more clearly than anything I could say.

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 three other gentlemen, to whom we are much indebted, viz., S. C. Smoke, B.A., and E. C. Jeffrey, B.A., of Toronto, Examiners in English Literature, and W. A. Douglas, B.A., of the same place, Examiner in Political Economy.

Bachelors of the Science of Agriculture.

Six 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 8th of June. The list is as follows :—

Harcourt, G.	County of Lincoln, Ont.
Hutton, J. R	County of Welland, Ont.
Lehmann, A.	County of Simcoe, Ont.
Morgan, J. H. A.	County of Middlesex, Ont.
Raynor, T.	County of Prince Edward, Ont.
Soule, R. M	County of Welland, Ont.

Recipients of Associate Diplomas.

Thirteen 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 28th of June, and the names of the recipients are as follows :—

Brodie, G. A	Bethesda, York, Ont.
*Derbyshire, J. A.	Brockville, Ont.
Gelling, J. A	Bridgewater, N. S.
Linfield, F. B.	Dunlop, Huron, Ont.
Marsack, F	Tunbridge Wells, England.
Marsack, H	" " "
McCallum, W	Ailsa Craig, Middlesex, Ont.
†McEvoy, T. A.	London, Middlesex, Ont.
McLaren, P. S.	McGarry, Lanark, Ont.
*Monteith, S. N	Fairview, Perth, Ont.
Rendall, W	Camperdown, Grey, Ont.
‡Rennie, E. A.	Hamilton, Wentworth, Ont.
Tinney, T. H	Oakwood, Victoria, Ont.

First-class Men.

The work in the college is divided into five departments, and all candidates who get an aggregate of 75 per cent. of the marks allotted to the subjects in any department are ranked as first-class men in that department. We would like to have a larger number of such men, but we are determined that none shall be so ranked unless they really deserve it. The following list contains the names of those who gained a first-class rank in the different departments at the examinations in 1889 :—

First Year.

1. **Bayne**, S. R., Calcutta, India.—In one department : Natural Science.
2. **Buchanan**, D., Hensall (Huron), Ont.—In one department : Veterinary Science.

* Required to take Veterinary Obstetrics again.
† Has to pass another examination in Organic Chemistry.
‡ Has to pass another examination in Systematic Botany.

3. Cowan, R. E., Galt (Waterloo), Ont.—In two departments: Agriculture, and Mathematics and Book-keeping.

4. Dolsen, W. J., Chatham (Kent), Ont.—In one department: Mathematics and Book-keeping.

5. Hadwen, G. H., Lille, France.—In one department: Agriculture.

6. Harcourt, J., St. Ann's (Lincoln), Ont.—In four departments: Agriculture, Natural Science, Veterinary Science, and Mathematics, and Book-keeping

7. Hutt, H. L., South End (Welland), Ont.—In three departments: Agriculture, Natural Science, and Veterinary Science.

8. Sleightholm, J. A. B., Humber (Peel), Ont.—In three departments: Agriculture, Natural Science and Mathematics, and Book-keeping.

9. Thompson, J. P., Uptergrove (Ontario county), Ont.—In one department: Mathematics and Book-keeping.

10. Whitley, C. F., Middlesex, England.—In one department: English Literature and Composition.

Second Year.

1. Brodie, G. A., Bethesda (York), Ont.—In four departments: Agriculture, Natural Science, Veterinary Science, English Literature and Political Economy.

2. Linfield, F. B., Dunlop (Huron), Ont.—In five departments: Agriculture, Natural Science, Veterinary Science, English Literature and Political Economy, and Mathematics.

3. Monteith, S. N., Fairview (Perth), Ont.—In one department: Agriculture.

4. Rendall, W., Camperdown (Grey), Ont.—In one department: Agriculture.

5. Tinney, T. H., Oakwood (Victoria), Ont.—In four departments: Agriculture, Natural Science, Veterinary Science, and English Literature, and Political Economy.

Medallists.

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

Gold Medallist.—G. A. Brodie, Bethesda, York, Ont.

First Silver Medallist.—F. B. Linfield, Dunlop, Huron, Ont.

Second Silver Medallist.—T. H. Tinney, Oakwood, Victoria, Ont.

Prize Men of First Year.

Agriculture and Dairying.—1st, J. A. B. Sleightholm, Humber, Peel, Ont.; 2nd, H. L. Hutt, South End, Welland, Ont.

Natural Science.—1st, J. Harcourt, St. Ann's, Lincoln, Ont.; 2nd, H. L. Hutt.

Veterinary Science.—1st, J. Harcourt; 2nd, D. Buchanan, Hensall, Huron, Ont.

English Literature and Composition.—1st, C. F. Whitley, Enfield, Middlesex, England; 2nd, H. L. Hutt.

Mathematics and Book-Keeping.—1st, J. Harcourt; 2nd, R. E. Cowan, Galt, Waterloo, Ont.

General Proficiency.—1st, J. Harcourt; 2nd, Hutt; 3rd, Sleightholm.

Prize Men of Second Year

Agriculture, Live Stock, Dairying.—1st, G. A. Brodie; 2nd, F. B. Linfield.

Natural Science.—1st, T. H. Tinney; 2nd, G. A. Brodie.

Veterinary Science.—1st, G. A. Brodie; 2nd, T. H. Tinney.

English Literature.—1st, F. B. Linfield; 2nd, G. A. Brodie.

Mathematics.—1st, F. B. Linfield; 2nd, T. H. Tinney.

General Proficiency.—1st, Brodie; 2nd, Linfield; 3rd, Tinney; 4th, W. Rendall, Camperdown, Grey, Ont.

Valedictory Addresses.

The second year men chosen by their fellow students to deliver the valedictory addresses at the closing exercises on the 28th June were S. N. Monteith and F. B. Linfield.

Farmers' Institutes.

The work of the Farmers' Institutes is still increasing in magnitude and importance. The professors of our college took part in about sixty institute meetings in January, 1889, and J. W. Robertson, our professor of dairy husbandry, was helping at institute and dairying meetings during the greater part of the year.

The gentlemen who composed the deputations in January, 1889, were: Professors Panton, James, Robertson, Grenside, Shaw, Mills; Messrs. John I. Hobson, John McMillan, M.P., Edward Jeffs, John Dryden, M.P.P., Simpson Rennie, A. H. Pettit, John Kernighan, and D. Nicol.

In addition to these, there were several representatives of the Fruit Growers' Association.

Professor Shaw, representative of the Central Farmers' Institute, and L. Woolverton, M.A., Secretary of the Fruit Growers' Asssociation, have consulted with me this year in regard to the programme and speakers for the meetings to be held in January, 1890. The list is as follows:—

I.—North-Western Division.

Drayton (West Wellington)	3rd & 4th	Prof. James, R. Gibson, Esq., and G. C. Caston, Esq.
Tara (North Bruce)	7th	
Chesley (Centre Bruce)	8th & 9th	
Teeswater (South Bruce)	10th	
Formosa (South Bruce)	11th	
Wroxeter (East Huron)	13th & 14th	Prof. James, W. Cowan, V.S., and G. C. Caston, Esq.
Mount Forest and Kenilworth (East Wellington)	15th & 16th	
Goderich (West Huron)	17th & 18th	
Hensall (South Huron)	20th	
Elora (Centre Wellington)	22nd	

II.—Western Division.

Lucan (North Middlesex)	7th	Prof. Shaw, John Hannah, Esq., and A. M. Smith, Esq.
Park Hill "	8th	
Dorchester Station (East Middlesex)	9th	
Alvinston (East Lambton)	10th & 11th	
Glencoe (West Middlesex)	13th & 14th	Prof. Shaw, F. Green, Esq., and M Pettit, Esq.
Botany (East Kent)	15th	
Zone "	16th	
Windsor (North Essex)	17th & 18th	
Amhurstburg (South Essex)	20th	
Tilbury Centre (West Kent)	21st	
Chatham (West Kent)	22nd	

III.—South-Western Division.

Freelton (North Wentworth)	2nd	Prof. Grenside, A. Lehmann, B.S.A., and A. H. Pettit, Esq.
Drumbo (North Oxford)	3rd	
Innerkip "	4th	
Mount Elgin (South Oxford)	7th & 8th	
Shedden (West Elgin)	9th	
Waterford (North Norfolk)	10th & 11th	
Aylmer (East Elgin)	13th & 14th	
Simcoe (South Norfolk)	16th	
Selkirk (Haldimand)	17th & 18th	
Marshville (Monck)	20th & 21st	

IV.—South Central Division.

St. George (North Brant)	3rd & 4th	Prof. Robertson, Edward Jeffs, Esq., and P. C. Dempsey, Esq.
Brantford (South Brant)	7th	
Welland (Welland)	8th	John Dryden, M.P.P., Edward Jeffs, Esq., and P. C. Dempsey, Esq.
Thorold "	9th	
St. Davids (Lincoln)	10th & 11th	Prof. Robertson, Edward Jeffs, Esq., and T. C. Dempsey, Esq.
Hamilton (South Wentworth)	13th	
Oakville (Halton)	14th & 15th	John Dryden, M.P.P., Edward Jeffs, Esq., and E. Morden, Esq.
Georgetown (Halton)	16th	
Brampton (Peel)	17th & 18th	
Weston (West York)	20th	Prof. Robertson, Edward Jeffs, Esq., and E. Morden, Esq.
Preston (South Waterloo)	22nd	

V.—North Central Division.

Shelburne (Dufferin)	3rd	Professor Mills, John McMillan, M. P., and T. H. Race, Esq.
Dundalk (South Grey)	4th	
Flesherton (East Grey)	7th	
Meaford (North Grey)	8th & 9th	
Creemore (West Simcoe)	10th & 11th	
Tottenham (South Simcoe)	13th	Professor Mills, Thomas McMillan, Esq., and T. H. Race, Esq.
Elmvale (Centre Simcoe)	15th & 16th	
Aurora (North York)	17th & 18th	Professor Mills, Thomas McMillan, Esq., and A. M. Smith, Esq.
Markham (East York)	20th	

VI.—East Central Division.

Uxbridge (North Ontario)	3rd	John I. Hobson, Esq., Chairman of the College Board, T. Raynor, B. S. A., and L. W. Croil, Esq.
Brechin (North Ontario)	4th	
Lindsay (South Victoria)	7th	
Bobcaygeon (North Victoria)	8th & 9th	
Peterborough (West Peterborough)	10th & 11th	
Norwood (East Peterborough)	13th	
Keene (East Peterborough)	14th	
Warkworth (East Northumberland)	15th & 16th	John I. Hobson, Esq., T. Raynor, B.S.A., and L. Woolverton, M.A.
Baltimore and Cobourg (West Northumberland)	17th & 18th	
v manville (West Durham)	20th	
kstock (West Durham)	21st	
awa (South Ontario)	22nd	

VII.—Eastern Division.

Picton (Prince Edward)	3rd	Prof. Panton, D. Nicol, Esq., and Thomas Beall, Esq.
Centreville (Addington)	7th	
Inverary (Frontenac)	8th & 9th	
Lansdowne (Leeds)	10th & 11th	
Algonquin (South Grenville)	13th & 14th	
Iroquois (Dundas)	15th	Prof. Panton, D. Nicol, Esq., and P. E. Bucke, Esq.
Lancaster (Glengarry)	16th	
South Finch (Stormont)	17th & 18th	
Lanark (South Lanark)	20th	
Carleton Place (South Lanark)	21st	
Renfrew (Renfrew)	22nd & 23rd	
Galetta (Carleton)	24th & 25th	

In the lists given above the speakers are so arranged that each deputation consists of a professor, a practical farmer and a representative of the Fruit Growers' Association. The only exceptions are in the case of Mr. Hobson and Mr. Dryden, who take the place of professors at the meetings for which they are announced. By this arrangement it was thought that the meetings might be made both interesting and profitable to all classes and sections of the farming community.

FINANCIAL STATEMENT.

I.—College Expenditure.

Maintenance.

1. *Salaries and wages*		$14,177 18
2. *Food*—		
Meat, fish, and fowl	3,062 52	
Bread and biscuits	582 64	
Groceries, butter, and fruit	3,184 29	
3. *Household Expenses*—		
Laundry, soap, and cleaning	163 25	
Women servants' wages	1,416 16	
4. *Business Department*—		
Advertising, printing, postage, and stationery	596 17	
5. *Miscellaneous*—		
Chemicles, apparatus, etc	226 46	
Medals	71 15	
Library and reading room (books, papers, and periodicals)	243 25	
Unenumerated	445 48	
		$24,168 55

Maintenance and Repairs of Government Buildings.

Furniture and furnishings	$700 54	
Repairs and alterations	787 58	
Fuel	2,849 59	
Light	796 70	
Water	650 00	
		$5,784 41
		$29,952 96

COLLEGE REVENUE.

1. Tuition fees		$2,767 40
2. Balances paid for board, after deducting allowances for work		3,612 42
3. Gas and chemicals used by third year students		66 00
4. Fines, breakage, etc.		63 13
5. Supplemental examinations		47 50
6. Old iron, bones, etc.		7 15
7. Sheets and pillows		6 85
		$6,570 45
Net cash expenditure of college		$23,382 51

The net sum voted by the Legislature for the maintenance of the College was $26,935. Consequently, the unexpended balance for the year is $3,552.49.

II.—FARM.

(a) *Farm Proper.*

1. *Permanent Improvements*—Fencing, etc.		$545 19
2. *Farm Maintenance*—		
Salaries and wages	$2,794 20	
Live stock to replace stock sold after fire	6,763 00	
Seeds	501 22	
Store stock for feeding	684 70	
Maintenance of stock	2,599 88	
Manure	240 90	
Binding twine	45 60	
Furnishings and repairs	848 96	
Fuel, light, etc.	50 00	
Printing, postage, and stationery	77 13	
Contingencies	190 48	
		$14,796 07
		$15,341 26
Less revenue		1,659 62
		$13,681 64

(b) *Experiments.*

1. Experimental Plots and Feeding:

Salaries and wages—		
Assistant Superintendent	$600 00	
Instructor (part wages)	100 00	
Labor	240 33	
		$940 33
Seeds		796 30
Manures		17 13
Live stock for experimental feeding		85 30
Furniture, furnishings, repairs, etc.		227 29
Printing, postage, and stationery		171 83
		$2,238 18

2. Experimental Dairy:

Salaries and wages—			
Assistant	$247 50		
Labor	508 35		
		755 85	
Live stock for experimental work		401 03	
Feed		235 98	
Furniture, furnishings, repairs, etc.		529 80	
Printing, postage, and stationery		76 68	
Contingencies		84 11	
		2,033 45	
			4,321 63

(c) *Garden, Lawn, Etc.*

Salaries and wages—			
Foreman (part salary)	$500 00		
Assistant	447 00		
Second Assistant	199 70		
Teamster	264 00		
Labor	930 12		
		2,340 82	
Manures		66 15	
Seeds, bulbs, plants, trees, etc		188 69	
Furniture, furnishings, repairs, etc.		444 71	
Fuel, light, etc.		22 17	
Contingencies		8 50	
		3,071 04	
		79 20	
Cash Revenue			2,991 84

(d) *Instruction.*

Salaries and wages—			
Farm Foreman (part salary)	$291 65		
Gardener (part salary)	199 96		
Carpenter (part salary)	500 00		
Instructor (part salary)	99 00		
Cattleman (part wages)	33 33		
		1,123 94	
Repairs and alterations—lumber, nails, oil, etc., for practice		24 59	
Furniture and furnishings—tools, etc., for use in shop		43 15	
Fuel, light, etc.		23 05	
			1,214 73
			$22,209 84

Total net Expenditure for Maintenance in all Departments in 1889.

College	$23,382 51
Farm proper	13,681 64
Experiments	4,321 63
Garden, lawn, etc	2,991 84
Instruction	1,214 73
	$45,592 35

By comparing these figures with the estimates for 1889, it will be seen that there are over-expenditures as follows: Farm Proper, $373.64; Experimental Plots, $518.18; Experimental Dairy, $583.45; Garden, Lawn, etc., $391.84;—amounting in all to $1,867.11; but there are unexpended balances—in the College, $3,552.49, and under Instruction, $259.27. Hence, when all is added together, the total maintenance expenditure for the year is less than the sum voted by the Legislature for that purpose.

Expenditure on Capital Account

In addition to the direct expenditure of the Department of Public Works for farm buildings, disposal of sewage, etc., the following sums were expended on capital account:

(*a*) *Farm Proper.*

Implements	$511 00	
Piggery	289 23	
		$800 23

(*b*) *Experiments.*

Constructing silo and fitting up stables in connection with the Dairy Department	$938 88	
Implements	149 09	
		1,087 97

(*c*) *Garden, Lawn, etc.*

Completing and grading roads	348 73
	$2,236 93

The total sum voted under these heads was $2,580. Consequently, there is here an unexpended balance of $343.07.

Buildings Needed.

In conclusion, I may say that we still require four or five additional buildings 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 1890,

I have the honor to be, sir,

Your obedient servant,

JAMES MILLS,
President.

APPENDIX I.

GRADUATES AND ASSOCIATES.

1. Bachelors of Science in Agriculture, Degree of B. S. A.

University of Toronto.

Date **C.**

1888—Craig, J. A.
1888—Creelman, G. C.

F.

1888—Fee, J. J.

H.

1889—Harcourt, G.
1889—Hutton, J. R.

L.

1889—Lehmann, A.

Date. **M.**

1889—Morgan, J. H. A.

P.

1888—Paterson, B. E.

R.

1889—Raynor.
1889—Soule, R. (ob.)

Z.

1888—Zavitz, C. A.

2. Associates.

The total number of Associates up to the present time is 177 and the list is as follows :

Date. **A.**

1888—Austin, A. M.
1880—Anderson, J.
1880—Ash, W. E.

B.

1881—Ballantyne, W. W.
1879—Bannard, E. L.
1888—Bayne, S. R. S,
1888—Birdsall, W. G.
1888—Bishop, W. R.
1889—*Brodie, G. A.
1888—Budd, W.
1885—‡Butler, G. C.
1884—Black, P. C.
1882—Blanchard, E. L.
1886—Broome, A. H.
1886—‡Brown, C. R.
1888—Brown, S. P.

Date. **C.**

1886—Calvert, S.
1877—Campbell, J. A.
1880—Campbell, D. P. L.
1884—*Carpenter, P. A.
1888—Carpenter, W. S.
1886—Cobb, C.
1880—Chapman, R. K.
1882—Charlton, G. H.
1882—Chase, O.
1879—Clark, J.
1879—Clinton, N. J.
1880—Clutton, A. H.
1887—Craig, J. A.
1887—Creelman, G. C.
1878—Crompton, E.

D.

1878—Davis, C. J.
1880—Dawes, M. A.

* Gold Medallist. ‡ Second Silver Medallist.

Date. **D.**

1882—Dawson, J. J.
1888—†Dean, H. H.
1882—Dennis, J.
1889—Derbyshire, J. A.
1881—Dickenson, C. S.
1887—Donald, G. C.
1887—Donaldson, F. N.
1877—Douglas, J. D.
1877—Dunlop, S.

E.

1888—Elton, C. W.
1888—Elton, R. F.
1882—Elworthy, R. H.
1887—Ewing, W.

F.

1878—Farlinger, W. K.
1886—Fee, J. J.
1881—File J.
1882—Fotheringham, J.
1883—‡Fotheringham, W.
1879—Fyfe, A.

G.

1883—Garland, C. S,
1889—Gelling, J. A.
1887—Gilbert, W. J.
1879—Gillespie, G. H.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindley, A. W.

H.

1882—Hallesy, F.
1888—*Harcourt, G.
1887—Harkness, A. D.
1888—Harrison, R. E.
1887—Hart, J. A.
1887—Hart, J. W.
1888—Heacock, F. W.
1886—Holtby, R. M.
1880—Holterman, R. F.
1882—Horne, W. H.
1888—Horrocks, T. J.
1887—Howes, J. S.
1882—Howitt, W.
1888—Hutton, J. R.

I.

1886—Idington, P. S.

Date. **J.**

1886—Jeffrey, J. S.
1883—Jeffs, H. B.
1879—Jopling, W.

K.

1888—Knowlton, S. M.

L.

1882—Lansborough, J.
1887—Leavens, D. H.
1884—‡Lehmann, A.
1887—‡Lick, E.
1877—Lindsay, A. J.
1889—†Linfield, F. B.
1887—Livesey, E. M.
1880—Lomas, J. W.
1878—Logan, T.

M.

1880—Macaulay, H.
1885—Macpherson, A.
1886—*Madge, R. W.
1882—Mahoney, E. C.
1884—Major, C. H.
1889—Marsack, F.
1889—Marsack, H. A.
1877—Mason, T. H.
1877—Meyer, G. W.
1887—Morgan, J. H. A.
1881—Motherwell, W. R.
1885—†Muir, J. B.
1887—McCallum, E. G.
1889—McCallum, W.
1889—McEvoy, T. A.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.
1889—McLaren, P. S.
1883—McPherson, D.
1889—Monteith, S. N.

N.

1878—Naismith, D. M.
1879—Nicol, A. (ob.)
1882—Nicol, G.
1886—Notman, C. R.

O.

1877—O'Beirne, A. C.
1887—Orsman, C. P.
1886—Owen, W. H.

* Gold Medallist. † First Silver Medallist. ‡ Second Silver Medallist.

Date. **P.**

1888—Palmer, W. J.
1887—Paterson, B. E.
1883—Perry, D. E.
1881—§Phin, R. J.
1881—Phin, W. E.
1881—Pope, H.
1886—Power, R. M.
1884—Powys, P. C.

R.

1882—‡Ramsay, R. A.
1879—Randall, J. R.
1885—*Raynor, T.
1885—Reid P.
1889—Rendall, W.
1889—Rennie, E. A.
1883—*Robertson, W.
1879—Robertson, J.
1881—Robins, W. P.
1879—Robinson, C. B.
1881—Ross, J. G.

S.

1884—Saxton, E. A.
1888—Serson, W. E.
1888—Sinclair, J. J.
1882—Silverthorne, N.
1888—Soule, R. M.
1877—Sykes, W. J.
1883—Schwartz, J. A.
1887—†Scrugham, J. G.
1888—Shantz, A.
1887—Sharman, H. B.
1877—Shaw, G. H.
1882—†Shuttleworth, A.
1884—†Slater, H. (ob.)
1887—*Sleightholm, F. J.
1885—Smith, E. P.

Date. **S.**

1884—Steers, O.
1888—Stevenson, C. R.
1878—Stewart, W.
1882—Stover, W. J.
1886—†Sturge, E.
1888—Sweet, H. R.

T.

1889—‡Tinney, T. H.
1879—Toole, L.
1883—Torrance, W. J.
1884—Tucker, H. V.
1885—Thompson, W. D.

V.

1888—Valance, R.

W.

1879—Warnica, A. W.
1884—Wark, A. E.
1878—Warren, J. B.
1880—§Webster, J. L.
1879—Wells, C.
1882—Wettlaufer, F.
1879—Wilkinson, J. P.
1888—Willans, T. B.
1888—Willans, N.
1879—Willis, J.
1883—Willis, W. B., (ob.)
1888—Wilmot, A. B.
1882—White, C. D.
1879—White, G. P.
1884—Wroughton, T. A.

Z.

1886—Zavitz, C. A.

*Gold Medallist. † First Silver Medallist. ‡Second Silver Medallist.
§ Winner of the Governor-General's Medal—the only medal given that year.

APPENDIX 2.

SYLLABUS OF LECTURES.

Lectures began as usual on the 1st October, 1888, and continued till the 28th June, 1889, which latter date was the end of the scholastic year 1888-9.

The following syllabus of lectures will convey some idea of the class-room work done by the several Professors in the nine months just mentioned :

FIRST YEAR.—FALL TERM—1st OCTOBER to 22nd DECEMBER.

Department 1.—*Agriculture.*

Introductory.—Ancient and modern agriculture ; agricultural literature ; different kinds of farming.

Soils.—Natural conditions of soil and plant ; examination and classification of soils ; physical properties of each kind.

Rotations in Cropping.—Importance and necessity of rotation ; principles underlying it ; rotations suitable to different kinds of soil ; examination and criticism of different systems of rotation.

Buildings.—Location of house, barn, and stables ; stables for horses, sheep, and cattle ; arrangement of farm buildings.

Miscellaneous.—Roads, lanes, fences.

Department 2.—*Natural Science.*

Chemical Physics.—Matter ; accessory and essential properties of matter ; attraction ; various kinds of attraction—cohesion, adhesion, capillary, electrical and chemical ; specific gravity ; weights and measures ; heat, measurement of heat, thermometers, specific and latent heat ; sources, nature, and laws of light.

Inorganic Chemistry.—Scope of subject ; elementary and compound substances ; chemical affinity ; symbols ; nomenclature ; combining proportions by weight and by volume ; atomic theory ; atomicity and basicity ; oxygen and hydrogen ; water—its nature, functions, decomposition, and impurities ; nitrogen ; the atmosphere—its composition, uses and impurities ; ammonia—its sources and uses ; nitric acid and its connection with plants.

Human Physiology and Hygiene.—Description of the different tissues of the body alimentary system ; circulatory system ; nervous system ; importance of ventilation and the influence of food on the body ; remarks on the proper care of the body and attention to its surroundings in order to keep it in a continual state of health.

Zoology.—Distinctions between animate and inanimate objects ; distinction between plants and animals : basis and classification among animals ; leading character of each sub-kingdom, with special reference to classes or animals connected with agriculture.

Department 3.—*Veterinary Science.*

Anatomy and Physiology of the horse, ox, sheep, and pig ; osseous system, muscular system, syndesmology, plantar system, and odontology.

Department 4.—English.

Composition.—The sentence, paragraph, and period; capitals and punctuation. Exercises in composition.

English Classics.—Critical study of Scott's "Lady of the Lake."

Department 5.—Mathematics.

Arithmetic.—Review of subject, with special reference to farm accounts. Interest, discount, stocks, and partnership.

Mental Arithmetic.—Calculations in simple rules.

Book-keeping.—Subject commenced.

FIRST YEAR.—WINTER TERM—22nd JANUARY to 16th APRIL.

Department 1.—Agriculture.

Breeding, rearing, and feeding of animals. Points to be considered in deciding what kind of animal to keep.

Cattle.—History and characteristics of Shorthorns, Herefords, Aberdeen-Angus Polls, Ayrshires, Jerseys, Guernseys, Holsteins, Devons, Galloways, etc.; grade cattle; milch cows—points of a good milch cow; breeding generally; pedigree.

Sheep.—Breeds of sheep generally considered; crosses between different breeds compared; quality, quantity, and uses of different kinds of wool.

Department 2.—Natural Science.

Inorganic Chemistry (Continued).—Carbon; combustion; carbonic acid and its relation to the animal and vegetable kingdom; sulphur and its compounds; manufacture and uses of sulphuric acid; phosphorus; phosphoric acid and its importance in agriculture; chlorine—its bleaching properties; bromine; iodine; silicon; potassium; calcium; magnesium; iron, etc.

Organic Chemistry.—Constitution of organic compounds; alcohols, aldehydes, acids and their derivatives; formic, acetic, oxalic, tartaric, citric, lactic, malic, uric, and tannic acids. Constitution of oils and fats—saponification; sugars, starch, cellulose; albuminoids, or flesh formers, and their allies; essential oils; alkaloids—morphine and quinine; classification of organic compounds.

Zoology (Continued).—Sub-kingdoms further described; detailed account of some injurious parasites, such as "liver fluke," "tape-worm," "trichina," etc.; insects—their influence on plant life; corals and mollusks as agents in the formation of soil; vertebrates, with special reference to those of importance in the economy of the farm.

Lectures illustrated by specimens and diagrams.

Department 3.—Veterinary Science.

Veterinary Anatomy.—Anatomy and physiology of the horse, ox, sheep, and pig—digestive system, circulatory system, respiratory system, urinary system, nervous system, sensitive system, generative system, tegumental system.

Department 4.—English.

Composition.—Exercises continued; abstracts of speeches and essays; letter writing.

English Classics.—Critical study of "Cowper's Task," Books 3 and 4.

Department 5.—Mathematics and Book-keeping.

Arithmetic.—Equation of payments; percentage; profit and loss; stocks; partnership; exchange.

Book-keeping.—Business forms and correspondence; general farm accounts; dairy, field, and garden accounts.

FIRST YEAR.—SPRING TERM—17th APRIL to 30th JUNE.

Department 1.—Agriculture.

Preparation of Soil.—Modes of preparation for different crops, and various kinds of soil.

Seeds and Sowing.—Testing the quality of seed; changing seed; quantity per acre; methods of sowing.

Improvement of Lands.—Drainage; ordinary cultivation; sub-soiling; fallowing; manuring. Farm-yard manure and management of the same; the properties, application and uses of special fertilizers—lime, plaster, salt, bone dust, superphosphates, etc.

Roots.—Cultivation of roots and tubers—effects of each kind on soil.

Green Fodders.—The cultivation and management most appropriate for each.

Management of pastures; harvesting and preparing crops for market or one's own use; crops for current year examined.

Department 2.—Natural Science.

Geology.—Connection between geology and agriculture; classification of rocks—their origin and mode of formation, changes which they have undergone after decomposition; fossils—their origin and importance; geological periods and characteristics of each.

Geology of Canada, with special reference to the nature and economic value of the rock deposits; glacial period and its influence on the formation of soil.

Lectures illustrated by numerous specimens and designs.

Botany.—Full description of seed, roots, stem, leaves, and flower. Plants brought into the lecture-room and analyzed before the class, so as to render students familiar with the different organs and their use in the plant economy.

Lectures illustrated by excellent diagrams.

Department 3.—Veterinary Science.

Materia Medica.—The preparation, doses, action and use of about one hundred of the principal medicines used in veterinary practice.

Department 4.—English.

English Grammar and Composition.—Authorized Grammar and Williams' Practical English.

Department 5.—Mathematics.

Mensuration.—Mensuration of surfaces—the square, rectangle, triangle, trapezoid, regular polygon, circle. Special application to the measurement of lumber. Mensuration of solids; special application to the measurement of timber, earth, etc.

SECOND YEAR.—FALL TERM—1st OCTOBER to 22nd DECEMBER.

Department 1.—*Agriculture.*

Experimental Plots.—The results of last season's experiments with crops and animals; liability to disease; effects of various manures on different crops, etc.

Farm Management.—Detailed account of the treatment of each field; results from different kinds of seed and soil; effects of manure; harvesting, storing, and threshing of crops; fall ploughing, sub-soiling, etc.

Stock Feeding.—Value of feeding materials; estimate for winter keep of live stock; housing, feeding, and fattening; points to be observed in selecting animals for fattening; feeding experiments; common diseases of animals; management of animals on pasture; value of green fodder. Dairy management and cheese making.

Department 2.—*Natural Science.*

Agricultural Chemistry.—Connection between chemistry and agriculture; the various compounds which enter into the composition of the bodies of animals: the chemical changes which food undergoes during digestion; chemical changes which occur during the decomposition of the bodies of animals at death; the functions of animals and plants contrasted; food of plants, and whence derived; origin and nature of soils; classification of soils; causes of unproductiveness in soil and how detected; preservation, development, and renovation of soils; manures classified; the chemical action of manures on different soils; commercial valuation of fertilizers.

Horticulture.—Ontario as a fruit-growing country; the natural divisions into which it may be divided for growing fruit; detailed account of the operations, layering, grafting, budding, pruning, etc.; laying out and cultivation of an orchard; list of fruits best suited for general purposes, with best methods for their cultivation; remarks on gardening as a source of profit; plants best adapted to bedding and potting.

Lectures illustrated by practical work in the garden, and specimens in the class-room.

Department 3.—*Veterinary Science.*

Pathology.—Osseous System.—Nature, causes, symptoms, and treatment of diseases of bone, as splint, spavin, ringbone, etc.

Muscular System.—Nature, causes, and treatment of flesh wounds, etc.

Syndesmology.—Nature, causes, symptoms, and treatment of curb, bog-spavin, and other diseases of the joints.

Plantar System.—Nature, causes, symptoms, and treatment of corns, sand-crack founder, and other diseases of the feet.

Odontology.—Diseases of the teeth and treatment of the same.

Department 4.—*English.*

English Classics.—Critical study of prose selections from DeQuincey, Lamb, and Ruskin.

Department 5.—*Mathematics.*

Dynamics.—Motion, forces producing motion, momentum; work; the simple machines, etc.

Drainage.—General principles; how to lay out a system of drains; how, where, and when to commence draining; depth of drains and distances apart; grades; cost of draining.

SECOND YEAR.—WINTER TERM—22nd JANUARY to 16th APRIL.

Department 1.—*Agriculture.*

Capital required in farming; laying out of farms; general management and economy; cost of production; buying, selling, and marketing.

Management of cattle, sheep and other animals in winter; breeding generally considered; special management of ewes before, during, and after the season of lambing; treatment of other animals in parturition; rearing of lambs, calves, and pigs; washing and dipping of sheep, etc., etc.

Aboriculture.—Importance of the subject and its special application to North America; what is being done in the conservation and replanting of forests in other countries; the objects of conserving and replanting—shelter for crops, animals and dwellings, regulation of temperature and rain-fall, ornament and profit; requisite proportion of tree surface to that under agricultural crops; existing condition of forests in North America; adaptability of soils and climate to rapid results; what parts of the country should be conserved and what parts replanted; conservation of indigenous forests generally considered; special attention to the care of young natural forest trees.

Department 2.—*Natural Science.*

Agricultural Chemistry.—Continuation of the subject from preceding term, as follows: Composition of plants in relation to the soils upon which they grow; rotation of crops; the classification of fodders according to their chemical composition and a general treatment of the science of cattle feeding; relation of feeding to manure; chemistry of the dairy.

Entomology.—Importance of the subject to agriculturists; beneficial and injurious insects—their habits and the best means of checking the ravages of the latter.

Lectures illustrated by specimens.

Meteorology.—Relation of meteorology to agriculture; composition and movements of the atmosphere; description of the barometer, different kinds of thermometers, pluviameter, anemometer and how to read them; temperature, its influence on agriculture; the elements which are to be considered in the discussion of climate; the principles considered in forecasting the weather.

Lectures illustrated by instruments referred to.

Department 3.—*Veterinary Science.*

Digestive System.—Nature, causes, symptoms, and treatment of spasmodic and flatulent colic, inflammation of the bowels, acute indigestion, tympanitis in cattle, impaction of the rumen, and many other common diseases.

Circulatory System.—Description of the diseases of the heart and blood.

Respiratory System.—Nature, causes, symptoms, and treatment of catarrh, nasal-gleet, roaring, bronchitis, pleurisy, and inflammation of the lungs, etc.

Urinary System.—Nature, causes, symptoms, and treatment of inflammation of the kidneys, etc.

Nervous System.—Nature, causes, symptoms, and treatment of lock-jaw, string halt, etc.

Sensitive System.—Nature, causes, symptons, and treatment of the diseases of the eye and ear.

Generative System.—Nature, causes, symptoms, and treatment of abortion, milk fever, etc.

Tegumental System.—Nature, causes, symptoms, and treatment of scratches, sallenders, mallenders, parasites, and other diseases of the skin.

Department 4.—*English Literature and Political Economy.*

English Classics.—The critical study of Shakespeare's "Julius Cæsar."

Political Economy.—Utility; production of wealth—land, labour, capital; division of labour; distribution of wealth; wages; trades unions; co-operation; money; credit, credit cycles; functions of government; taxation, etc.

Department 5.—*Mathematics.*

Statics.—Theory of equilibrium; composition and resolution of forces; parallelogram of forces; moments; centre of gravity, etc.

Hydrostatics.—Transmission of pressure; the hydraulic press; specific gravity density; pumps, siphons, etc.

Book-keeping.—Review of previous work.

SECOND YEAR.—SPRING TERM—17th APRIL to 30th JUNE.

Department 1.—*Agriculture.*

Review of past lectures, with special drill on outside work. Reasons for management, etc.

Department 2.—*Natural Science.*

Determination of soils and fertilizers by physical properties.

Analytical Chemistry.—Chemical manipulation, preparation of common gases and reagents; operations and analysis—solution, filtration, precipitation, evaporation, distillation, sublimation, ignition and the use of the blow-pipe; testing of substances by reagents; impurities in water; adulterations in foods and artificial manures; injurious substances in soils.

Systematic and Economic Botany.—Classification of plants and characters of the most important orders.

This course is illustated by a large collection of plants in the college herbarium, and also by analysis of several plants collected in the fields and woods of the farm.

Green-house Plants.—Special study of all plants grown in our green-houses, and the shrubs, etc., on the lawn.

Department 3.—*Veterinary Science.*

Materia Medica.—The preparation, actions, uses, and doses of medicines—continued from the spring term of the first year. Lectures on special subjects, such as pleuro-pneumonia, the rinderpest, tuberculosis, etc.

Veterinary Obstetrics.—Description of fœtal coverings. Pneumonia in connection with puberty, œstrum, gestation, sterility, abortion, normal and abnormal parturition. Diseases incidental to pregnant and parturient animals.

Department 4.—*English.*

English Classics.—The critical study of Milton's "L'Allegro" and "Il Penseroso."

Department 5.—*Mathematics.*

Surveying and Levelling.—Fields surveyed with chain and cross-staff; measurements of heights.

Road-making.—Determination of proper slopes; shape of road bed; drainage of roads; friction on different roads; various road coverings; the maintenance of roads; cost, etc.

APPENDIX 3.

TIME TABLE FOR FALL TERM.

The following Time Table indicates our class-room work from the 1st October to the 22nd December.

TIME TABLE.

FIRST YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
8.45	Agriculture.	Arithmetic.	Agriculture.	1. Physiology and Hygiene (6 weeks), and Zoology (5 weeks). 2. Arithmetic. 3. Book-keeping.	Agriculture.
9.45	Literature.	Physiology and Hygiene (6 weeks,) Zoology (5 weeks.)	Grammar and Composition.		Grammar and Composition.
10.45	Veterinary Anatomy.	Chemistry.	Veterinary Anatomy.	Chemistry.	Chemistry.

SECOND YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
8.45	Literature.	Agricultvre.	Mechanics.	Agriculture.	Mechanics.
9.45	Agriculture.	Literature.	Drawing.	Hort'ure (8 weeks) Entomology (3wks)	Agricultural Chemistry.
10.45	Agricultural Chemistry.	Hort'ure (8 weeks) Entymology (3wks)	Agricultural Chemistry.	Veterinary Pathology.	Veterinary Pathology.

THIRD YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
8.45	Dairying.	Shakespeare's Richard II.	Natural History and Microscopy.	Bacon's Essays.	Natural History and Microscopy.
9.45	Chemistry.	Chemistry.	Drawing.	Agriculture.	Agriculture.
10.45	Addison's Spectator.	Pope's Essay on Criticism.		Themes.	Tennyson's In Memoriam, etc.

APPENDIX 4.

EXAMINATION PAPERS.

I. Papers Set Easter Examinations, 1889.

FIRST YEAR.

AGRICULTURE.

Examiner :—Thomas Shaw.

1. What are the principal points of merit in good ploughing?

2. Why is it not a safe rule to apply manures on the basis of the amount of ingredients required by certain crops?

3. What effect have the age and condition of the animals upon the value of the manure?

4. What influence does lime exert as a fertilizer?

5. Enumerate the advantages of a rotation of crops, and give a suitable rotation for sandy or gravelly soils.

6. To which localities is soiling best adapted. Give the chief objections urged against it and answer these.

7. Give the best method for the eradication of wild mustard.

8. Why is it often hazardous for beginners to choose prize-winning animals as the foundation of their herds and flocks?

FIRST YEAR.

INORGANIC CHEMISTRY.

Examiner :—C. C. James, M.A.

1. Give a brief statement of the properties of hydrogen, nitrogen, and chlorine.

2. Give the names and formulas of the principal compounds of ammonia.

3. Explain the chemical changes taking place in the burning of limestone, and the application of gypsum to manure.

4. Give an account of the allotropic forms of carbon, and of sulphur.

5. Give names and formulas of the compounds of oxygen with carbon, sulphur, iron, nitrogen, hydrogen.

6. Sketch the apparatus in use for making chlorine gas. State the chemical equation representing the action.

7. What are the impurities (name and formulas) of common salt? How can they be easily detected?

8. Wherein does the bleaching action of sulphur di-oxide differ from that of chlorine?

9. How is the density of water affected by heat and by pressure?

10. How many pounds of chlorate of potash will be necessary to produce sufficient gas to explode exactly the gas obtained from five pounds of water by the use of potassium? What is the compound resulting, and how much?

FIRST YEAR.

Organic Chemistry.

Examiner :—C. C. James, M.A.

1. Define and criticize the term "Organic Chemistry." Give basis and peculiarities of its compounds.

2. Give formulas of butyl alcohol, glycogen, lactose, butyrin, dextrin, cellulose, cane sugar, distearin, dextrose, carbamide.

3. Explain malting, brewing, vinegar making, and soap making.

4. State the exact constituents of milk.

5. Distinguish amides, albuminoids, and alkaloids.

6. Describe four fermentations.

7. Explain: radical, isomeric, levulose.

8. Explain: "under proof," methylated spirits, wood spirits, formic acid, theine.

FIRST YEAR.

Zoology.

Examiner :—J. Hoyes Panton, M.A., F.G.S.

1. Show in what way mollusks and worms have aided in the formation of soil.

2. Explain what is meant by "alternation of generations" and alternation of host," and give examples.

3. Give the theories regarding the origin and formation of coral reefs.

4. Describe fully the life history of the so-called liver fluke (Fasciola hepatica.)

5. Explain the term metamorphosis as applied in Zoology, and illustrate by examples from two sub-kingdoms.

6. Mimicry.—Give examples showing it, and state its use in the animal kingdom and explain the terms hybernation and migration as applied to animals.

7. Compare the characters of a ganoid fish with those of a telcostean, and give the distribution of those fishes in time and space.

8. Identify the specimens before you, giving sub-kingdom, class, and order to which each belongs.

FIRST YEAR

Veterinary Anatomy.

Examiner :—F. C. Grenside, V.S.

1. State how to distinguish the temporary from the permanent incisors of the horse, and explain the appearance of a four, five, and six-year-old mouth respectively.
2. Explain the differerences between the incisors of the horse, and ox.
3. Describe the mucous membrane of the horse's stomach.
4. Describe the rectum, and explain how Defecation is accomplished.
5. Name the secretions that take part in Chylification, and state the particular function of each secretion.
6. Draw a diagram of the Trachea, Bronchia, and bronchial tubes, and explain each.
7. Mention the organs that occupy the space between the right and left lung.
8. Describe the bladder, and process of urination.
9. Draw a diagram of a Malpigian body of the kidney, and explain it.

FIRST YEAR.

Grammar.

Examiner :—E. Lawrence Hunt, B.A.

1. Analyse and parse the following :—
   (*a*) He sprang hastily from his grassy couch.
   (*b*) The superhuman energy which their German leader there displayed saved them from the dreaded calamity.
2. Substitute equivalent phrases or clauses for the adjectives and adverbs *a* and *b*.
3. Classify the pronouns.
4. Distinguish the active from the passive voice. What are the advantages of using the passive voice? Illustrate by examples.
5. Form sentences illustrating the rule that the verb must agree with its subject in number and person.
6. Criticise the following :—
   (*a*) He paid the workmen who has just went home.
   (*b*) The children who you gave them oranges to looks dreadful sick.
   (*c*) I intended to have wrote last week.

FIRST YEAR.

English Literature.

Examiner :—J. Hoyes Panton, M.A., F.G.S.

1. "The swain responsive, as the milk-maid sung,
   The sober herd, that lowed to meet their young,
   The noisy geese, that gabbled o'er the pool,
   The playful children just let loose from school,

The watch-dog's voice, that bayed the whispering wind,
And the loud laugh, that spoke the vacant mind,
Those all in sweet confusion sought the shade,
But now the sounds of population fail,
No cheerful murmurs fluctuate the gale."

(*a*) Specify the words not of English origin.

(*b*) Note the figures of speech in the extract.

(*c*) Give the chief characteristics of this poet as a writer, and name his chief works.

2. Give meaning and derivation of ponderous, elapsed, mansion, disaster, transitory, impotence, and mole.

3. Quote the description of the village preacher beginning, "Thus to relieve the wretched was his pride."

4. Explain the following extracts:—"coming day," "hollow-sounding bittern," "stern to view," "mantling bliss," "sickly trade" and "western main."

5. "For who to dumb forgetfulness a prey,
This pleasing anxious being e'er resigned,
Left the warm precincts of the cheerful day
Nor cast one longing lingering look behind."

(*a*) Re-write this stanza in prose so as to show the meaning.

(*b*) Indicate figures of speech in the extract, and cite others from the poem.

(*c*) Give meaning of words underlined.

6. Explain the phrases:—"the boast of heraldry," "with dirges due, in sad array," "narrow cell," "storied urn," "some village Hampden," "fretted vault."

7. What are the leading thoughts in the Elegy? What distinguished men have referred to its excellence?

8. Paraphrase:—

"Let not ambition mock their useful toil,
Their homely joys, and destiny obscure,
Nor grandeur hear with a disdainful smile
The short and simple annals of the poor."

FIRST YEAR.

Composition.

Examiner:—E. Lawrence Hunt, B.A.

1. What is meant by purity, and precision of diction? Distinguish:—character and reputation; womanly and womanish; childish and childlike. Write a sentence in which each is properly used.

2. Explain the terms:—loose sentence, periodic sentence, balanced sentence; and state the advantage of each. Compose a sentence of each kind, of two or three lines apiece, on the Holstein and the Jersey; or, on intelligence and industry. Draw up a series of contrasts about two of the authors whose works you have studied this year.

3. Compose one simple, one compound, and one complex sentence on "How to Study"; then change each into the other two.

4. What must be attended to in the formation of sentences to promote clearness? Illustrate by examples.

5. Make the following sentences more forcible by changing the construction; and briefly state in each case why the one form is more forcible than the other:—(*a*) Diana of the Ephesians is great. (*b*) The scenes of my childhood are dear to my heart, (use exclamatory form). (*c*) You cannot put your hand into the fire and not be burned, (use interrogative form).

6. State concisely the advantages of figurative language. Define and give examples of:—simile, apostrophe, motonymy, euphemism. Re-write each sentence in plain language and note the loss.

7. Punctuate the following:—2 chron XII 10 Jas R Black Esq MP Surely said Rip I have not slept here all night He recalled the occurrences before I fell asleep the strange man with the keg of liquor the mountain ravine the wild retreat among the rocks the woe begone party at ninepins the flagon Oh that flagon that wicked flagon said Rip what excuse shall I make to Dame Van Winkle.

8. Express, in your own words, the thoughts, in the following passage from Ruskin, p. 33,—Sesame and Lilies:—

"But, granting that we had both the will and the sense to choose our friends well, how few of us have the power! or, at least, how limited, for most, is the sphere of choice! Nearly all our associations are determined by chance or necessity, and restricted within a narrow circle. We cannot know whom we would; and those whom we know, we cannot have at our side when we most need them. All the higher circles of human intelligence are, to those beneath, only momentarily and partially open..... Meantime, there is a society continually open to us, of people who will talk to us as long as we like, whatever our rank or occupation; talk to us in the best words they can choose, and with thanks if we listen to them..... Kings and statesmen are lingering patiently in those plainly furnished and narrow ante-rooms, our book-case shelves."

FIRST YEAR.

Arithmetic.

Examiner:—E. Lawrence Hunt, B.A.

1. Calculate the profits from a flock of 30 sheep, stating the details of cost and returns.

2. Calculate the profits from 20 acres of barley, supplying the necessary data.

3. Oats are 30 cents a bush.; peas, 55 cents; barley, 60 cents; rye, 40 cents; Indian corn 95 cents. (*a*) Find the cost of 20 pounds of the mixture. (*b*) How many bushels of each will make a mixture worth 50 cents a bush?

4. A drains 12 acres at a cost of $35 an acre. Take any rotation of crops and find approximately what the resulting increase in each crop per acre must be, to give A 8% interest on the cost of drainage.

5. A plants 10 acres with orchard at a cost of $24 an acre, and gets no returns for 4 years. If the land itself was worth $65 an acre, find the value of the orchard at the end of 4 years; compound interest at 6%.

6. On Jan. 1, 1889, A sells B 650 bushels of wheat at $1.05 a bush., and takes B's note for the amount, due 6 months hence, bearing interest at 5%. On April 22, A gets this discounted at the bank at 8%. Find the amount he received for the note. Write the form of the promissory note if it is negotiable by endorsement.

7. A sends B $1,481.90 to invest in cattle. If B charges one and a-half per cent. commission, find the amount invested in cattle.

8. A owns $9,650 of the 8% stocks at 110½. He sells out (brokerage a-half per cent.) and invests the proceeds in a farm. He rents the farm to B for one-third of the annual proceeds. B's income from the farm is $900. Find the rate per cent. of interest A receives on his money, and the difference in his income.

FIRST YEAR.

Book-keeping.

Examiner :—E. Lawrence Hunt, B.A.

1. "A farmer's work is of such a nature that a thorough system of book-keeping is practically impossible. The results cannot be satisfactory, nor will they justify the labor of the undertaking." Discuss fully these statements, mentioning the chief difficulties of keeping accurate accounts on the farm ; and indicating the system whereby the necessary knowledge may be obtained.

2. Make out and close an account with cows.

3. Briefly explain the method of closing the books.

4. Mention the accounts affected by the following :—(*a*) Sold 10 lambs to S. Jamieson at $5 each. (*b*) Paid $12 insurance on barns. (*c*) Sold 200 bbls. apples at $1.25 a bbl. (*d*) Put 40 loads manure at $1 per load on field No. 1. (*e*) Sold 20 doz. eggs at 10 cents a dozen to R. Jones, grocer, entered in pass-book. (*f*) Sowed 20 bushels fall wheat worth $1.10 per bush. in field No. 2. (*g*) Sold Holstein bull $225 to D. Black, taking his note due 6 months hence and bearing interest at 8%. (*h*) Oct. 18, D. Black pays his note with interest. (*i*) Holding P. Grey's promissory note of $800 legally due Dec. 30, I got it discounted at the Bank of Commerce, Sep. 15, at 7%.

SECOND YEAR.

Agriculture.

Examiner :—Thomas Shaw.

1. Give reasons based on the disposition, habits, and physical conformation of Ayrshires for a belief in their mixed ancestry.

2. Give the leading characteristics of the Sussex and Kerry breeds of cattle.

3. How do the Devon, Ayrshire, Guernsey, Holstein, and Norfolk Polled breeds compare for dairy purposes ?

4. Describe the color, head, and udder of the Jersey.

5. Enumerate some of the principal properties of fine wools.

6. In selecting breeding stock what are the principal considerations ?

7. Give the principal methods to be adopted in the complete eradication of the Canada thistle.

SECOND YEAR.

Practical Live Stock.

Examiner :—Thomas Shaw.

1. Do you consider the Hereford bull (Conqueror) a good representation of the beefing breeds ? If so, give the reasons in detail.

2. Point out the principal deficiencies of conformation in the Devon bull "Rose's Duke" [929].

3. Point out the most prominent deficiencies in the Grade cow "Lady Norton." (1) As to symmetry. (2) As to milking indications.

4. Give the strong and weak points in the Oxford Down Ram "Duke of Gloucester."

SECOND YEAR.

Agricultural Chemistty.

Examiner :—C. C. James, M.A.

1. State the relationship of the following substances to plant development :—ammonia, silica, iron, chlorine.

2. Give the conditions of germination and the chemical changes accompanying it.

3. What is meant by "the retentive power of soils?" What changes or actions underlie it?

4. Discuss the composition, value and application of wood and of coal ashes.

5. What is meant by N-free extract? How is it determined and what is its use in the animal?

6. Distinguish albumoids and amides as to (*a*) composition ; (*b*) occurrence ; (*c*) uses.

7. What circumstances affect the composition and feeding value of timothy hay? Explain how.

8. Explain the sources of the food of the following :—muscle, mechanical force, wool, butter, fat.

9. "The pig is undoubtedly the most economical meat producing machine at the farmer's disposal." Give reasons for this statement.

10. "Milk is not simply a secretion, it is the liquified organ" (Armsby). Explain what is meant and how proven.

SECOND YEAR.

Meteorology.

Examiner :—J. Hoyes Panton, M.A., F.G.S.

1. Show in what way a knowledge of the principles of meteorology is of practical importance to agriculture, horticulture, and commerce.

2. Explain how the physical features of a country may modify its climate, and give illustrations from districts in Canada.

3. Thermometer—name the different kinds, and state how read and how the readings may be of use. Describe Rutherford's, and reduce 16 F. to C. and 28 C. to F.

4. Upon what does the amount of moisture in the atmosphere depend? Describe the instrument used to ascertain it.

5. Where are the following winds found :—mistral, dust winds, chinook? Account for their presence.

6. Compare the rainfall of North and South America and account for the difference.

7. Define latent heat, isobars, isothermals, and area of low pressure.

8. Account for the heavy rains in India and the absence of rain in some parts of Africa.

SECOND YEAR.

Entomoloy.

Examiner :—J. Hoyes Panton, M.A., F.G.S.

1. Show how a knowledge of insect life becomes of service in preventing their ravages.

2. Give the life-history of the root-louse, and name the families in which beneficial beetles are found.

3. Name the genera in which the most injurious cutworms are found. Describe the larva of any, and give remedies to prevent their attacks.

4. Name the different insects that are destroyed by the application of Paris green.

5. Give the remedies for the wire-worm, and contrast its larva with that of the crane-fly, May-beetle and cutworm.

6. What insects belonging to the order Hemiptera are injurious, and to what order do the saw-flies belong?

7. Some insects are injurious in the larval condition only, some in the perfect, and some in both. Give examples of each.

8. Explain what is meant by an emulsion. Give one of the best, and state how and when to use it.

9. Describe the larva and imago of the canker worm, and give two remedies—one depending upon a habit of the larva and the other upon the nature of the mature insect.

SECOND YEAR.

Veterinary Pathology.

Examiner :—F. C. Grenside, V.S.

1. Give the causes of corns, and explain means of relieving them.
2. Describe the symptoms and treatment of punctures and bruises in horses' feet.
3. Give the symptoms of lock-jaw.
4. Explain the causes of digestive troubles in the horse.
5. Give the causes, symptoms, and treatment of hoven in the ox.
6. Give the differential symptoms of impaction of the rumen and fardel round.
7. Give the symptoms and treatment of spasmodic colic in the horse.
8. Explain the differential symptoms of acute indigestion and flatulent colic.
9. Describe the symptoms of pneumonia.
10. Describe the symptoms and treatment of Lymphangitis.

SECOND YEAR.

Practical Horse.

Examiner :—F. C. Grenside, V.S.

1. Explain the different modes of giving medicines to horses and how we should be guided in the choice of the methods.

2. Give the normal temperature of horses, cattle, and sheep. Explain how to take the temperature, and the theories with regard to the production of heat in the animal economy.

3. Explain the measures to be adopted in physicing a horse.

4. Describe how to treat a case of choking in the ox.

5. Explain the diseases and irregularities of the teeth of horses.

SECOND YEAR.

GRAMMAR.

EXAMINER :—E. Lawrence Hunt, B.A.

1. Define inflection and briefly indicate its extent in modern English. Give, in detail, the inflections of pronouns.

2. What are the advantages of giving different grammatical values to the same word? Illustrate with the words, iron, house, but.

3. Define conjugation. Distinguish the conjugation of English verbs. Conjugate the following: keep, deal, fly, flee, flow, lose, loose, lie, rid, abide, grow, sink, hide.

4. Analyze the following and parse each word :—

> "Passion, I see, is catching; for mine eyes,
> Seeing those beads of sorrow stand in thine,
> Began to water."

6. Criticise the following :—

(*a*) Neither the employer nor his workmen were to blame.
(*b*) He likes you better than me.
(*c*) He likes me better than you.
(*d*) He insisted on the rule's being observed.
(*e*) The soldiers, after ten hours' fighting, laid down to sleep.
(*f*) Whom do men say I am?
(*g*) Next to the governor comes the mayor and council.
(*h*) I intended to have done that last month.

SECOND YEAR.

JULIUS CÆSAR.

Examiner :—S. C. Smoke, B.A.

1. Sketch briefly the political situation in Rome at the time of the events described in this play.

2. "There was a Brutus once that would have brook'd
Th' eternal devil to keep his state in Rome,
As easily as a king."

(*a*) To what Brutus is reference here made?
(*b*) Quote any other reference to him in this play.
(*c*) Give some account of the religious beliefs of the Romans of this time. account for the reference here to "the eternal devil." How long after was it that Christianity was introduced into Rome?

3. "And that same eye, whose bend doth awe the world,
Did lose his lustre."

"Hoping it was but an effect of humor,
Which sometime hath his hour with every man."

Remark upon and explain the use of *his* in these extracts.

4. "Till then, my noble friend, chew upon this."

What is the meaning of *chew* here? What other word of the same root-meaning is now used in this sense?

5. "He hears no music." Of whom is this said and what feature of his character is it intended to describe? Quote any similar passage from another of Shakespeare's plays.

6. Say by whom the following passages were spoken, and explain fully their meaning:—

(*a*) "Those that with haste will make a mighty fire
Begin it with weak straws."

(*b*) "It is the bright day that brings forth the adder."

(*c*) "Cowards die many times before their deaths."

(*d*) "O world? thou wast the forest to this hart,
And this, indeed, O world, the heart of thee."

(*e*) "What villain touched his body, that did stab,
And not for justice?"

(*f*) "You know that I hold Epicurus strong,
And his opinion: now I change my mind,
And partly credit things that do presage—"

7. Quote from this play any five passages of not less than four lines each, and say why you have thought them worthy of being committed to memory.

8. What is a drama?

SECOND YEAR.

Political Economy.

Examiner:—W. A. Douglas, B.A.

1. Name the four classes of the subject.

2. Tell to which class the following facts belong: (1) Strikes; (2) wages; (3) machinery; (4) increase or diminution of value; (5) ships; (6) division of labor.

3. Wealth—state which of the following indicates an increase and which a diminution of wealth in the commodity named: (1) Water became worth $3 per gallon; (2) an ass's head became worth four score pieces of silver; (3) steel rails that formerly cost $200 per ton are now sold at $25; (4) Some lots in Toronto are worth nearly one million dollars per acre.

4. State the circumstances under which water may be classed as wealth.

5. Production:

(1) Give examples of how people try to work at the best time, best place, and in the best manner.

(2) How much law do we require to make people observe these rules?

(3) What law aims to make people work at the best place?

(4) Name three methods adopted to increase production.

(5) Name three advantages of division of labor.

6. Distribution: Of the three following items: rent, interest, wages—

(1) Which increases with population?

(2) Which declines in the course of years?

(3) Which depends on the toil of the recipient?

(4) Which continues independently of the toil of the recipient?

7. Exchange :
   (1) Show how an exchange may enrich both parties
   (2) Show the relation of exchange to the division of labor.
   (3) Name three plans adopted to facilitate exchange.
   (4) Name a law adopted to stop exchange.
   (5) Name some impediments to exchange.

8. Value—give examples of the following :—
   (1) Increased value caused by labor.
   (2) Increased value not caused by labor.
   (3) Increased value coincident with increased poverty.
   (4) Increased value coincident with increased wealth.
   (5) Distinguish value in use and value in exchange.

9. Money :
   (1) Name two of its uses.
   (2) Name one essential condition that money must possess.
   (3) Distinguish between money and bank or government notes.

II.—Papers Set at Midsummer Examinations.

FIRST YEAR.

Agriculture.

Examiner :—Thomas Shaw.

1. Give the modes of preparing soil for wheat best adapted to Ontario conditions.

2. Mention the best time to sow winter wheat, rye, oats, barley and pease in this Province, and the respective amounts of seed required per acre.

3. State the place in the rotation that should ordinarily be occupied by wheat, barley, oats, pease, root crops, rape, meadow, ordinary pasture.

4. State the advantages of growing rape, and when should it be sown ?

5. What beneficial effects followed the introduction of turnip culture into Great Britain ? and what is the probable effect the general introduction of the silo will have upon their cultivation in Canada ?

6. Give the soils best adapted to the growth of the carrot ?

7. Give the leading principles that should govern the pruning of apple orchards.

8. Mention some of the most important essentials to be borne in mind in the construction of a cattle barn.

FIRST YEAR.

Geology.

Examiner :—J. Hoyes Panton, M. A., F. G. S.

1. Draw diagrams illustrating the different kinds of valleys, and state how they have been formed.

2. How do you account for the absence of strata in some parts of the world ? Name the systems represented in Ontario.

3. Give the economic products of the Silurian system, and give brief notes regarding the condition of animal and plant life at that time.

4. Show in what respects the terms saliferous, cretaceous, and carboniferous are misleading as applied to the rock systems in geology.

5. Compare the following minerals: apatite, gypsum, graphite, and chalk; and name the rock systems in which they are found.

6. Give reasons for believing that the interior of the earth is in a highly heated condition, and the most popular view regarding the distribution of the heated material.

7. State the chief characters of the metamorphic rocks, and give their distribution in Ontario, with some of the most valuable economic minerals in them.

8. Compare the coal of Pennsylvania with that of the North-west, as regards its age and the materials from which it was formed.

FIRST YEAR.

Botany.

Examiner:—J. Hoyes Panton, M. A., F. G. S.

1. Name the parts of a flower, and describe them as represented in the Shepherd's Purse and the Dandelion.

2. Classify roots with reference to shape and duration, giving examples of each.

3. Explain the terms cohesion and adhesion as applied to the stamens, and give the terms applied.

4. Give the characters of the order you have attended in the Botanical Instructive Bed, and describe the fifth plant.

5. Give examples of monoecious and dioecious flowers, and state how this affects the perpetuation of the species of such plants.

6. Compare the chief characters of the lily with those of the apple.

7. Give examples illustrating how parts of a plant may become developed into food.

8. Analyze and identify the plant before you.

9. What is meant by tissue in plants, and what are the different kinds? Draw figures illustrating each.

FIRST YEAR.

Veterinary Materia Medica.

Examiner:—F. C. Grenside, V. S.

1. Explain the theory of the allopathic mode of cure.

2. Name the circumstances which modify the actions of medicines.

3. Define the following terms: antiseptic, emollient, cathartic, and diuretic.

4. Define the meaning of the term alkoloid, and name the active principles of belladona and aconite.

5. Give actions and dose of aloes for the horse.

6. Give two prescriptions of purgative drenches for the ox.

7. State how linseed oil is obtained, the dose for horse and ox, and its uses.

8. Explain how arsenic is supposed to establish its action as an alterative. Name some diseases in which it is particularly beneficial.

9. Give the source and properties of Iodine.

10. Give the names of any of the drugs that we have studied that act as stomachics.

FIRST YEAR.

English Literature—Selections from Wordsworth.

Examiner :—E. Lawrence Hunt, B. A.

1. State, either in your own words or in the poet's, what you consider four of the most desirable and essential traits of character in the ideal "Happy Warrior."

2. In the poem of "The Fountain," shew clearly why the same scene produced such different feelings in the two friends.

3. (*a*) Give in your own words the outline of the thoughts in the "Ode to Duty."
   (*b*) Quote what you consider the choicest stanza.

4. (*a*) Quote from "Peele Castle" the lines referring to the poet's imagination. Quote any lines which illustrate this power, and show how they do so. What is the chief distinguishing feature of true poetry?
   (*b*) Describe, after Wordsworth, the picture of Peele Castle, by George Beaumont; and, in contrast, the representation which Wordsworth would have made.
   (*c*) "Not for a moment could I now behold
   "A smilling sea, and be what I have been." Why? Explain the illusion.

5. (*a*) "'Tis her privilege,
   "Through all the years of this our life, to lead
   "From joy to joy:" Explain.
   (*b*) How did Wordsworth look on nature in boyhood? in youth? and in manhood?

6. Explain the following :—
   (*a*) "We are laid asleep in body, and become a living soul."
   (*b*) "We see into the life of things."
   (*c*) "I have owed to them
   "In hours of weariness, sensations sweet."
   (*d*) "When thy mind
   "Shall be a mansion for all lovely forms,
   "Thy memory be as a dwelling-place
   "For all sweet sounds and harmonies."
   Write a note on the person addressed in (*d*).
   (*e*) "On whose head must fall,
   "Like showers of manna, if they come at all." (H. W.)

FIRST YEAR.

English Composition.

Examiner :—James Mills, M. A.

1. State the principal differences between prose and poetry.

2. (*a*) "Art is long, and time is fleeting,
   "And our hearts though tough and brave,
   "Still, like muffled drums, are beating
   "Funeral marches to the grave."
   (*b*) "The power of music all our hearts allow,
   "And what Timotheus was is Dryden now."

Change (*a*) into prose, and transpose (*b*) by removing the measure and the poetic arangement.

3. Quote the rules for the use of the *Colon* and the *Semicolon*.

4. Punctuate the following passages, giving the rule for each mark inserted:—

(1) Greece fell but how did she fall did she fall like Babylon did she fall like Lucifer never to rise again.

(2) It will I am sure it will more and more as time goes on be found for his good.

(3) Charity on whatever side we contemplate it is one of the highest Christian graces.

5. Write a short composition on "Farming as an Occupation," paying special attention to spelling, capital letters, and punctuation.

FIRST YEAR.

Mensuration.

Examiner:—E. Lawrence Hunt, B.A.

1. A barn is 110 yards long and 66 wide. With the same amount of wall, how much more floor would there be, if the barn were square? if it were round?

2. The fall, etc., being the same, how many 2-inch tile are required to discharge as much water as one 6-inch tile in the same time?

3. A silo is 30 by 18 feet and 18 feet high. If there are 45 pounds in a cubic foot of silage, find the number of tons in the silo, when the silage is 15 feet deep.

4. The water from the roof of a barn 80 feet square is drained into a tank in the form of a frustrum of a cone, the diameters of the ends 9.6 feet and 13.8 feet and the height 7.2 feet.

(*a*) Find the depth of rainfall required to fill the tank.

(*b*) Find the amount of zinc required to line the tank.

5. A log 40 feet long and of uniform thickness, has a circumference of 16 and a half feet. Find the largest prism, having its ends equilateral triangles, that can be cut from the log.

SECOND YEAR.

Agrictlture and Arboriculture.

Examiner:—Thomas Shaw.

1. Give the style of finished hog adapted to the markets of the present, and mention the modification that has taken place in this respect during recent years.

2. Give the care and food best adapted to breeding sows during the period of gestation.

3. Describe the process of curing pork for farm use.

4. Mention various rations suitable to be fed to pigs during the period immediately following weaning.

5. What do you understand by the term "early maturity?" Why should it be sought? How may it be attained?

6. Describe the feeding and management during the first year best adapted to calves intended ultimately for shipping for beef purposes, when the whole milk is wanted for dairy uses.

7. What remedy would you use for young foals affected with constipation?

8. Give the food and management adapted to spring foals the first winter.

9. Mention the varieties of trees best adapted to Ontario conditions to plant as wind-breaks, and give the reasons.

10. In planting trees in arable land for purposes of ornament, how would you proceed? for purposes of shade? which varieties would you choose?

SECOND YEAR.

PRACTICAL EXAMINATION.—JUDGING SHEEP.

Examiner:—Thomas Shaw.

1. Point out what you consider the defects of conformation in the Oxford Down ewe No. 375.

2. Mention the good points of conformation in the Shropshire Down lamb of ewe No. 143, and in what particular or particulars does the lamb excel its dam? What do you consider its chief deficiency?

3. Which of the three ewes, having regard to individuality only; the Shropshire Down No. 143, the Oxford Down No. 375, and the Dorset No. do you consider most suitable for producing mutton-lambs with the least expenditure of feed, and state the reasons?

SECOND YEAR.

DAIRYING.

Examiner:—James W. Robertson.

1. What are the advantages of underdrainage?

2. Describe the way to grow and treat a corn crop in order to secure the largest feeding value per acre in the form of silage.

3. Name, in the order of their merit, the points of a dairy cow, indicating large milking power.

4. State the composition of milk and describe how it is elaborated.

5. Give a scale of points for use in judging butter.

6. Describe a centrifugal cream separator.

7. Briefly describe the process of Cheddar cheese-making.

8. Describe the necessary buildings and equipment for a cheese factory of 500 cow capacity.

SECOND YEAR.

PRACTICAL HORTICULTURE.

Examiner:—J. Hoyes Panton, M.A., F.G.S.

1. State how you would proceed to prune a tree.

2. Describe some different forms and methods of bedding plants.

3. Arrange the following plants in a circular bed: Alleranthera, Alyssum, Canna, Ricinus, Ageratum, Geranium, Dahlia.

4. A vegetable garden contains three acres. Arrange it as you think best for practical purposes, and give a diagram illustrating your arrangement.

5. Name trees or shrubs best suited for hedges, and state under what circumstances you would use one in preference to another.

6. Give ten shrubs that are well suited for ornamental purposes, mentioning size and time when they are in bloom.

7. Name some plants well adapted for hanging baskets.

8. Identify the specimens before you.

SECOND YEAR.

Systematic and Economic Botany.

Examiner :—J. Hoyes Panton, M.A., F.G.S.

1. Upon what characters does classification largely depend? Illustrate by referring to the Rose, Lobelia, Indian turnip, and the beet.

2. Describe the cell and its contents, and name some of the modifications which it undergoes as growth proceeds.

3. Give the life history of the so-called smut, and the remedies recommended to destroy it.

4. Name orders of plants of economic value in supplying dyes, oils, sugar and cloth.

5. What are the chief characters of the orders :—Leguminosæ, Araceæ and Graminæ?

6. Compare a seed with a spore, and distinguish between saprophyte and parasite as applied to plants—give examples.

7. Name fifteen weeds and give the orders to which they belong and how you would identify at least five of them.

8. Identify the specimen before you.

SECOND YEAR.

Veterinary Obstetrics.

Examiner :—F. C. Grenside, V. S.

1. Describe the ovaries and Fallopian tubes.

2. Explain the sources, properties, and functions of the liquor Amnii.

3. Explain the constitution of the umbilical cord.

4. Give the causes of difficult parturition, and state its relative frequency in the mare and the cow. Explain why it is more difficult to afford relief in the mare.

5. Give the average periods of gestation in the mare, cow, ewe, sow, and bitch.

6. Explain the proper mode of removing the foreleg at the shoulder of the foetus in Utero. Give the cases in which this operation would be an advantage.

7. Explain how to afford relief in the following cases of mal-position : Fore legs presented, and head deviated towards the sternum ; knees presented ; hocks presented.

8. Describe the symptoms of the sequels of retained after-birth.

9. Give the treatment of inverted womb.

10. Give the symptoms of paturient apoplexy.

SECOND YEAR.

L'Allegro & Il Penseroso

Examiner :—S. C. Smoke, B. A.

1. Compare the poems L'Allegro and Il Penseroso, (1) as to subject, (2) as to method of treatment, and (3) as to the effect produced on yourself.

2. Explain the force of the following italicised epithets : *Low-browed* rocks, *heart easing* mirth, *ivy-crowned* Bacchus, *frolic* wind, *eating* cares, *immortal* verse, *half-regained* Eurydice, *twilight* groves, *monumental* oak.

3. Quote the passages beginning respectively with the following lines :
"Straight mine eye hath caught new pleasures,"
"Oft on a plot of rising ground,"
"There in close covert by some brook."

4.
"Hard by, a cottage chimney smokes,
"From betwixt two aged oaks ;
"Where Corydon and Thyrsis met,
"Are at their savou y dinner set
"Of herbs, and other country messes,
"Which the neat-handed Phillis dressess."

"Thee, chantress, oft, the woods among,
"I woo to hear thy even-song ;
"And, missing thee, I walk unseen
"On the dry smooth-shaven green,
"To behold the wandering moon,
"Riding near her highest noon,
"Like one that had been led astray,
"Through the Heaven's wide pathless way ;
"And oft, as if her head she bowed,
"Stooping through a fleecy cloud."

(*a*) Which of these two extracts impresses you as being the more truly poetic.
(*b*) What test do you apply to reach your conclusion ?
(*c*) What is the primary meaning of the word *poet* ?
(*d*) Show how the recollection of this meaning assists in the proper criticism of a poem.

SECOND YEAR.

Road-Making, Levelling and Surveying.

Examiner :—E. Lawrence Hunt, B. A.

1. Write an essay on the advantages of good country roads.

2. State concisely what you consider the four most important general principles to be kept in view in making or improving country roads.

3. Classify roads as to the road coverings, and give detailed directions for the construction of any one.

4. What are the objections to putting large stones on a road ?

5. Describe the process of making the road which is now being made in the Experimental Farm lane.

6. With a scale of 1 inch to the chain, draw a sketch of the field whose measurements are given in the following field book :

Left Offsets.	Chain-Line.	Right Offsets.
	500 to 0_3	
	375	280
	225	160
	125	50
	From 0_2 turn to the left	
	1125 to 0_2	
To 0_3 400	825	
	450	
	From 0_1	600

7. Explain the process of taking levels to determine whether there be sufficient fall to drain a certain field.

8. With a scale of 1 inch to the 100 ft. for length, and of 1 in. for 2 ft. for height, determine the height of A above B and the grade between the first two stations. Record your measurements in the field book. (A sketch of an undulating line accompanied this question.)

1. Papers Set at the Matriculation Examinations, October, 1889.

Arithmetic.

Examiner :—E. L. Hunt, B. A.

1. A farmer feeds 2 tons, 13 cwt., 65 lbs. of hay to each of 7 horses. Find the cost at $11 a ton.

2. Simplify $\frac{3}{4} + \frac{5}{12} \times \frac{2}{3} - \frac{7}{9}$ of $\frac{4}{21}$.

3. Multiply 4.025 by .0036, and divide the product by 1.8.

4. Estimate the profits from a 10-acre crop of wheat, supplying the detail of cost and returns.

5. A can do a piece of work in 15 days. After he is working at it for 2 days, B joins him. A and B work together for 3 days, and are then joined by C. The three together finish the work in 5 days. If B and C do an equal amount of the work, find how long it would take each by himself to do the whole work.

Composition.

Examiner :—C. C. James, M. A.

I. Point out any errors in the following sentences, re-writing the sentence correctly :

(1) Whom do men say that I am ?
(2) Neither you nor he are going to occupy that room.
(3) As neither of them is here, let us start.
(4) Every one will answer their own questions.
(5) There is not as many in this room as there might be.

II. Write a short essay on one of the following subjects :

(1) The Importance of the Study of Forestry.
(2) Any trip taken by yourself.
(3) Perseverance.

English Grammar.

Examiner :—C. C. James, M. A.

I. State and illustrate the various methods of forming the plural of English nouns, giving examples.

II. Compare the adjectives pleasant, gentle, nigh, ill, happy, first, old, beautiful, little, golden.

III. Distinguish between possessive, relative, and interrogative pronouns, giving examples.

IV. What is meant by mood and voice.

V. Analyze the following sentence:

In *every* country, then, and at every period, the investigation of the *principles* on which the *rational practice* of agriculture is founded, *ought* to have commanded the *principal* attention of the greatest minds.

VI. Parse the words in italics.

VII. Distinguish principal and principle; practice and practise.

VIII. Express the ideas contained in V. in other words.

Geography.

Examiner:—J. Hoyes Panton, M.A., F.G.S.

1. Define latitude, isthmus, strait, bay, and give examples.
2. Where and what are: Anticosti, Sicily, Vesuvius, Panama, Siam, Lisbon?
3. Name the largest rivers in Europe and America.
4. Name the capitals of the British Isles and of the provinces of Canada.
5. Describe the physical features of the North-West.
6. Draw an outline map of North America, indicating the position of Chicago, Washington, and Winnipeg.

Reading and Dictation.

Examiner:—J. Hoyes Panton, M.A., F.G.S.

APPENDIX 5.

CLASS LISTS:

I.—EASTER EXAMINATIONS, 1889.

II.—MIDSUMMER EXAMINATIONS, 1889.

I.—EASTER EXAMINATIONS, 1889.

FIRST YEAR.

Classes.	Agriculture.	Inorganic Chemistry.	Organic Chemistry.	Zoology.
HONOURS. I.	1 Hutt, H. L. 2 Sleightholm, J. A. B. 3 Harcourt, J. 4 Cowan, R. E. 5 Dolsen, W. J. 6 Rowen, E. 7 Hadwen, G. 8 Wilkinson, J. J. 9 Buchanan, D. / Mulholland, F. 11 Watson, G. C. 12 White, J. / Thompson, J. P.	1 Holliday. 2 Bayne. 3 Harcourt, J. 4 Hutt. 5 Sleightholm. 6 Dolsen. 7 Buchanan.	1 Harcourt, J. 2 Hutt. 3 Sleightholm. 4 Whitley. 5 Bayne. 6 Buchanan. 7 Holliday.	1 Bayne. 2 Sleightholm. 3 Hutt. / Harcourt, J. 5 Hadwen.
HONOURS. II.	1 Cowan, J. H. 2 Webster, F. E. / Urquhart, W. H. A. 4 Elliott, R. 5 Noxon, H. S. 6 Hewgill, E. A. 7 Bate, E. H. 8 Holliday, W. B. / Bayne, P. R. C. 10 Brown, H. H. 11 Whitley, C. F. / McCrae, H. E. / Field, H. 14 Rorke, J. R. / Cathcart, W.	1 Whitley. 2 Hadwen.	1 Dolsen. 2 Hadwen. 3 Mulholland. 4 Hewgill. 5 Cowan, R. E. 6 Bate. 7 Mattice.	1 Dolsen. 2 Cowan, R. E. 3 Mattice. 4 Whitley. 5 Holliday. 6 Buchanan. / Thompson, J. P. 8 Bate. 9 Cowan, J. W. 10 Field.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	INORGANIC CHEMISTRY.	ORGANIC CHEMISTRY.	ZOOLOGY.
PASS. III.	1 Mattice, W. A. Campbell, C. S. 3 Shaw, P. G. 4 Seymour, F. B. 5 Farlinger, F. E. 6 Wells, E. 7 Fairbairn, O. G. Smith, D. 9 McDonald, H. 10 Thomson, H. C. 11 Grant, R. S. 12 Woolverton, E. L. 13 Stagg, J. C. 14 Dunne, H. R. 15 Macfarlane, T. W. R. Bertram, H. Benyon, E. A. G. Wilson, F. G.	1 Webster. 2 Shaw. 3 Hewgill. 4 Mulholland. 5 Cowan, J. H. 6 Thompson, J. P. White. 8 Mattice. 9 Rorke. 10 Noxon. 11 Cowan, R. E. 12 Urquhart. 13 Field. Brown. McDonald. 16 Bate. Rowen. Watson. McCrae. Elliott. Wilkinson. Stagg. Dunne Thomson, H. C. Macfarlane. Grant. Fairbairn. Wells. Cathcart. Campbell. Smith. Woolverton. Benyon. Bertram. Farlinger. Seymour. Wilson.	1 Brown. 2 Webster. 3 Cowan, J. H. 4 Urquahart. 5 Rowen. 6 Shaw. 7 Thompson, J. P. 8 Field. 9 Elliott. 10 White. 11 Macfarlane. 12 Noxon. 13 Rorke, 14 McCrae. 15 Stagg. 16 Fairbairn. McDonald. Grant. Wilkinson. Wilson. Watson. Campbell. Wells. Thomson, H. C. Dunne. Smith. Farlinger. Woolverton. Bertram. Benyon. Seymour.	1 Mulholland. 2 Noxon. Rorke. 4 Shaw. 5 Fairbairn. 6 Rowen. 7 Dunne. 8 Brown. 9 Campbell. 10 McDonald. 11 Seymour. 12 Hewgill. 13 Wilson. 14 White. Elliott. 16 Wilkinson. 17 Cathcart. 18 Watson. 19 Webster. 20 Urquhart. 21 Wells. 22 Stagg. 23 McCrae. Thomson, H. C. Macfarlane. Grant. Smith. Woolverton. Benyon. Bertram. Farlinger. ....

Names unnumbered are those of students who failed to pass in the subject.

The minimum for first-class honours is 75 per cent.; for second-class honours, 60 per cent.; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATONS)—*Continued.*

FIRST YEAR.

CLASS.	VETERINARY ANATOMY.	GRAMMAR.	ENGLISH LITERATURE.	COMPOSITION.
HONOURS. I.	1 Harcourt, J. 2 Buchanan. 3 Bayne. 4 Hutt.	1 Whitley. 2 Harcourt, J. 3 Buchanan.	1 Hutt. 2 Holliday. 3 Whitley. 4 Bayne.	1 Whitley. 2 Cowan, R. E. 3 Hutt. 4 Bayne.
HONOURS. II.	1 Urquhart. 2 Whitley. 3 Dolsen. 4 Rowen. 5 Cowen, R. E. 6 Hadwen. 7 Sleightholm, Rorke, Bate.	1 Brown. 2 Hutt. 3 Holliday. 4 Sleightholm. 5 Cowan, R. E. 6 White. 7 Dolsen. 8 Noxon, Thompson, J. P. 10 Webster. 11 Bayne. 12 Fairbairn.	1 Sleightholm. 2 Hadwen. 3 Field. 4 Harcourt, J. 5 Rorke. 6 Cowan, R. E. 7 Rowen.	1 Dolsen. 2 Holliday, Harcourt, J. 4 Sleightholm. 5 Brown, Rowen. 7 Buchanan. 8 Rorke. 9 Wells. 10 Cowan, J. H. ....
PASS. III.	1 McDonald. 2 Mulholland, Thompson, J. P. 4 Fairbairn. 5 Wilkinson. 6 Macfarlane, Elliott. 8 Hewgill, Mattice. 10 Noxon, Dunne. 12 White. 13 Brown. 14 Cathcart. 15 Watson. 16 Cowan, J. H. 17 Campbell, Field. 19 Webster. 20 Wells. 21 Holliday, Shaw. 23 Thomson, H. C., Stagg. McCrae. Grant. Smith. Seymour. Woolverton. Bertram. Benyon. Farlinger. Wilson (Ill.)	1 Rorke. 2 Rowen. 3 Stagg. 4 Wells. 5 Mulholland. 6 Shaw. 7 Elliott. 8 Hadwen. 9 Field. 10 Thomson, H. C. 11 McCrae. 12 Cowan. 13 Wilkinson. 14 McDonald, Hewgill. 16 Woolverton. 17 Campbell. 18 Bate, Dunne, Grant, Watson. Mattice. Cathcart. Urquhart. Wilson. Farlinger. Bertram. Macfarlane. Smith. Benyon. Seymour.	1 Buchanan. 2 Shaw. 3 Mulholland, Noxon. 5 Thompson, J. P. 6 Dolsen. 7 Mattice. 8 White. 9 Brown. 10 Bate. 11 Fairbairn, Seymour. 13 McDonald. 14 Wilkinson. 15 Webster, Urquhart. 17 Cowan. J. H. 18 Thomson, H. C. 19 Hewgill, Cathcart. 21 Elliott. 22 Stagg. 23 Macfarlane. 24 Bampbell. 25 Wells. Dunne. Grant. Benyon. Watson. Wilson. McCrae. Woolverton. Smith. Bertram. Farlinger.	1 Webster, Field. 3 Thompson 4 Fairbairn. 5 Stagg. 6 Thomson, H. C. 7 Hadwen. 8 Wilkinson. 9 Mulholland. 10 Bate. 11 White. 12 Hewgill. 13 Shaw. 14 Noxon. 15 McCrae. 16 Watson. 17 McDonald, Urquhart. 19 Seymour. 20 Mattice. 21 Campbell. 22 Elliott. 23 Grant. Smith. Cathcart. Dunne. Macfarlane. Farlinger. Woolverton. Bertram. Benyon. Wilson (Ill.) ....

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CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

		ARITHMETIC.	BOOK-KEEPING.	GENERAL PROFICIENCY.
HONORS.	I	1 Cowan, R. E. 2 Hutt 3 Harcourt, J. 4 Dolsen 5 Noxon 6 Buchanan, Thompson, J. P.	1 Thompson, J. P. 2 Whitley 3 Dolsen 4 Harcourt, J. 5 Cowan, R. E. 6 Hadwen 7 Hutt	1 Harcourt, J. 2 Hutt 3 Sleightholm, Whitley ....
	II	1 Sleightholm 2 Brown 3 Cowan, J. H. 4 Dunne 5 Rowen 6 Whitley, Wilkinson	1 Buchanan 2 Sleightholm 3 Cowan, J. H. 4 Elliott 5 Webster	1 Dolsen 2 Buchanan 3 Bayne 4 Cowan, R. E. 5 Hadwen 6 Holliday 7 Thompson, J. P.
PASS.	III.	1 Mulholland 2 Bayne 3 Rorke 4 Hadwen 5 Webster 6 Field 7 White 8 Hewgill 9 Bate 10 Thomson, H. C. 11 Grant, Elliott 13 Watson 14 Stagg 15 Macfarlane 16 Holliday 17 Cathcart 18 Urquhart 19 McCrea 20 Wells, Campbell, McDonald 23 Farlinger, Fairbairn, Shaw, Mattice, Seymour Woolverton Smith Benyon Bertram Wilson	1 Hewgill 2 Watson 3 Rorke, Stagg 5 Bayne, Brown 7 Noxon 8 Campbell, Mulholland, Mattice 11 Rowen, McDonald, Field 14 Wilkinson 15 Holliday 16 Wells 17 Bate 18 Fairbairn 19 White 20 Shaw 21 Dunne 22 McCrea 23 Cathcart, Grant Wilson, (Ill.) Seymour Smith McFarlane Farlinger Urquhart Thomson, H. C. Woolverton Bertram Benyon	1 Rowen 2 Mulholland 3 Brown 4 Cowan, J. H. 5 Rorke 6 Noxon 7 Webster 8 Field 9 White 10 Hewgill 11 Bate 12 Shaw 13 McDonald .....

☞ Names unnumbered are those of students who failed to pass in the subject.

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CLASS LISTS (EASTER EXAMINATIONS).—*Continued.*

SECOND YEAR.

CLASS.		AGRICULTURE.	LIVE STOCK.	AGRICULTURAL CHEMISTRY.	METEOROLOGY.
HONOURS.	I.	1 Brodie, G. A. 2 Linfield, F. B. 3 Montieth, S. N. 4 Rendall, W. 5 McLaren, P. S.	1 Brodie. 2 McLaren. 3 { Monteith. { Linfield. 5 Tinney. 6 Rendall.	1 Linfield. 2 Brodie.	1 Brodie. 2 Tinney. 3 Linfield. ....
	II.	1 Tinney, T. H. 2 McCallum, W. 3 Asbury, E. 4 { Marsack, F. A. { Derbyshire, J. A. 6 Makinson, T. C.	1 Monk. 2 Asbury. 3 Derbyshire. 4 Gelling. 5 McCallum. 6 McEvoy.	1 Tinney. 2 Rendall.	1 Rendall. 2 Monteith. ....
PASS.	III.	1 Monk, N. 2 McEvoy, T. A. 3 Gelling, J. A. 4 Marsack, H. 5 McKergow, J. G.	1 Marsack, F. 2 McKergow. 3 Marsack, H. 4 Makinson.	1 Monteith. 2 McEvoy. 3 Galling. 4 McCallum. 5 Marsack, H. 6 McLaren. 7 Derbyshire. 8 Makinson. 9 Marsack, F. 10 McKergow. Asbury. Monk.	1 McCallum. 2 Marsack, F. 3 McKergow. 4 McLaren. 5 Makinson. 6 McEvoy. 7 Gelling. 8 Monk. 9 Derbyshire. 10 Asbury. 11 Marsack, H. ....

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CLASS LISTS (EASTER EXAMINATIONS).—*Continued.*

SECOND YEAR.

CLASS.		ENTOMOLOGY.	VETERINARY PATHOLOGY.	PRACTICAL HORSE.	GRAMMAR.
HONOURS.	I.	1 Brodie.	1 Tinney. 2 Brodie. 3 Linfield.	1 Brodie. 2 Tinney. 3 Rendall. 4 Linfield.	1 Tinney.
	II.	1 Linfield. 2 Tinney.	1 Marsack, H.	1 McLaren. 2 Marsack, F.	1 Linfield. 2 Brodie. 3 McCallum.
PASS.	III.	1 Rendall. 2 Marsack, F. 3 Gelling. 4 Monteith. 5 McEvoy. 6 McLaren. Makinson. 8 McKergow. 9 Monk. McCallum. Derbyshire. Marsack, H. Asbury.	1 Rendall. 2 McCallum. 3 Marsack, F. 4 McEvoy. Monk. 6 Gelling. 7 McLaren. 8 Makinson. 9 McKergow. Monteith. 11 Derbyshire. Asbury.	1 Makinson. McEvoy. 3 Monteith. McCallum. 5 Gelling. Monk. 7 Derbyshire. 8 McKergow. 9 Asbury. 10 Marsack, H.	1 Gelling. 2 Monteith. 3 Marsack. 4 Derbyshire. 5 McEvoy. 6 McLaren. 7 Rendall. McKergow. 9 Monk. 10 Marsack, H. Asbury. Makinson.

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CLASS LISTS (EASTER EXAMINATIONS).—*Continued.*

SECOND YEAR.

CLASS.		LITERATURE.	POLITICAL ECONOMY.	GENERAL PROFICIENCY.
HONOURS.	I.	1 Linfield. 2 Tinney.	1 Rendall. 2 McEvoy. 3 Linfield. 4 Tinney. 5 Monteith. 6. Brodie.	1 Brodie. 2 Linfield. 3 Tinney.
	II.	1 Brodie. 2 Rendall. 3 Monteith. 4 Marsack, H. 5 Derbyshire.	1 McLaren. 2. Gelling.	1 Rendall. 2 Monteith.
PASS.	III.	1 McEvoy. 2 McLaren. 3 Gelling. 4 Monk. 5 McCallum. 6 Makinson. 7 McKergow. 8 Asbury. 9 Marsack.	1 Asbury. 2 McCallum. 3 Marsack, F. 4 Derbyshire. 5 Monk. 6 Marsack, H. 7 {Mackinson, McKergow.	1 McLaren. 2 McEvoy. 3 McCallum. 4 Gelling. 5 Marsack, F. 6 Derbyshire. 7 McKergow.

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CLASS LISTS.

II. MIDSUMMER EXAMINATION, 1889.

FIRST YEAR.

CLASS		AGRICULTURE.	GEOLOGY.	BOTANY.	MATERIA MEDICA.
HONORS.	I.	1 Hutt, H. L. 2 Sleightholm, J. A. B. 3 Harcourt, J. 4 Cowan, R. E. 5 Dolsen, N. G. Mulholland, F. 7 Bate, E. H. 8 Buchanan, D. Cowan, J. H. 10 Mattice, W. A. Rowen, E. Whitley, C. F. 13 Hadwen, G. 14 Thompson, J. P. Hewgill, E. A.	1 Hutt. 2 Harcourt. 3 Bayne.	1 Harcourt, J. 2 Hutt. 3 Sleightholm.	1 Hutt. 2 Cowan, R. E. 3 Harcourt, J. 4 Dolsen.
	II.	1 Webster, F. E. Brown, H. H. 3 Noxon, H. S. 4 Campbell, C. S.	1 Whitley. 2 Sleightholm. 3 Dolsen. Holliday. 5 Cowan, R. E. 6 Hadwin. 7 Mattice. Bate. 9 Brown. 10 Mulholland. 11 Fairbairn. 12 Thompson, J. P.	1 Hawden. 2 Whitley. 3 Buchanan. 4 Holliday. 5 Bayne. 6 Mulholland. 7 Newcomen.	1 Buchanan. 2 Bate. 3 Cowan, J. H. 4 Mulholland. 5 Brown. Hewgill. 7 Hawden. 8 Mattice. 9 Macfarlane. 10 Newcomen. 11 Whitley.
PASS.	III.	1 Holliday, W. B. 2 Elliott, R. Bayne, P. R. C. 4 Stagg, J. C. 5 Field, H. 6 Shaw, P. G. 7 Thomson, H. C. Wells, E. 9 McCrae, H. E. 10 Wilson, F. 11 Fairbairn, O. 12 McFarlane, T. W. R. Farlinger, F. E. 14 McDonald, H. 15 Wood, W. D. 16 Smith, D. 17 Seymour, F. B. 18 Newcomen, W. F. Young, T. L. Dunne, H. R. Alloway, L.	1 Buchanan. 2 Campbell. 3 Webster. Noxon. 5 Cowan, J. H. 6 Field. 7 Rowen. 8 Wilson. 9 Macfarlane. 10 McDonald. 11 Hewgill. 12 Newcomen. 13 Thomson, H. C. 14 Dunne. 15 Elliott. 16 Wood. 17 Shaw. 18 Stagg. 19 Alloway. 20 Wells. 21 McCrea.	1 Cowan, R. E. 2 Hewgill. 3 Brown. 4 Field. 5 Dolsen. 6 Shaw. Webster. 8 Elliott. 9 Bate. 10 Thompson, J. P. 11 Rowen. 12 Fairbairn, Mattice. 14 Noxon. 15 Wood. 16 Cowan, J. H. 17 Macfarlane. 18 Wilson. Campbell. 20 Stagg. 21 Wells. 22 Dunne. McCrea. Smith. Thomson, H. C. McDonald. Alloway. Young. Farlinger. Seymour.	1 Bayne. 2 Noxon. Sleightholm. 4 Rowen. Campbell. 6 Holliday. 7 Thomsen, H. C. 8 Wood. 9 McDonald. 10 Stagg. 11 Wilson. 12 Thompson, J. P. 13 Webster. Field. 15 McCrea. 16 Shaw, Elliott. Wells. Alloway. Seymour. Fairbairn. Smith. Young. Farlinger. Dunne.

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CLASS LISTS (MIDSUMMER EXAMINATIONS.)—*Continued.*

FIRST YEAR.

Class.	English Literature.	Composition.	Mensuration.	Dairying.	General Proficiency.
HONOURS. I.	1 Whitley.		1 Dolsen. 2 Whitley. 3 Thompson, J. P. 4 {Bayne. Sleightholm.	1 Sleightholm. 2 Harcourt, J. 3 {Hewgill. Mulholland. {Hutt. Whitley. 7 Cowan, R. E. {Dolsen. Thompson, JP 10 Webster. 13 {Cowan, J. H Wells. Elliott.	1 Harcourt, J. 2 Hutt. 3 Whitley.
HONOURS. II.	1 Hutt. 2 {Dolsen. Harcourt. 4 Sleightholm.	1 Whitley. 2 Newcomen. 3 Harcourt, J. 4 Holliday. 5 Hutt. 6 Sleightholm. 7 Cowan, R. E, 8 Field.	1 Brown. 2 {Harcourt, J Cowan, R. E 4 {McDonald. Webster. 6 Newcomen. 7 Cowan, J. H. 8 Wells. 9 Noxon. 10 {Mulholland. Hutt.	1 Mattice. 2 Bate. 3 Hawden. 4 McCrea. 5 Rowen. 6 Campbell. 7 Seymour. 8 Thomson, H.C. 9 Holliday. 10 {Bayne. Noxon. 12 Brown.	1 Sleightholm. 2 Cowan, R. E. 3 Mulholland. 4 Buchanan. 5 Bayne. 6 Holliday.
PASS. III.	1 Thompson, J. P. 2 Buchanan. 3 Newcomen. 4 Elliott. 5 {Holliday. Cowan, R. E. 7 Hewgill. 8 Rowen. 9 Bate. 10 Bayne. 11 Webster, 12 Mulholland. 13 Campbell. 14 Field. 15 Noxon. 16 Fairbairn. 17 Brown. 18 {Wells. Alloway. McCrea. 21 {Shaw. Cowan, J. H. Thompson, H.C McDonald. Wilson. Hadwen. Stagg. Macfarlane. Wood. Dunne. Farlinger. Smith. Young. Mattice. Seymour.	1 {Bayne. Brown. Wells. 4 Buchanan. 5 Hawden. 6 {Bate. Fairbairn. 8 Mulholland. 9 Cowan, J. H. 10 Noxon. 11 Thomson, J.P 12 Shaw 13 Stagg. 14 Thomson, H.C 15 {Alloway. Campbell. Elliott. 18 {McDonald. Webster. 20 Hewgill. 21 Dolsen. 22 Macfarlane. 23 {McCrea. Rowen. 25 {Dunne. Wilson. Wood. Young. Smith. Farlinger. Mattice. Seymour.	1 Thomson, H.C 2 Holliday. 3. Field. 4 {McCrea. Hawden. Rowen. 7 Hewgill. 8 Campbell. 9 Buchanan. 10 Wood. 11 Stagg. 12 Shaw. 13 Bate. 14 Elliott. 15 Fairbairn. 16 Dunne. 17 {Wilson. Macfarlane. Alloway. Young. Smith. Mattice. Seymour. Farlinger.	1 Field. 2 Wood. 3 {Buchanan. Wilson. 5 Macfarlane. 6 Shaw. 7 Fairbairn. 8 Stagg. 9 Farlinger. 10 Newcomen. 11 Smith. 12 Dunne. 13 {McDonald. Alloway. Young.	1 Bate. 2 Thomson, P.C. 3 Hewgill. 4 Brown. 5 Cowan, J. H. 6 Dolsen. 7 Rowen. 8 Webster. 9 Noxon. 10 Newcomen. 11 Field. 12 Campbell. 13 Elliott. 14 Shaw. 15 Wells.

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CLASS LISTS.

MIDSUMMER EXAMINATIONS.—1889.

SECOND YEAR.

CLASS.	AGRICULTURE AND ARBORICULTURE.	PRACTICAL JUDGING OF SHEEP.	DAIRYING.	ANALYTICAL CHEMISTRY.	HORTICULTURE. (Written Exam.)
HONORS. I.	1 Brodie, G. A. 2 Linfield, F. B. 3 Rendall, W. 4 Tinney, F. H. 5 { McLaren, P. S. { McCallum, W.	1 Brodie. 2 Linfield. 3 { Monteith, { Tinney. 5 Rendall. 6 McLaren.	1 Linfield. 2 Brodie. 3 { Monteith. { Tinney.	1 Linfield. 2 Tinney. 3 Brodie. 4 Rendall.	1 Brodie. 2 Linfield.
HONORS. II.	1 Monteith. 2 Asbury.	1 McCallum. 2 McEvoy. 3 Makinson. 4 Asbury. 5 { Gelling. { McKergow. 7 Monk.	1 Rendall. 2 Derbyshire.	1 McKergow.	1 Tinney. 2 Rendall. 3 McCallum. 4 Monteith.
PASS. III.	1 Derbyshire. 2 McKergow. 3 Gelling. 4 Monk. 5 McEvoy. 6 Makinson.	1 Derbyshire.	1 McLaren. 2 Gelling. 3 McCallum. 4 McKergow. 5 Asbury. 6 Makinson. 7 McEvoy. 8 Monk.	1 McLaren. 2 Derbyshire. 3 McCallum. 4 Monteith. 5 Asbury. 6 McEvoy. 7 Makinson. 8 Gelling. 9 Monk.	1 Gelling. 2 McLaren. 3 McEvoy. 4 Makinson. 5 McKergow. 6 Derbyshire. 7 Asbury. 8 Monk.

CLASS LISTS (MIDSUMMER EXAMINATIONS.—*Continued.*

SECOND YEAR.

CLASS.		SYSTEMATIC AND ECONOMIC BOTANY.	VETERINARY PATHOLOGY AND OBSTETRICS,	ENGLISH LITERATURE.	ROAD-MAKING, LEVELLING AND SURVEYING.	PRACTICAL PLOUGHING.
HONORS.	I.	1 Brodie. 2 Linfield. 3 Tinney.	1 Brodie. 2 Tinney.	1 Brodie 2 Linfield.	1 Brodie. 2 Rendall.	1 Rendall. 2 McLaren. 3 Brodie. 4 Linfield. 5 Tinney. 6 Monteith. 7 McCallum.
	II.	1 Rendall.	1 Linfield. 2 Rendall.	1 Tinney.	1 Linfield. 2 McCallum. 3 Tinney.	1 Asbury. 2 Gelling.
PASS.	III.	1 McLaren. 2 Monteith. 3 Makinson. 4 McKergow. 5 Gelling. 6 Derbyshire. 7 McEvoy. 8 McCallum. 9 Monk. 10 Ashbury.	1 Makinson. 2 McLaren. 3 {McKergow. {McEvoy. 5 McCallum. 6 Monk. 7 {Asbury. {Gelling. Monteith. Derbyshire.	1 McLaren. 2 Rendall. 3 Monteith. 4 McEvoy. 5 Makinson. 6 Gelling. 7 {Derbyshire. {McCallum. 9 Monk. McKergow. Asbury.	1 Gelling. 2 Monteith. 3 McKergow. 4 Derbyshire. 5 McEvoy. 6 {McLaren. {Monk. 8 {Asbury. {Makinson.	1 McEvoy. 2 Makinson. 3 Monk. 4 Derbyshire. 5 McKergow.

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CLASS LISTS (MIDSUMMER EXAMINATONS)—*Continued.*

SECOND YEAR.

CLASS.	HORTICULTURE PRACTICAL EXAMINATIONS.	CARPENTERING.	PRACTICAL EXAMINATIONS IN FARM WORK.	GENERAL PROFICIENCY, WRITTEN EXAMINATIONS.
HONOURS. I.	1 Brodie. 2 McEvoy. 3 Monteith. 4 Linfield. 5 Rendall. 6 Asbury.	1 Rendall. 2 { Brodie. { Linfield.	1 Brodie. 2 Rendall. 3 Linfield. 4 Monteith. 5 Asbury. 6 Tinney.	1 Brodie. 2 Linfield. 3 Tinney.
HONOURS. II.	1 Tinney. 2 McKergow.	1 Monteith. 2 Tinney. 3 Asbury.	1 McLaren. 2 McEvoy.	1 Rendall.
PASS. III.	1 Gelling. 2 McLaren. 3 Monk. 4 Makinson. 5 Derbyshire. 6 McCallum.	1 McLaren. 2 McCallum. 3 McEvoy. 4 McKergow. 5 Gelling. 6 Derbyshire. 7 Monk. 8 Makinson.	1 McCallum. 2 Gelling. 3 McKergow. 4 Monk. 5 Makinson. 6 Derbyshire.	1 McLaren. 2 McCallum. 3 Gelling.

UNIVERSITY OF TORONTO.

DEPARTMENT OF AGRICULTURE—CLASS LISTS, 1889.

THIRD YEAR.

CLASS.	CHEMISTRY.	BOTANY.	ENGLISH.	DRAWING.	GEOLOGY.
HONOURS. I.	Harcourt, G. Hutton, J. R. Lehmann, A. Soule, R. M.	Hutton.	Hutton. Raynor.	Harcourt. Hutton.	
HONOURS. II.	Morgan, J. H. A. Raynor, T. G.	Harcourt. Lehmann. Morgan. Raynor. Soule.	Harcourt. Morgan. Soule.	Lehman. Raynor.	Hutton. Morgan. Raynor. Soule.
PASS. III.			Lehmann.	Morgan. Soule.	

DEPARTMENT OF AGRICULTURE—CLASS LISTS, 1889—*Continued.*

THIRD YEAR.

CLASS.	ENTOMOLOGY.	LATIN.	DAIRYING.	AGRICULTURE.
HONOURS. I.	Hutton.			Harcourt. Morgan. Soule.
HONOURS. II.	Harcourt. Lehmann. Soule,		Harcourt. Hutton. Lehmann.	
PASS. III.	Morgan. Raynor.	Raynor.		Lehmann.

PART II.

REPORT OF THE

PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December 31st, 1889.

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.

While we cannot boast of a very large museum, still we are yearly improving it, and hope in time to see one of a pre-eminently practical nature. Last year some very much needed changes were made, and in many respects the specimens were arranged so as to aid materially students in the prosecution of studies connected with natural history and geology. I think the time has come when a small annual grant, say of one hundred dollars, should be made so as to enable us to buy a few specimens, such as insectivorous birds, etc., so as to add to our list when an opportunity is afforded. I would suggest that this year cases for plants be put up along the walls of the museum, in which specimens of the weeds common to Ontario will be placed so as to render it an easy matter for visitors to identify obnoxious plants that have come under their observation in localities where they reside.

We have received a few donations to our collection during 1889, for which I express thanks to the donors, and hope they and others will remember we are always ready to receive any specimens that will aid us in instruction.

The following is a list of the contributors:—W. F. Newcamen, student, fossil shells from Niagara; James Edmonstone, Johnson, Ont., four plants; C. Frith, Durham, calf's double head; Miss Robertson, Guelph, ant eggs from Africa; A. Wiggins, Fairmont, iron pyrites; Prof. James, O.A.C., eight minerals; John Ramsay, Eden Mills, two minerals; Rev. John Wilkie, Indore, collection of Himalaya ferns; George Carlaw, Warkworth, cutworms; F. H. Worthington, student, seeds from West Indies.

2. LIBRARY.

This attractive room is at present very convenient, and is each year becoming better arranged and equipped for educational purposes. We should have an annual grant of at least two hundred dollars for the purchase of new books. The college is largely

referred to for information upon subjects connected with agricultural science, to furnish such we should be equipped with the very best books on science. Such books are expensive, and consequently, without funds, we are unable to have the books at our command we need from time to time for reference.

We certainly are in much need of some two to three hundred dollars worth of books at present for the various departments.

The present grant is largely spent in the purchase of papers, journals, etc., for the reading-room. Although we appear to have a large collection of books, yet many of them are of little service in our work, hundreds of them being bound up volumes of Blackwood, etc., sent to us when the Depository of the Educational Department at Toronto was abolished.

Our Library now contains 5,480 volumes, of which 114 have been added this year. The books added may be grouped as follows:—

Reports, chiefly agricultural	52
Botany	5
Geology	2
Agriculture	8
Chemistry	2
Literature	20
Encyclopædias	4
Entomology	1
General Science	1
Parliamentary reports	18
Examination papers, bound	1
	114

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.

Rules regarding the proper use of the reading-room are posted in conspicuous places.

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	Chicago.
7. Sheep Breeder and Wool Grower	Winnipeg.
8. Manitoba Weekly Free Press	St. Catharines.
9. Canadian Horticulturist	London, Ont.
10. Canadian Entomologist	Beeton.
11. Bee Journal	Newmarket.
12. North York Reformer	Acton.
13. Acton Free Press	Erin, Ont.
14. Ontario Evangelist	Erin, Ont.

(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. Farmer's Advocate	"
10. Canadian Stock-Raiser's Journal	London, Ont.
11. Nor'-West Farmer	Hamilton.
12. Breeder's Gazette	Winnipeg.
13. North British Agriculturist	Chicago.
44. 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).
20. Cultivator and Country Gentleman	"
21. Scientific American	Albany, N.Y.
22. Live Stock Journal	New York.
23. Live Stock Journal	England.
24. American Dairyman	Chicago.
25. Botanical Gazette	New York.
26. Agricultural Science	Crawfordsville, Indiana.
27. Canadian Honey Producer	Geneva, N.Y.
	Brantford.

4. Practical Work.

In the department of Natural History much has been done to make the study of science popular and practical. A trip to Niagara Falls with students, at their own expense, gave them an excellent opportunity to see the varied flora of the park and the magnificent exposure of rocks in that region, besides the general face of the country through which they passed on the way. The quarries of Guelph are convenient for illustrations in geology. 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 any evening 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 wonderful 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 magic lantern, illustrating facts in Zoology, Botany and Geology.

In the spring of this year much time was occupied in preparing a bed of plants to be used in connection with lectures in botany. We commenced it the previous year and completed it this, so that the 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 3 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, Ranunculaceæ 20, Papaveraceæ 1.

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, moss, 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, and the divisions, polypetalous, gamopetalous and apetalous 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 :—

ORDER I.

Polypetalous Exogens.

Ranunculaceæ (Crowfoot Family).

Row 1—

1 Hepatica acutitoba	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 trifolii	Goldthread.
3 Aconitum Napellus	Monkshood.
4 Pæonia tenuifolia	Cut-leaved pæony.
5. P. officinalis	Pæony.

Row 3—

1 Aquilegia Canadensis	Columbine.
2 Thalictrum dioicum	Meadow rue.
3 " speciosum	Cærulean Columbine.
4 Aquilegia cærulea	Larkspur.
5 Delphinium splendens	

Row 4—

1 Clematis viorna	Clematis.
2 C. corymbosa	"
3 Helleboras viridis	Hellebore
4 Eranthes hyernalis	Winter aconite.
5 Nigella damascena	Love-in-the-mist.

ORDER II.

Row 5— *Berberidaceæ (Barberry F.)*

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

ORDER III.

Row 6— *Papaveraceæ (Poppy Family).*

1 Sanguinaria Canadensis ..... Blood root.
2 Papaver rhoeas ..... English poppy.
3 Chelidonium majus ..... Celandine.
4 Glaucum luteum ..... Horn poppy.
5 Bocconia cordata ..... Bocconia.

ORDER IV.

Row 7— *Fumariaceæ (Fumitory F.)*

1 Dicentra Canadensis .....
2 " Cucullaria ..... Squirrel corn.
3 " Spectabilis ..... Deer fly.
4 " Formosa ..... Bleeding heart.
5 Corydalis aurea ..... Dicentra.
..... Golden corydalis.

ORDER V.

Row 8— *Cruciferæ (Cress F.).*

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 .....
2 Dentaria diphylla ..... Hedge mustard.
3 Lunaria biennis ..... Toothwort.
4 Camelina sativa ..... Honesty
5 Sinapis alba ..... False flax.
..... White mustard.

Row 10—

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

ORDER VI.

Violaceæ (Violet F.).

Row 11—

1	Viola pubescens	Yellow violet.
2	" blanda	White violet.
3	" Canadensis	Canadian violet.
4	" cucullata	Common blue violet.
5	" tricolor	Pansy.

ORDER VII.

Caryophyllaceæ (Pink F.).

Row 12—

1	Cerastium arvense	F. mouse ear chickweed.
2	Tunica saxifraga	Tunica.
3	Dianthus deltoides	Deltoid pink.
4	Lychnis vespertina	White cockle.
5	Dianthus barbatus	Sweet William.

Row 13—

1	Saponaria Caucasia	Soapwort.
2	Cerastium vulgatum	Mouse ear chickweed.
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 officinalis	Bouncing Bet.
3	Vaccaria vulgaris	Cow-herb.
4	Stellaria media	Chickweed.
5	Lychnis diurua	Day-blooming lychnis

ORDER VIII.

Portulacaceæ (Purslane F.).

Row 15

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

ORDER IX.

Malvaceæ (Mallow F.).

Row 16—

1	Malva rotundifolia	Mallow.
2	Abutilon striatum	Indian mallow.
3	Malva moschata	Musk mallow.
4	Malope trifida	Malope.
5	Althæa rosea	Hollyhock.

ORDER X.

Linaceæ (*Flax F.*).

Row 17—

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

ORDER XI.

Geraniaceæ.

Row 18—

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

Row 19—

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

ORDER XII.

Leguminosæ (*Pulse F.*).

Row 20—

1	Lotus corniculatus	
2	Vicia cracca	Bird's-foot trefoil.
3	Pisum sativum	Wild tare.
4	Trifolium rubens	Pea.
5	Baptisia tinctoria	Crimson clover.
		Wild false indigo.

Row 21—

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

Row 22—

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

ORDER XIII.

Rosaceæ (*Rose F.*).

Row 23—

1	Waldsteinia fragaroides	
2	Fragaria vesca	Barren strawberry.
3	Geum uniflorum	Wild strawberry.
4	Spiraea	Avens.
5	Rosa rugosa	Spiraea.
		Single rose.

Row 24—		
1	Potentilla argentea	Cinquefoil.
2	" verna	Green cinquefoil.
3	" sulphurea	Yellow cinquefoil.
4	Spiraea	Spiraea
5	Rubus strigosus	Raspberry.

ORDER XIV.

Saxifragaceæ (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 ternatum	
3	Sempervivum tectorum	House-leek.
4	Sedum sieboldii	
5	Sedum telephinum	Live-forever.

ORDER XVI.

Onagraceæ (Evening primrose F.).

Row 27—		
1	Circaea lutetiana	Enchanter's night-shade.
2	Oenothera biennis	Evening primrose.
3	Clarkia pulchella	Clarkia.
4	Fuchsia	Fuchsia.
5	Epilobium angustifolium	Willow-herb.

ORDER XVII.

Umbelliferæ (Parsley F.)

Row 28—		
1	Carum petroselinum	Parsley.
2	Apium graveolens	Celery.
3	Pastinaca sativa	Parsnip.
4	Daucus carota	Carrot.
5	Eryngium amethystinum	Eryngo.

ORDER XVIII.

Cucurbtaceæ (Gowad F.).

Row 29—		
1	Cucurbita verrucosa	Vegetable marrow.
2	Cucumis melo	Mush melon..
3	Cucumis sativus	Cucumber.
4	Citrullus vulgaris	Watermelon.
5	Cucurbita pepo	Pumpkin.

ORDER XIX.

Gamopetalous Exogens.

Compositæ (Composite F.).

Row 30—

1 Achillæa Millefo[illegible]m ..... Yarrow.
2 Gaillardia grandi[illegible] ..... Gaillardia.
3 Cereopsis ....
4 Achillæa filipendula. .....
5 Ambrosia artemisæfolia ..... Golden yarrow. Ragweed.

Row 31—

1 Taraxacum dens-leonis ..... Dandelion.
2 Senecio vulgaris ..... Groundsel.
3 Pyrethrum roseum ..... Pink feverfew,
4 Maruta cotula ..... Mayweed
5 Cineraria maritima ..... Cineraria.

Row 32—

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

Row 33—

1 Bellis perenius ..... Daisy.
2 Leucanthemum vulgare ..... Ox-eye daisy.
3 Lappa major ..... Burdock.
4 Erigeron Philadelphicum ..... Fleabane,
5 Helianthus annuus ..... Sunflower.

Row 34—

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

Row 35—

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

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	Canterbury bell.
4	"	latifolia	
5	"	rotundifolia	Harebell.

ORDER XXII.

Plantaginaceæ (Plantain F.).

Row 38—

1	Plantago	major	Plantain.
2	"	lanceolata	Rib-grass.
3	"	lanceolata	Rib-grass.
4	"	"	"
5	"	"	"

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	officinalis	Speedwell.
2	Linaria	purpurea	Purple toadflax.
3	Minrulas	ringens	Monkey flower.
4	Penstemon	pubescens	Penstemon.
5	Chelone	glabra	Turtle-head.

Row 41—

1	Pedicularis	Canadensis	Wood betony.
2	Linaria	vulgaris	Toadflax.
3	Antirrchinum	majus	Snapdragon.
4	Digitalis	purpurea	Fox glove.
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.

ORDER XXVI.

Labiatæ (*Mint F.*)

Row 43—

1 Marrubum vulgare ..... Horehound.
2 Perilla nankinensis ..... Perilla.
3 Colens veitchii ..... Foliage plant.
4 Salvia officininalis ..... 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 bergamot.

ORDER XXVII.

Borraginaceæ (*Borage F.*)

Row 45—

1 Myosotis palustris ..... Forget-me-not.
2 Cynoglossum officinalis ..... Burr.
3 Echinospernum lappuba ..... 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 canescens ..... Hoary puccoon.

ORDER XXVIII.

Polemoniaceæ (*Phlox F.*)

Row 47—

1 Phlox subulata ..... Low phlox.
2 " " ..... "
3 " divaricata ..... Wild "
4 Gilia tricolor ..... Gilia.
5 Polemnonium caeruleum ..... Jacob's ladder.

ORDER XXIX.

Convolvlaceæ (*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 nyctaginifolia ..... Petunia.
2 Datura fastuosa ..... Datura.
3 Solanum tuberosum ..... Potato.
4 Lycopersicum esculentum ..... Tomato.
5 Nicotiana rustica ..... Tobacco.

ORDER XXXI.

Asclepiadaceæ (*Milkweed F.*)

Row 50—

1 Asclepias tuberosa ..... Butterfly-weed.
2 ..... Milkweed.
3 A. cornuti ..... Poke-milkweed.
4 A. phytolaccoides ..... Swamp milkweed.
5 A. incarnata ..... Swamp milkweed.

ORDER XXXII.

APETALOUS EXOGENS

Chenopodiaceæ (*Goosefoot F.*)

Row 51—

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

ORDER XXXIII.

Amarantaceæ (*Amaranth F.*)

Row 52—

1 Achyranthes ..... Achyranthes.
2 Gomphrena 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 Fagopyrrum 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 " Cypraissias .....
4 ..... Cypress spurge.
5 Ricinus communis ..... Castor oil plant.

ORDER XXXVI.

ENDOGENS.

Araceae (Arum F.)

Row 55—

1. Arisaema triphyllum ..... Indian turnip.
2. Symphoricarpus foetidus ..... Skunk cabbage.
3. Acorus Calamus .....
4. ..... Calamus.
5. Calla Ethiopica ..... Calla lily.

ORDER XXXVII.

Iridaceae (Iris F.)

Row 56—

1. Crocus vernus ..... Spring crocus.
2. Gladiolus cardinalis .....
3. Pardanthus chinensis ..... Gladiolus.
4. Sisyrinchium Bermudiana ..... Blackberry lily.
5. Iris versicolor ..... Blue-eyed grass.

Row 57—

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

ORDER XXXVIII.

Liliaceae (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. Allium stellatum ..... Star onion.
3. Funkia variegata ..... Funkia.
4. Lilium tigrinum ..... Tiger lily.
5. Polygonatum ..... Solomon's seal.

Row 60—

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

ORDER XXXIX.

Amaryllidaceae (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.

Gramineae (Grass F.)

Row 62—

1. Festuca ovina ..... Sheep's fescue.
2. T. pratensis ..... Meadow "
3.
4. Dactylus 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. Alopecurus 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 grasss.
2. Hordeum vulgare ..... Barley.
3. Triticum vulgare ..... Wheat.
4. Avena sativa ..... Oat.
5. Zea Mays ..... Indian corn.

40 orders. 225 genera. 325 species.

The following bulletins have been issued from the Natural History Department during '89.

STRAWBERRIES.

Having had strawberries planted among some of our grape vines for three years, until the vines became thoroughly established, I have thought it expedient to give our experience in the form of a bulletin, which may be of service to those who read it.

Few berries are more luscious than the strawberry, and few plants can be more successfully cultivated, and yet how many farm homes there are in which this fruit is seldom eaten.

It is hoped the time is not far distant when the fruit and vegetable garden will form an important feature in the vicinity of the farmhouse, and that on the farmer's table will be seen the fruits of each summer month, when strawberries, raspberries, etc., will be found at home and not require to be sought after in distant "berry patches." A little taste and comparatively little time and care will supply these attractive treats to those who desire them.

Conditions Surrounding the Plants.

Location: Latitude north 43.38°, height above sea level 1,100 feet, above Lake Ontario 858 feet.

Exposure: South-west.

Soil: Clay loam.

Meteorological: Mean annual temperature, 42.2°, 1880-1886; mean summer temperature, 57.1°, winter, 27.3°; highest temperature (1881), 98°, lowest (1884), 35°; average number of days rain fell per year, 72; rainfall, including snow, 24.7 inches; prevailing winds, south-west 43 per cent., north-west 31 per cent.

Management.

The plants are placed in rows three feet apart, and the plants one foot apart in the row. Arranged in this way the cultivation can be largely done with the horse hoe. They were allowed to occupy the ground for three years, when they were removed to another place. The ground was well manured before planting, and another application made the second year. In winter they were protected by scattering some pea-straw over them.

First year—The runners were kept well back, so as to get strong single plants.

Second year—The same course was followed as far as possible.

Third year—The plants were allowed to grow freely and the runners untouched.

Thorough cultivation and keeping the ground free from weeds were observed.

Varieties.

Wilson's Albany, 10 rows; Crescent Seedling, 20 rows; Early Canada, 4 rows; Arnold's Pride, 1 row; Captain Jack, 10 rows; Alpha, 2 rows; Nicanor, 2 rows; Maggie's, 2 rows; Cumberland Triumph, 4 rows; Monarch of the West, 4 rows.

Results.

Wilson's Albany has done excellently, and may be ranked first. It yields well, and is a very suitable variety for shipping.

Crescent Seedling ripened sooner than Wilson, and has been quite productive, but there is a tendency among these berries to be imperfect, owing to incomplete fertilization of the flowers, but this is overcome by having a variety rich in pollen planted near or

among the rows. We overcame the difficulry by planting the Wilson side by side. Crescent Seedling seems to bear more pistillate flowers than staminate. The foliage of the Crescent, being somewhat sparse, does not assist in keeping the berry so clean as the varieties that grow more leaves.

Early Canada ripens soon, but is liable to be caught by frost, and on the whole has done poorly with us.

Arnold's Pride is a clean, good-sized nice berry, but has not been very prolific.

Monarch of the West proved to be a large berry, but only gave a fair yield.

Captain Jack was somewhat late, but very prolific and a good berry.

Alpha has been a slim bearer, but it has a delightful flavor.

Nicanor gave only a fair crop and ordinary berry.

Maggie's was rather small in berry and as comparatively poor a bearer.

Cumberland Triumph is a large and irregularly shaped berry, with only a fair yield. It is a variety more for the amateur than one desiring to raise berries for market.

Conclusions.

1. Strawberries will do well in a locality such as ours, if the soil is rich, friable and well drained.

2. Ground for strawberries should have a good supply of plant food, be easily worked, and should certainly be well drained, kept clean of weeds and well cultivated.

3. We are inclined to favor growing in rows where large quantities are to be grown, and to renew the plants every two years.

4. In well drained, sheltered and good soil, planting out in September is advisable, so as to enable the plant to get thoroughly established. A fair crop next season may be expected ; but if such conditions are absent, then plant in spring, and only a medium crop may be looked for.

5. Strawberries may be grown in almost any climate if care be taken. Where the climate is severe protect the plants by scattering over them pea-straw or some other light covering. Avoid heavy substances such as manure ; some place boughs with good results.

6. The following is a list which embraces varieties that are likely to succeed well :— Wilson, Crescent Seedling, Daniel Boone, Manchester, Sharpless, Alpha, Prince of Berries, Bidwell and Jewell. Crescent Seedling and Manchester, being poor in pollen, require such as Wilson among them. Sharpless is large, delicious, but somewhat late. Bidwell is a good family berry, sweeter and larger than the popular varieties, Wilson and Crescent.

CHESS.

Bromus Secalinus—Order Graminæ.

Questions are repeatedly sent to the college asking for information concerning chess. The answers to these sometimes entail a good deal of work. Consequently I have thought it expedient to prepare a bulletin upon the subject, and thus put the information in a form that will be of service to those interested. It may appear strange that it is worth while to say so much about this plant, but when it is remembered that there are persons

in various parts of the province who maintain that it is a modification of the wheat plant, brought about by winter-killing of the wheat, it will not be such a matter of surprise that I should deem it expedient to write something about this apparently doubtful member of the grass family, endeavoring to show that it is a species (*Bromus secalinus*) just as much as any other plant is, and that it does not depend for its existence upon a modification of wheat plants growing in adverse conditions.

Much discussion has taken place regarding its origin in some other way than a plant perpetuated by its seed. As it usually appears among fall wheat that has been winter-killed it seems quite natural to suppose it is a degenerated condition of the wheat, and there are not a few farmers who insist upon this as being the only correct explanation of its presence under such circumstances. Thus it is that few questions at a Farmers' Institute will lead up to a more lively discussion than that which deals with the origin of chess.

It seems remarkable that, if this is the true origin of the plant, one cannot readily grow it from wheat, while there is no difficulty whatever in raising it from seeds of chess. Those who sow wheat containing chess never fail to get a good crop, while those who are very careful to sow clean seed seldom are troubled with the weed.

The following are some reasons why a person should be ready to conclude that this plant is no exception to others and depends for its perpetuation upon the seeds which it matures :

1. The plant is widely different from wheat in appearance, so much so that botanists place it in the genus Bromus, while wheat belongs to the genus Triticum. Couch grass (*Triticum repens*) being in the same genus as wheat, comes much nearer in its characters than chess does, and yet no one ever hints that it is derived from wheat. If chess is a degenerated condition of wheat we might reasonably expect some resemblance to the plant from which it was derived.

2. The most devoted evolutionist would not expect to see develop in the short space of a few months, owing to the effect of frost, a plant so unlike in structure, form and habit to that from which it is derived. It is only through long periods of time that such modifications in a plant can take place as to change its character so much that it may be viewed as a new species. But in this case one season brings about such a remarkable change that the plant is ranked in another *genus*—a more comprehensive term than *species*.

3. If chess be sown it yields chess. If it were degenerated wheat, and sown under favorable surroundings, it should soon return to wheat ; for we observe both in animal and plant life that a deteriorated form will return to its proper nature when conditions are suitable for growth. Some have gone so far as to say chess will not grow from seed, but this is a mistake that can easily be seen by sowing some of the seed.

4. Chess will mature seed under adverse conditions, though the plant be only two or three inches high, while if surroundings are favorable it grows three or four feet high before seed is matured. This may account for its never being seen in good crops, while it may be seeding the ground for a more suitable time, when the crop in which it is seeded is injured by frost ; then this hardy annual (the seeds of which possess great vitality) is ready to take the vacant soil and yield a crop no longer hid from the farmer's eye.

5. The conclusions arrived at by all men who make plant life a special study are (*a*) that chess is a typical plant, producing seed yearly, which gives rise to plants of the same character ; (*b*) that a seed of wheat cannot be sown so as to produce chess, and (*c*) that chess cannot produce wheat under the most favorable conditions of growth.

6. In instances where parts of a plant, apparently a combination of chess and wheat, were so mixed as to seem but one plant, close examination proved them to be parts of separate plants, and that the apparent union was not real. In some cases microscopic examination has been required to prove it.

7. Wheat has been grown in some places and often winter-killed and no chess has appeared. There are places where chess is unknown, and wheat in these passes through all the vicissitudes which seem favorable to the development of this weed in other parts where the plant is common. Farmers careful in using clean seed often have winter-killed wheat unaccompanied by chess.

8. Liberal rewards have been offered by agricultural papers to any one who could prove conclusively that chess is derived from wheat, and as yet no successful competitor has appeared, though as high as $500 was the prize.

With these facts before us, it does seem difficult for a person to accept a theory which demands greater concessions than the most sweeping form of evolution. Though this plant may appear under circumstances difficult to explain, we are forced to believe that if its origin is carefully considered it will not require one to pin his faith to views so antagonistic to the teachings of science as those required to be accepted by persons claiming wheat as its source.

Remedy.

The great remedy for chess is to be exceedingly particular about the seed you sow. A few scattered seeds among wheat do not seem to amount to much in the heap, but if they were taken out we would be surprised at the quantity mixed among the grain.

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1888

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.

Maximum 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.

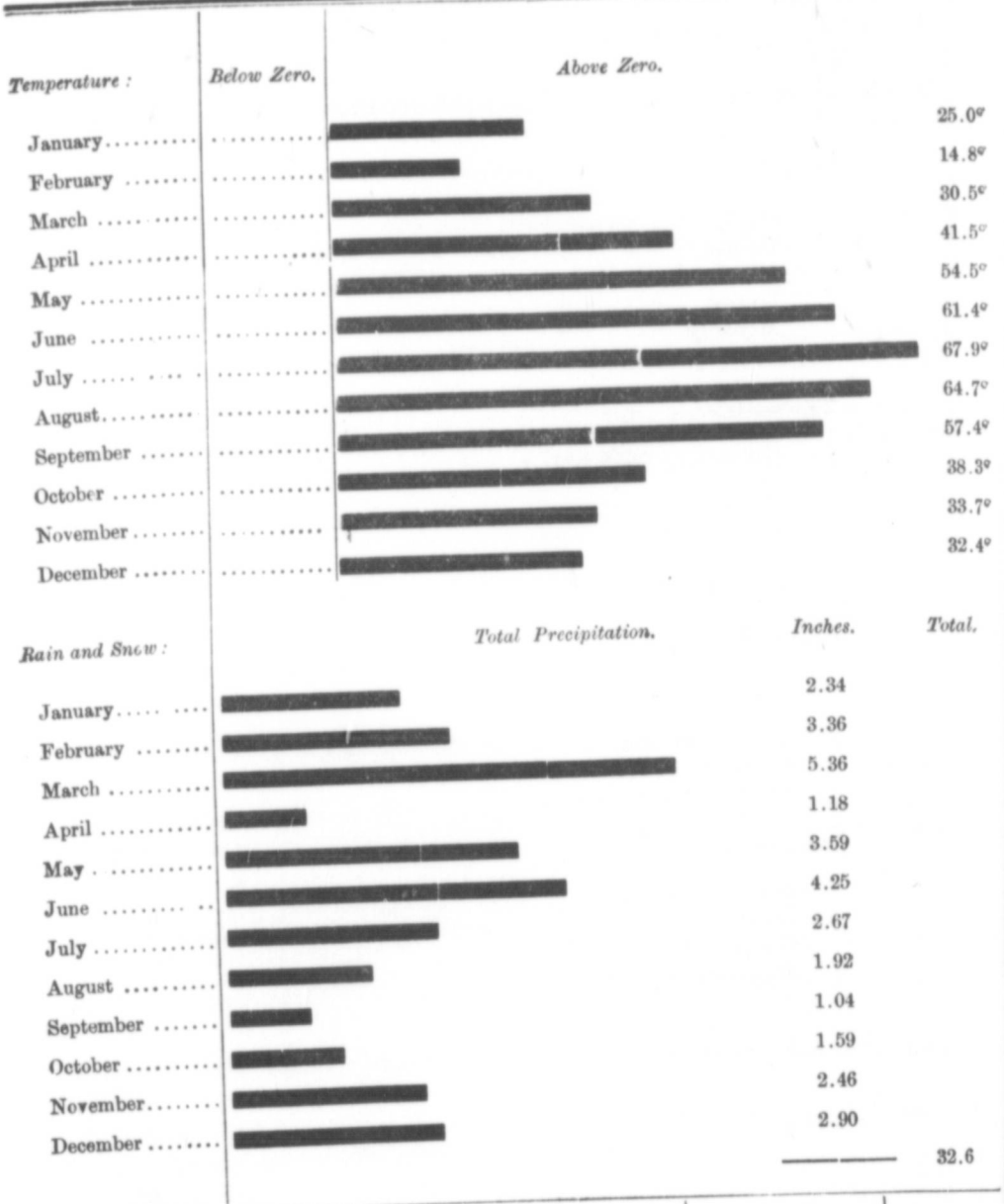
Pluviameter—

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.

Diagram Illustrating the Mean Meteorological Results for 1889.



Cloudiness :					
January	6.4	May	5.1	September	5.0
February	6.6	June	4.6	October	5.8
March	5.3	July	3.9	November	7.4
April	5.1	August	4.6	December	6.7

SUMMARY OF THE METEOROLOGICAL RESULTS FOR 1889.

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Barometer—	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
Highest barometer	29.992	29.464	29.236	29.260	29.032	28.270	29.132	29.132	29.082	29.310	29.410	29.500
Lowest barometer	27.804	28.080	28.180	28.232	28.464	28.148	28.566	28.618	28.150	28.348	28.158	28.042
Highest mean barometer	29.446	29.425	29.142	29.143	29.000	29.258	29.047	29.111	29.071	29.281	29.408	29.463
Lowest mean barometer	27.935	28.264	28.199	28.342	28.442	28.418	28.589	28.649	28.197	28.601	28.213	28.146
Monthly mean barometer	28.987	28.931	28.189	28.897	28.631	28.790	28.847	28.688	28.843	28.782	28.746	28.883
Monthly range	2.188	1.384	1.056	1.028	.568	1.122	.566	.514	.932	.962	1.252	1.458
Thermometer.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.
Highest temperature	47.5	41.2	53.0	76.0	88	87	88.0	99.4	88.5	62.0	51.4	60
Lowest temperature	-.7	-18.5	10.0	17.2	25	42	51.0	41.5	39.2	17.2	11.0	1.1
Highest mean temperature	35.8	32.0	40.3	63.5	73.7	71.6	75.4	71.7	72.3	49.1	47.8	39.7
Lowest mean temperature	7.5	-8.8	20.4	28.3	35.4	49.6	60.4	56.7	41.8	26.0	18.7	12.6
Monthly mean temperature	25.0	14.8	30.5	41.5	54.2	61.4	67.9	64.7	57.4	38.3	33.7	32.4
Monthly range	48.2	59.7	43.0	58.8	53.0	45	37.0	57.9	49.3	44.8	40.4	58.9
Pluviameter.												
Number days rain fell	2		2	3	14	11	10	6	8	8	11	8
Number days snow fell	14	14	3	2							3	2
Greatest rainfall, inches	.15		2.5	.48	1.50	1.18	.67	.85	.39	.44	.33	.82
Rainfall for month, inches	.15		4.5	1.03	3.59	4.25	2.67	1.92	1.04	1.59	1.76	2.79
Greatest snowfall, inches	6.00	6.00	8.0	1.00							5.00	.8
Snowfall for month, inches	21.95	33.6	8.6	1.52							7.00	1.15
Total precipitation	2.34	3.36	5.36	1.18	3.59	4.25	2.67	1.92	1 04	1.59	2.46	2.90
Anemometer.												
Predominating winds												
Greatest number of miles in 24 hours	Owing to the great storm in January our apparatus was so injured that our observations for the year have been incomplete.											
Mean velocity for the month												
Clouds.												
Cloudy days	17	11	13	15	11	11	6	11	8	16	20	14
Clear days	10	16	11	12	12	11	16	12	10	9	7	6
Mean cloudiness for the month	6.4	6.6	5.37	5.1	5.1	4.6	3.97	4.67	5.00	5.8	7.4	6.7

Mean Meteorological Results for the Year 1889.

—	1889 — Guelph.	Average of 40 years. — Toronto.
Barometer.		
Month of highest mean pressure	December.	September.
Highest mean monthly	29.463	29.664
Lowest " "	28.189	29.572
Month of the lowest mean	March.	June.
Highest pressure	29.992	30.358
Lowest "	27.804	28.692
Thermometer.		
Mean temperature of the year	43.4°	44.17
Warmest month	July.	July.
Mean temperature of the warmest month	67.9°	67.64°
Coldest month	February.	February.
Mean temperature of the coldest month	14.8°	22.73°
Highest temperature	99.4°	91°
Lowest temperature	—18.5°	11.9°
Range of the year	117.9°	10.2°
Pluviameter.		
Total depth of *rain* in inches	25.3	28.3
Number of days on which *rain* fell	83	110
Month in which the greatest depth of *rain* fell	March.	September.
Greatest depth of *rain* in one month in inches	4.5	3.55
Month with most *rainy* days	May.	October.
Greatest number of *rainy* days in one month	14	13
Total depth of *snow* in inches	73.8	.....
Number of days on which *snow* fell	38	.....
Month in which the greatest depth of *snow* fell	February.	.....
Greatest depth of *snow* in one month in inches	33.6	.....
Month with most *snowy* days	Jan. and Feb.	.....
Greatest number of *snowy* days in one month	14	.....
Total precipitation in inches	32.6	.....

Your obedient servant,

J. HOYES PANTON.

PART III.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December, 1889.

To the President of the Agricultural College:

SIR,—I have the honor to present herewith through you, my report upon the work done during the year 1889, in the Department of Chemistry, and shall endeavor to make it as concise as possible consistent with its results. The college work, that of giving instruction to the students of the first, second and third years, has developed nothing of special importance that need be reported upon here—that part of our work we can dispose of simply with the remark that as full a course of lectures has been given in all cases as the time would permit, and as far as possible experiments have been called upon to assist in the work.

Outside of the lecture work much has been done in the way of analyzing fertilisers, etc., and reporting upon the same to the farmers specially interested. Much that is done through correspondence, cannot of course, find its way into this report, being of interest merely to the person to whom answer has already been communicated. From the work done I shall select merely that which I think is of general public interest.

In my report of 1888, I promised to gather together our laboratory results on milk analysis. I have done so, and in May I issued a condensation of the following bulletin:

THE COMPOSITION OF MILK.

The enormous production of milk on the farms of Ontario and its daily use in every household are quite sufficient reasons for the issuing of a bulletin upon its nature or composition, especially at this time of the year, the commencement of the milk producing season. The facts are based on the work done at this institution during the past five years, where we have had special opportunities for studying the subject, as well as upon accumulating work on milk analysis, which, once published, becomes the common property of all interested.

The constituents of normal cow's milk are the following:—Water, fat, albuminoids, sugar, and ash or mineral matter. We shall briefly refer to them.

WATER.—This constitutes from 80 per cent. to 90 per cent. of the whole milk, and hence the total solids constitute from 10 per cent. to 20 per cent. In our experience here we have found the water of normal milk to vary from 83.9 per cent., the lowest to 90.5 per cent., the highest, and the average from all animals, under all circumstances, to be 87.19 per cent.

FAT.—When fresh milk is observed under the microscope, it is found to be a clear liquid in which are floating clusters of fat globules, these fat globules varying in size from

less than one ten-thousandth of an inch in diameter to about one two-thousandth of an inch in diameter. The large globules are observed in Jersey milk, and the small in Holstein. The fat, being lighter than the liquid or serum in which it is floating, gradually comes to the surface in the form of cream, and among the many circumstances affecting the rising of the cream the size of the fat globule is very important. The larger the globules the more quickly and thoroughly they will separate in a layer at the surface. There is a variation in different animals, and in the same animals under different treatment, in the amount of total solids, and there is also a variation in the respectivo amounts of the constituents that make up the the total solids; the variation, however, is principally due to the quantitity of the fat, *i.e.*, the fat in the milk of different animals and of the same animal varies far more than the albuminoids, sugar and ash; hence it is that in making or stating an analysis of milk, the water, fat and ash alone are generally considered. The fat may vary from 2 per cent. to 8 per cent. of the total milk. We have found it to vary from 2.4 per cent. to 7.5 per cent., and the average of all classes of milk to be 4.03 per cent. The fat, however, is far more complicated than at first is apparent. It is, in reality, a mixture of fats or oils, of which the four leading kinds are: *stearin*, *palmitin*, *olein* and *butyrin*. The two former are hard fats, the two latter soft or liquid fats. The texture or consistency of the butter depends upon the relative amounts of hard and soft fats found in the milk, and this is influenced greatly by the foods of which the animal partakes. Butyrin is peculiar to butter; when the butter becomes rancid, the cause is in the fact that the butyrin has, by fermentation, been changed into butyric acid. Oleomargarine contains a considerable quantity of hard fats and less liquid fats, with no butyrin, unless it has been added in milk or butter.

Albuminoids.—These are the nitrogenous compounds of milk, the flesh and muscle formers, the basis of the curd or cheese. In normal conditions they are dissolved in the serum or liquid. There are two forms, viz., casein and albumen. Some lately published investigations of Dr. Babcock, of Wisconsin, (Bulletin No. 18), tend to the conclusion that minute quantities of *fibrin* also are found in normal milk. Casein, which passes into the cheese, is thrown out of solution, or coagulated by acids and by rennet; albumen is coagulated by heat. In the first milk or colostrum, the albumen is in excess, but in the after milk as we use it the casein is in excess; the casein forms about 3.6 per cent., the albumen about 0.7 per cent.

Sugar.—Milk sugar or lactose has the same composition as ordinary cane sugar, but is less soluble, less sweetening in its effect, gritty to the taste. It forms about 4.5 per cent. of milk, and is liable to speedy change. During lactic fermentation, by exposure to the air, the milk sngar changes to lactic acid, *i.e.*, the milk sours As a result of the formation of the acid, the casein is thrown out of solution, *i.e.*, the milk coagulates or curdles.

Ash.—There is but little variation in the quantity of salts or mineral matter above or below 0.7per cent. From thirty samples we got an an average of 0.695 per cent. The addition of such substances as borax, soda, salt, give a large increase in the ash. In 100 lb. of milk, there are about 0.20 lb. of phosphoric acid, 0.17 lb. of potash, and 0.16 lb. of lime, all of which are intended for the building of bones and the ash material of the animal body.

The milk produced at the Ontario Experimental Farm may be taken as an average of pure milk, produced from fairly good animals of all the various breeds and grades, with varied but good feeding and with good care. Our average of 92 samples, taken from five years' results, will therefore be a little above what is produced on many farms and supplied in many towns and cities.

Water	87.19	
Fat	4.03	Total solids....12.81
Albuminoids and sugar	8.08	
Ash	0.70	

In contrast with this average let us place the duplicate analysis of a sample of milk taken from a city milk seller, and sent to us for analysis.

Water	88.023	88.019
Fat	3.148	3.147
Albuminoids and sugar	8.239	8.249
Ash	0.590	0.585

Our conclusion in regard to this sample of milk is, that either it is produced from poor food, *i.e.*, adulterated through the animal, or that it has been adulterated after being produced. Milk sellers should be compelled to produce a better class of milk than this, or should be prohibited from selling it. Milk as poor as the above should be classed as watered or adulterated.

In determining the value of milk, too great stress is frequently put upon our simplest instruments for detrrmining the amount of fat present. Let me say a word or two about these instruments and their use.

LACTOMETER.—This instrument, giving the specific gravity or weight of the milk, is sometimes relied upon as a true test of the quantity of fat in a sample of milk. We find the specific gravity of milk to vary from 1.028 to 1.040, though generally it will be between 1.029 and 1.036. The latest ten readings given here averaged 1.0299. The specific gravity of the fat is 0.911 ; both pure water and the fat of the milk are, therefore, lighter than the whole milk. If the milk be skimmed the specific gravity will be increased, if it be watered it will be decreased ; but if the milk should be both skimmed and watered, the specific gravity may be altered so little that the lactometer will give no abnormal reading, and by it alone we can conclude nothing as to the condition of the milk.

CREAM GAUGE.—This alone is also not always a safe indicator of the quantity of the fat. The size of the globules and the surrounding conditions exert a marked influence upon the rise of the cream.

LACTOSCOPE.—This instrument indicates for us the *opacity* of the milk and thus the quantity of fat, as the globules prevent the passage of light rays through the milk. The size of the globules, the brightness of the day, the way in which the light strikes, the seeing power of the eye, the freshness of the milk, all exert a marked influence, and many cases have been observed when the results were erroneous.

The above three instruments, in the hands of experienced persons who thoroughly understand their use, and who are familiar with the nature and peculiarities of milk, will prove very useful for the comparison of samples of milk, and as indicators of extreme conditions, but to determine accurately the composition of any sample of milk and to put beyond doubt its value, one of the several chemical methods must be adopted.

MILK STANDARDS.—At present, to determine whether a milk is adulterated, the sample offered and a sample freshly drawn from the cow have to be analyzed. If we had a standard fixed by law, the matter would be much simplified, and we cannot urge too strongly the wisdom of having a fair milk standard, up to which all samples of milk must come to be recognized as normal and unadulterated. It would simplify the inspection and analysis, ensure a better quality of about the same average, and have a tendency to weed out the poor contributors. Adulteration through the animal could then be prevented.

In addition to our own average let us note a few others :

	Water.	Fat.
Inland Revenue Department, Ottawa, 162 samples	87.52	3.86
Minnesota Dairy Report, 125 cows	85.64	4.47
Boston Milkmen. (Babcock.) 130 samples	86.89	3.45
New Jersey. (Newton.) 85 dairies	86.20	4.22
Martin and Moller's Report, New York, 296 cows	86.27	4.21
Br. Dairy Farmer's Ass., 8 years, 173 cows	86.08	4.04

After careful consideration of many reports and tables of analyses, the standard used by some other countries commends itself as being fair for our condition, workable and conducive of good results. It has also the recommendation of the Department of Inland Revenue, Ottawa.

Water	88.00	per cent.
Total solids	12.00	"
Fat	3.50	"
Solids other than fat	8.50	"

If we have a milk standard established by law, the question of adulteration is easily settled. At present, in many cases it is absolutely impossible to determine whether a certain sample of milk was produced poor by the animal, cow, or made poor by the animal, man. Having a standard, every sample that did not come up to it, would be rated as watered or adulterated; and it should be as great a crime to water the milk by watery food, as to water the milk by the addition of water to the milk. The effect of a fair standard, I believe, would be stimulating, wholesome, and quite justifiable in the case.

ONTARIO OATS.

Having been requested to contribute to the proceedings of the 1889 meeting of the American Association for the Advancement of Science held at Toronto, I undertook an investigation into the chemical composition of Ontario oats. The following is an elaboration of some results submitted to that meeting.

These conclusions are submitted to the farmers of Ontario with the hope of adding somewhat to their information and of contributing to agricultural science. The composition of oats has been quite extensively investigated in some countries, but as yet we have had little or nothing contributed from our own province.

Importance of the Crop.

The great importance or value of the oat crop is due to the following causes:

1. A great variety of soils can be used for the production of this crop.
2. Land of good fertility properly handled can be made to yield enormous crops.
3. The grain is an almost universal food for man and beast, being well balanced, building up muscle, fat and bone, and supplying heat, force, and even a nerve stimulant.
4. In addition to the grain the straw is a very valuable article of farm produce.

Composition of Ontario Oats.

From the Ontario oats used at the Ontario Experimental Farm during the present year I took ten fair samples which may be considered as representing the best of our home-grown oats. The following table gives the chemical composition of these ten samples as determined in our chemical laboratory at the College:—

Chemical Analysis.

Variety.	Water.	Crude Protein.	Fat.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Egyptian White	12.95	9.28	4.83	55.49	14.15	3.30
White Australian	13.69	10.94	4.01	56.75	11.55	3.15
Rennie's Prize White	13.60	9.75	4.13	57.47	12.23	2.81
Acclimatized Black Tartarian	12.40	10.45	5.37	57.50	11.22	3.06
Bavarian	13.30	11.19	5.95	55.57	10.30	3.69
Black Champion	13.75	10.88	4.35	59.61	9.59	2.82
Improved Scotch Potato	13.54	9.19	7.49	57.71	9.11	2.96
Cluster or Triumph	11.53	11.81	6.41	51.97	15.41	2.87
Welcome	12.99	8.53	4.23	61.89	9.23	3.13
Early Calder	12.93	6.19	5.64	55.74	16.33	3.17
Average	12.96	9.82	5.24	56.97	11.91	3.10

Let us now compare our average with that given by others :—

——	No. of Samples.	Water.	Crude Protein.	Fat.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Average above given	10	12.96	9.82	5.24	56.97	11.91	3.10
Koenig	153	12.37	10.41	5.23	57.78	11.19	3.02
Brewer	20	10.56	11.41	4.97	61.10	9.01	2.95
Jenkins	25	10.94	11.38	4.81	60.05	9.85	2.97
Richardson, U. S.	179	6.42	10.76	6.64	66.67	6.33	3.18
Average	387	9.45	10.67	5.84	62.18	8.78	3.08

The average of the Ontario samples will thus be seen to be closely identical with the average of the German samples analysed by Koenig.

The grain of the cereals varies less than the straw, the endeavor of the plant being always to produce a perfect grain at the expense of the straw. Nevertheless seasons, soils and cultivation all have their effect in causing variations. The variations possible in the oat grain are thus given by Armsby, collected from many German analyses.

——	Water.	Protein.	Fat.	Soluble Carbohydrates.	Fibre.	Ash.
Minimum	7.6	6.3	4.4	48.0	4.1	
Maximum	16.4	18.5	7.3	71.8	16.1	
Average	13.7	12.0	6.0	56.6	9.0	2.7

The greatest variation is thus, as also shown in the previous table, in the amount of crude fibre, due to the husk of the grain.

Oats are a remarkably well balanced food, containing a large quantity of the most valuable constituents. viz., protein and fat; they approach what may be called a perfect food. They, however, contain a larger proportion of husk or fibre than do other grains, such as wheat and barley. The quantity of husk or fibre can be approximately determined by examination, and we have thus an easy mode of determining the comparative values of two samples of oats as to their food values—the more husk, in most cases, the less valuable. Without going further into examples I cannot do better than quote here one sentence from Bulletin 9, Department of Agriculture, Washington, D.C., 1886, as follows: "The proportion of husk to kernel and the compactness of the grain prove to be the all-important factors, and the weight per bushel the best means of judging of the value of the grain." (*Clifford Richardson.*)

Physical Characteristics.

Variety.	Color.	Weight per bushel.	Weight of 100 kernels.	No. of kernels per bushel.
		lb.	grams.	
Egyptian White	yellow to dark	39.94	2.829	640,391
White Australian	dark yellow	38.24	2.894	599,365
Rennie's Prize White	yellow	39.61	3.716	483,503
Acclimatized Black Tartarian	black	37.80	2.583	646,351
Bavarian	dark yellow	35.83	3.023	537,625
Black Champion	dark brown	33.15	2.380	631,790
Imported Scotch Potato	yellow	40.43	3.103	591,604
Cluster or Triumph	light yellow	36.91	3.253	514,669
Welcome	yellow	35.19	3.160	505,132
Early Calder	yellow	37.78	2.154	795,586
Average		37.39	2.910	594,542

The average weight per bushel of the United States oats (see bulletin quoted above) was 37.2 lb., the average weight of 100 kernels 2,507 grams. The individual samples giving the heaviest and lightest weights came from the following States: Colorado, 48.8 lb.; Dakota, 48.6 lb.; Alabama, 24.7 lb.; Florida, 26.9 lb. Taking the average of the States in the great divisions we have the following interesting table:—

Northern States, 38.0 lb. per bushel.
Southern States, 34.5 lb. "
Western States, 37.8 lb. "
Atlantic Slope, 37.0 lb. "
Pacific Slope, 43.2 lb. "
All States, 37.2 lb. "

The best samples of oats came from the rich soils of the northern and western States.

A Suggestion in Conclusion.

In studying the samples of Ontario oats I was much impressed with the great variety in each sample as regards the size, shape and plumpness of the grains. What were apparently choice samples contained a large proportion of inferior kernels. It occurred to me that there is a possibility of great improvement by, in some way, culling each sample of seed grain. It may at present be impossible for the farmer to select and inspect minutely every individual grain he sows; but I believe that the farmer who can find the

time and means or devise a method of selecting his grains individually as he does his animals will have taken one step, one very important step, in advance of his less careful neighbor. "Trifles make perfection, and perfection is no trifle."

Sugar Beets and Beet Sugar.

In the year 1889 the available sugar output of the world, we are told, amounted to about 5,000,000 tons, of which 2,248,000 tons were cane sugar and 2,735,000 tons were beet sugar. The almost universal consumption of sugar by civilized man brings this question home to us as one of importance here in Ontario. The Agricultural Department at Washington has taken up the sugar production question as one of great vital interest, and from the chemical department at Washington we have from year to year received many comprehensive and interesting bulletins on the subject of sugar production. Laboratories in charge of chemists have been established in various States to experiment upon the methods of sugar extraction. To show the great work accomplished in one State by the union of science and art, by carrying on field work and laboratory work hand in hand, I shall take the liberty of quoting a sentence or two from one of the latest bulletins to hand. Dr. Wiley, in presenting a report to the Secretary of Agriculture, says :—

"In 1884 the Department established, in connection with the exposition at New Orleans, a complete sugar laboratory. At the same time the experimental diffusion battery, used by the Department in its work of the preceding year, was placed on exhibition.

"During the same year the Department of Agriculture established at Magnolia plantation, Lawrence, La., a complete chemical control of the sugar factory.

"The practical result of the work first undertaken in Louisiana by the Department of Agriculture is seen already in a more scientific agriculture, a better knowledge of the problem of sugar manufacture, a more scientific method in the sugar-house, and the introduction of recent and improved machinery. Before the time first mentioned the average yield of sugar per ton on the best plantations in the State was scarcely 145 pounds. It is now over 200 pounds.

"Perhaps there has never been an instance in the history of the Department where its efforts have been so promptly manifested in such wonderful practical results. It is but just to the Department, in submitting the data herein contained, to call attention to the above facts in the history of the sugar industry of Louisiana."

The aid which chemistry has brought to sugar production in the United States is thus clearly demonstrated.

Early in the present year two samples of sugar beets were received at the chemical laboratory. I determined the sugar to be 50 per cent. and 11.48 per cent. and reported that unless beets could be produced having a higher percentage of sugar there are doubts as to whether successful sugar production could be carried on.

During the year German and Bohemian seed was distributed to farmers in various sections by Mr. R. H. Lawder, Toronto, and this fall some twenty-six samples of beets grown from this improved seed were received at the laboratory, and the results of my analysis are contained in the table submitted below.

In connection with this work I am exceedingly indebted to Mr. Wilfrid Skaife, B. A. Sc., of Montreal, for the loan of a Soleil Polariscope with which the polarizing was done.

In each case I selected a fair sample beet, had it grated or pulped, juice extracted in a small hand press, determined degrees brix of juice, clarified by subacetate of lead solution and polarized. The following table gives the results of this analysis :

Analysis of Sugar Beets.

Name of Grower and Location.	Nature of Land.	Weights of beets analyed.	Degrees Brix Saccharometer.	Polariscope reading.	Per cent. of sugar in beets.	Coefficient of purity.
		lb. oz.				
Mr. Martin, Whitby Town	rich garden soil	1 13½	19.70	13.50	12.83	68.0
" Reid, Whitby Township	stiff clay	3 4	16.60	13.00	12.35	78.3
" Pindar, "	heavy clay	2 5	19.55	14.50	13.78	74.2
" Bateman, "	rich clay	1 10½	20.15	16.00	15.20	79.4
" Lick, "	stiff clay	2 12½	12.65	8.00	7.63	63.3
" Lick, "	"	1 5	21.60	17.50	16.63	81.0
" Sinclair, "		1 15	20.05	15.50	14.73	77.3
" Walker, "	clay loam	2 12	18.60	14.50	13.78	77.9
" Leng, Pickering Township	clay	1 10	17.15	12.50	11.88	72.9
" Trebell, Reach Township	sandy loam	2 3	15.10	11.50	10.93	76.2
" Forman, "	clay, not stiff	3 0	18.80	14.00	13.30	74.5
" Forman, "	" "	1 5	21.30	15.50	14.73	72.8
" Whitefield, "	strong clay	0 11½	18.60	15.00	14.25	80.6
" Steele, W. & G., Reach Township	sandy loam	2 14	16.35	11.00	10.45	67.3
" Graham, Scugog Island		2 7	15.35	11.00	10.45	71.6
" Earls, Peterborough	loam	2 0	22.75	17.50	16.63	76.9
" Graham, Smith Township	clay loam	2 11	20.25	14.00	13.30	69.1
" Bowman, Hamilton Township	sandy loam	3 2	20.30	14.50	13.78	71 4
" Russel, "		2 3	21.45	16.50	15.68	76.9
" Wright, Hope Township		0 10	22.15	17.00	16.15	76.7
" McKenzie, E., Whitby		2 12½	15.85	12.50	11.88	78.8
Sir W. P. Howland, Toronto	garden soil	0 7	21.95	17.50	16.63	79.7
John Hume, Port Hope		3 12	16.55	12.50	11.88	75.5
Ontario Experimental Farm, Guelph		2 1½	21.00	18.00	17.10	83.7
Unknown		0 11½	18.10	14.00	13.30	77.3
Unknown		2 5	21.50	16.00	15.20	74.4
Average of 26 samples		2 2	18.95	14.35	13.63	75.7

Weight of beets.—This refers to beets after being washed and topped.

Degrees Brix.—This gives the percentage of total solids in juice.

Polariscope reading.—This gives percentage of sugar in juice.

Coefficient of purity.—This gives the percentage of sugar in total solids of juice and is a guide to determine the possibility of extracting sugar thoroughly. In some of the beets above given the low coefficient of purity would seriously interfere with the economical extraction of sugar. High percentage of sugar and high coefficient of purity are found, however, in several instances and prove that good beets can be grown for sugar extraction in some instances.

As the whole question is to be taken up in bulletin by the Agricultural Department at Toronto I would refer any wishing further information upon the experiments of the past year along this line to the office at Toronto.

Phosphates.—A block of phosphate of lime from Loughboro' Township, County of Frontenac, was sent to Cincinnati in 1888 to the Centennial Exposition. The weight was 870 lb. It came from a vein ranging in width from six to sixteen feet and being seventy feet in length. As this represents fairly a great deal of the supply of Canadian phosphate of lime I give an analysis of it made here.

Insoluble matters	0.608%
Phosphoric acid	38.370%, or
Phosphate of lime	83.790%

Four samples of commercial phosphates made by mixtures of bones and other animal matters gave of total phosphoric acid the following :—

9.01% ; 5.84% ; 8.71% ; 10.95%.

Wool Refuse.—A sample of wool refuse gave 3.70 per cent. of nitrogen. Woollen waste of various kinds has had at various times a prominent place in agriculture, its use being for crops requiring nitrogen and for soils in need of organic matter. The use of wool waste at the present day should be very carefully considered for the following reasons :—

1st. Woollen goods are very much adulterated ; formerly the refuse contained from 15 to 20 per cent. of nitrogen.

2nd. They are slow in action, much slower than many other nitrogenous manures, such as guano and dried blood.

3rd. They are now quite variable in composition, 2 to 7 per cent. of nitrogen.

Pea Meal.—Early in the spring Mr. Wm. Donaldson, of South Zorra, sent me a sample of pea meal obtained from a mill where split peas are produced :—Below we give the analysis side by side with the average of whole peas :

	Whole Peas.	Sample of Pea Meal.
Water	13.20	8.47 p. c.
Crude protein	22.40	25.93 "
Fat	3.00	2.51 "
Soluble carbohydrates	52.60	50.30 "
Crude Fibre	6.40	9.85 "
Ash	2.40	2·90 "

The main and only appreciable difference according to the chemical analysis is that the pea meal sent was much drier than ordinary peas, and correspondingly higher in nitrogen and fibre, so that on the whole the pea meal was a little stronger, had more nitrogen, than the ordinary peas.

Corn Analysis.—At the time of completing this report an extensive series of corn analyses is being carried forward in the laboratory in connection with the experimental work of the dairy department. From the corn raised by Prof. Robertson, forty-two samples have been selected of which duplicate analysis are being made by Messrs Zavitz and Harcourt. The results will be handed to Prof. Robertson, and given to the public by him in some form of his reports.

REPORT ON THE METEOROLOGICAL OBSERVATIONS, LYSIMETERS, DRAINAGE WATERS, ETC.

By Mr. C. A. Zavitz, B.S.A.

Prof. C. C. James :

Sir,—I have the honor of herewith submitting for your consideration, the report of that part of my work which comes under your supervision.

On June 30th, the thermometers were placed in the soil the roof of the rain gauge was removed, and everything prepared to commence reading the instruments by the first of May.

The soil in each lysimeter excepting the one with sod was cultivated on May 1st, and a fertiliser was applied to each at the rate of six hundred pounds per acre. The fertiliser was purchased at Hamilton, cost about $40 per ton, and contained, nitrogen, phosphoric acid and potash. No. 2 lysimeter was sown with barley on May 1st. No. 1 was continued as sod, and the rest were summer fallowed.

The drainage water from each lysimeter was collected during the summer, measured and a sample taken for chemical analysis, but owing to the pressure of other work none of the samples have yet been analysed.

The accompanying tables show the amounts of rain fall and drainage waters during five summer months, and a summary of readings of the air and ground thermometers, barometer, etc.

Rain Gauge.—The rain which fell during the summer, as compared with that of the two previous years was as follows :—

	1887.	1888.	1889.
	ins.	ins.	ins.
May	1.58	1.08	3.59
June	2.36	2.92	4.25
July	.61	2.21	2.67
August	2.71	2.16	1.92
September	1.52	1.55	1.04
	8.78	9.92	12.47

Lysimeters.—The amounts of drainage water received from the different lysimeters at the times when collected, are as follows :—

June 1st,	Pasture-loam	Receiving jar broken.
	Fallow-loam	1,600 c.c.
	Barley-loam	1,225 c.c.
	Sand	955 c.c.
	Clay	3,108 c.c.
	Loam	790 c.c.
July 1st,	Pasture-loam	Receiving jar broken.
	Fallow-loam	8,600 c.c.
	Barley-loam	1,065 c.c.
	Sand	4,830 c.c.
	Clay	2,305 c.c.
	Loam	3,035 c.c.
Oct. 1st	Sand	1,205 c.c.
	Clay	705 c.c.

Average of each Thermometer for each Month and for Whole Period.

Instruments.	May.	June.	July.	August.	September.	Average of the Whole Period.
Barometer	28.737	28.859	28.954	28.907	28.915	28.8
Attached thermometer	53.8	61.9	69.9	67.3	60.3	62.6
Temperature of the air	52.3	59.8	67.8	64.4	58.3	60.5
Temperarure maximum	62.9	72.4	83.9	76.1	69.2	72.9
Temperature minimum	40.4	52.1	51.5	50.0	43.3	47.2
Soil temperature at 1 inch in depth	55.9	62.0	72.4	69.2	61.1	64.1
" 3 inches in depth	54.7	61.5	69.7	67.0	60.9	62.7
" 9 "	54.2	58.8	67.4	65.1	61.1	61.3
" 24 "	51.4	56.3	63.2	63.5	61.3	59.5
" 36 "	50.9	53.1	62.2	62.2	61.3	57.9
" 48 "	49.0	51.1	60 1	60.4	60.1	56.1
Soil temperature at 3 inches in sand	53.7	60.0	69.0	66.6	60.4	61.9
" 3 " clay	55.3	61.1	71.6	67.5	60.0	63.1
" 3 " loam	55.9	61.6	71.3	66.9	59.7	63.1
" 9 " sand	54.8	69.0	66.9	65.3	60.6	61.3
" 9 " clay	55.3	59.4	68.3	66.6	61.6	62.2
" 9 " loam	54.8	59.8	67.5	66.1	60.6	61.8

THE INCREASE AND THE DECREASE OF THE AVERAGE OF EACH THERMOMETER FOR EACH MONTH.

(+ represents increase, and — represents decrease.)

INSTRUMENTS.	May to June.	June to July.	July to August.	August to September.
Air thermometer	+ 7.5	+ 8.0	— 3.4	— 6.1
Thermometer 1 inch in soil	+ 6.1	+10.4	— 3.2	— 8.1
" 3 inches in soil	+ 6.8	+ 8.2	— 2.7	— 6.1
" 9 "	+ 4.6	+ 8 6	— 2.3	— 4.0
" 24 "	+ 4.9	+ 6 9	+ 0.3	— 2.2
" 36 "	+ 2.2	+ 9.1	.0	— 0.9
" 48 "	+ 2.1	+ 9.0	+ 0.3	— 0.3

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.
Thermometer in air	Sept. 23	36.2	69.0	32.8	July 29	75.2	52.4	22.8
Ther. in soil at depth of 1 inch	Aug. 28	58.5	96.8	38.3	Aug. 28	96.8	64.0	32.8
" " 3 inches	Aug. 22	45.5	81.5	36.0	June 15	80.3	55.9	24.4
" " 9 "	July 16	61.2	85.7	24.5	July 17	85.7	57.8	27.9
" " 24 "	June 19	53.4	67.5	14.1	June 22	67.5	56.3	11.2
" " 36 "	July 18	50.0	62.7	12.7	July 20	63	53.0	10.0
" " 48 "	May 15	47.5	56.1	8.6	May 15	56.1	47.9	8.2
Ther. in sand at depth of 3 inches	May 23	38.7	68.7	30.0	Aug. 22	78.7	55.3	23.4
" clay " 3 "	May 23	41.0	73.0	32.0	May 23	73.0	44.8	28.2
" loam " 3 "	May 23	39.1	70.4	31.3	July 26	81.4	56.0	25.4
" sand " 9 "	July 18	55.3	69.2	13.9	Aug. 13	71	57.7	13.3
" clay " 9 "	Aug. 23	63.5	86.6	23.1	Aug. 23	86.6	70.0	16.6
" loam " 9 "	July 19	53.3	70.9	17.6	July 18	69.6	53.3	16.3

TABLE OF HIGHEST SINGLE READINGS OF THERMOMETERS at different depths with d ate o same (for air also).

SITUATION OF THERMOMETER.	DATE OF MAXIMUM TEMPERATURE.			MAXIMUM TEMPERATURE.
	Month.	Day.	Hour.	
Thermometer in air	September	2	1 p.m.	86
Thermometer in soil at depth of 1 inch	August	28	1 p.m.	96.8
" " " 3 inches	May	18	1 p.m.	88.2
" " " 9 "	July	17	1 p.m.	85.7
" " " 24 "	September	2	9 p.m.	73.0
" " " 36 "	July	7 and 14	1 p.m.	69.7
" " " 48 "	August	25	1 p.m.	62.6
Thermometer in sand at depth of 3 inches	August	27	1 p.m.	85.2
" clay " 3 "	July	8 and 18	1 p.m.	90.7
" loam " 3 "	July	8 and 18	1 p.m.	89.8
" sand " 9 "	July	10	1 p.m.	72.7
" clay " 9 "	July	10	1 p.m.	76.8
" loam " 9 "	July	10	1 p.m.	77.4

TABLE of each day's reading of Recorded Rain ; also of following day.

Inches of rain.	DATE.	Barometer.	Attached Thermometer.	Air.	Temperatures of Soil. 1 inch.	3 inches.	9 inches.	24 inches.	36 inches.	48 inches.	Sand 3 inches.	Clay 3 inches.	Loam 3 inches.	Sand 9 inches.	Clay 9 inches.	Loam 9 inches.
		28.818	54.8	46.7	52.2	52.4	54.6	51.6	51.8	49.0	52.4	53.6	52.6	55.6	55.9	54.6
	May 15	28.816	58.8	55.6	60.5	59.1	55.2	54.8	50.3	47.9	55.2	58.7	58.4	55.3	55.9	55.7
	" 16	28.948	71.3	63.0	68.1	65.5	58.6	51.6	49.6	50.6	64.6	65.1	65.0	58.9	59.5	60.1
	" 17	28.568	45 6	44.6	50.6	50.7	54.8	53.6	52.3	49.3	52.4	52.3	54.1	58.2	57.9	56.8
	" 21	28.657	41.6	40.9	46.4	45.8	51.1	52.9	52.3	49.7	46.5	47.1	46.6	52 6	52.3	50.8
	" 22	28.455	52.3	49.3	53.3	53.5	54.5	52.3	51.2	49.1	53.6	53.5	53.4	55.0	55.4	54.7
	" 27	28.663	37.2	36.1	40.8	41.9	49.7	51.8	51.2	49.1	43.5	42.8	43.5	51.1	50 5	49.2
	" 28	28.892	42.8	38.4	48.0	43.9	46.0	50.6	50.9	49.3	43.5	43.8	43.4	47.2	50.0	46.1
	" 29	28.598	41.6	43.5	42.0	42.6	44.8	49.4	50.1	48.9	42.5	42.6	42.1	45.5	45.1	44.3
	" 30	28.621	52.7	54.5	54.5	53.5	48.9	48.3	49.2	48.6	52.9	53.4	53.6	48.2	49.2	49.7
	" 31	28.637	52.5	45.4	49.7	49.5	50.3	48.6	48.9	48.0	49.8	50.4	49.9	50.6	50.7	50.8
	June 1	28.744	51 5	49.8	50.3	50.3	50.6	48.9	49.0	48.0	50.8	50.8	50.9	50.4	51.0	51.1
	" 2 (Sunday)	28.722	55.9	52.2	53.7	54.2	51.4	49.2	49.0	48.0	53.4	53.9	53.9	51.2	51 7	52.0
	" 3	28.570	51.2	51.3	54.6	54.2	53.1	48.9	49.0	48.0	54.9	55.2	55.4	53.2	53.4	54.1
	" 4	28.478	49.6	48.7	51.2	51.5	52.2	49.6	49.2	48.0	49.2	52.9	53.5	52.6	52 6	52.9
	" 5	28.568	57.6	56.4	55.6	54.5	52.6	50.1	49.6	48.1	53.5	51.7	52 6	53.8	53.9	54.1
	" 7	28.604	60.9	58.6	56.4	59.6	56.2	51.1	50.0	48.3	56.5	59.4	59.8	55.9	56.4	57.5
	" 8	28.694	61.0	59.0	60.2	58.6	55.5	52.9	50.4	48.6	58.3	58.5	58.4	55.9	56.7	56.1
	" 9	28.882	61.8	59.4	61.4	60.8	58.7	53.9	51.0	49.2	61.2	58.1	62.5	58.6	58.8	60.0
	" 10	28.926	69.0	78.4	68.9	66.0	61.0	56.0	54.0	51.7	64.0	65.2	65.0	62.1	62.0	62.0
	" 16	28.722	70.5	70.3	72.5	71.3	64.9	57.0	54.6	52.3	69.3	71.6	66.5	64.0	65.0	66.1
	" 17	28.596	69.3	64.3	57 0	57.3	60.6	54.7	53.3	53.0	61.3	61.4	61.6	62.7	61.9	63.6
	" 19	29.938	58.3	53.6	57.9	57.6	55.6	57.9	56.2	55.1	56.3	57.4	57.1	60.0	58 9	58.4
	" 20	28.667	63.0	60 6	67.3	63.4	63.2	57.3	54.2	51.9	64.5	65.4	63.5	62.8	62.6	62.7
	" 21	28.680	62.2	56.6	62.2	60.6	62.0	60.0	58.3	53.3	60.7	63.2	64.2	62.6	62.9	63.5
	" 22	29.033	65.4	61.6	67.0	66.6	63.3	58.7	57.2	55.4	63.5	61.8	63.4	64.7	64.0	63.7
	" 27	29.060	65.3	60.7	62.4	67.0	56.4	57.2	51.9	54.0	58.6	61.7	62.0	58.8	62.4	63.5
	" 28	28.923	78.0	72.8	79.3	75.6	69.1	62.3	59.6	56.4	74.6	77.3	76.1	67.8	69.2	69.3
	July 2	28.749	75.1	70.1	72.7	70.2	69.1	62.4	60.0	57.0	61.0	71.7	69.7	67.2	68.5	68.6
	" 3	28.856	77.6	75.6	78.2	74.8	70.9	64.6	61.8	59.0	75.4	78.9	78.7	41.8	71.8	72.5
	" 19	28.879	70.2	71.3	74.5	70.7	69.3	65.0	62.7	59.2	71.2	75.1	73.5	69.0	70.8	70.9

TABLE of eachdays readings of Recorded Rain ; also of following day.—*Concluded.*

Inches of rain.	DATE.	Barometer.	Attached Thermometer.	Air.	Temperatures of Soil. 1 inch.	3 inches.	9 inches.	24 inches.	36 inches.	48 inches.	Sand 3 inches.	Clay 3 inches.	Loam 3 inches.	Sand 9 inches.	Clay 9 inches.	Loam 9 inches.

Inches of Rain.	DATE.	Barometer.	Attached Thermometer.	Air.	Temperatures of Soil. 1 inch.	3 inches.	9 inches.	24 inches.	36 inches.	48 inches.	Sand 3 inches.	Clay 3 inches.	Loam 3 inches.	Sand 9 inches.	Clay 9 inches.	Loam 9 inches.
21	July 13	28.766	71.7	70.6	71.5	70.8	70.1	65.2	63.0	60.0	70.3	71.6	71.4	71.6	71.8	71.8
	" 14 (Sunday)	28.786	61.0	57.0	69.0	66.0	65.0	63.5	69.7	60.0	65.1	68.8	66.6	68.9	62.4	67.7
	" 22	28.819	69.4	66.8	75.7	70.8	69.4	61.4	62.9	60.2	68.6	72.5	71.0	68.0	68.9	68.3
	" 23	28.816	73.7	71.1	75.0	72.2	67.0	64.9	63.0	60.3	70.5	72.4	72.3	68.6	69.2	69.2
	" 27	28.656	73.0	68.4	72.4	70.1	66.8	63.9	63.4	60.6	69.1	69.0	69.6	67.1	67.8	66.2
	" 28 (Sunday)	28.778	59.0	58.0	61.3	59.5	66.0	64.6	63.0	60.5	58.3	66.5	60.0	68.0	67.0	67.7
	" 29	28.870	63.1	60.6	67.1	64.7	65.5	64.5	62.2	60.4	68.6	61.4	68.6	65.0	64.7	64.3
	" 30	28.845	60.3	60.9	58.5	60.3	61.3	60.7	62.7	60.7	59.8	59.6	61.6	59.9	62.5	62.8
	Aug. 2	28.773	64.5	63.3	68.8	65.5	61.4	64.5	62.6	60.6	64.6	66.5	65.5	66.1	65.9	65.4
	" 3	28.867	67.1	64.5	70.9	68.5	65.8	63.9	62.6	60.6	67.6	67.8	66.0	66.1	67.3	66.7
	" 9	28.796	64.8	63.3	68.3	66.5	67.1	64.8	63.0	60.6	65.2	67.1	66.7	65.2	68.5	68.0
	" 10	28.658	66.8	66.6	74.4	73.7	63.9	63.9	62.8	60.7	70.3	72.9	73.2	62.9	64.5	63.3
	" 20	28.874	74.8	71.3	73.4	71.5	67.2	62.2	60.9	59.6	67.0	70.8	70.1	67.0	67.3	67.8
	" 21	28.727	71.8	70.0	70.4	69.5	67.4	65.4	61.2	59.7	65.8	65.7	66.0	67.2	66.6	67.3
	Sept. 5	28.750	70.1	68.7	71.8	69.8	69.4	64.7	63.2	61.1	69.4	68.7	69.2	66.6	69.6	69.7
	" 6	28.915	63.8	59.4	62.6	63.1	65.1	64.6	63.6	61.2	61.9	62.5	61.5	66.3	75.8	65.0
	" 16	28.926	53.2	51.9	53.8	55.6	62.7	63.8	62.9	61.0	56.1	56.5	56.9	64.3	63.[illegible]	62.4
	" 17	28.785	54.8	52.0	57.1	57.8	59.5	62.8	62.3	61.0	55.6	56.0	57.1	60.1	59.[illegible]	58.8
	" 20	28.287	50.8	51.9	50.9	51.9	55.0	59.2	60.2	59.8	51.3	52.0	52.6	55.2	55.2	54.9
	" 21	38.639	47.5	48.4	47.5	48.4	54.2	58.9	59.4	59.0	49.4	49.3	50.5	55.6	54.8	53.6
	" 30	28.414	60.4	55.7	57.7	56.5	55.3	55.5	56.5	56.5	56.1	56.5	56.5	54.8	54.7	54.8

TABLE of eachdays readings of Recorded Rain ; also of following day.—*Concluded.*

I would again like to bring to the notice of the Minister of Agriculture the advisability of appointing a permanent assistant in the chemical laboratory, one to whom could be given the carrying on of valuable analytical work. The growth of the experimental work in connection with both farm and dairy presents to us important chemical work, more than we can at present manage. The thorough carrying on both of the lecturing department and of the analytical and experimental department demand, I think, the services of two men, one for each.

During the early months of the year Mr. Zavitz assisted in the laboratory. He is also engaged there now, and assisted by Mr. Harcourt, Prof. Robertson's dairy assistant, he is carrying out analytical work for the dairy department. During the early summer weeks valuable assistance was rendered by Mr. S. C. Calvert, one of our associates, who is at present completing the chemistry course at McGill College, Montreal.

I wish to refer here especially to the valuable work of Mr. Zavitz and to call attention to the fact that his work in the laboratory and his work in the experimental department should be given to two men.

To the Minister of Agriculture and to yourself I wish in closing to express my thanks for the encouragement given to the chemical department, and trust that increased liberality on the part of the Government will enable us to add to our appliances library and conveniences so that I shall be enabled speedily to bring the laboratory and analytical department to that degree of excellence to which it is my desire.

I remain, sir, your obedient servant,

C. C. JAMES,
Prof. of Chemistry.

PART IV.

REPORT OF THE
PROFESSOR OF VETERINARY SCIENCE.

The Veterinary Surgeon has nothing to report this year owing to the sale of all Stock after the destruction of the farm buildings a year ago.

JAMES MILLS, President.

PART V.

REPORT OF THE
FOREMAN OF HORTICULTURAL DEPARTMENT.

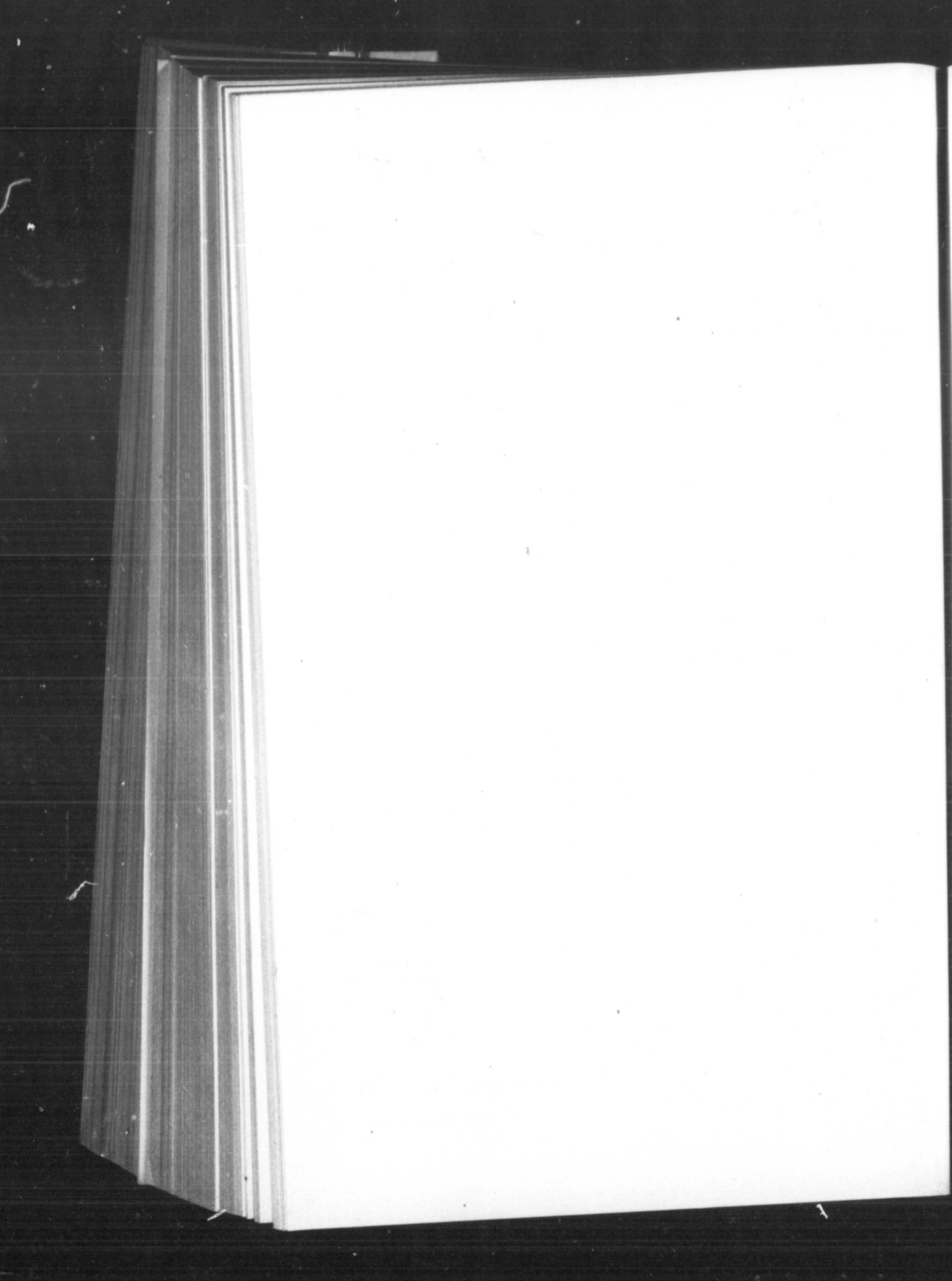
To the President of the Agricultural College: December 31st, 1889.

SIR,—In submitting to you the garden produce supplied to the college during the year, I deem it unnecessary for me to make anything in the shape of a report. Prof. Panton has in this, as in the last two or three years, issued various bulletins on horticulture, which, together with his report of this year will, I presume, cover all that is noteworthy in this department. I might, however, remind you that on account of the very severe late spring frost which we experienced at the end of May, the fruit crop here, in common with that in a larger portion of the province, was very small. Apples, pears, plums, cherries and grapes, were with us a complete failure, reducing to a considerable extent our usual supply. Of the smaller fruits, strawberries, raspberries, gooseberries and currants, a small crop was produced, nearly sufficient to meet the requirements of the college. All other vegetable crops were a large average, and in their season good in quality and abundant in quantity, and such as could be kept are as usual stored in sufficient quantity for winter use; and also a small surplus as here shown, has been sold and added to revenue.

Vegetables and fruit supplied to College at current rates.....	$641 54
Sold for cash.....	80 37
	$721 91

Your obedient servant,

JAS. FORSYTH.



PART VI.

REPORT OF THE PHYSICIAN.

To the Hon. CHARLES DRURY,

Minister of Agriculture :

SIR,—I have the honor to present to you my fifteenth Annual Report. During the year just closed we have had about the usual run of ailments, with one exception, and that was an outbreak of Tonsillitis, attacking many of the students and several of the servants, the disease in most cases showing well marked ulceration, but nothing of a serious nature occurred.

The College is in a good sanitary condition.

The flushing power of the students' water closet and used by them in case of sickness, might be increased to advantage.

I have no doubt that the system of sewerage introduced by you at the College this year will ultimately be of great service from a sanitary point of view.

I have the honour to be, Sir,

Your most obedient servant,

E. W. McGUIRE,

Physician Ontario School of Agriculture.

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To the Preside

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PART VII.

REPORT OF

THE PROFESSOR OF AGRICULTURE.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,

To the President: 31st December, 1889.

SIR,—I have the honor of herewith submitting my report for the respective Departments of this Institution under my more immediate supervision for the year 1889. These include, in addition to my own report, those of Mr. J. E. Story, the Farm Foreman, and of Mr. C. A. Zavitz, Assistant in the Experimental Department.

In view of the constant assistance given by these gentlemen in the most ungrudging spirit, without which much less would have been accomplished, I feel it my duty to refer to this fact here, and also to bear testimony to the fidelity and diligence of the work-hands generally, and of the students during the past year. In consequence of this many improvements were completed which would otherwise have been impossible in a season so prolific in weed-production, and which produced a harvest so difficult to reap.

The year 1889 has been one of abundant labors at the Experimental Farm. As mentioned in the last report, the fine set of outbuildings, including the barn, horse-stable, sheep-house, bull-house and silo, all went up in smoke on the evening of November 26th, 1888. This calamity disconcerted all the plans, virtually, that had been made prior to that time for conducting the work of 1889, and very much enhanced the difficulty of executing new ones that were formed subsequently.

The inconvenience arising from having to keep the horses in the stables at the Creamery when the stabling and accommodation were imperfect was very great, and it entailed the loss of a large amount of valuable time. The additional oversight in consequence of the renewal of the buildings was also a great tax in the same direction, and the amount of time required for the careful selection of the animals wanted in the re-stocking of the farm, added to the three weeks spent in delivering lectures at the farmers' institutes, left too little to be given to the improvement of the farm and its surroundings.

The improvements undertaken during the year were confined chiefly to the renewal of old fences, the erection of new ones, the destruction of weeds within the farm and along the public roads bordering upon it, and the improvement of the roads around and within the farm.

NEW FENCES ERECTED.

New fences were put up on both sides of the town line, extending from the Brock Road to the Edinburgh road. This road forms a portion of the town line between the townships of Guelph and Puslinch. The length of the fence thus erected was in all one and one-fourth miles, with the exception of a few rods that had been put up in 1888. This work was commenced in the autumn of 1888, and was all done by farm and student labor with the exception of sinking the post-holes. The old rail snake-fences

were first taken away, and the heaps of stones, rubbish and brush-wood that lined their borders were removed. These stones which lay in heaps in the fence corners and in confused masses nearly all along both sides of the road were removed, the large ones in the winter on stone boats, and the small ones in the summer on wagons. The former were collected for building into a fence in another part of the farm, and the latter were deposited to form the road-bed of the private road that was graded later on in the season. I think it no exaggeration to say that from four hundred to five hundred stone-boat, cart or waggon loads of stones were removed from this road. And here I would like to enter a strong, yet friendly protest against the mischievous practice adopted by so large a number of farmers of gathering stones in promiscuous heaps all along the fence bottoms. They are sure to produce trouble in time, and when a new fence is to be built give rise to a very large amount of labor in their removal. It may be necessary to pile them in heaps for a time, but they should never be allowed to remain there during a whole year.

A ridge eight feet wide was then formed with the plow, upon the centre of which the fence was built. This ridge was gently rounded—not violently so, lest the rains should lower the crown, and so form too large an opening below the bottom board of the fence. The advantages of such a ridge are two—first, the comparative height of the fence is increased, and second, the water is borne away from the posts. This ridge was made smooth by running over it from end to end a plank leveller.

The fence consisted of round cedar posts eight feet apart, sunk three feet in the ground, and pointed in the low parts. The bottom board, following close upon the line of the ground, is pine, and eight inches wide. The top board, of the same material, is six inches broad and comes up even with the top of the posts. Between these boards there are stretched along four strands of ordinary barbed wire, the lower one of which is five inches from the bottom board. Ascending the post the other spaces are 6, 6½, 7½ and 9 inches apart respectively. The height of the fence is four feet.

The portion built in 1888 consisted of but three strands of barbed wire, but this was not found sufficient to keep out the lambs that fed upon the adjoining highway. The spaces in this portion were 7, 8½, 9 and 9½ inches respectively.

The Destruction of Weeds on the Farm.

A good deal of attention was given to this branch of the work. In several of the fields the Canada thistles were growing more numerously than they should be on a model farm. We allowed none of them to go to seed. In some instances they were cut with the spud, especially in fields where they were not very numerous. The principal mode, however, adopted for their destruction was the growing of hoed crops.

Of this, in field number 3, twelve acres of roots were grown; in field number 9, twenty acres of corn, rape and millet were grown, but chiefly corn, and in field number 17 seven and one-half acres of potatoes. (See Farm Foreman's report, pp. 120.) In each of these fields most thorough work was made of the thistles, so that we do not anticipate much trouble on the score of thistles from these fields in the near future. Particular attention was also given to the spudding of the few surviving thistles that were found in fields devoted last year to the growth of corn and roots, as it is the intention to hold the fort if possible in any of the fields in which weeds are virtually subdued.

This cannot probably be successfully done in any case unless such fields are gone over at least twice a year, say June and September, with spud in hand, and every form of weed life detected and destroyed that may be found lingering there, or that may recently have got a hold. This process will require one hand to go over about every ten acres per day, and will certainly prove a wise outlay. Indeed I am convinced that the farmer who will not do this cannot have a farm that is absolutely clean.

It is the intention next year to try and make a thorough cleaning of eighty-five acres and without the introduction of the bare fallow.

Destruction of Weeds along the Highways.

The highways around the farm are foul with thistles, blue-weed and other mischievous forms of weed life. It is our purpose to have these made absolutely clean. The thistles were cut many times with the spud in 1889.

Blueweed is very abundant along all the roadsides in this part of the country. It is a biennial, branching in its habit of growth, attains to the height of one to two feet, and blossoms from June to September. The flowers are a beautiful blue colour, and each plant produces an enormous number of seeds. Many of these remain in the pods until winter, when they are driven by the fierce winds for miles over frozen surfaces. This plant does not well withstand vigorous cultivation, but becomes very troublesome in pastures and along highways. The only effectual mode of destroying it in such places seems to be to cut it below the crown with the spud. This requires to be done several times each season for two years as younger plants follow from time to time, producing fresh blossoms. When thus treated for two seasons the plants will all be destroyed, unless such as may have been produced in the interval from seeds lodged in the ground. Cutting with the scythe only seems to encourage the growth of the young plants by increasing the number of the branches.

Ox-Eye Daisy was found troublesome in one of the newly sown meadows. Because the meadows were new the plants were found growing singly, but in some they were very numerous. When in blossom they were cut say an inch below the surface with the spud, and pulled with the hand. They were gathered in piles and drawn away with the carts. It is believed that thorough work was done.

Wild flax was also found in many places in the meadows, and this was carefully pulled by hand. The same was done with the wild mustard and the different species of cockle. Burdocks received no quarter, nor did couch grass wherever it was found. Only a few heads of the wild oats were found, and these were of course pulled, and the pigeon weed found in the winter crop shared the same fate.

Improvement of Roads Bordering on the Farm.

The road already referred to as having had new fences put up along its borders was taken in hand in the spring. The tens of thousands of stones were first removed from its borders. The heaviest of these had been drawn away in the winter. The unsightly, scrubby trees were then dug out by the roots, when the borders of the road as far as the ridges which form the fence beds were plowed and harrowed, and then levelled with the plank leveller. These were again plowed later in the season, and levelled again in the same way. Seven or eight furrows were then plowed where the ditches were to be made. Great pains were taken to have these made perfectly straight. The grading of the road-bed was the next operation. This was done chiefly by the aid of the scraper, although shovels were used when necessary, in order to perfect the uniformity of the grading. The road-bed is 34 feet wide between the outer rims of the ditches, is fairly rounded, but only gently so, and is quite wide enough for two loaded hay wagons to past without any difficulty. This cannot be said of many of the graded roads of Ontario. It is also about the proper width for harmony of appearance when compared with the sides bordering upon it. With the aid of a small grant from the Legislature and from each of the neighboring townships this road was gravelled throughout three-fourths of its entire length at the rate of three loads of gravel to the rod. The gravel was made to cover ten feet in width of the road ; no coarse stones were allowed in the gravel, and great pains were taken by Mr. Wm. Squirrel who was put in charge of the spreading. So completely did he succeed in this that a divergence of six inches in the borders of the gravel part of the road-bed could not be seen from end to end. Thus it is everywhere. We find some who do everything neatly that they turn their hand to, and others who do all their work in a slovenly, uncouth manner although they do no more in quantity than the former.

The borders of this road have been levelled as smoothly as the surface of a cultivated field, and the whole road except the part gravelled will be sown to grass in the spring. It is the intention to keep down weeds by the use of the mower, as the grading is of a character that will admit of this. If a herd law is passed in the adjoining townships prohibiting sheep from running at large, shades will be planted along this road, but so as to interfere very little with the use of the mower.

Why is it not easily possible to grade a majority of the roads in the Province as this has been graded ; that is, to have the grade even and uniform and so thoroughly done that no more will be required to put the same in order than the adding of some

gravel occasionally, or the repairing of a sluiceway? And why may not each farmer level the sides of the highway bordering on his farm and plant trees along the same, thus adding to the value of the farm in case of selling, more, it may be, than twice the outlay?

The most laborious piece of work undertaken during the year was the improvement of the private road running from the Brock road past the outbuildings and on toward the rear of the farm. In our portion of this road many hundreds of loads of stones of all sizes had been buried. They had been dumped promiscuously into the road-bed to the depth of from one to three feet, and to the width of about thirty feet. Deep, wide ditches had then been made at the sides to get earth to cover these, with the result that the road-bed was quite too high, and the ditches quite too low to correspond with the other portions of the road. These were taken out at an enormous expenditure of muscle and piled where they are to be made into a fence. The whole road was then ploughed and levelled twice during the season. The road-bed was scraped to the width of ten feet and to the depth of from nine to twelve inches, and the excavation was filled with small stones. The road was then graded with the plough and scraper, great pains being taken to have the grade uniform and the edge of the borders straight. The width of the road between the outer edge of the ditches is thirty feet. The grade therefore of the road is less in this case than in that of the town-line above described, as the road-bed is a little narrower. Gravel will be drawn upon this road during the winter and spread evenly upon it in the spring.

The borders of this road are being nicely smoothed by means of horse and hand labour, and will be planted with forest trees of different varieties. These will of course require protection for a few years, which will be furnished in the form of a fence on the sides of the borders next the drive. The present year the private road on the opposite side of the farm will be dealt with in the same way.

Four bull-paddocks were enclosed during the year, in which these animals may get exercise. They are 170 feet long and 76 feet broad, and are surrounded by a board fence 6 feet high. The posts, which are cedar, are sunk 4 feet in the ground and are 7 feet apart. Three rows of scantling 2 x 4 inches were stretched along these and sunk one inch into the posts on both sides of the post and directly opposite to each other. The distance of these from the ground (top side) is 13, 34 and 56 inches respectively. Half way between the posts a block was inserted between the scantlings opposite to each other and spiked there to give strength to the fence. The boards are inch hemlock, and of course nailed on both sides of the posts, and will yet be covered with a cap.

All these improvements, and many others not enumerated here, were done with farm and student labour, the only exception being the drawing of the gravel on the town-line, which was done by the neighbouring municipalities; nor was any special grant used in the accomplishment of these improvements unless in the material used in building the fence.

The Experimental Work.

Owing to the loss of the buildings and the sale of the live stock, very little was done in the line of live stock experiments. The experiments in the field naturally divide themselves into experiments with cereals, root crops, fodder crops and fertilisers. Experiments with cereals are again sub-divided into those conducted in large plots in the field and small plots in the experimental grounds, proper.

The experiments of the past year in grains were undertaken on a large scale compared with those of former years. And although some valuable lessons are to be learned from them, they are in some respects to myself at least disappointing. This arises from two causes that in common phrase may be termed accidental. I refer to the action of rust on some of the grains, especially the wheat, and the ravages of the cutworm on the principal field devoted to the large plot experiments.

The former of these causes acted with unusual virulence. To so great an extent did rust prey upon the crop of the farm that no one field of grain grown on the place altogether escaped, although the early sown barley was affected but little. Nearly every kind of grain sown grew with unusual luxuriance and gave promise, in most instances, of an abundant yield till within a few days of harvesting, when on several of the varieties rust appeared.

Something of this is to be attributed to the season, rust being present in an unusual degree in most parts of the province. It was perhaps caused in part by the nature

the soil, much of it being loam with an abundant supply of humus. But these reasons taken together do not furnish a sufficient explanation, as the grain in this neighborhood was afflicted with rust in an unusual degree. It cannot be attributed to lateness of sowing, for the spring crop had scarcely ever been sown so early in the history of the farm. I cannot but conclude that locality has much to do with the scourge. It may be that the gentle current of air coming from the low lying valleys of the Speed, move the fogs in the direction of the wide valley that angles across this and other farms, over which they brood long enough to accomplish the mischief referred to. This view finds further confirmation in observations made in the various sections of the outlying neighborhood. In the vicinity of Puslinch Lake, but a few miles to the southward where the land is a little lighter, there was but little injury from rust, and the same may be said of grain in the opposite direction at an equal distance. To so great an extent has the evil prevailed not only the past season but in previous years, that unless some means can be adopted for obviating the rust difficulty in the near future it will be well perhaps to consider if some plot of ground in another locality had better not be chosen for carrying on duplicate experiments with field grain. Meantime it is the intention next season to prepare field No. 18, the highest lying field on the farm, for the experimental work. The grain experiments will be removed to this when the soil is more uniform.

The visitation of the cutworm was quite unlooked for, although it is of periodical occurrence in many sections. No traces of its ravages had been observed on the farm the previous year. Reference to the means that should be adopted to destroy the cutworm does not, properly speaking, belong to this department, but I desire to mention here notwithstanding that the bare fallow, the growing of peas and the cultivation of hoed crops are amongst the most effective methods of banishing the intruder. Cutworms do not seem to relish peas. The bare fallow destroys them by starving them; and the cultivation of hoed crops acts on the same principle. Fields liable to be infested with them should not be allowed to lie long in grass. Some have argued that a heavy dressing of salt at the time of sowing the grain where their presence is suspected will check their ravages. If the top dressing is quite heavy this remedy may prove of some efficacy. It may be mentioned here, however, that in the field above referred to, where the ravages of the cutworm were so disastrous, salt had been sown on the pasture grown there the previous season to the extent of 400 lbs. per acre. This makes it evident that salt sown on a pasture or meadow that is ploughed in the fall and sown with some kind of crop the following spring, will not provo efficatious in preventing the ravages of the cutworm.

For experimenntal purposes in the farm and live stock departments the sum of $1,720.00 was set aside, and in the dairy department $1,750.00. For the present year the Minister of Agriculture has set aside more than $3,000.00 in the experimental department alone. An expenditure that will, I believe, meet with the hearty approval of every farmer in the land, as it will enable us to embark freely in conducting valuable experiments connected with the production of live stock.

The amount devoted to experimental purposes in the United States for the present year is fully $725,000, or about $15,000 for each of the experimental stations that have been established there. This fact presses home the thought that if we are to keep the agriculture of Ontario in the front rank, we must bestir ourselves in the line of experiment, which is always of necessity conducted with no little outlay.

The Minister has also kindly acceded to my request to have a person employed, whose whole time subject to the supervision of myself and assistant will be given to this department when the same may be found necessary. This arrangement will enable us to overtake a very large amount of work in this important department.

Experiments with Cereals in Plots.

The various experiments carried on in growing cereals in plots were conducted on a much larger scale than ever before in the history of this institution. During the winter of 1889 one of the most extensive importations of seed grain that was ever made to this continent, that is, if we consider the number of the varieties included in the importation was arranged for. Messrs. Oakshott & Millard, seedsmen, of Reading, England, collected

the grains, which embraced 54 samples of barley, 10 of peas, 77 of spring wheats, 71 of oats, and 25 of winter wheats. To these grains, were added a large number of varieties picked up in Canada, and were grown side by side with the former, the full details of which are given in the report of the assistant in this department.

The whole number of grain and grass plots was no less than 464, which does not include the experiments with field roots and potatoes. The work undertaken in this line was almost double that undertaken during any previous year. Experimental work is of no value without it gives results that are either positive or negative, and but few experiments should be regarded as final or conclusive that are not repeated under the same conditions. Some of them require repeating many times owing to the variableness of the seasons and other attendent conditions. When so repeated and the results point generally in the one direction, it may be that even then it is the general trend of the experiments that becomes of value rather than the exact results obtained. This is true both in experiments with grains and animals. With the former important variations may result from climate as affected by locality. This, so far, impairs the worth of all field experiments, hence the great value of having them repeated simultaneously in several sections of the one province. In regard to experiments with animals, individuality plays so important a part that the general trend of the results forms the valuable feature rather than the exact results, as in the case of grains.

Viewed in this light, time is necessary before reliable conclusions can be published which shall serve as guides to the farmer in his practice. We feel, therefore, that this year we have but laid the foundation of a series of experiments which it is believed will be of great value to the farmer.

These experiments will all be repeated the coming season, not only from the same samples as were grown last year, but also from the product of these, when if we have a favorable season we will undoubtedly get some results of much value.

A summary is given below of the various kinds of grains grown in the plots with their general behavior as regards germination, length of straw, yield of grain and straw per plot, and yield of grain per acre.

Grain.	No. of Varieties.	Country.	Germination.	Length of staw, inches.	Grain per plot. lb.	Straw per plot lb.	Grain per acre bush.
Barley.	18	Germany	90.3	33.3	33.9	68.3	34.5
	4	Sweden	89.4	37.5	29.4	63.0	30.6
	1	Russia	90.0	43.0	41.0	84.0	42.7
	2	Scotland	95.0	39.0	22.5	50.0	23.0
	10	England	91.4	37.7	26.6	65.2	27.7
	9	France	83.5	38.6	32.0	66.2	33.3
	12	Ontario	91.4	36.3	35.7	55.3	37.2
	56	Average	77.7	39.3	32.8	63.8	30.3
				Peas in pod.			
Peas.	10	England	89.2	3.8	34.0	39.1	28.3
	6	Ontario	91.3	4.2	48.9	65.0	40.6
	16	Average	89.9	3.3	39.6	48.8	32.9
Spring Wheat.	12	Germany	86.3	37.3	5.0	25.	8.4
	12	Russia	81.2	31.0	4.3	21.3	7.2
	1	Scotland	81.0	6.0	.....	.....	.....
	5	England	.....	.....	2.5	27.5	4.2
	21	France	81.9	36.8	3.9	23.2	6.5
	9	Australia	79.4	26 2	1.9	15.7	3.2
	8	Ontario	76.1	43.1	5.4	28.2	8.9
	68	Average	81.5	36.0	3.9	23.1	6.6
Oats.	16	Germany	79.5	60.	17.9	62.8	52.5
	2	Sweden	67.5	60.1	10.7	71.6	31.6
	6	Russia	77.8	58.3	15.8	65.3	49.5
	14	Scotland	80.9	58.6	12.3	68.9	36.2
	10	England	84.0	52.5	14.1	43.9	41.5
	20	France	82.5	49.2	18.6	52.2	54.8
	3	Australia	72.6	52.0	7.5	46.6	22.1
	19	Ontario	86.5	50.4	18.8	53.5	53.6
	90	Average	77.4	54.1	16.4	7.2	47.8

From the preceding table it is apparant that the seed was in good condition for growing, as the percentage of seeds which germinated is high.

The Barley Plots.—In all, there were 61 plots of barley, including 56 varieties. In point of germination, the Scotch varieties stood the highest, but in yield of both grain and straw they were the lowest. The varieties from Germany behaved well on the whole, and we hope to get from them some kinds that will be useful to grow here. The yield of the 18 varieties from that country was at the rate of 34.5 bushels per acre, being about 13 per cent. above the average of all varieties.

In handling so many varieties maturing at different dates, it is impossible to harvest them all under like conditions, as the time of ripening varies so much that some are more exposed than others to adverse conditions of weather. It is therefore not easy to make a comparison between the different varieties in regard to color that would be accurate.

It is worthy of notice, that of the thirty-seven two-rowed varieties in the table on (page 126) of which the yields are given, they averaged at the rate of 31.7 bushels per acre, while the seventeen samples of six-rowed averaged at the rate of 36.3 bushels per acre, but it must be borne in mind that six of the six-rowed samples were of the common Ontario variety, which all gave a high return, excluding these six lots, the remaining eleven varieties gave an average of 30.5 bushels per acre.

Of the different varieties of barley the common six-rowed Canadian gave on the whole the best results. Every tenth plot was sown with this variety, and the returns from these varied from 41.7 to 52.1 bushels per acre, the average being 46.9 bushels.

The two varieties first in point of yield, are the Cheyne from Germany, and the Improved Scotch, the latter grown at least two years in this country. The yield in both cases was at the rate of 47.9 per acre. The former was two-rowed, and the latter six-rowed, and the quality of grain in both medium. The straw of the Cheyne was taller and gave a greater weight than that of any other variety, but was weak and loops pretty badly. The Italian Rice from Germany behaved very well. It has a beautiful somewhat fan-shaped head ; strong and stiff straw, and ripens early. It is two-rowed, and in quality and size of grain is medium. This variety will likely give satisfaction on soils where the grain is inclined to lodge.

The other early ripening varieties are the Skinless, originally from Australia, which matured July 19th, then Oderbrucker from Germany, July 28th and the Early Black from France, on July 30th.

Pea Plots.—Of the sixteen varieties of peas tested, ten came from England and six were procured in Ontario. The varieties from Ontario average at the rate of 40.6 bushels per acre, while those from England averaged 28.3 bushels. The best yielding English variety was the Glory, rather short in the straw and but a medium grower. The pea is pale blue in color and large in size. The Prussian Blue took the lead of the Canadian varieties, yielding at the rate of 45 bushels per acre. This kind gave the highest average of peas per pod, viz., 5.1, and also the largest quantity of straw. Next to this variety in point of yield came the White-eyed Marrowfat, which produced at the rate of 43.9 bushels per acre. As this variety was sown at the same rate per acre, it is probable that had it been sown more thickly it would have come out first in yield.

These plots were sown on April 17th and therefore ripened in good season. There was not the slightest indication of the pea-bug in any of the plots.

Spring Wheat Plots—There were ninty-two plots of spring wheat. Past experience during recent years has demonstrated that in many parts of Western Ontario spring wheat cannot usually be grown successfully. Our object in testing so large a number of varieties is to ascertain if some kinds cannot be secured that will withstand the ravages of rust, and at the same time give a profitable return. A large proportion of the plots were struck with rust some time before they were ripe. This could not have been caused by late sowing, as nearly all the plots were sown April 18th, but three days later than the barley, which I believe is the earliest grain sowing that has been done on the farm since it came into the hands of the Government. It is encouraging to note that some of the plots were almost entirely free from rust, since, as these varieties successfully withstood the rust this year, we can reasonably expect that they will do so in any season.

Straw per plot lb.	Grain per acre bush.
68.3	34.5
63.0	30.6
84.0	42.7
50.0	23.0
65.2	27.7
66.2	33.3
55.3	37.2
63.8	30.3
39.1	28.3
65.0	40.6
48.8	32.9
25.	8.4
21.3	7.2
27.5	4.2
23.2	6.5
15.7	3.2
28.2	8.9
23.1	6.6
62.8	52.5
71.6	31.6
65.3	49.5
68.9	36.2
43.9	41.5
52.2	54.8
46.6	22.1
53.5	53.6
7.2	47.8

Of the foreign varieties, those from Germany gave the best average returns, those from Russia came second, and from France third. The best yielding variety was the Wild Goose, (page 131) which gave a return at the rate of 26.7 bushels per acre. This will be recognised by readers as an old variety, noted for uniformily large returns, but not in favor with the millers even at the reduced rate at which it sells, it will probably pay better to grow it than many other kinds now grown throughout Ontario.

The best yielding variety of foreign wheats was the Herison bearded, which came from France. It yielded at the rate of 18.3 bushels per acre. It is a red wheat with club head, supported by strong straw, and virtually free from rust. The berry is small but plump. The straw stands well and is of medium height, viz., 42 inches.

The ordinary Bearded March, also from France, gave a return at the rate of 13.3 bushels per acre. The straw was medium, and almost free from rust and the grain above the average in quality. The March Bearded is from the same country, gave a similar yield. There is a rather close resemblence between these two varieties, but yet the year apparently distinct.

The Red Fern variety, now pretty generally known, gave a yield at the rate of 13.3 bushels per acre. It was but slightly rusted.

The Oat Plot.—Of the 92 oat plots grown, the German and Swedish varieties gave the longest straw, but it will be observed that the straw of the latter outweighed that of the former, and the difference in the average yields of grain was even more apparent but in favor of Germany. The straw of the French varieties was below the average in height but gave a greater weight notwithstanding, than those of any of the countries in the table. This was owing doubtless, to their branching habits of growth and the large amount of leaves borne by the plants. They also grew more thickly than those of any other country, caused in part by the smaller size of the grains sown, as the same quantity by weight was sown in each of the plots. The straw from the French oats is certainly most valuable for fodder owing to its fairness, as, when fed direct and uncut, it will be eaten with a relish by stock. The oat plots were, many of them, badly lodged by a storm which swept over them about two weeks before cutting. Nearly all the plots were affected more or less with rust.

The two leading varieties in point of yield came from France Those were the Goanette and Chenailles (see p. 134) both black and both spreading in the head. The yields per acre were 80.9 bushels in each instance. The straw of the first, however, was strong and that of the second weak, the rust on the first was slight and on the second medium in quantity. Both varieties also ripen early and the grain in each instance is larger and has a thin hull.

Next in point of yield are two German varieties the Oderboucker and the Danebrog both of which are white and both have spreading heads. The yield in both instances was at the rate of 75 bushels per acre. The straw of the Oderboucker was stronger than that of the Danebrog and stood up well. Both had some rust but the Oderboucker less than the Danebrog. The grain of the former was long and plump and was highly recommended by the Oatmeal Miller's Association when assembled in convention in Toronto last autumn. No less than eighty-two varieties grown upon this farm were submitted to them at their request. Their object was to ascertain which of those would be most suitable for making roller meal.

The three varieties from Russia behaved very well on the whole but of these the most promising is the Siberian, a white oat with a spreading head. It yielded at the rate of 73½ bushels per acre and was also recommended by the Oatmeal Millers' Association, as indeed were all three of the Russian varieties. This variety, however, was considerably rusted.

The Bavarian headed the list in the yield from the Canadian varieties. This oat was imported some years since to the state of New York. From there it was

brought into Canada by Mr. Daniel Zavitz, of Coldstream, Ont. Its record has been good during the five or six years which it has been tried in this country. It is a vigorous grower, but was somewhat affected with rust. The straw stands up well. It is white in color and yielded at the rate of 71.2 bushels to the acre.

The three earliest ripening varieties were the early blossom from England, the Siberian from France, and the White from Australia, all of which were harvested on the 6th of August. All three had but little rust. The Siberian had strong straw and yielded at the rate of 66.2 bushels per acre. The one objection to it is that the hull of the grain is thick.

The Flying Scotchman, Rennie's Prize White, Cluster or Triumph and Welcome ripened on the 7th of August, and yielded respectively at the rate of 63.2, 57.4, 60.3 and 63.2 bushels per acre. The former was imported from England and was medium in straw with but slight rust, while the other varieties, all Canadian, were weak in the straw and had some rust.

It is but fair to mention that the yields obtained from these small plots do not fairly represent the yields likely to be obtained from the same varieties when grown in the fields. They give larger proportionate yields than will be reaped when sown in large lots. This is caused, in part at least, by cultivation around the borders of the plots when keeping these borders clean, by a freer circulation of air through the plots and by a larger amount of sunlight reaching the grain. It would not be safe to fix the amount definitely of the increased proportionate return, but probably it should not be put at less than one-sixth or even one-fifth of the whole yield.

Exhibit of Experimental Grains—With the approval of the Minister of Agriculture an exhibit of the experimental grains was made at the Provincial Exhibition held at London and at the Toronto Industrial. They were also shown at Embro at a later period. The press of Ontario paid some high compliments to this institution when speaking of the exhibit.

In reference to the same as shown at London, the following extracts are taken from the notices given at the time :—

"The tastefully arranged and carefully labelled exhibit of grains grown during the present year (1889) on experimental plots at the Ontario Agricultural College Farm, Guelph, is not only one of the most interesting at the fair, but affords good evidence that new life is being infused into that institution from which it came."—*Western Advertiser.*

"The managers of the Experimental Station at Guelph, in order to test the vitality and prolificacy of the several species of grain and small seeds, have obtained specimens from 18 different places in Europe, Africa, North America and Australia. The total collection consists of 300 varieties of the different cereals, both in the straw and also in the threshed state. The whole makes a most attractive appearance, while at the same time the collection and experiments should be of practical benefit to the farmers of Ontario. The specimens of all the cereals were of first-class quality and were the growth of 1889." *London Free Press.*

"One of the most pleasing features of the Exhibition is the display made by the Ontario Agricultural College of grains grown on the experimental plots. The experimental department has been made a feature of late. The farmers seem to be alive to the importance of the work carried on and all day Mr. Zavitz was kept hard at work answering questions."—*Toronto Globe.*

"Upon entering the main door of the Dairy Building our attention is first attracted to a magnificent grain exhibit from the Ontario Agricultural College. Taking this exhibit as a whole, it is the finest we have ever seen in Canada and certainly reflects creditably upon those in authority at the college."—*Farmer's Advocate.*

In reference to the Exhibit at the Toronto Industrial, the Toronto *Mail* says :—

"The Exhibit of grains grown by the Experimental Department of the Model Farm at Guelph is very creditable to that institution."

Salt on four different kinds of soils.—This experiment as stated in the report (p. 136) has been conducted two years in succession. From this we glean that the application of salt has increased the yield of grain both years on four different kinds of soils, viz., loam, marl, clay and muck. In the experiment of 1888, the greatest proportionate increase was in the grain grown in the muck when the salt increased the yield at the rate of 60.7 per cent. This year the test in the muck soil proved a failure, owing to the excessive amount of wet in the early part of the summer. The increase in the barley in 1888 on the salted portion of the clay, was at the rate of 36.7 per cent. and in the oats, in 1889, at the rate of 17.1 per cent. The proportionate increase in the clay loam and marl soils was much less.

From this it is apparent that salt applied at the rate of 400 pounds per acre, materially increases the yield of grain (barley and oats) in a clay soil, in a wet or in a dry year. Is it not a matter very much to be regretted, that the combine in salt has so raised the price, that it is put to a large extent beyond the reach of the farmers to apply to soils?

The increase was caused, apparently, by the action of the salt on the soil, by way of rendering the dormant plant food in the latter more available. No very marked difference was observed in the color or strength of the straw, and the difference as stated above in the yield was very considerable.

Comparative yields from barley sown at different dates.—The particulars relating to this experiment will be found on p. 137 of the report. I wish leave to call attention to the vast importance of early sowing as demonstrated in the table referred to. It will be observed that the common six rowed Ontario barley, sown April 15th, yielded at the rate of 44.3 bushels per acre, that sown May 5th, 20.3 bushels and that sown June 7th, 4.2 bushels, the sample of the first being also very much superior to that of the second, and the second to that of the third. The importance of sowing barley early cannot well be over-estimated, even though it may render the crop liable to injury from frost, as in the above instance the first sown plot was browned on the tops by severe frost when about two inches high, and yet the yield was more than twice that of the plot sown twenty days later. To enable the farmers to sow spring grains at the earliest moment, it is absolutely necessary to have the ground ploughed the previous autumn, a practice which is attended with other important advantages.

A seven years' rotation of crops.—The idea in the conception of this experiment is an excellent one, (see p. 138) as it would enable us to ascertain whether in the succeeding crops, enough more could be obtained to repay the farmer for the loss of a crop during the year of the bare fallow. It is to be regretted that the date regarding the first and third years of this experiment are entirely wanting. This, to a great extent, neutralizes the value of the experiment, which is also further weakened by the lack of similarity in some of the conditions during those years. I mean the sowing of fall wheat on one plot and of spring wheat on the other, which probably also necessitated seeding to grass on different dates and under different conditions, which very likely explains the difference in the amounts of hay obtained in 1886, the fourth year of the rotation.

Experiments with Cereals in Acre Plots.

I have already stated that grains grown in small plots give a larger proportionate yield than when grown in ordinary fields, and have also given my reasons for this belief. In view of this fact a number of grains, including spring wheat, barley, oats and peas, were grown in acre plots. The varieties chosen were those that had already attained some notoriety in this country. We were, however, unfortunate in our choice of location for these tests, as the cutworm, excessive wet and other causes so interfered with the yields as to render them unsafe guides in the farm practice of the future. Some of these will be repeated the present year.

Experiments with Root Crops.

Potatoes.—By reference to p. 139 of the report, it will be noticed that an experiment was carried on with eleven varieties of potatoes. One row of each was planted across the whole width of the field. They were all planted the same day and under precisely similar conditions. Several of the varieties it will be noticed were new.

The three leading kinds were all early. They are named the Early Sunrise, the Early Ohio and the Halton Seedling, and yielded respectively at the rate of 348.8, 314.4 and 306 bushels per acre. The Early Sunrise proved a very thrifty grower, carried a profusion of bloom, and was one of the first to ripen. The stems were short and strong. Altogether it was a very promising variety. The Early Ohio is a strong grower, medium in earliness, and an excellent yielder; and the same may be said of the Halton Seedling, which produces short, stout and low-lying vines. The best of the late sorts was the Rural Blush, which gave at the rate of 304.1 bus. per acre. This variety produces vines strong and tall. The two well-known varieties, Beauty of Hebron and White Elephant, produced at the rate of 278.8 and 257 bus. respectively per acre. The Early Sunrise therefore gave a return 25 per cent. greater than the Beauty of Hebron, and 35 per cent. more than the White Elephant. Some of these newer varieties are certainly very promising.

Mangolds.—Eight varieties of Mangolds were sown. One row of each was sown across the field and under similar conditions. The date of sowing was May 17th.

Comparing the largest yielding varieties with the Mammoth Red, which in the past has been the standard mangold of the country, the Giant Yellow Globe yielded 49.2 per cent. more, the Carter's Ward Orange Globe 34.3 per cent. more. and the Red Intermediate 28.4 per cent. more. The Giant Yellow Globe mangolds grew largely above ground and were smooth and easily handled, but did not keep so well as some other varieties. The Mammoth Red also did not keep well, but the season may have had something to do with this.

The Central German Sugar Beet did uncommonly well with us, as stated in the report of the farm foreman (p. 118), where also the reasons are assigned for the moderate yield obtained.

Carrots.—Six varieties of carrots were sown on on May 6th (see p. 140).

The White Belgian has long been the standard carrot of the country, but it must certainly give place to the White Vosges, a carrot possessing many excellences. It grows well underground, is large and curves abruptly to a point, which renders it easily handled, nor is it easily broken as the White Belgian and the Long Red Altringham. It also yielded 73.5 per cent. more than the White Belgian, and is an excellent keeper. The Scarlet Intermediate is a heavy cropper, easy to handle, and has also good keeping qualities. The White Belgian grows largely above ground, is crooked and easily broken when being handled. The Long Red Altringham is small, easily broken and does not keep well.

It is to be regretted that we cannot furnish a chemical analysis of the mangolds and carrots, which would have been done had not so much time been required in analysing the corn.

Experiments with Fodder Crops.

Cultivation of Rape.—The experiments in rape culture was of peculiar interest owing to its bearing upon flat and ridged culture, thick and thin seeding in ridges and on the level, the distances between the ridges, and on culture broadcast and in drills.

There were nine drills in each instance except in plot four (where there were seven drills owing to the less distance between them), and plots five and six which were sown broadcast, but which covered an equal area of grounnd. The plots were also of the same shape and width.

The yield from the plots 1 and 2, cultivated on the level, was at the rate of 18.08 tons per acre as compared with 13.1 tons per acre from that grown on ridges. The drills sown on the level were more vigorous from the first, and this I apprehend is likely to be the case with future tests.

Plots 2 and 3 ridged alike were sown, the first at the rate of four pounds of seed per acre, and the second at the rate of half a pound. The former gave 13.1 tons and the latter 14.2, and the quality of the rape in plot No. 3 was evidently the best, as it was more succulent. From this it is evident that thin seeding in drills is preferable when the season is moist.

Plot No. 2, in which the drills were twenty-two inches apart, was pitted against plot No. 4 with drills 18 inches apart, the amount of seed in both cases being at the rate of four pounds per acre. The yield from plot No. 2 as stated above was at the rate of 13.1 tons per acre, and from plot No. 4 at the rate of 16.68 tons per acre. This return points rather in the direction of closer culture than is generally adopted for rape, as it is usual to make the distance between the drills from twenty-four to twenty-six inches. Another element in this experiment must be borne in mind, viz., that the seeding in plot No. 4 was of necessity not so thick as in plot No. 2, as the same quantity of seed was distributed over a greater number of drills.

The yield of plot No. 3, sown in drills at the rate of one-half pound per acre, as pitted against that of plot No. 5, sown broadcast and of course on the level, was as 14.2 to 14.68 tons per acre. It must not be inferred from this, however, that broadcast culture is superior to that in drills, as rape is generally sown, like roots, to aid in cleaning the land. If, therefore, it were sown broadcast on a field wanting cleaning it would in no way effect this purpose. This experiment, however, tends to show that in clean fields more rape can be obtained when sown broadcast and at a much less cost for labor than when sown in ridges. The element of the effects of the two modes of culture on the succeeding crop must also be considered, in which case that grown in drills would undoubtedly have a decided advantage.

Plot No. 5, described above, gave a less return than plot No. 6. The cultivation in each was broadcast, but the rate of seed per acre sown on the latter was eight pounds. The comparative yields were at the rate of 14.68 and 17.3 tons per acre. The quality of the latter, however, was inferior to that of the former owing to its woody condition.

It is to be regretted that two other plots sown broadcast at the rate of two and four pounds of seed per acre were injured accidentally, so that a comparison from these could not be made.

It should also be borne in mind that the weights given above are for the whole plant including the root, for which probably twenty-five per cent. should be deducted in computing the yield.

Different Systems of Raising Fodder Corn.—For details of this experiment see p. 148. The value of the experiment is much impaired because of the fact that only about one-half of the seed germinated, owing probably to the cold damp weather at the time of sowing. The real test, therefore was about as follows, viz.: No. 1 plot, one grain per foot in the drill; No. 2 plot, six grains per foot; No 3. plot at the rate of one peck per acre sown broadcast, and No. 4 plot at the rate of one and a-half bus. per acre.

The respective yields were at the following rates per acre:—

Plot No. 1	11.7 tons.
" " 2	12.1 "
" " 3	11. "
" " 4	13.4 "

This experiment tends to prove that corn grown broadcast, when one and a half bus. of seed are sown per acre, will give a greater weight than when sown in drills forty-two inches apart, the plants being either two inches or twelve inches apart, and at a great expenditure of labor. But analysis may yet show that the corn in plot No. 1 contai

the greatest feeding value, as it produced ears, while in plot No. 4 there were none. The same objection may also be urged against broadcast corn culture that has been offered against broadcast rape culture. The repetitions of this experiment in future may give entirely different results, as the past was a peculiar season for corn production.

Experiments with Fertilisers.

There were not many experiments with fertilizers conducted during the past season. This was owing in part to the large number of grain plots grown, and in part to the disarrangement of our plans generally in consequence of the fire.

Action of different Fertilisers on successive crops.—No. 1. In 1887, 1888 and 1889, the crops consisting of spring wheat, barley and oats, were grown successively on plots of one-fortieth of an acre each, which had been manured in the spring of 1887 with salt, superphosphate, ground apatite and farmyard manure, one being left without manure (for details see p. 146). The behavior of these plots has been so eccentric that no conclusions of value can be drawn from the experiment. This is caused in part by a difference in the character of the soil, even in these small plots, which lie side by side. This difference was easily apparent to an attentive observer while the grain was growing. It has been determined, therefore, to discontinue the experiment until a suitable location can be secured for commencing it again, when the experimental field is ready.

Action of different fertilisers on successive crops.—No. 2. The experiment commenced in the spring of 1889 (see p. 147). Four plots were set apart containing one-fortieth of an acre each. Mineral superphosphate costing $26.00 per ton was applied at the rate of 400 lbs. per acre to plot No. 1. Sure Growth composed of refuse from pork factories, chemically treated, and costing $40.00 per ton, was applied at the rate of 400 lbs. per acre to plot No. 2. This is considered a complete fertiliser, as it contains nitrogen, phosporic acid and potash. Barnyard manure was applied to plot No. 3 at the rate of 14 tons per acre, and was valued at the rate of $7.00 per load. No fertiliser was put upon plot No. 4. The fertilisers were all applied as a top-dressing just before sowing, and were harrowed in. They were sown with oats April 22nd. There was a difference in the time of the maturing of the grain. That on plot No. 1 matured August 11th; plot No. 2, August 12th; plot No. 4, August 13th, and plot No. 3, August 15th.

The following were the yields per acre:—

Plot No.	1,	at the rate of	69½	bush.
"	2,	" "	69⅛	"
"	3,	" "	66⅝	"
"	4,	" "	59¾	"

Putting the oats at 30 cents per bushel and not taking labor into account, the comparative returns were for the past year, after deducting the value of the fertilizers:—

Plot No.	1	$15 65
"	2	12 73
"	3	5 86
"	4	17 92

Two cereal crops following, summer-fallow and manure, had been taken from the land during the years immediately preceding the experiment. This experiment will in all probability be continued five years, the crop being changed every year.

The comparative yields of straw differ considerably:—

Plot No.	3	gave at the rate of	4,910	lb.	per acre.
"	2	" "	4,650	"	"
"	1	" "	4,030	"	"
"	4	" "	3,810	"	"

Farmyard manure therefore added 29 per cent. more straw as compared with no manure.

Live Stock Experiments.

Feeding Pigs Cold versus Warm Food.—This experiment was conducted for about three months in the winter of 1889. For particulars see page 140. The results showed but little difference. The experiment however will be repeated.

Pasturing Sheep on Permanent Grasses.—On May 15th two plots of 1½ acres each, sown with permanent grasses in the spring of 1884, were set aside for the purpose of ascertaining what amount of pasture they would afford for sheep during the season. The number of sheep put upon the pasture at each successive period was gauged by the luxuriance of the grass. They were furnished with water and shelter in the plots. It was found that from May 15th to August 25th one acre carried an average of 5.5 sheep and 3.8 lambs, equivalent to 7.4 sheep, allowing that one lamb ate one-half as much as a sheep. At the latter date the experiment was closed, although, had not other arrangements required it, the same might have been continued for two months longer, but with a somewhat reduced number of sheep. They were kept one week at a time on each plot, alternating from the one to the other. Farmers who can adopt an alternation of a longer or a shorter period in pasturing will find it an excellent practice, owing to the stimulus that lack of molestation gives to the grass in the field from which the stock has been removed.

A very large amount of pasture was thus afforded by these plots and the sheep did fairly well upon it, but the soil is peuliarly adapted to the production of grass.

It may be mentioned here that on these plots *Meadow Fescue* has proved one of the best of the foreign grasses. It is medium in growth, comes on late and continues to grow during dry weather. It holds well in the ground and grows with a good deal of vigor.

Orchard Grass retains its footing well, but no better than the Meadow Fescue. It grows vigorously during the first half of the summer, and if kept pastured off does not become rank, and produces a large amount of pasture.

Meadow Foxtail, the earliest of all grasses, has held its own well on these plots. It was in blossom about the 1st of May in 1889, and has come out in head on this farm as early as April 27th. It is however only a moderate producer.

Hard Fescue has also retained its footing well but it cannot be praised for furnishing a large amount of food. Unless kept closely eaten off it is apt to become wiry.

The *Oat Grasses*, although they furnish a fair amount of food while they last, hold out only moderately well.

The *Rye Grasses* for the first year give a larger proportionate yield than any other foreign grass, but are scarcely seen at all after the second year.

The *Kentucky Blue Grass* while taking a prominent place occupies much the same position in the pastures as at the commencement.

Most of the *Red Clover* disappeared by the end of the second year. There is a goodly sprinkling of the *Alsike* upon the ground yet. There has been almost none of the *White Dutch* and *Yellow Clover* found on the plots during the past two years. The *Lucerne* has diminished a little but is holding well in the ground, and it gives a good bite during the latter part of the season.

Feeding Lambs on Rape.—Some twelve acres of rape were grown on the farm, eight of which were in drills. The balance was sown broadcast. Owing to the great amount of rain that fell in June this rape was unduly late in being sowed. It grew, however, fairly well. On that sown in drills 48 lambs were pastured from October 10th to December 3rd, when they had to be housed because of the snow, but the rape would have sustained a much larger number had they been in our possession. These lambs were purchased in the latter part of September, were brought home and weighed October 9th, and were put upon the rape the following day. They weighed at that time 96½ lbs. each, and cost for the lot $184.70, or an average of $3.84¾. The price thus paid per pound was 4.04 cts. They were removed from the rape December 3rd and were again weigh

December 10th, or two months from the time when they were brought home. At the weighing of December 10th they averaged 114¼ lbs., a gain of 872 lbs. in the aggregate, or 18⅛ lbs. each, for the two months. When on they were fed about one pint of oats each per day, which was all they would take. They ate more grain proportionately as the season advanced.

These lambs were sold to a local buyer about the middle of December for 5¾ cts. per lb. live weight, with the proviso that we would keep them until an experiment relating to the relative cost of winter feeding and the gains accruing therefrom would be completed, which experiment, however, was not to be prolonged beyond the end of March. This experiment was undertaken because of the wish expressed by many prominent farmers that it should be done in order to give information to the country on the lines indicated above.

Full particulars relating to the whole experiment will be given in a bulletin soon to be published on the subject and also in the next annual report.

Had those lambs been sold at the date of the second weighing for 5½ cents per pound, to be shipped at once or soon after, and I am satisfied they could have been sold for that price, they would then have been worth to us $6.28⅜ each, which would have been a gain of $2.44⅜ on each lamb for the two months' keep. It should be remembered, however, that the selling price was unusually high last autumn, but in any case I am satisfied that good value is to be obtained from growing rape, and feeding lambs upon it, where the soil is suitable. I believe further that good results may be obtained from fattening lambs for the British market, but, as it is results obtained, rather than convictions expressed, that are required of this institution, I forbear saying more on that subject until we can allude to it bye-and-bye in due form.

Live Stock Experiments for 1889-90.

The following experiments in live stock were commenced in the autumn of 1889, as early in the season as they could be taken up properly in the new buildings :—

1. *Experiment in Fattening Steers.*—Ten steers were purchased in the early autumn and, after having been pastured on rape for a time, were divided into two lots for purposes of experiment. The first lot consisting of six head was divided into three pairs. The first pair, Nos. 1 and 2, are each to be fed 12 lbs. of meal per day and all the ensilage they can take. The second pair, Nos. 3 and 4, are each to receive 12 lbs. of meal, 45 lbs. of ensilage, and all the cut hay they can take. The third pair, Nos. 5 and 6, are to be fed 12 lbs. of meal, 45 lbs. of pulped roots, and all the pulped hay they can take. The object here is to test the comparative values for fattening of ensilage and meal; ensilage, hay and meal; and of roots, hay and meal; the meal being the same in quantity and quality in each instance.

The second lot consisting of four animals was divided into two pairs. The first pair, Nos. 7 and 8, are to be fed hay, roots and meal, and a food condiment; and the second pair, Nos. 9 and 10, are to receive a similar food ration without the condiment.

2. *Experiment in Rearing Grade Calves of the Different Beefing Breeds.*—The design of this experiment is to ascertain the comparative gains that will be made by grade steers of the different beefing breeds up to say 2½ years when fed on a ration the same in quality but varying in quantity to suit the requirements of the different individual animals in the contest, and also to ascertain the comparative cost of rearing them. With this end in view it was determined to purchase grades of the Shorthorn, Hereford, Aberdeen Poll, Galloway, Devon, Holstein, and scrub sorts. The sire in each case was to be pure, except in that of the scrub, and the dam to be a good Canadian cow. The experiment is now well under way.

3. *Experiment in Feeding Young Pigs.*—This experiment comprises three lots of four young pigs in each lot, weighing about 50 pounds apiece. Each lot comprises one pure Berkshire and three Berkshire grades, four distinct litters of our own breeding being

equally represented in each lot. The first lot are to be fed equal parts of whole peas and barley; the second lot the same mixture but ground; and the third lot a mixed meal ration consisting of oats, barley, wheat middlings and peas, in the proportion of 1, 1, 1 and 2 respectively. Each lot is to be fed all that will be eaten clean.

4. *Experiment in Feeding Store Pigs.*—This experiment comprises three lots of store pigs, three in each lot, Berkshire grades, which were about seven months old when they entered the experiment. They also are home-bred. The first lot are to receive a certain amount of meal consisting of barley, oats, wheat middlings and peas, in the proportion of 1, 1, 1 and 2 respectively, and in addition all the corn ensilage that they will take. The second lot are to be fed meal similar in quantity and quality to that fed to the first lot, and all the roots they will take. The third lot are to be fed meal of a similar quality to that given the first and second lots, but they are to get three times the quantity with no additional ration.

A number of other experiments will be taken up in the live stock department as the season advances, and in selecting these experiments it will be our aim to take up those first which it is hoped will be of direct practical value to the farmer.

I have the honor to be, Sir,

Your obedient servant,

THOS. SHAW.

REPORT OF FARM FOREMAN.

Dec. 29, 1889.

To Professor Thomas Shaw:

SIR,—I have the honor to submit to you my third annual report in connection with the respective departments.

The past year has been a very trying one owing to the loss by fire of the farm buildings and crop in the fall of 1888, which upset many of our plans for the year's work and hindered us not a little in the material progress of the farm.

The principal employment of the students last winter was the removing of the debris from the scene of the fire; first, in carting away the roots that had escaped damage and then clearing out the place preparatory to the erection of new buildings. Fixing up buildings for the accommodation of stock and hauling food and bedding for the same also occupied no small amount of time.

Another thing that is to be deeply regretted, was the lack of instruction to the students occasioned by the burning of the buildings and crop. Much of the stock had to be sold after the fire owing to the restricted accommodation. Nor could any instruction be given in the use of the machinery in connection with the barn, such as running farm engine, cutting boxes, cleaners, thresher, chopper, pulper, etc., or in reference to our usual way of preparing and handling the food. The loss of the silo was also keenly felt, especially by the second year students who could not again have an opportunity of becoming familiar while at this institution with the feeding properties of silage. It came through the fire but little the worse and we were able to use the greater part of it, but with our facilities at that time, testing it experimentally was out of the question.

Since the re-opening of the college in October last, we have been able to give the usual instruction in plowing, but I feel that the one team and man set apart for that purpose is quite insufficient to do justice to a class of eighty or more students when we consider the limited time in which instruction can be given.

During the year a great amount of labor has been spent on the making of roads, fences and other permanent improvements outside the regular farm work, which will add materially to the appearance and to the convenience of the farm. Although this work

has been done by our ordinary farm help, I think it a mistake to charge it against the farm proper. I would suggest for your earnest consideration that a special grant be asked from the Government for such labor, as under the present method the work of the farm proper is represented as costing more than it really does. For instance, I find that the farm teams and teamsters have done work to the value of $389 on such improvements, and the labor of the students has amounted to $285.05.

Owing to the great reduction of the stock after the fire, it was deemed expedient by the Advisory Board to dispense with all the farm help, including the herdsman, which threw on me the responsibility of looking after the stock. Very much credit is due to those students who aided me in this work under the very trying circumstances in which we were placed owing chiefly to the poor accommodation provided. This detracted not a little from the well-doing of the stock, particularly the horses and sheep, which did not do as well last winter as in past seasons, and were it not for the deep interest taken in them by some of the students my report of them could not have been so favorable as it is. But I am pleased to say that notwithstanding the hardships of the winter, during the summer they have recruited so that they have come into the stables this fall in fine condition.

I would like to call your attention to a part of field No. 20 (situated in the north corner of the farm and containing about fifteen acres) which, as it is at present, is of no practical benefit to the farm. I would suggest that a division fence be made between Nos. 19 and 20, a well sunk and a windmill procured to pump water for stock, as then the field would make a very valuable pasture, but it cannot be utilised in its present condition.

We have just opened the silo, which contains about one hundred tons of silage, and find it in splendid condition. The cattle seem very fond of it and eat it with great avidity.

Before submitting to you my report of the crops, I must call attention to the fact, that owing to the vast amount of work which requires attention and which we expect to accomplish by means of student labor, and also in order to have suitable work for the students during the winter months, we are obliged to let the greater part of the threshing stand until the college re-opens, which of course prevents me from reporting in many instances the exact yield of the grain crops.

In previous years I have been able to place the most important part of the crop in the barn so that it was threshed before the fall term closed and to submit my report of it. But last spring according to your directions all grains to be tested were first sown, consequently first cut, and had to be placed in that part of the barn where they will be threshed out. Had the barn been finished sufficiently early this would not have been the case. The roofers commenced roofing from the west end of the building and we filled it as fast as the roof was put on. This accounts for my not being able to report on the barley test of No. 13 and the spring wheat test of No. 4.

Field No. 1 contains twenty acres, and was used as pasture up to August 1st, when it was mown and about five tons of hay gathered from it. It was then ploughed at intervals when other work was not so pressing, and on the 17th and 18th of September it was sown with rye, at the rate of two bushels per acre.

Field No. 2 contains seventeen acres, ten of which was meadow yielding a crop of two tons per acre. The balance was sown with Rennie's improved six-rowed barley (not yet threshed) and seeded down with a mixture of four lbs. timothy, one lb. red top, one lb. perrenial rye, one lb. tall oat, 3 lbs. red clover, one lb. mammoth clover, two lbs. lucerne, and one lb. alsike per acre. The clovers and timothy were sown from the grain drill and the light grasses scattered by hand afterwards.

Field No. 3 contains twenty acres, four acres of which are used by the experimental department, four acres were planted with trees by the horticultural department, and the balance was under root crop as follows :—One and one-half acres carrots of six varieties. The crop was a good one, the White Vosges giving considerably the largest yield. Three acres were sown with mangels, which were not as good a crop as the carrots. They con-

sisted of six varieties, viz., giant yellow globe, Carter's ward orange globe, long yellow red globe, yellow Tankard and mammoth red intermediate. The exact weight of one row of each kind both of carrots and mangels is in the hands of Mr. Zavitz, who will report on them in connection with other experiments in his department. On the 23rd of May I received a packet of central German sugar beet seed from Hon. Charles Drury, which was not sown for some days, owing to the fact that the ground prepared for such crop was then planted, so that we were obliged to use a piece which required some preparation. I sowed along with them twenty lb. of super-phosphate per acre. At the same time, and under precisely the same treatment, I planted one-fourth of an acre of mammoth red mangels to get an idea of the difference per acre. The weights will be reported as above.

In the fall, during your absence, I received a letter from Mr R. Lawder, of Toronto, asking the weight of the sugar beets per acre, and also requesting me to send a sample to Mr. Scaife, of Montreal, who has been so kind as to furnish me with a report of the analysis of sample, and also to say that they were the best sample he had received this year, although tests had been made in several counties in the Province. The balance of this field was sown with Swede turnips of six varieties, which, owing to the very unfavorable season, was a poor crop.

Field No. 4 contains twenty acres, five of which were used by the dairy department as pasture, four acres, known as "the hill side," were sown with spring wheat of three varieties, viz., red fern, defiance and magyar, one acre each, and one acre of oats and peas, mixed, two and one lb. per acre. The latter grew very heavy and lay down before filling. The wheat is not yet threshed. The defiance and magyar filled poorly, but the red fern was a fine crop. The balance of the field is worked with No. 5, and had on it a very fine crop of oats and peas, so far as the yield of straw is concerned—not yet threshed.

Field No. 5 contains twenty acres, ten of which is wood land, and has on it a lot of very valuable timber. The remaining ten acres is worked in with the ten acres on the west side of No. 4, and had on it a crop of oats and peas, of a heavy growth of straw. Six acres of this were cut green and cured for fodder, the balance were allowed to ripen and grew so heavy that it lay down and will not yield well.

Field No. 6. This field contains twenty acres, and was meadow, yielding two and one-half tons per acre. We tried an experiment with wood ashes of different quantities on this field, also of leached ashes *versus* unleached.

Field No. 7. This field contains twenty acres and has been under meadow for the past four years. The crop this year was of splendid quality, being pure timothy, and yielded about one ton per acre. Two acres of it were allowed to ripen, and were cut with the binder, and will be used for seeding next spring. The greater part of this field is now plowed.

Field No. 8. This field contains twenty acres, and was sown with common six-rowed barley and seeded down with a similar mixture of grasses and clovers to that of No. 2. The barley is yet unthreshed, but the yield will be good.

Field No. 9. This field contains twenty acres. In the fall of 1888, it had two plowings, and six acres of it were manured in the spring; four acres of it were manured with well rotted manure hauled from the city during winter. At that time No. 9 was calculated for the root crop of 1889, but afterwards it was given to the experimental dairy department for corn. After the corn was removed, it was plowed by the farm help.

Field No. 10. This field contains twenty acres, ten of which are used by the horticultural department for an orchard; the balance was sown with oats and peas, two to one, and grew a fine clean crop of straw, yielding 48 bushels of grain per acre.

Field No. 11. This field contains twenty-three acres, was broken from sod last spring and sown with peas of two varieties—seven acres of Prussian blue peas and sixteen acres of golden vine. As only a part of the golden vine and none of the Prussian blue

variety is threshed, we cannot give the yield, but would judge from handling that they will yield about twenty bushels per acre. After the pea crop was removed we prepared a portion of No. 11 for winter wheat by cultivating it thoroughly with the Corbin disc harrow, and sowed the following samples of wheat between the 6th and 9th days of September: 5½ bushels Garfield at rate of 1½ bushels per acre, 5½ bushels Bonnell, 5½ bushels Democrat, 5½ bushels Hybrid Mediterranean, 2 bushels Surprise. All are looking remarkably well.

Field No. 12. This field contains twenty acres and was sown with white Egyptian oats. During the latter part of May and first week of June it was attacked by cut worms and about one-half of it destroyed, which reduced the yield at least one-third. One-half the crop was stacked and threshed in the field, the balance is yet unthreshed. In October the field was ploughed again.

Field No. 13. This field contains nineteen acres. In the fall of 1888 eight acres of the east end were sown with Manchester wheat, which promised to be a heavy crop till about the 25th of June, when it was suddenly struck with rust, which completely destroyed it. The remainder of the field was sown with barley of four varieties, viz., one acre Duckbill, one acre Chevalier, one acre imported six-rowed, and eight acres of common six-rowed, not yet threshed. With the exception of about four and one-half acres at the east end put down for orchard, this field was seeded to grass with a similar mixture to that of No. 2 and No. 8. We also tried an experiment while seeding, of scattering the grass and clover seeds before *versus* after the drill hoes, but as far as could be seen in the fall no difference was visible, both seemed to have caught well.

Field No. 14. This field contains twenty-four acres, seventeen acres of which are used by the experimental department, and one acre as a nursery by the horticultural department. The balance was meadow, principally clover, and yielded a wonderfully heavy crop.

Field No. 15. This field, containing twenty acres, was laid down to permanent pasture by Prof. Brown some years ago and still retains a luxuriant growth. Eight tons of grass was mown off it this year besides giving pasture to a large herd.

Field No. 16. This field contains twenty-six acres, and was broken from sod in November, 1888. Ten acres were sown with ten different kinds of oats, and six acres with six different kinds of pease, and ten acres with different mixtures of grain and different quanties, which would have been a very valuable experiment but for the ravages of the cut-worm, which so destroyed it as to prevent us reporting on any of them.

Field No. 17. This field contains seventeen acres, seven and one-half of which were planted with potatoes of eleven varieties. One row of each kind was planted on the north-west side of the field, the crop of which Mr. Zavitz will report to you. The balance was planted with two common varieties, and yielded one hundred and sixty-four bushels per acre. The balance was used as a pasture for sheep, being divided from potatoes by a portable fence, and in August was lightly ploughed and afterwards harrowed across with the Corbin disc harrow. About one-half of it was ploughed a second time by the students while receiving instruction.

Field No. 18. This field contains twenty acres, seven acres of which is woodland and natural pasture. The balance was this year sown with oats and pease, one and one-half bushels of each per acre. It grew a heavy crop of straw, but did not yield grain accordingly. It was ploughed this fall by the experimental department.

Field No. 19 contains thirty acres, and was sown with oats of two varieties, viz., New Zealand and early Calder. They were sown the same time and on the same preparation, yet the early Calder rusted considerably, while the New Zealand stood up with a bright stiff straw, but did not ripen for about nine days later than the other. The field was ploughed in October.

Field No. 20 is woodland and natural pasture, but as there is no water on it nor a division fence between it and No. 19, it is not at present of much value to the farm.

Field No. 21 contains twelve acres and is naturally a poor gravelly soil. As opportunity occurred through the winter, manure was procured in the city and piled on

this field, but the supply was insufficient. In the early part of July we carted and spread the manure, plowing it in as quickly as possible, after which it was well harrowed and rolled. We next drilled it into very light drills 23 inches apart and sowed with rape one pound per acre on part of it and two pounds per acre on the other part. The part sown with one pound per acre was the best crop, growing stronger and not having so many dry leaves. According to your directions, I purchased forty-eight spring lambs, Cotswold and Oxford Down grades. These lambs were weighed separately, ear-numbered, and turned into the rape on the tenth day of October. Some rough troughs were made and a little oats put in each evening. For the first three weeks they scarcely ate one-half pint each per day, but as the nights grew cold they gradually grew more fond of them. On the 1st of December, owing to stormy weather, they were taken into the sheep shed and fed hay and roots and a little oats. On the 10th of December they were again weighed, being exactly two months from date of first weighing, when we found an increase in weight of 864 pounds, or an average gain of 18 pounds per lamb. They were purchased at a very small fraction, over $4 per cwt., or an average of $3.84¾ per head, and are now sold at $5.75 per cwt. live weight, but may not be taken away till March.

The implements purchased this year for farm use were principally to replace those lost in the fire of 1888, and consisted of the following:

One threshing machine	$280 00
One cutting box	56 00
One grain chopper	30 00
One fanning mill	24 00
One Corbin harrow	25 00
One mowing machine	40 00
One mowing machine	30 00
One root slicer	23 00
	$508 00

The value of implements at present on hand is $1,719 00.

The live stock at present on hand consists of eight breeds of pure bred cattle, two breeds of pigs, five breeds of sheep, working horses, and some grade cattle, grade sheep and grade pigs.

Horses:		
9 working horses	$1,110 00	
1 general purpose horse	60 00	
2 mares for express material and instruction work	450 00	
		$1,620 00
Total value of horses		
Herefords.		
1 bull, 7 years old	$ 100 00	
1 heifer, 2 years calf	300 00	
		$ 400 00
Galloways:		
1 heifer, 2 years old	$ 50 00	
1 cow, 7 years old	125 00	
1 bull calf	50 00	
		$ 225 00
Aberdeen Angus:		
1 bull, 1 year old	$ 250 00	
1 cow, 8 years old	175 00	
1 bull calf	50 00	
1 heifer, 2 years old	275 00	
		$ 750 00
Ayrshires:		
1 bull, 7 years old	$ 75 00	
1 cow, 4 years old	60 00	
		$ 135 00
Devons:		
1 bull, 7 years old	$ 75 00	
		$ 75 00

Holsteins :

1 cow, 8 years old	$ 70 00	
1 bull, 1 year old	30 00	
		$ 100 00

Jerseys :

1 bull, 3 years old	$ 100 00	
1 cow, 5 years old	300 00	
1 cow, 5 years old	180 00	
1 heifer, 2 years old	215 00	
1 heifer calf	60 00	
		$ 85500

Shorthorns :

1 bull, 2 years old	$ 600 00	
1 cow, 3 years old	120 00	
1 cow, 4 years old	120 00	
1 heifer, 2 years old	100 00	
1 heifer, 1 year old	100 00	
1 heifer, 1 year old	75 00	
1 cow and calf, 3 years old	400 00	
		$1,515 00

Grade Cattle :

10 steers, fat, @ $57.50	$ 575 50	
2 Shorthorn grade steers @ $15.00 and $20.00	35 00	
1 Shorthorn grade heifer, 1 year	15 00	
1 Gallow grade steer, 2 years	40 00	
1 do do do do	30 00	
1 Angus grade calf	10 00	
11 grade milch cows @ $40	440 00	
1 Gallow grade calf	4 00	
		$1,148 00
Total value of cattle		$5,204 00

Berkshire hogs :

1 boar, 1 year	$ 20 00	
1 sow, 1½ year	40 00	
1 sow, 9 months	15 00	
1 sow, 2 years	18 00	
1 sow, 14 months, improved	75 00	
1 sow, 14 months	50 00	
4 sows, 3 months	25 00	
		$243 00

Improved Yorkshire hogs :

1 boar, 5 months	$20 00	
1 sow, 5 months	15 00	
		$35 00

Grade hogs :

3 sows, 2 years, @ $12.00	$36 00	
3 sows, 10 months, @ $9.00	27 00	
11 young pigs, 6 months, @ $6.00	66 00	
6 young pigs, 1 month, @ $2.00	6 00	
14 young pigs, 3 months, @ $2.50	35 00	
		$170 00
Total value of swine		$448 00

Oxford Down sheep :

4 ewes, 2 years	$ 100 00	
1 ram lamb	10 00	
4 ewe lambs @ $10	40 00	
		150 00

Hampshire Down sheep :

7 ewes, 2 years, at $30	$210 00	
1 ram, 2 years, improved	140 00	
3 ewe lambs @ $13.33⅓	40 00	
		390 00

Southdown sheep:		
5 ewes, 2 years, improved, @ $30.00	$ 150 00	
1 ram, 2 years, improved	100 00	
1 ewe lamb	10 00	
2 ram lambs @ $8.00	16 00	
		276 00
Cotswold sheep:		
4 ewes, 2 years, @ $20.00	$ 80 00	
1 ram lamb	40 00	
1 ram lamb	8 00	
		128 00
Dorset sheep:		
1 ram, 2 years	$ 25 00	
2 ewes, 2 years, at $20.00	40 00	
		65 00
Grade sheep:		
48 lambs for market	$ 278 00	
		278 00
		$1,287 00
Total value of sheep		$8,5900 00
Total value of live stock in connection with farm proper		

I have the honor to be, sir,

Your obedient servant,

J. E. STORY

EXPERIMENTAL DEPARTMENT.

To Prof. Thomas Shaw:

Sir,—I have the honor of herewith submitting, for your consideration, the report of the work conducted in the Experimental Department during the year 1889. All conclusions to be drawn from the experiments I shall leave for you to report upon as may seem best to your judgment.

The work at which I am directly engaged at this Institution, and upon which I report to the different departments, may be represented under the following heads:

(1) Field plot and live stock experiments, Prof. Shaw's department.

(2) Chemical analyses, soil temperatures, and drainage waters, Prof. James' department.

(3) Meteorological observations, Prof. Panton's department.

The past season has, on the whole, been a fairly favorable one for experimental work upon the field plots, as there was about 44 per cent. more rain during five months of this season than for the five corresponding months of the previous two years, as may be observed from the following statement:

Depths of Rain Fall.

	1887. Inches.	1888. Inches.	1889. Inches.
May	1.58	1.08	3.59
June	2.36	2.92	4.25
July	.61	2.21	2.67
August	2.71	2.16	1.92
September	1.52	1.55	1.04
Total	8.78	9.92	13.47

The seed grains imported by yourself last spring have all been tested upon the field plots during the past summer, with the exception of the fall wheats, which were sown this fall. The greater part of the grains were from Germany, Russia, France, Scotland, England and Sweden, while a few varieties came from Greece, Italy, Sicily, Hungary, Africa, Japan, Switzerland, and the United States.

No less than 237 varieties of cereals were imported, and the testing of these, along with a number of Canadian varieties, has required much very careful work. We have, nevertheless, conducted in addition to these a number of other experiments, the particulars of which will be given in the following pages.

Owing to the loss of the barns by fire in the autumn of 1888, only one experiment with live stock was conducted. There are six in progress during the present winter.

I wish, just here, to ask permission to give a very concise account of the objects, and the rise and development of experimental stations outside of Canada, as gleaned from Bulletin No. 1 of the United States Department of Agriculture, after which I shall endeavour to give an outline of the progress of experimental work in Canada.

Object of Experimental Stations.

"Farming is a perpetual trying of experiments with soils, manures and crops; with cattle and cattle food; with milk, butter and cheese; with plows, harrows and harvesters; with an almost endless list of things. The most successful farmers—those who get the most out of their land, their cattle, their crops, their fertilisers, their implements, and their labor—are those who experiment themselves most industriously, most skilfully, and most intelligently, and who take the fullest advantage of the experiments of others. The best agriculture is that which, in old countries, on worn and intractable soils, has learned by long continued and varied experiment to make the gain of farming sure. Within recent times farmers and men of science interested in farming have seen the advantages of using the resources of science to improve the practice of agriculture, and have established agricultural experiment stations.

"The object of these stations is to experiment and to teach, to make a regular business of discovery for the use of farming, to promote agriculture by scientific investigation and experiment, and to diffuse as well as increase the knowledge, which improves farm practice and elevates farm life.

"Established for the benefit of agriculture, and hence of the community at large, the most of them connected with educational institutions, where experience shows their work is most successfully done, these stations seek answers to the questions which agricultural practice is asking as to the tillage of the soil; the nature and action of manures; the culture of crops; the food and nutrition of domestic animals, and of man; the production of milk, butter and cheese; the diseases of plants and animals; and, in general, whatever the agriculturist needs to know and experimental science can discover."

Rise and Development of the Stations.

"Nearly forty years ago, a company of farmers joined themselves together in the little village of Moechern, near the city, and under the influence of the University of Leipsic, called a chemist to their aid, and with later help from the government, organised the first agricultural experiment station.

"The seed thus sown has brought forth many fold. In 1856 there were five; in 1861, fifteen; in 1866, thirty; and to-day there are more than one hundred experimental stations and kindred institutions in the different countries of Europe. In each of these, from one to ten or more investigators are engaged in the discovery of the laws that underlie the practice of farming, and in finding how they are best applied.

"The first agricultural experiment station in America was established at Middletown, Conn., in the chemical laboratory of Wesleyan University of 1875. The example was speedily followed elsewhere. In 1880 four were in operation, and in 1887 there were

some seventeen of these institutions in fourteen States. In that year Congress made the enterprise national by an appropriation of $15,000 per annum to each of the states and territories which have established agricultural colleges or agricultural departments of colleges. This has led to the establishment of new stations or the increased development of stations previously established under state authority, so that there are to-day forty-six, or, counting branch stations, fifty-seven agricultural experiment stations in the United States. Every state has at least one station, several have two, and one has three.

"These forty-six stations now employ over three hundred and seventy trained men in the prosecution of experimental enquiry. The appropriation by the United States Government for the fiscal year just closing, for them and for the office of experiment stations in the U. S. Department is $595,000; for the coming year it is $600,000. The several states appropriate about $125,000 in addition, making the sum total of about $720,000 given from public funds the present year for the support of agricultural experiment stations in the United States."

Agricultural Experiments in Canada

One year previous to the first agricultural experiment station in the United States, was established the Ontario Agricultural College at Guelph. It was not, however, until two years after the commencement of the College that actual work was performed in the Experimental Department, this being the year 1876. When the fifth year's work was being conducted at the above institution there were still but four other agricultural stations upon the American continent.

In the year 1886 an Act of Parliament was passed by the Dominion Government, making provision for the establishment of five experimental farms throughout Canada, the principal one to be established at Ottawa, and to serve for both Ontario and Quebec; the other four being located as follows: one in the Maritime Provinces, one in Manitoba, one in the North-west Territories, and one in British Columbia.

The farms have been purchased, and a superintendent engaged for each. Experimental work was commenced on the Central Farm in 1886, and upon the others about two years later. No pains are being spared in making these experimental centres an honour to Canada. There is truly a great work before these institutions, and we wish them every success in their laudable undertakings.

The fourteenth year of work in the Experimental Department of the Ontario Agricultural College has just closed. Did space allow, a review of the many scientific and practical experiments and investigations both in the field plots and with live stock would be interesting and no doubt highly instructive. It must suffice, however, to give herein a very brief review of the development of the work from its commencement.

In 1876 there were 40 field plots; in 1885, 170; and in 1889, 464. In 1885 23 acres were devoted to experiments, and during the present year about 58 acres have been used for similar work. The live-stock tests which have been conducted since 1886 have much increased in both number and complexity, there being five distinct experiments going on at the present time.

Chemical analyses were commenced during the year 1883, and since that date the new laboratory has been erected, and the conveniences greatly increased for this very important branch of the station's work. All the waters, milks, soils, fertilisers, roots, grains and plants have been analysed so far as time could be secured for this.

When the Professor of Dairying was appointed, the dairy experiments were put under his direct supervision; the creamery was continued, a silo erected, and numerous experiments with corn and dairy stock conducted.

Not only has there been a direct line of experimental work carried on at the College for the past fourteen years, but we are proud to say that there is a noble work being performed over this Province by members of the Ontario Agricultural and Experimental Union—an association of O. A. C. ex-students, students, and professors. Grains and fertilisers, with full instructions as to conducting the experiments, have been sent out

from the College for the past four years. In 1886 there were twelve members engaged in the work; in 1887, sixty; and in 1888, about one hundred, besides others, who are conducting experiments in horticulture and in bee-keeping. Results of the tests for 1889 are now being received at the College, and reports on field plots, live-stock, horticulture, dairy and bee-keeping experiments will be presented at the next meeting of the Union, to be held at the College. From the increased enthusiasm by which members of the Union have taken hold of the work, and by the encouraging remarks received from experiment stations of the United States on the reports, we feel that the active part taken by the Experimental Department of the College for the advancement of this field of labour has been work accomplished in the right direction.

Testing of Cereals.

The imported and Canadian cereals tested during the past year may be divided under the following heads:—Barley, 56 varieties; Pease, 16; Spring Wheats, 92; Oats, 92.

There is we consider no better way to present the details of experimental work of this nature than by tables. Our aim has been to so tabulate the results that full information regarding each cereal can be obtained at a glance at the horizontal lines, and the comparative merits obtained easily by examination of the perpendicular columns.

The size of the plot used in all these tests was $\frac{1}{100}$ of an acre, a clean path was left around each plot. The seed was sown broadcast, and the crop all cradled by the same person. The soil on which the grains were grown has received no manure for the past four years. All the barleys and pease were grown in the old experimental field, and the spring wheats and oats in the field which was partly divided off into plots in the fall of 1886.

Besides having a plot of each variety, two hundred grains of each were counted out and planted carefully in a row two rods long, thus making about three hundred rows with two hundred seeds planted in each. This plan allowed us to get the grain all on uniform soil, and hence under better control. The plants were afterwards counted, to find the germination of the seeds from a practical standpoint.

The following tables give in detail the results of the tests with different varieties of cereals.

Different Varieties of Barleys.

Station No.	Variety.	Seed from—	Date of— Seeding.	Date of— Maturing.	Germination of seeds in soil.	Straw. Length with head.	Straw. Strength.	Straw. Smut—per cent. of plants.	Head. No. of rows.	Head. Arrangement of grain.	Grain. Size.	Grain. Quality.	Yield. Grain per plot.	Yield. Straw and chaff per plot.	Yield. *Grain per acre.	Remarks.
					%	In.							lb.	lb.	Bush.	
1	Cheyne	Germany	April 15	Aug. 2	90.	47	Weak	1.5	2	Close	Medium	Medium	46	109	47.9	A good variety.
2	Emperor	"	"	" 3	100	42	"	0	2	"	"	Poor	35	95	36.5	Excellent germination.
3	Golden Drop	"	"	" 2	80.	45	"	0	2	Medium	"	Medium	39	88	40.6	Thrifty grower.
4	Hallett's Pedigree	"	"	" 1	91.	38	Medium	1.	2	Close	"	Good	33	67.5	34.4	Medium qualities.
5	Oderbrucker	"	"	July 28	96.5	39	"	0	6	Open	Small	"	42.5	51.5	44.3	Early variety.
6	Phœnix or Shielari	"	"	" 30	92.5	43	"	0	2	Close	Large	"	45	79	46.9	One of the best varieties.
7	Diamond	"	"	Aug. 3	97.	45	Strong	1.	2	"	....	....	....	....	....	A good variety, label lost.
8	Scholey's Chevalier	"	"	" 9	87.	36	"	1.	2	"	Large	Good	33	69.5	34.4	A good grower.
9	Victoria	"	"	" 9	89.5	37	"	1.5	2	"	"	"	25	49	26	Small yield of grain.
10	Common	Ontario	"	July 26	96.5	37	Medium	1.5	6	Medium	Small	Medium	49	56	51	Familiar to Ontario farmers.
11	Probitier	Germany	"	Aug. 30	89.	38	"	0	2	Close	Medium	Good	36	72	37.5	Medium qualities.
12	Invel	"	"	" 9	71.	38	Strong	1.	2	"	"	Medium	22	58.5	22.9	Small yield of grain.
13	Three-rowed	"	"	July 28	89.	39	Medium	0	6	"	"	"	25	58	26	An early variety.
14	Besthorns	"	"	Aug. 3	96.5	38	"	0.5	2	"	Large	"	37.5	65.5	29.1	Medium qualities.
15	Italian Rice	"	"	July 31	87.5	30	Strong	0	2	Very close	Medium	"	44	69	45.8	Head fan-shaped.
16	Golden Melon	"	"	Aug. 2	92.	35	Medium	0	2	Close	Large	"	30	52	31.3	Medium qualities.
17	Dutch	"	"	" 3	96.	35	Strong	0.5	2	"	"	"	22	46	20.8	Light yield.
18	White Australian	"	"	" 2	95.	37	"	0	2	"	....	....	....	....	....	Label lost.
19	Improved Imperial	"	"	" 3	85.5	37	Weak	0	6	Medium	Medium	Poor	27	63.5	28.1	Inferior sample.
20	Common	Ontario	"	July 30	92.5	37	Medium	0	6	"	Small	Medium	42.5	51	44.3	Familiar to Ontario farmers.
21	Kalina	Sweden	"	Aug. 3	95.5	36	"	0	2	Close	Large	"	34	58	35.4	Medium qualities.
22	Guymalaya	"	"	" 1	84.	35	"	0.5	6	"	"	Good	33	63	34.4	One of the best six-rowed varieties.
23	Pfanen	"	"	" 2	91.	42	Strong	0.5	2	"	"	"	27	64.5	28.1	Strong grower.
24	Kinnakulla	"	"	" 3	87.	37	"	1.	2	"	"	Medium	23.5	66.5	24.5	Medium qualities.
25	Very Early Lapland	Russia	"	July 24	45.5	37	Weak	0	6	"	....	....	....	....	..	Label lost; one of the earliest.
26	Maudschuri	"	"	" 30	90.	43	Strong	0	6	Medium	Medium	Poor	41	84	42.7	A good six-rowed variety.
27	Annats	Scotland	"	Aug. 3	94.	38	"	3.	2	Close	Large	Good	22	52	22.9	Light crop.
28	Chevalier	"	"	" 3	96.	40	"	0.5	2	"	"	Medium	23	48	24	Light yield.
29	Peerless White	England	"	" 3	92.	34	Medium	0	2	"	Medium	"	18	44.5	18.8	One of the poorest this season.
30	Common	Ontario	"	Aug. 2	88.5	36	Medium	0	6	Medium	Small	Medium	42.5	52.5	44.3	Familiar to Ontario farmers.
31	Golden Drop	England	"	" 3	100	34	"	0	2	"	Medium	"	27.5	63	28.6	Medium qualities.
32	Thanet	"	"	" 3	95.5	33	"	0.5	2	Close	"	"	25	54.5	26	Medium qualities.
33	Hertfordshire Hero	"	"	Sept. 1	72.5	....	"	...	6	Medium	"	Very poor	7	....	7.3	Very late and poor.
34	Improved Golden Melon	"	"	Aug. 3	91.5	40	"	1.	2	Close	"	Medium	33	64.5	34.4	Good growth.
35	Early Minting	"	"	" 3	96.	39	"	0	2	"	....	....	....	....	....	Label lost.
36	Improved Cheyne	"	"	" 3	94.	38	Strong	0	2	Medium	Medium	Medium	28.5	67	29.6	Fairly good variety.
37	Improved Beardless	"	"	" 4	96.5	40	Weak	0	2	Close	Large	"	26.5	....	27.6	Medium qualities.
38	Selected Chevalier	"	"	" 3	84.5	40	"	1.	2	Medium	"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39	Empress (new variety)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

22	Guymalaya	"	"	"	2	91.	42	Strong	0.5	2	"	"	Medium	23.5	66.5	24.5	Medium qualities.
23	Pfanen	"	"	"	3	87.	37	"	1.	2	"						Label lost; one of the earliest.
24	Kinnakulla	"	"	July	24	45.5	37	Weak	0	6	"						
25	Very Early Lapland	Russia	"	"	30	90.	43	Strong	0	6	Medium	Medium	Poor	41	84	42.7	A good six-rowed variety.
26	Maudschuri	"	"	"													
27	Annats	Scotland	"	Aug.	3	94.	38	"	3.	2	Close	Large	Good	22	52	22.9	Light crop.
28	Chevalier	"	"	"	3	96.	40	"	0.5	2	"	"	Medium	23	48	24	Light yield.
29	Peerless White	England	"	"	3	92.	34	Medium	0	2	"	Medium	"	18	44.5	18.8	One of the poorest this season.
30	Common	Ontario	"	Aug.	2	88.5	36	Medium	0	6	Medium	Small	Medium	42.5	52.5	44.3	Familiar to Ontario farmers.
31	Golden Drop	England	"	"	3	100	34	"	0	2	"	Medium	"	27.5	63	28.6	Medium qualities.
32	Thanet	"	"	"	3	95.5	33	"	0.5	2	Close	"	"	25	54.5	26	Medium qualities.
33	Hertfordshire Hero	"	"	Sept.	1	72.5	....	"	....	6	Medium	"	Very poor	7	....	7.3	Very late and poor.
34	Improved Golden Melon	"	"	Aug.	3	91.5	40	"	1.	2	Close	"	Medium	33	64.5	34.4	Good growth.
35	Early Minting	"	"	"	3	96.	39	"	0	2	"						Label lost.
36	Improved Cheyne	"	"	"	3	94.	38	Strong	0	2	Medium	Medium	Medium	28.5	67	29.6	Fairly good variety.
37	Improved Beardless	"	"	"	4	96.5	40	Weak	0	2	Close	Large	"	26.5	....	27.6	Medium qualities.
38	Selected Chevalier	"	"	"	3	84.5	40	"	1.	2	Medium	"	Poor	32	85.5	33.3	Medium qualities.
39	Empress (new variety)	"	"	"	3	91.	41	"	0.5	2	"	Medium	Medium	42	77.5	43.7	Fair yield.
40	Common	Ontario	"	July	30	92.	38	Medium	0	6	"	Small	"	50	57	52.1	Familiar to Ontario farmers.
41	Imperial	France	"	Aug.	2	81.	39	"	2.5	2	"	Medium	"	38	76	39.6	....
42	Large Skinned	"	"	"	1	59.5	35	Weak	0	2	"	Very large	Good	35	70	36.5	Without hulls.
43	Two-rowed Italian	"	"	"	2	91.	45	Strong	0	2	"	Large	Medium	38	83	39.6	Head fan-like.
44	Chevalier	"	"	"	2	87.	38	"	4.	2	Close	"	"	38	71	39.6	Very bad with smut.
45	Early Black	"	"	July	30	77.5	36	Medium	5.	6	Medium	Medium	"	39	50	40.6	Seeding done too late, badly affected by smut and rust
46	Six-rowed	"	"	Sept.	1	95.	....	Medium	....	6	Open	Small	Very poor	45	...	4.7	Total failure.
47	Chevalier	"	"	Aug.	5	81.5	44	Weak	0	2	Close	Large					Label lost.
48	Spreading or Fan	"	"	July	31	90.5	34	Strong	0	2	Very close	"	Poor	35	60	36 5	Very compact head.
49	Celeste	"	"	Aug.	1	88.5	38	Medium	0.5	6	Medium	"	Good	28.5	53.5	29.6	Medium 6-rowed variety.
50	Common	Ontario	"	July	30	92.5	37	"	0	6	"	Small	Medium	46	51	47.9	Familiar to Ontario farmers.
51	Peerless White	D.C.F., Ottawa.	"	Aug.	5	91.	38	Strong	0	2	Close	Medium	"	28	64	29.6	Fairly good yield.
52	English Malting		"	"	5	93.	35	"	0	2	"	Large	"	24.5	68.5	25.5	Medium qualities.
53	Beardless		"	"	5	93.	35	"	0	2	Medium	"	"	21	55	21 9	"
54	Carter's Prize Prolific		"	"	9	93.5	36	"	0.5	2	Close	"	"	25	63.5	26.6	"
55	.....	.....	"	July	19	100	40	"	0	2	"	.....	.....	...	...	...	Label lost.
56	Skinless	Ontario	"	"	19	89.	30	"	0	6	"	Medium	Medium	21	27	29.9	Grain without hulls.
57	Italian	Italy	May 11	Sept.	9	....	.....	.....	....	2	Medium	Large	Poor	5.5	96.5	5.7	One of two varieties which were sown very late.
58	Chevalier	Ontario	April 15	July	29	85.	39	Medium	0	2	"	"	Medium	37.5	69.5	39.1	Earlier than a good many varieties.
59	Improved Scotch	"	" 15	.....		85.5	42	"	0	6	"	Medium	Poor	46	52	47.9	Good six-rowed barley.
60	Common	"	" 15	July	30	90.	38	"	1.5	6	"	Small	Medium	40	47.5	41.7	Familiar to Ontario farmers.
61	White	Hungary	May 11	.....		.....	.....	.....	.....	.....	.....	.....	.....	8	....	8.3	One of two varieties which were sown very late.

* Estimate from plot.

Different Varieties of Peas.

Station Number.	Variety.	Seed from.	Date of Seeding.	Germination of seed in soil.	Straw—length.	Pod—average number of peas in each.	Grain. Color.	Grain. No. of grains per oz.	Yield. Grain per plot.	Yield. Grain per acre.	Yield. Straw per plot.	Yield. Straw per acre.	Remarks.
				%					lb.	Bush.	lb.	lb.	
61	Sweet Jessie..........	England ...	April 17	91	Long...	3.5	Yellowish green.	117	38	31.7	47	2350	Grain very uneven.
62	Early Britain..........	"	" 17	99	Long...	3.1	Yellowish green.	114	32	26.7	40.5	2025	Grain very uneven.
63	Perfection White	"	" 17	95.5	Medium	3.6	White	90	29.5	24.6	30.5	1525	Beautiful large pea.
64	Earliest of all Blue.....	"	" 17	91	Medium	4.5	Blue	192	21	17.5	29	1450	Vine bunchy
65	Glory	"	" 17	92	Short ..	3.4	Pale blue.......	88	44.5	37.1	42	2100	Large and crinkled pea.
66	Early Racehorse..	"	" 17	99	Medium	4.4	Yellowish white.	153	43.5	36.2	58.5	2925	Medium size, slightly crinkled pea.
67	Hero of Reading......	"	" 17	72.5	Short ..	3.3	Greenish white .	93	36.5	30.4	35.5	1775	Large and regular sized pea.
68	Selected Maple........	"	" 17	92.5	Medium	4.1	Mottled brown..	166	28.5	23.9	36.0	1800	Medium, indented and regular sized pea.
69	Veetches Perfection...	"	" 17	69.0	Short ..	4.7	Greenish white .	76	28.0	23.3	38.5	1925	Large, indented, a good sample.
70	Princess Royal	"	" 17	91.0	Short ..	3.6	White....	77	38.5	32.1	54	2700	Grain large and uniform.
71	Black-eyed Marrowfat.	Ontario	" 17	95	Long...	3.9	Yellowish white.	99	49.0	40.8	68.5	3425	Heavy, coarse straw.
72	White-eyed Marrowfat.	"	" 17	93.5	Long...	3.8	White..........	87	52.5	43.9	47.5	2375	Large and fairly smooth.
73	Grass	"	" 17	78.0	Medium	....	Dirty white	314	41.5	34.6	73	3650	Grain small and angular.
74	Multipliers	"	" 17	98.0	Long...	......	Yellowish white.	223	49.5	41.3	......	......	Small and smooth.
75	Golden Vine.	"	" 17	90	Medium	......	Golden white...	220	46	38.3	......	....	Small, round and regular.
	Prussian Blue	"	" 17	93	Medium	5.1	Blue	141	54	45.0	79	3950	Grain uniform.

71	Black-eyed [illegible]	"	....	"	17	93.5	Long...	3.8	White.....	87	52.5	43.9	47.5	2870	[illegible]	
72	White-eyed Marrowfat.	"	....	"	17	78.0	Medium	....	Dirty white	314	41.5	34.6	73	3650	Grain small and angular.	
73	Grass	"	....	"	17	98.0	Long...	.....	Yellowish white.	223	49.5	41.3	.....	.....	Small and smooth.	
74	Multipliers	"	....	"	17	90	Medium	.....	Golden white...	220	46	38.3	.....	....	Small, round and regular.	
75	Golden Vine.	"	....	"	17	93	Medium	5.1	Blue	141	54	45.0	79	3950	Grain uniform.	
	Prussian Blue	"	....	"	17											

DIFFERENT VARIETIES OF SPRING WHEATS.

Station No.	Variety.	Seed from	Date of Seeding.	Date of Heading.	Percentage of seeds producing plants.	Straw. Length with head.	Straw. Strength.	Straw. Rust.	Head bearded or bald.	Grain. Color.	Grain. Quality.	Yield. Grain per plot.	Yield. Straw and chaff per plot.	Yield. Grain per acre.	Remarks.
					%	In.						lb.	lb.	Bush.	
77	Spelz	Germany...	April 18	July ...	88	41	Strong .	Very little..	Bearded	Red..	Shrunken considerably.	9	....	15	Enclosed in chaff.
78	Pringle's Champion.	"	"	"	13	79½	44	Medium	"	"	"	Small plump berry..	9	28½	15	Promising variety.
79	Holben's Improved.	"	"	"	14	92½	41	"	Bad	Bald ...	"	Shrunken	7	10½	11.7	Fair yield but grain shrunken.
80	Chidham	"	"	"	26	85½	38	"	Medium....	"	White	"	4	27	6.7	Rather coarse.
81	King Bartigen.....	"	"	"	16	69½	35	Weak ..	"	Bearded	Red..	"	4½	17	7.5	Poorly germinated.
82	Summer.....	"	"	"	16	89	37	" ..	Slight	"	"	Very poor.....	6	29	10	Miserable sample of grain.
83	Fern or April.	"	"	"	26	84	34	" ..	Bad	Bald ...	"	Poor	1½	23½	2.6	Just medium.
84	Nenhert.....	"	"	"	18	85	43	Medium	Medium....	"	"	"	3½	39	5.8	Good shaped head.
85	Spelz Black Beere ..	"	"	"	19	89	48	Strong .	"	Bearded	Red..	"	4	30	6.7	Grain enclosed in chaff.
86	Triticum Spelta	"	"	"	17	94	40	Weak ..	Slight	"	"	.....	.....	.....	.....	Failure.
87	Pringle's Defiance .	"	"	"	13	90½	38	" ..	Bad	Bald ...	White	Somewhat shrunken.	2	20½	3.3	Medium qualities.
88	Crystal Rock.....	"	"	.....	.....	89½	9	.....	.....	.....	.....	.....	.....	.....	.....	Failure.
89	Spelz	Russia.....	"	July	19	97½	38	Medium	Slight	Bald ...	Red..	Poor	3½	30	5.8	Chaff adheres to grain.
90	Saxonka	"	"	"	16	65	37	"	Medium....	"	"	Large and plump ...	7	....	11.7	Good sample of grain.
91	Kubanka	"	"	"	15	77	41	Strong .	Very little..	Bearded	"	Medium.....	2	13	3.3	Light yield.
92	Odessa Ghirka.....	"	"	"	15	80	38	"	Slight	Bald ...	"	Fair sample	5	27	8.3	Grain, fair sample.
93	Konisburg	"	"	"	16	75½	41	"	Almost none	Bearded	"	"	6½	27	10.9	Promising variety.
94	Azima	"	"	"	17	83	36	"	Very little..	"	"	One of best.....	2	6½	3.3	Medium.
95	Sebastopol Azima...	"	"	.....	..	81½	5	.....	.....	.....	.....	.....	.....	.....	.....	Failure.
96	Danubian Ghirka...	"	"	.....	.....	84	35	Strong .	.....	Bearded	Red..	Fair sample	1	3	1.7	A small quantity of grain of fair quality.
98	Poland	"	"	July	19	82	48	"	Slight	"	"	Medium sample	7	42½	11.7	Very large coarse variety.
99	Danubian	"	"	.....	.....	81	7	.....	.....	.....	.....	.....	.....	.....	.....	Failure.
100	Dantzic White	"	"	.....	..	86	9	.....	.....	.....	.....	.....	.....	.....	.....	"
101	Dantzic	"	"	July	19	82½	38	Medium	Slight	Bearded	Red..	Good sample	5	....	8.3	Promising variety.
102	Red Chaff White ...	Scotland....	"	.....	.....	81	6	.....	.....	.....	.....	.....	.....	.....	.....	Failure.
103	Champion White ...	England ...	"	.....	.....	80½	4	.....	.....	.....	.....	.....	.....	.....	.....	"
104	Selected Talavera White.....	"	"	.....	.....	86½	7	.....	.....	.....	.....	.....	.....	.....	.....	Total failure.
105	Soft White.....	Australia...	"	July	11	82½	27	Strong .	.....	Bearded	White	.....	.....	.....	.....	"

Different Varieties of Spring Wheats.—*Continued.*

Station No.	Variety.	Seed from	Date of Seeding.	Date of Heading.	Percentage of seeds producing plants.	Straw. Length with head.	Straw. Strength.	Straw. Rust.	Head bearded or bald.	Grain. Color.	Grain. Quality.	Yield. Grain per plot.	Yield. Straw and chaff per plot.	Yield. Grain per acre.	Remarks.
					%	In.						lb.	lb.	Bush.	
106	April Bearded Red.	England ...	April 18	July 19	82	46	Medium	Slight	Bearded	Red..	Shrunken	2½	27½	4.2	Medium qualities.
107	Improved Red Nursery	" ...	"	.....	91	7	.....	.....	.... ..	.....	.....	....	....	.. ...	Total failure.
108	Malaga White.....	" ...	"	.....	91½	12	.....	.....	.... ..	.....	.....	....	....	.. ...	"
109	St. Land Red.....	France.....	"	July 28	92	38	Medium	Slight	Bald ...	Red..	.....	1	17½	1.7	Filled badly.
110	Noé or Blue	"	"	" 27	87	39	"	Medium....	"	"	Badly shrunken	¾	17½	1.2	"
111	Victoria March....	"	"	" 30	86½	41	Strong .	Slight	Bearded	"	"	2	24½	3.3	Medium qualities.
112	March Bearded	"	"	" 15	82½	42	"	.....	"	"	Medium sample	8	36	13.3	One of the very best.
113	Richelle White	"	"	" 22	81	41	Medium	Medium....	Bald ...	"	Shrunken	1	16	1.7	Named white, color red.
114	Lonzelle White.....	"	"	" 22	88	43	Strong .	"	"	"	"	1½	27½	2.5	Poor sample.
115	Large Flag.....	"	"	" 12	84	37	"	.....	"	White	Medium	2	17	3.3	Medium qualities.
116	Ordinary March....	"	"	" 18	93	39	Weak ..	Very little..	"	Red..	"	4	24½	6.7	Promising variety
118	Heavy Lonzelle	"	"	.....	99	8	*	.....	.....	.....	.....	.....	.....	.....	Failure.
119	French Summer	"	"	July 28	93½	33	Strong .	Slight	Bald ...	Red..	Badly shrunken	2½	19½	4.2	Medium qualities.
120	Sandomisza	"	"	.....	88	5	.....	.....	.....	.....	.....	.....	.....	.....	Failure.
121	Victoria.....	"	"	July 18	86½	48	Strong .	Slight	Bearded	Red..	Fair sample	4½	32	7.5	May do well in some parts.
122	Red Bearded March.	"	"	" 13	85	44	Weak ..	.....	"	"	Above the average..	6	26	10	Promising variety.
123	Hickling March White	"	"	" 28	85	40	Medium	Medium....	Bald ...	"	Badly shrunken	1	19½	1.7	Named white, color red.
124	Ordinary Bearded March	"	"	" 16	90	36	"	.....	Bearded	"	Above the average..	8	25	13.3	One of the best varieties.
125	Herison Bearded....	"	"	" 13	85	42	Strong .	Almost none	"	"	Plump and good....	11	29	18.3	Perhaps the best variety.
126	Bearded Red	"	"	" 16	75	39	Weak ..	....	"	"	Medium	4	16½	6.7	Promises well.
127	Herison Bearded....	"	"	" 15	76	41	Strong .	Almost none	"	"	Plump and good....	9½	24½	15.8	Perhaps the best of imported varieties.
128	Ohne Bart.....	"	"	" 28	68	36	"	Medium....	Bald ...	"	Badly shrunken	3	19½	5	Good strong grower when young.
129	March de Brie.....	"	"	" 24	90	37	"	Bad	"	"	Shrunken	3	25	5	Above average in yield.
130	Rousselin	"	"	.....	68½	43	"	.....	"	White	Badly shrunken	2	25	3.3	Grain very poor.
131	Defiance	Ontario	"	July 19	67	38	Medium	Bad	"	"	.....	2	23½	3.3	Poorer in germination than most imported varieties.
132	New Magyar	Ontario	April 18	July 21	76	40	Weak ..	Bad	Bald ...	Red..	Medium.....	1½	21	2.5	Poor sample.
133	Red Fern	"	"	" 17	78	47	Medium	Very little..	Bearded	" ..	Fair sample	8	35	13.3	Did very well indeed for this season.
134	Purple Straw.	Australia...	"	" 16	88½	37	Strong .	....	Bald ...	White	Badly shrunken	1½	12	2.5	Poor sample.
135	White Essex	" ..	"	" 18	87½	37	"	....	"	"	Very uneven	1½	11½	2.5	"
136	Purple Tuscan	" ..	"	.....	86	37	Weak ..	....	"	"	....	....	....	....	Failure.
138	White Tuscan	" ..	"	July 22	85	38	"	....	"	"	Shrunken	1½	19½	2.5	Very poor.
139	African Bearded ...	" ..	"	" 19	76	40	Strong .	....	Bearded	"	"	1	18½	1.7	"
140	Indian	" ..	"	June 24	69½	28	"	....	"	"	"	1	18½	1.7	"
141	Roseworthy Improv-														

126	Bearded Red	"	"	"	"	15	76	41	Strong	Almost none	"	"	Plump and good	9½	24½	15.8	Perhaps the best of imported varieties.
127	Herison Bearded	"	"	"	"	28	68	36	"	Medium	Bald	"	Badly shrunken	3	19½	5	Good strong grower when young.
128	Ohne Bart	"	"	"	"	24	90	37	"	Bad	"	"	Shrunken	3	25	5	Above average in yield.
129	March de Brie	"	"	"	"		68½	43	"	"	"	White	Badly shrunken	2	25	3.3	Grain very poor.
130	Rousselin	"	"	"	July	19	67	38	Medium	Bad	"	"		2	23½	3.3	Poorer in germination than most imported varieties.
131	Defiance	Ontario	"	"													
132	New Magyar	Ontario	April 18	July	21	76	40	Weak	Bad	Bald	Red	Medium	1½	21	2.5	Poor sample.
133	Red Fern	"	"	"	17	78	47	Medium	Very little	Bearded	"	Fair sample	8	35	13.3	Did very well indeed for this season.
134	Purple Straw	Australia	"	"	16	88½	37	Strong		Bald	White	Badly shrunken	1½	12	2.5	Poor sample.
135	White Essex	"	"	"	18	87½	37	"		"	"	Very uneven	1½	11½	2.5	"
136	Purple Tuscan	"	"			86	37	Weak		"	"					Failure.
137	White Tuscan	"	"	July	22	85	38	"		"	"	Shrunken	1½	19½	2.5	Very poor.
138	African Bearded	"	"	"	19	76	40	Strong		Bearded	"	"	1	18½	1.7	"
139	Indian	"	"	June	24	69½	28	"		"	"	"	2½		4.2	Very early variety.
140	Roseworthy Improved Bearded	"	"	July	11	75	41	"		"	"	Medium	3	22	5	Early variety.
141	Soft White	"	"	June	25	74	28	"	Bad	"	"		2½	10½	4.2	Very early variety.
142	Ward's Prolific	"	"	July	23	73	40	Weak		Bald	"					Failure.
143	Wild Goose	Ontario	"	"	20	73	48	Strong	Very little	Bearded	Red	Large and plump	16	40	26.7	Well known, but poor quality.
144	Ladoga	Ottawa	"	"	15	71½	39	Weak		"	"	Medium	5		8.3	Introduced by D.C.F., Ottawa.
145	Triumph	Ontario	"	"	13	79	42	"		Bald	"	Shrunken considerably.	4½	27	7.5	Fair for this season.
146	Campbell	"	"	"	13	84	45	"		Bald	White	Shrunken considerably.	3	24	5	Medium.
147	Donald	"	"	"	16	80½	46	Medium		"	"	Badly shrunken	3	27	5	"
148	Paros	Greece	May 11			86½	32	Strong		Bearded						Very late seeding.
237	Voto	"	"	July	23	86	35	"		"						Failure.
238	Grecian	Russia	"	"	16	82	37	Medium		"						"
239	Bart Trimenia	Greece	"	"	20	84	36	Strong		"	Red	Fair sample	4	20½	6.7	May do well another year.
240	Missogen	"	"	"	20	86	33	"		"						Failure.
241	Atalank	"	"	"	23	72	34	"		"						"
242	Grand Cianco	Italy	"			81	11									"
243	Sorentino	"	"	July	19	81	41	Strong		Bearded	Red	Fair sample	2	14	3.3	Fairly good grain, but small yield.
244	Neapel	"	"	"	24	85.5	38	"		"						Failure.
245	Square Head	Sicily	"	"	27	80.5	33	Weak		Bald						"
246	Red Wheat	"	"	"	28	70.5	33	Medium		"						"
247	White Chaff	Hungary	"			66.5	28	"		Bearded						"
248	Mountain	"	"	July	24	85	30	"		Bald						"
249	Hungarian	"	"			80.5	35									"
250	Banter	"	"			86.5	28	Strong		Bearded						"
251	Square Head	"	"			87	6									"
252	Medeah	Africa	"	July	15	92	48	Strong		Bearded	Red	Large and somewhat shrunken	5½	28½	9.2	The best sample of the late seeding.
253	Algiers	"	"	"	22	86.5	42	"		"	"					Failure.
254	Cape	"	"	"	27	81.5	33	Medium		Bald			1½	19½	2.5	"
255	March	California	"	"	12	81.5	32	Weak		"						"
256	Egyptian	Egypt	"			92	10									"
257	Spelz	Switzerland	"			80	8									"
258	Early Japan	Japan	"			91.5	7									"
259																	

Different Varieties of Oats.

Station number.	Variety.	Seed from.	Date of Seeding.	Date of Maturing.	Germination of seeds in soil.	Straw. Length—inches.	Straw. Strength.	Straw. Smut—per cent. of plants.	Straw. Rust.	Head shape.	Grain. Color.	Grain. Shape.	Grain. Quality.	Yield of Grain per plot.	Yield of Straw per plot.	Yield of Grain per acre.	Remarks.
					%									lb.	lb.	Bush	
149	Amer'cn Welcome	Germany.	April 22	Aug. 8	82	62	Medium	4.5	Medium	Spreading	White.	Short ..	Somewhat uneven.	17	44	50	Uniform in height.
150	California White Prolific.....	"	"	" 19	88.5	64	Strong .	0	Slight..	Mane	"	Medium	Plump and uniform	16	61.5	47.1	Recommended by oat-meal millers. Very vigorous grower.
151	Oderbrucker.....	"	"	" 8	78.5	56	Strong .	0	Medium	Spreading	"	Long..	Most of grain good and plump	25.5	52.5	75	Recommended by oat-meal millers.
152	Thuringen.	"	"	" 16	85.5	60	Strong .	.5	Bad....	"	Yellow	Long...	Poorly filled.....	11	78.5	32.1	Recommended by oat-meal millers.
153	Danebrog	"	"	" 12	88	63	Medium	1.5	Bad....	"	White.	Medium	Nice plump berry.	25.5	64	75	Tall and good growth.
154	Hopetown.....	"	"	" 15	75	59	Medium	.5	Medium	"	"	Short ..	Small and uneven.	8	....	23.5	As usual did poorly.
155	Yellow August ..	"	"	" 18	76	60	Strong .	1	Medium	"	Yellow	Medium	Good berry.....	15.5	78.5	45.6	Recommended by oat-meal millers.
156	Longfellow.....	"	"	" 13	83	66	Medium	0	Bad....	"	White.	Short ..	Only fairly well filled.	8.5	79	25.0	One of the latest varieties.
157	Victoria.....	"	"	" 9	91	59	Medium	6.5	Slight..	"	"	Short ..	Thick berry	16	57	47.1	A very early oat.
158	Probitier.....	"	"	" 11	83	58	Medium	0	Medium	"	"	Long...	Good quality grain	23.5	57	69.1	Promising well.
159	Waterloo..	"	"	" 11	75	60	Medium	1	Medium	"	"	Long...	Good quality grain	22	62	64.7	Recommended by oat-meal millers.
160	White Canadian.	"	"	" 14	82.5	63	Strong .	1	Medium	"	"	Medium	Rather spindly....	21.5	62.5	63.2	Medium in qualities.
161	Impr'vd Besthorn	"	"	" 13	84	56	Strong .	1.5	Bad....	"	Yellow	Long...	Good plump berry.	24	33	70.6	Recommended by oat-meal millers.
162	Nubian Black ...	"	"	" 15	69.5	62	Strong .	1.0	Medium	Mane	Black .	Medium	Rather poorly filled	16.5	66	48.5	Plot rather low lying.
163	August White...	"	"	" 14	77	57	Medium	.5	Medium	Spreading	White.	Short ..	Small but fairly well filled.	14	75	41.2	Plot rather low lying.
164	Georgien White .	"	"	" 13	53	56	Weak ..	.5	Slight..	"	"	Medium	Small but fairly well filled.	21.5	72	63.2	Plot rather low lying.
165	Providence	Sweden ..	"	" 13	65	62	Medium	0	Medium	"	"	Medium	Medium.....	12.5	65.5	36.8	Affected most by wet weather.
166	Barboo leaved ...	"	"	" 15	70	59	Strong .	0	Bad ...	"	"	Medium	Small and spindly	9	78	26.5	Slow in starting to grow
167	Scotch Potato ...	Russia ...	"	" 16	72	60	Strong .	1	Medium	"	"	Medium	Poorly filled.....	9	63.5	26.5	Slow in starting to grow
168	White Poland ...	"	"	" 12	73	60	Medium	1	Medium	"	"	Long...	Very well filled...	15	68.5	44.1	Vigorous grower.
169	Podolischer.....	"	"	" 8	68.5	61	Weak ..	4	Slight..	.....	"	Short ..	Thick hull but almost empty.	11	58	32.4	Very early variety.
170	Egyptian.....	Ontario ..	April 22	Aug. 9	84	58	Weak...	1	Medium	.....	White.	Medium	Thick hulled very well filled.	19.5	73.5	57.4	Early variety.
171	Legona	Russia ..	"	" 10	77	56	Medium	.5	"	Spreading	"	Long...	Nice berry well filled.	20.5	60	60.3	Recommended by oat-meal millers.
172	Siberian.	" ..	"	" 13	85	57	"	.5	Bad....	"	"	" ..	Nice berry well filled.	25	66	73.5	Recommended by oat-meal millers.
173	White Tartarian.	" ..	"	" 14	81.5	56	"	0	Slight..	Mane	"	" ..	Medium.....	20.5	76	60.3	Recommended by oat-meal millers.
174	Berwick White.	Scotland .	"	" 12	90	58	"	4	"	Spreading	"	Short ..	Rather small				
175	Victoria White	"															

164	Georgien White	"	"	"	13	53	56	Weak	.5	Slight			Medium	Small but fairly well filled.	21.5	72		
165	Providence	Sweden	"	"	13	65	62	Medium	0	Medium	"	"	Medium	Medium	12.5	65.5	36.8	Affected most by wet weather.
166	Barboo leaved	"	"	"	15	70	59	Strong	0	Bad	"	"	Medium	Small and spindly	9	78	26.5	Slow in starting to grow
167	Scotch Potato	Russia	"	"	16	72	60	Strong	1	Medium	"	"	Medium	Poorly filled	9	63.5	26.5	Slow in starting to grow
168	White Poland	"	"	"	12	73	60	Medium	1	Medium	"	"	Long	Very well filled	15	68.5	44.1	Vigorous grower.
169	Podolischer	"	"	"	8	68.5	61	Weak	4	Slight		"	Short	Thick hull but almost empty.	11	58	32.4	Very early variety.
170	Egyptian	Ontario	April 22	Aug. 9	84		58	Weak	1	Medium		White.	Medium	Thick hulled very well filled.	19.5	73.5	57.4	Early variety.
171	Legona	Russia	"	"	10	77	56	Medium	.5	"	Spreading	"	Long	Nice berry well filled.	20.5	60	60.3	Recommended by oatmeal millers.
172	Siberian	"	"	"	13	85	57	"	.5	Bad	"	"	"	Nice berry well filled.	25	66	73.5	Recommended by oatmeal millers.
173	White Tartarian	"	"	"	14	81.5	56	"	0	Slight	Mane	"	"	Medium	20.5	76	60.3	Recommended by oatmeal millers.
174	Berwick White	Scotland	"	"	12	90	58	"	4	"	Spreading	"	Short	Rather small, very well filled	15	69	44.1	Plot somewhat low lying.
175	Victoria White	"	"	"	10	94.5	65	"	0	Medium	"	"	"	Very well filled	19	56	55.9	Early variety.
176	Dun	"	"	"	14	69	63	"	.5	"	"	Dun	Medium	Good size hull but rather empty.	11	87	32.4	Plot somewhat low lying.
177	Black Tartarian	"	"	"	15	79	57	"	0	"	Mane	Black	Long	Fairly well filled	18	77	52.9	Vigorous grower.
178	Sandy	"	"	"	16	77.5	60	Weak	0	"	Spreading	White	Short	Uneven	12	94	35.3	Coarse straw.
179	Hamilton	"	"	"	14	65	57	"	0	Bad	"	"	"	Small berry, medium in plumpness.	10.5	72.5	30.9	Lodged badly.
180	Bertrum Prolific	"	"	"	14	93	62	Medium	0	Medium	"	"	"	Small berry, medium in plumpness.	13.5	71.5	39.8	Medium qualities.
181	White Tartarian	"	"	"	16	70.5	60	"	0	Slight	Mane	"	Medium	Spindling berry	14.5	89.5	42.6	Recommended by oatmeal millers.
182	Black Poland	"	"	"	12	75	54	Strong	0	Medium	"	Black	Short	Pretty uniform sample.	18.5	56	54.4	Fairly good grower.
183	Birlie	"	"	"	12	85	58	Weak	0	Slight	Spreading	White	Medium	Very poor	8.5	52	25.0	Part destroyed in harvesting.
184	Angus	"	"	"	13	77	50	Medium	0	Medium	"	"	"	Very poor	7.5	46	22.1	Part destroyed in harvesting.
185	Longfellow	"	"	"	13	86.5	54	"	0	"	"	"	Short	Just medium	10	70	29.4	Medium qualities.
186	Hopetown	"	"	"	13	81	58	Strong	0	"	"	"	"	Very poor	7.5	69.5	22.5	Plot rather low lying.
187	Potato	"	"	"	9	90	55	"	.5	Bad	"	"	"	Very poor	7	55	20.6	Plot rather low lying.
188	Flying Scotchman	England	"	"	7	83.5	54	Medium	0	Slight	"	"	Long	Thick berry well filled.	21.5	48.5	63.2	Very early variety.
189	Selected Winter	"	"	"	11	84	52	Strong	1	Medium	"	Dun	"	Long and spindly.	7.5	46.5	22.1	Very slow grower.
190	Improved White Tartarian	"	"	"	11	86.5	54	"	.5	"	Mane	White	Short	Poorly filled	8	61	23.5	Recommended by oatmeal millers.
191	Dutch Bren	"	"	"	7	73	58	Medium	0	Slight		"	Long	Thick and plump	16	44	47.1	Very early variety.
192	Sandy	Scotland	"	"	10	87.5	47	Strong	0	Bad	Spreading	Brown	Medium	Medium	11	....	32.4	Weight of straw mislaid
193	Improved Black Tartarian	England	"	"	12	84.5	50	Medium	1.5	Medium	Mane	Black	Medium	Fair size but poorly filled.	12	43.5	35.3	Medium qualities.
194	Early Racehorse	"	"	"	7	65.5	47	Strong	0	Slight		White	Short	Fair size but poorly filled.	11	31	32.4	Very early variety.
195	Victoria Prize White	"	"	"	7	92.5	54	"	2.5	"		"	"	Thick berry very well filled.	16	35	47.1	Very early variety.

*Estimated from plot.

Different Varieties of Oats.—*Continued.*

Station No.	Variety.	Seed from	Date of Seeding.	Date of Maturing.	Germination of seeds in soil.	Straw. Length—inches.	Straw. Strength.	Straw. Smut—per cent. of plants.	Straw. Rust.	Head—shape.	Grain. Color.	Grain. Shape.	Grain. Quality.	Yield of Grain per plot.	Yield of Straw per plot.	Yield of *Grain per acre.	Remarks.
					%									lb.	lb.	bush.	
196	Improved Waterloo White	England	April 22	Aug. 11	92	53	Strong	2.5	Medium	Spreading	White.	Long	Good sample.	17.5	39.5	51.5	Recommended by oatmeal millers.
197	Early Blossom White	"	"	" 6	91.5	56	Medium	0	Slight	.....	"	Short	Hull well filled	20.5	40.6	60.3	Very early variety.
198	Yellow Flanders	France	"	" 13	85	58	"	1.5	Bad	Spreading	Yellow	Long	Very Spindly	11.5	64.5	33.8	Vigorous grower.
199	Brie Black	"	"	" 14	75.5	47	"	1.5	Medium	"	Black	Medium	Medium	12.5	68.5	36.8	Rather small berry.
200	Egyptian	Ontario	"	" 12	86	50	"	2.5	"	Mane	White.	Short	Thick hull fairly well filled.	19	53	55.9	Used for comparison.
201	White Abundance	France	"	" 9	70.5	51	"	2	Bad	Spreading	"	Long	Medium	21	47	61.8	An early variety recommended by oatmeal millers.
202	Black Red Crown	"	"	" 13	83.5	46	"	0	"	"	Pale Black.	Medium	Spindly	14	60	41.2	Medium qualities.
203	Georgie White	"	"	" 11	88	48	"	0	Slight	"	White.	"	Good quality	21	52.5	61.8	Fairly early oat.
204	White Hungarian	"	"	" 13	92	56	Strong	0	Medium	Mane	"	"	Fairly well filled	16	53.5	47.1	Uniform in growth.
205	Poland White	"	"	" 9	88	51	Medium	0	"	Spreading	"	"	"	22	37.5	64.7	Recommended by oatmeal millers.
206	Houdan Black	"	"	" 10	80.5	47	"	0	Slight	"	Black	Long	"	23	47.5	67.6	Good sample.
207	Yellow Gigantic	"	"	" 15	86.5	52	"	0	Medium	Mane	Yellow	"	Medium	18.5	54	54.4	Recommended by oatmeal millers.
208	Coalommiers	"	"	" 15	80	54	"	0	"	Spreading	Black	Medium	Fair sample	13	68.5	38.2	Medium qualities.
209	Red Spot	"	"	" 7	84	43	Weak	0	Slight	.....	Dun	Small	Exceptionally small.	12	50	35.3	Exceedingly small grain.
210	Goanette Black	"	"	" 11	83.5	42	Strong	1.5	Slight	Spreading	Pale Black.	Medium	Very superior	27.5	48	80.9	One of the very best yielders.
211	Round or Branching Black	"	"	" 15	83.5	50	"	0	Bad	"	Black	"	Poor	12	53	35.3	Rather late variety.
212	Flanders' White	"	"	" 13	80.5	56	"	0	"	"	White.	Long	Uneven	18.5	53.5	54.4	Vigorous growth.
213	Chenailles Black	"	"	" 11	89.5	45	Weak	.5	Medium	"	Black	Medium	Excellent quality	27.5	....	80.9	One of the very best yielders.
214	Black Hungarian	"	"	" 10	83.5	56	"	0	"	Mane	"	"	Medium	15.5	54.5	45.6	Fine straw.
215	Black Etampes	"	"	" 11	83.5	47	Medium	4.5	"	"	"	"	Excellent quality	21.5	48.5	63.2	Fine straw.
216	Black Etampes	"	"	" 8	64.5	46	"	.5	"	Spreading	"	"	"	22.5	52.5	66.2	An early oat.
217	Houdan Black	"	"	" 10	93.5	42	"	0	"	"	Pale Black.	"	"	21	36.5	61.8	Fine straw.
[illegible]	[illegible]	"	April 22	Aug. 6	83	43	Strong	1.5	Slight	.....	White.	Medium	Thin hull and well filled.	22.5	42.5	66.2	Very early variety.
219	Triumph	Australia	"	" 5	52.5	53	"	0	Bad	Spreading	"	"	Very poor	7	45.5	20.6	Rather late oat.
220	White	"	"	" 6	95.5	48	Medium	1.5	Slight	.....	"	Short	Thick & well filled.	18	46	52.9	Very early variety.
221	Carter's Prize Cluster	Ontario	"	" 7	85.5	49	Weak	0	Medium	.....	"	Medium	Poorly filled	17	43	50	"
222	Hamilton	"	"	" 13	90.2	50	Medium	0	"	Spreading	"	"	Very poor	8.5	55	25	As usual a poor yielder.
223	Hopetown	"	"	" 14	85	44	Strong	0	Bad	"	"	"	"	14.5	66.5	42.6	Slow growth in early
224	Black Tartarian	"	"	" 11	86	53	Medium	.5	Medium								
225	Raeburn	"	"														

*Grain per acre.

211	Round or Branching Black	"	"	"	15	83.5	50	"	0	Bad	"	Black	"	Poor	12	53	30.5	Rather late oat.
212	Flanders' White	"	"	"	13	80.5	56	"	0	"	"	White	Long	Uneven	18.5	53.5	54.4	Vigorous growth.
213	Chenailles Black	"	"	"	11	89.5	45	Weak	.5	Medium	"	Black	Medium	Excellent quality	27.5	....	80.9	One of the very best yielders.
214	Black Hungarian	"	"	"	10	83.5	56	"	0	"	Mane	"	"	Medium	15.5	54.5	45.6	Fine straw.
215	Black Etampes	"	"	"	11	83.5	47	Medium	4.5	"	"	"	"	Excellent quality	21.5	48.5	63.2	Fine straw.
216	Black Etampes	"	"	"	8	64.5	46	"	.5	"	Spreading	"	"	"	22.5	52.5	66.2	An early oat.
217	Houdan Black	"	"	"	10	93.5	42	"	0	"	"	Pale Black	"	"	21	36.5	61.8	Fine straw.
	[illegible]	"	"	April 22	Aug. 6	83	43	Strong	1.5	Slight		White	Medium	Thin hull and well filled	22.5	42.5	66.2	Very early variety.
219	Triumph	Australia	"	"	5	52.5	53	"	0	Bad	Spreading	"	"	Very poor	7	45.5	20.6	Rather late oat.
220	White	"	"	"	6	95.5	48	Medium	1.5	Slight	"	"	Short	Thick & well filled	18	46	52.9	Very early variety.
221	Carter's Prize Cluster	Ontario	"	"	7	85.5	49	Weak	0	Medium		"	Medium	Poorly filled	17	43	50	"
222	Hamilton	"	"	"	13	90.2	50	Medium	0	"	Spreading	"	"	Very poor	8.5	55	25	As usual a poor yielder.
223	Hopetown	"	"	"	14	85	44	Strong	0	Bad	"	"	"	"	14.5	66.5	42.6	Slow growth in early season.
224	Black Tartarian	"	"	"	11	86	53	Medium	.5	Medium		Black	Long	Medium	19	54	55.9	Medium qualities.
225	Racehorse	"	"	"	7	82	53	Weak	1.5	"		White	Medium	Plump hull, but rather empty	16.5	50.5	48.5	Very early variety.
226	Egyptian	"	"	"	9	81	51	"	0	"		"	"	Thick hull fairly well filled	19.5	60	57.4	An early oat.
227	White Australian	"	"	"	13	88	52	"	1	"		White	Long	Very thick hull	22	56.5	64.7	Superior quality of oat.
228	Rennie's Prize White	"	"	"	7	89	60	"	2.5	"	Mane	"	Short	Medium	19.5	51	57.4	Very early variety.
229	Acclamatized Bl'k Tartarian	"	"	"	12	87.5	46	Stroug	1	"	Spreading	Black	Medium	Fairly well filled	21	50	61.8	Good yielder.
230	Pedigreed Black Tartarian	"	"	"	11	89	49	"	0	"	Mane	"	"	Fair	17	50	50	Medium qualities.
231	Black Champion	"	"	"	10	88	48	Medium	5.5	"	"	Pale Black	"	Nice plump oat	19	54.5	55.9	Smutted badly.
232	Improved Scotch	"	"	"	11	65.5	50	Strong	1	"	Spreading	White	Short	Very poor	7.5	63	22.1	Poor in germination.
233	Cluster or Triumph	"	"	"	7	89	52	Weak	1.5	"	"	"	"	Thick hull but well filled	20.5	49.5	60.3	Very early variety.
234	Welcome	"	"	"	7	98	51	"	4.5	"	"	"	"	Thick hull but fairly well filled	21.5	48	63.2	"
235	Early Calder	"	"	"	10	86.5	47	Medium	11	Bad	"	"	Medium	Good quality	21.5	53.5	63.2	Affected by smut more than any other variety.
236	Bavarian	"	"	"	10	....	51	Strong	0	Medium	"	"	.....	Medium	24.5	57	72.1	A good variety.
260	Hungarian Black	Hungary	May 11	"	23	59	51	"	4	Bad	Mane	Black	Long	Very poor	7	48	20.6	Poorly germinated.
261	Port Adelaide	Australia	"	"	16	87	53	Medium	5.5	Medium	Spreading	White	Short	Medium	8.5	45.5	25	Badly affected by smut.
262	Australian White	"	"	"	23	78.5	50	Strong	1	Bad	"	"	"	Poor	7	49	20.6	Nice uniform growth.
263	Prolific Black	California	"	"	21	80.5	51	"	3.5	"	Mane	Black	Medium	Poor	8.5	47.5	25	Grain paler than seed.

* Estimated from plot.

Application of Salt with Oats on Four Kinds of Soil.

About six 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 the present year salt was again applied at the rate of 400 lb. per acre upon the same portions as last year and oats sown over the whole plot.

The following table shows the yields of the present year and those of 1888:

Yields of Barley and of Oats upon Four Kinds of Soil with and without Salt.

Variety of Soil.		Date of maturity.	1888. Yield of Barley.		1889. Yield of Oats.		Yield of Grain per Acre.	
			Grain per plot.	Straw per plot.	Grain per plot.	Straw per plot.	Barley. 1888.	Oats. 1889.
		August.	lb.	lb.	lb.	lb.	Bush.	Bush.
Loam	Salt	20	21¼	23¾	23½	58	35½	55⅛
	No salt	20	21	21½	22¼	50	35	52⅛
Marl	Salt	22	11¼	36¼	16¾	68¼	18¾	38¼
	No salt	24	10½	31⅛	15½	41	17½	36½
Clay	Salt	22	16¾	15¼	20½	57½	28	48¼
	No salt	23	12¼	17¾	17½	45	20½	41⅛
Muck	Salt	24	11¼	15¼	.....	.....	18¾	.....
	No salt	23	7	20	.....	.....	11⅜	.....

Barley Yields from Different Dates of Seeding.

For this experiment three varieties of barley were sown, at three different periods, upon plots one-fiftieth of an acre in size. The soil was a clay loam and had not received any manure for the past four years. Owing to the exceedingly wet weather during the latter part of May and the commencement of June the last seeding took place at a later date than was intended. The seed of the common six-rowed variety was from Ontario, while that of the other two was imported from England.

Barley Yields at Different Dates of Seeding.

Varieties.	Grain Per Plot.			Yield Per Acre		
	Seeded April 15.	Seeded May 5.	Seeded June 7.	Seeded April 15.	Seeded May 5.	Seeded June 7.
	lb.	lb.	lb.	Bush.	Bush.	Bush.
Common 6-rowed	42.5	19.5	4.0	44.3	20.3	4.2
Peerless White	18.0	5.0	3.5	18.8	5.2	3.6
Golden Drop	27.5	6.0	5.0	28.6	6.3	5.2

Varieties of Potatoes.

Small quantities of nine varieties of potatoes were received by us from Steele Bros., Toronto. It was late when the seed reached us, and could we have planted them earlier the yield would no doubt have been considerably greater, but the test is nevertheless valuable as a comparison of the different varieties. In each hill was planted a section of a potato containing a single eye, and there were forty hills of each variety. The soil in which the potatoes were planted was quite uniform throughout, and the care and cultivation similar for all the varieties. The Late Rose and White Elephant, two well-known varieties, were used as a basis for comparison.

Varieties.	Crop of Potatoes.		Remarks.
	Number.	Weight.	
		lb. oz.	
Rough Diamond	97	5 14½	Small, round, rough skinned.
Lady's Finger	50	2 9½	Very small, long and slender, with deep eyes.
Mrs. Foraker	95	6 11	Some fair size, smooth, and shallow eyes.
Crown Jewel	81	16 13½	Some large size, eyes medium depth, fairly smooth.
Rural, No. 2	56	8 11½	Uniform, roundish, and smooth.
Summit	96	13 4½	Mostly fair size, medium length and good shape.
Sweet St. Vernal	84	11 2½	Fair size, long, smooth, shallow eyes, and good shape.
Minister	108	8 12	Small, round, deep eyes.
Footaluck	81	9 6½	Medium size, rather uneven, deep eyes and roundish shape.
White Elephant	91	13 11½	Part large, somewhat scabby, good shape.
Late Rose	86	12 11½	Some large, rather uneven, fairly smooth.

Rotation of Crops.

In the year 1883 Prof. Brown commenced an experiment to compare the relative advantages of two rotations of crops, each extending over a period of seven years. The main feature of comparison in the rotations was roots followed by spring grain *versus* bare fallow followed by fall wheat.

There were two plots, each one-tenth of an acre in size and consisting of clay loam. The plots were situated near the centre of Experiment Field No. 1. In commencing the test the root plot received farm-yard manure at the rate of twenty loads per acre, which was plowed under on May 15th, and the fallow plot received the same quantity of manure on the 24th of July.

With the present year the rotation has closed, and I herewith present a concise statement of the results. I am responsible for the correct returns of the last four years of the rotations, previous to which time I did not have charge of the experiments, but have given the results as fully as research could unfold.

Year.	Rotation.	Crops.	Returns. Per Plot.	Returns. Per Acre.	Remarks.
1883.	A	Roots			Nothing in the records except the words "light yield."
	B	Bare fallow			
1884.	A	Spring Wheat and Grass Seed	22.8 lb	3.8 bush	
	B	Winter Wheat and Grass Seed	152.4 lb.	25.4 bush	
1885.	A	Hay			Nothing in back notes to show the yield of hay for 1885.
	B	Hay			
1886.	A	Hay	771 lb	3.86 tons (green)	The clover was weighed immediately after being cut.
	B	Hay	1071 lb	5.36 tons (green)	
1887.	A	Pasture	Pasture	Pasture	Put hurdle fence around plots and pastured by sheep; no difference between the pasture on the plots.
	B	Pasture	Pasture	Pasture	
1888.	A	Pease	Straw 150 lb Grain 119 lb	Straw .75 ton Grain 19.8 bush	The pease grown were the common Golden Vine.
	B	Pease	Straw 162 lb Grain 154 lb	Straw .81 ton Grain 25.8 bush	
1889.	A	Oats	Straw 388 lb Grain 194 lb	Straw 1.94 ton Grain 57.90 bush	No difference could be observed in the date of maturing.
	B	Oats	Straw 406 lb Grain 182 lb	Straw 2.03 ton Grain 53.5 bush	

Experiments on the Farm.

Not only were there experiments conducted on the small experimental plots, but a number of larger tests were made in the fields of the farm. Part of the work of these farm experiments, such as harvesting the grain and grass plots, and the seeding, cultivation and harvesting of the mangolds and carrots, was done by Mr. Story, the farm foreman, while the measuring of the land, sowing of the grain, cultivation of the paths, and oversight in weighing came in my department. This line of work has compelled us to secure extra help both for the farm and experimental departments, but we think it very wise on your part for requesting this important line of work to be done. These numerous tests have caused no small amount of anxious thought on the part of Mr. Story, but I wish to make mention just here of the great carefulness used by him in that part of the work under his supervision. He has certainly taken much interest in the work, and it is as these departments work most harmoniously together that the greatest good can be done for the farmers of Ontario.

We have had some failures this year, and there are some experiments on which I cannot yet report owing to the crops not yet being threshed. Ten acre plots containing different varieties of Canadian oats, and nine acre plots with mixtures of grains, were destroyed by the cut-worm as far as the experiment goes, although there was a medium crop taken from the land. Four acre plots with different varieties of barley, and three acre plots with different kinds of spring wheat have not yet been threshed as will be explained no doubt by Mr. Story. An experiment was conducted with different quantities of ashes to the acre upon clover, but the season was somewhat advanced when they were applied and the amount of rainfall made a tremendous growth of clover. The effects of the ashes could not be seen this year, but may have an influence upon next year's yield.

The experiments with potatoes, mangels and carrots gave the following results :—

VARIETIES OF POTATOES.

No. of Variety.	Variety.	Notes taken July 2.			Notes taken August 27.		Yield per row.	Yield per acre.
		Thriftiness.	Blossoming.	Quantity of blossoms.	Condition of tops.	Ripeness of tops.		
							lb.	bush.
1	Dakota Red.....	Poor	Late	Medium....	Thick and spreading.	Green.....	418	271
2	Early Ohio	Medium....	Medium....	Numerous..	Strong but few	Partly dead.	485	314.4
3	Rural Blush.....	Good.....	Late	Medium....	Strong and tall	Green.....	469	304.1
4	Halton's Seedling.	Medium....	Early.....	Numerous..	Short and low lying .	Partly dead.	472	306.0
5	Early Sunrise.....	Good.....	Early.....	Numerous..	Short and low lying.	Partly dead.	538	348.8
6	Crown Jewel	Poor	Early.....	Medium....	Short and low lying..	Partly dead.	401	260.0
7	Empire State.....	Poor	Early.....	Medium....	Strong	Green	388½	259.9
8	Rosy Morn	Medium....	Medium....	Medium....	Medium growth....	Partly dead.	349	226.3
9	Stray Beauty.....	Good.....	Late	Scarce	....	Earliest of all	401	260.0
10	Beauty of Hebron.	Good.	Late	Medium....	Heavy tops.	Early	430	278.8
11	White Elephant ..	Good.....	Medium....	Medium....	Heavy tops.	Turning slightly ..	396½	257.0

VARIETIES OF MANGELS.

Variety.	Weight per row.	Yield per acre.
	lb.	Bush.
nt Yellow Globe.....	904	644.3
ter's Ward Orange Globe	814	580.1
g Yellow	754	537.4
Globe	714	508.8
tral German Sugar Beet.....	411	294.1
Mangoids.....	854	431.9
Tankard.....	422	301.4
moth Red Intermediate.....	778	554.5

VARIETIES OF CARROTS.

Variety.	Weight per row.	Yield per acre.
	lb.	Bush.
White Belgian	532.0	403.6
Long Red Surrey	583.5	450.3
Orange Belgian	562.5	434.1
Scarlet Intermediate	635.0	490.0
Long Red Altringham	400.0	308.7
Large White Vosges	908.0	700.7

CULTIVATION OF RAPE.

Of the cultivation of rape for pasturing off by lambs is becoming a feature of no mean importance in Ontario farming. To obtain, if possible, some accurate information regarding the cultivation of this crop, an experiment was conducted during the past season. The results are given in the following table :—

ts.	Manner of seeding.	Condition of soil.	Distance apart of rows.	Rate of seed per acre.	Weight of crop per plot.	Weight of crop per acre.
					lb.	Tons.
No. 1.	Drills	Level	22 inches	4 lbs	1,808	18.08
No. II.	Drills	Ridges	22 inches	4 lbs	1,310	13.10
No. III.	Drills	Ridges	22 inches	½ lb	1,420	14.20
No. IV	Drills	Ridges	18 inches	4 lbs	1,668	16.68
No. V.	Broadcast	Level	Not in rows	½ lb	1,468	14.68
No. VI.	Broadcast	Level	Not in rows	8 lbs	1,730	17.30

Numbers I and II plots were under as near the same conditions as was possible to have them, except that No. II was ridged up to a medium height with a plow, No. I, being left entirely level. Of the rape on the two plots, that on No. I was taller, larger, and a more thrifty growth throughout. The plants on No. III plot were thinly scattered over the ground but grew to a very large size, the leaves, over nearly the whole plot touching their edges. On No. IV plot, the ridges were smaller and closer together. There was a very great difference between the size and nature of the plant on Nos. V and VI plots ; those on the former being large and very succulent and tender, and consequently well adapted for pasturing by lambs, while those on the other plot were small and of woody nature.

The cultivation of the drilled plots was precisely the same throughout. Much care was taken at the time of sowing to have the seed evenly distributed over each plot, and no thinning of plants took place. The crop was all pulled by hand, and weighed immediately afterwards.

EXPERIMENT IN PIG-FEEDING.

During the earlier part of the present year an experiment in pig-feeding was conducted to determine whether or not, there was any advantage in heating food for pigs during the cold winter weather. The test extended over the time from January 14th to April 14th. There were two sets of pigs in the same experiment, and each set was divided into two lots. There were two animals in the first set, and the test lasted for three periods of thirty days each. In number two set there were six animals—three in each lot—and these were fed for two periods of thirty days each. The pigs of set one were Berkshire grades, about five months old at commencement of experiment; those of set two were from a Berkshire sow and Suffolk boar, and had reached the age of about six months.

The feed consisted of swill (apple peelings, potato peelings, etc., from College) and wheat middlings. Part of the feed at each meal was warmed to a temperature of about 80° F., and part was given the animals when cold at a temperature of about 40° F. At the end of each period the feed was changed, the pigs receiving cold feed for one period would have the warm during the following period and *vice versa*.

The following shows the details of each part of the experiment :—

PIG-FEEDING EXPERIMENT—SET I.

Period.	Date.	Name of animal.	Conditon of feed.	Quantity of swill fed.	Quantity of wheat middlings fed.	Weight of Pig on entering each period.	Weight of Pig on closing each period.	Increase in live weight.
						lb.	lb.	lb.
I.	January 14 to February 13.	Spot	Warm ...	150	73	181	220	39
		Black	Cold	150	73	183	212	29
II.	February 13 to March 15.	Spot	Cold	126	90	220	271	51
		Black	Warm	150	90	212	243	31
III.	March 15 to April 14.	Spot	Warm	150	90	271	299	28
		Black	Cold	150	90	243	264	21

PIG-FEEDING EXPERIMENT—SET II.

Period.	Date.	Number of animals.	Condition of feed.	Quantity of swill fed.	Quantity of wheat middlings fed.	Name of Animal.	Weight of pig on entering each period.	Weight of pig at close of each period.	Increase in live weight of each animal.	Increase in live weight of each group.
				lb.	lb.		lb.	lb.	lb.	lb.
I.	Feb. 13 to March 15.	3	Warm	324	168	A sow	114	150	36	109
						B barrow	122	163	41	
						C sow.....	114	146	32	
		3	Cold	324	168	X sow	105	140	35	110
						Y barrow	132	171	39	
						Z sow.....	104	140	36	
	March 15 to April 14.	3	Cold	324	168	A sow	150	176	26	107
						B barrow	163	217	54	
						C sow	146	173	27	
		3	Warm	324	168	X sow	140	190	50	126
						Y barrow.	171	201	30	
						Z sow.....	140	186	46	

The pig experiment may be thus summarised:

Set I.—Warm feed gave live weight increase of 98 pounds; cold feed gave live weight increase of 101 pounds.

Set II.—Warm feed gave live weight increase of 235 pounds; cold feed gave live weight iLcrease of 217 pounds.

From both of these taken together we find that there was an increase of 15 pounds in favor of the warm feed.

The animals had a sleeker coat and looked more thrifty when fed upon warm d

It is expected that the experiment will be condncted again during the winter of 1889-90.

Ontario Agricultural and Experimental Union.

The experimental work here at the College is most intimately connected with the work carried on over the province by members of the Ontario Agricultural and Experimental Union. The formation and work of this association was spoken of at some length in the earlier part of my report. The instructions and material for the plot experiments are all sent from here, and the reports, after being completed, are again returned to the College; but some do not reach here until after the College Report has been completed for the year.

The full number of the Union experiments with grains and fertilisers have been conducted at this institution, and I shall now give, first, the instructions sent out to experimenters, and a summary of those grain tests as reported at the Union meeting of 1889, and which are near enough alike in character to allow an average to be taken, and second, the results of the Union tests of 1889, as conducted at this institution.

Summary of the Experimental Union Tests for 1888.

Instructions for Experiments wth Fertilisers.

1st. 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. If you can choose your plots in such a position as to allow them to remain for experiment another year, so much the better.

2nd. Mark off six plots of one-fortieth of an acre each, having clean path of two feet wide between the plots. Two rods square is a convenient shape.

3rd. Submit all plots to same treatment, and sow one-sixth of grain sent on each Aim at seeding one inch deep.

4th. Apply the salt sent to plot No. I, the superphosphate to No. II, the ground apatite to No. III, wood ashes to No. IV, farmyard manure to No. V, and no manure to No. VI. The fertilisers to be sown at time of seeding.

5th. Keep plots at all times clear from trespassing by poultry, etc.

6th. Each experimenter is allowed to use his own judgment in reference to the quantity of barnyard manure applied.

7th. It is requested that No. V. plot be sown with 10 lb. fresh wood ashes, the same as the other fertilisers, as no Kainit can be obtained in Canada.

We have sent by express to those experimenting, expressage prepaid, one of the following lots of grain for six plots:—18 lb. White Russian wheat; 18 lb. Red fife wheat; 11¼ lb. Egyptian oats; 11¼ lb. White Cluster oats, or 12¾ lb. common two-rowed barley. Also 10 lb. salt for plot No. I., 10 lb. superphosphate for plot No. II. and 10 lb. apatite for plot No. III. The produce from the plots becomes the property of the experimenter.

Make out reports of experimental plots and meteorological observations as full and careful as you can, and forward to Mr. C. A. Zavitz, O. A. C., Guelph, not later than 1st November.

NOTE.—To those who carried on somewhat similar experiments last season, on five plots, and two years ago on four plots, we send additional grain to be sown on the same plots. The object is to test the influence of the fertilisers over two and three seasons. Report in the same manner as for the new plots.

OPTIONAL EXPERIMENTS.

If you can furnish us any accurate information as to the results obtained by any others in your neighborhood with the same fertilisers, we shall be glad to receive it. As for your own work, the success of the experiment and your own reputation demand carefulness, accuracy, and a little sacrifice.

In addition to, or entirely independent of the above general experiments, we are looking for some individual work. We wish every experimenter to send in an accurate statement in regard to some one or more of the following experiments:—

(1) Testing some imported cereals.
(2) Testing if chess sown will mature to seed.
(3) Testing whether plowing under barnyard manure or leaving as top-dressing is the best
(4) Testing a mixture of grass seeds for use as a permanent pasture.
(5) Any experiment you are in a position to carry out, but which is not mentioned in the above.

The price of the superphosphate used was $26 per ton, and that of the ground apatite or phosphate $12 per ton. Both were obtained from Smith's Falls. The same class of fertilisers was used in 1888 as during 1887, the latter giving the following analyses:

	I. Apatite.	II. Superphosphate.
Water	.016 per cent.	5.885 per cent.
Soluble phosphoric acid	.... "	10.489 "
Reverted " "	.... "	5.808 "
Insoluble " "	27.848 "	1.318 "
	27.848 per cent.	17.615 per cent.

The analysis 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 analysis 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.

From the returns received by the committee for 1888, forty-five valuable reports are ained. Owing to various circumstances, such as the dry season and misfortunes of ious kinds, a number of those who undertook the work were unable to send satisfac- reports. The reports forwarded to the committee were carefully read, and only se retained which were considered to be reliable and valuable.

AVERAGE Results of "Union" Experiments with Grains and Fertilisers during 1888.

	Fertilisers per acre.	Weight per acre in lb.		Weight of grain per bush.
		Straw.	Grain.	
Egyptian Oats, 10 Experiments.	Salt.....400 lb.	2,557	1,427	39.6
	Superphosphate.....400 "	2,481	1,487	39.6
	Ground apatite.....400 "	2,410	1,428	39.6
	Fresh wood ashes..... *	2,300	1,298	39.1
	Farmyard manure.....	2,706	1,576	38.7
	No manure.....	2,480	1,294	38.7
White Cluster Oats, 12 Experiments.	Salt.....400 lb.	2,064	1,168	37.0
	Superphosphate.....400 "	1,979	1,204	37.3
	Ground apatite.....400 "	1,711	1,013	36.8
	Fresh wood ashes..... *	1,912	1,076	37.4
	Farmyard manure.....	1,946	1,119	37.7
	No manure.....	1,806	983	37.1
Common 6-rowed Barley, 12 Experiments.	Salt.....400 lb.	2,394	1,758	49.3
	Superphosphate.....400 "	2,377	1,769	50.0
	Ground apatite.....400 "	2,220	1,656	49.1
	Fresh wood ashes..... *	2,221	1,588	48.5
	Farmyard manure.....	2,406	1,698	49.2
	No manure.....	2,087	1,512	48.5
Red Fife Wheat, 5 Experiments.	Salt.....400 lb.	1,371	916	61.1
	Superphosphate.....400 "	1,565	992	60.3
	Ground apatite.....400 "	1,495	868	62.0
	Fresh wood ashes..... *	1,580	952	59.1
	Farmyard manure.....	1,755	1,108	58.9
	No manure.....	1,580	896	58.5
Average of Total, 40 Experiments.	Salt.....400 lb.	2,221	1,393.2	44.9
	Superphosphate.....400 "	2,189	1,432.0	45.0
	Ground apatite.....400 "	2,032	1,307.6	44.9
	Fresh wood ashes..... *	2,073	1,274.4	43.9
	Farmyard manure.....	2,272	1,412.8	44.2
	No manure.....	2,053	1,221.6	44.0

HORTICULTURAL EXPERIMENTS.

A synopsis is presented below of the reports upon experiments in potato culture showing in a concise way the results obtained by the different persons who undertook the work. These experiments will be continued for a series of years, until sufficient data is obtained from which a fair conclusion may be deducted. The following circular was sent to experimenters; together with a blank form for report:

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 results.

No. 1. Planting large whole potatoes.
" 2. " small uncut potatoes.
" 3. " small potatoes, all eyes cut out except one.
" 4. " medium potatoes cut in two.
" 5. " " " fresh cut two eyes.
" 6. " " " old cut (five days) two eyes.
" 7. " " " cut, with one eye.
" 8. " " " seed ends.

Nos. 1 and 2 to be planted 12 inches apart in rows. Nos. 3, 4, 5, 6, 7, 8, planted eight inches apart in rows. Plant that variety which does best with you. Potatoes, to be planted on eight adjoining rows. Where land is uniform, give same manure and cultivation as rest of field. Each row to be seven rods long. In digging, be careful to weigh accurately and forward results to N. J. Clinton, Windsor, Ont.

Result of Experiments in Potato Culture.

Experimenters.	Variety of Potato.	Large, whole.	Small, uncut.	Small; all eyes cut out but one.	Medium, cut in two.	Fresh cut, two eyes.	Old cut (5 days) two eyes.	Cut, with one eye.	Seed ends.	Average of eight kinds.
		1	2	3	4	5	6	7	8	
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
E. Lick	White Elephant	111	99½	96	103	103	103	90	88	99.2
E. M. Zavitz	do	150½	95	99	127	130	124	91¼	106½	115.4
J. Kitchen	do	125	89	73	123	112	78	97	73	96.3
G. B. Boyce	do	111	115	120	135	140	114	105	153	124.1
N. J. Clinton	Early Rose	153	110	101	121	82	78	99	85	103.6
G. F. Marsh	do	97	95	94	80	70	68	66	65	79.4
A. G. McKenzie	do	138	72	96	113	116	95	84	105	102.4
Wm. Ratcliffe	White Star	120	120	109	123	100	77	79	88	102.0
R. Harcourt	do	128	54	74	63	54	55	50	67	68.1
J. McMillan	Beauty of Hebron	86	47	46	44	45	40	44	37	48.6
Jas. Forsyth	do	95	86	100	95	81	81	86	78	87 8
J. Soule	Late Hebron	163	166	162	185	140	175	144	182	164.6
J. French	Grangers	186	220	183	175	138	140	145	139	165.8
J. F. Peacock	.....	113½	107	113	113	120	123	120	100	113 7
.....	.....	155	105	112½	112	90	115	103	109	112.7
Average yield, one row (7 rods		128.8	105.4	105.2	114.1	101.4	97.7	93.5	98.3	105.6
		Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.
Average seed used per acre		55.5	14.4	13.3	24.5	14.4	14.4	8.2	8.2	19.1
Average yield per acre		263.9	216.0	216.1	240.8	213.9	209.1	197.3	207.4	220.6
Net yield per acre (less seed)		208.4	201.6	202.8	216.3	199.5	194.7	189.1	199.2	201.5

No. 1 gave the largest yield ten times, No. 4 twice and Nos. 2, 3 and 5 once each. In point of quality No. 5 stood first, No. 7 second, No. 6 third, No. 4 fourth, No. 2 fifth, No. 1 sixth, No. 3 seventh, and No. 8 eighth. In point of yield per acre, after deducting the quantity required for seed, No. 4 ranked first, No. 1 second, No. 3 third, No. 2 fourth, No. 5 fifth, No. 8 sixth, No. 6 seventh, and No. 7 eighth. A majority of the experimenters cut the potatoes for planting with two eyes to the piece, and nearly all of them plowed in every third furrow, dragging the ground just as the tops peeped through, then cultivated well and hilled up with a hiller or cultivator.

Union Experiments of 1889.

I. A continuation of the experiments of 1888 (salt, superphosphate, ground apatite, fresh wood ashes, farmyard manure and no manure), with grain on the same plots without further application of fertilisers.

II. A test of superphosphate, dried blood and scrap, farmyard manure and no manure, with oats.

III. A comparison of different systems of raising fodder corn.

IV. A trial of Kaffir corn growing in Ontario.

Experiment No. I.

Instructions same as those given for 1888, the fertilisers belng applied in the spring of 1887.

Plot. No.	Fertilisers.	Application per plot.	Date of maturing.			Yield of grain.			Yield of straw.	
			Spring Wheat.	Barley.	Oats.	Spring Wheat.	Barley.	Oats.	Barley.	Oats.
		lb.	July.	July.	Aug.	lb.	lb.	lb.	lb.	lb.
I.	Salt.....	10	27	28	11	14.4	58.5	56.8	53.5	42.8
II.	Superphosphate..	10	27	28	13	13.9	43.5	76.2	43.0	37.8
III.	Ground Apatite..	10	26	28	11	13.1	55.5	70.2	52.0	39.3
				Aug.						
IV.	Farmyard manure	700	26	3	15	16.5	54.7	100.7	61.3	49.3
V.	No. manure.....	.....	26	3	14	16.5	52.2	74.2	56.8	45.8

Note.—Size of plot in each place was one-fortieth of an acre. The date of seeding on each plot was for spring wheat, April 22, 1887, for barley, April 26, 1888, and for oats, April 22, 1889.

EXPERIMENT No. II.

Instructions.

(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 fertilizers to be sown at the time of seeding.

(5) Keep plots at all times clear from trespassing by poultry, etc.

(6) Aim at applying 700 lb. farmyard manure on No. 3 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, lb.....oats; 10 lb. superphosphate for plot No. I, and 10 lb. of dried blood and scrap for plot No. II.

Note.—The superphosphate was obtained at Smith's Falls and cost $26 per ton, and the dried blood and scrap (manufactured from pork factory refuse) was procured from Hamilton and sells for $40 per ton.

No. of Plot.	Fertilisers.	When Sown	When Matur'd	Weight of Straw	Weight of Grain	Remarks.
		April	Aug.	lb.	lb.	
I.	Superphosphate, 10 lbs. per plot (400 lbs. per acre).	22	11	100¾	59¼	About ⅓ of plot lodged.
II.	Dried blood or scrap, 10 lbs. per plot (400 lbs. per acre).	22	12	116¼	58¾	About ½ of plot lodged.
III.	Farmyard manure, 700 lbs. per plot (14 tons per acre).	22	15	122¾	56¼	About ½ of plot lodged.
IV.	No manure.	22	13	95¼	50¾	About ⅓ of plot lodged.

Remarks on nature of soil, previous cropping, etc.—The plots were situated on experimental field No. 2, the soil consisting of a clay loam. The previous cropping was: 1886, fallow, with manure in autumn; 1887, spring wheat, and 1888, oats. The farmyard manure was applied as a top dressing after seeding in the spring of 1889, and the superphosphate and dried blood and scrap were sown upon their respective plots at the same time.

EXPERIMENT No. III.

Instructions.

(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. 1, 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 May. Note—Shallow planting for early seeding, and deeper planting if late enough for the 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 lbs. 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 Experimental funds of the Committee are exhausted. This will save much unnecessary expense in postage. If you cannot obtain the corn apply to the Secretary, mentioning your address 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 the head of "Remarks" in blank form.

(9) Fill out the accompanying blank form and return.

TABLE OF RESULTS No. 3.

No. of Plot.	Seeding and Cultivation of Crops.	Distance apart of rows.	Average depth of planting.	Dates of Cultivation or Hoeing.	No. of stalks grown per 100 ft.	Depth of cultivation.	Weight of Produce.	Percentage of stalks having ears.	Previous Cropping.
		In.				In.	Lb.		
I.	Drills, 2 grains per foot.	42	1 inch.	Horse cultivation July 2, 23 and August 15. Hand hoeings July 16 and August 15.	592.5	2	2,344	5	1884, Roots.
II.	Drills, 12 grains per foot.	42	1 inch.	Same as No. I.	97.9	2	2,413	0	1885, Barley. 1886, Clover.
III.	Broadcast or close drill, 2.8 lb. per plot.	....	1 inch.	Cut weeds July 16.	....	0	2,201	11	1887, Oats.
IV.	Broadcast or close drill, 16.8 lb. per plot.	....	1 inch.	Cut weeds July 16.	....	0	2,677	0	1888, Green fodder.

Remarks.—The ground (clay loam) received well-rotted manure at the rate of ten load[illegible] er acre, which was plowed under a short time before planting. Each plot was planted on May 18. The corn was not up until ju[illegible] after the sev[illegible]re frosts were over, but owing to the cold wet weather the growth was very slow for a long time. At the time of cutting many of the leaves on No. IV plot had turned yellow, a smaller proportion on No. II, while the leaves on Nos. I and III were yet green and thrifty looking.

Conclusions.—Owing to only about one-half of the seed grain germinating, the character of this experiment is considerably modified.

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GRAIN EXHIBIT.

At your request an exhibit of the grains grown upon the experimental plots during the present year, was shown at both the "Provincial" exhibition at London and the "Industrial" exhibition at Toronto. The samples of grain for this exhibit were taken from single rows, put in for that purpose, so as not to destroy in any way the exact record of the plot yields. We were much pushed for time when collecting and preparing the samples, it being the period of the year in which we were cutting and threshing our plot experiments; but we firmly believe that much good resulted from making this exhibit and we would further suggest that an exhibit be taken another year to many of the other leading exhibitions in Ontario.

At the "Provincial" in London, our exhibit extended for a distance of forty-five feet along one side of the building, and reached from the floor to the ceiling. It consisted of six rows of glass jars along the front, containing different varieties of imported cereals, and upon the wall was arranged the grain in the head as grown by the Experimental Department during the present year from the imported seed. At one end was arranged a number of varieties of ensilage corn from the dairy department. At your request and at the wish of many others, a photograph of the display was taken.

At the "Industrial" in Toronto we had not as good a place in which to arrange the materials, the glass jars all being on shelves at one end, and the whole exhibit extending sixty feet in length. We were unable to get all the grains upon the limited wall space, but on the whole, the exhibit looked fairly well.

At both the "Provincial" and "Industrial" exhibitions we had large notices up containing the following: "*Information given here regarding the course of study given at the Ontario Agricultural College, Guelph.*" I was usually kept busy answering questions about the different varieties of grains, and giving information regarding the advantages of the college course for a farmer's son.

CONCLUSION.

The experimental work is rapidly increasing, there being at present eight times as many plots as there were when I took charge in 1886; and my duties during the past year have certainly been heavy. It is only as a person becomes actively engaged in the details of experimental work that he realises the immense amount of care and watchfulness needed in the seeding, labelling, note-taking, harvesting, threshing, weighing, etc., of more than 300 plots of grain; in the planting, cultivation, and harvesting of such crops as potatoes, fodder corn, rape, etc., in the collecting, preparing, and arranging of some 250 varieties of grain in the head for the Ontario exhibitions; and in all the many requirements of experimental work.

I think we can look upon the year 1889 as a fairly successful one in bringing forth valuable information for the Ontario farmer for whose interest we are laboring.

Respectfully submitted,

C. A. ZAVITZ,

EXPERIMENT NO. IV.

Instructions and also Description of the Kaffir Corn.

From the Southern States, where this corn is extensively grown, we obtain the following information :

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 lb. 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 numerous wide leaves. The stalks keep green and are brittle and juicy, not hardening like other samples of the 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 three to four 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.

Name of Fodder.	When Planted.	Distance apart of Rows.	Average Depth of Planting.	Dates of Cultivatings or Hoeings.
Kaffir Corn.	June 11.	3 feet.	1 inch.	Horse cultivatings July 9, 23, August 15. Hand hoeings July 9, 23.

Depth of Cultivation.	Weight of Produce.	Percentage of Stalks having Ears.	Nature of Soil.	Previous Cropping.
2½ ins.	1,379 lbs.	2	Clay loam.	1886, Bare fallow. 1887, Oats. 1888, Fall wheat.

Area planted, one-fifth acre.

Remarks.—The ground had not received manure for three years. The early part of summer was apparently too cold and wet for the rapid growth of the Kaffir corn. A few stalks which headed out stood about four feet in height. This corn may do much better another season than it has during the past one, especially with a little earlier seeding, but at present it certainly appears to be unprofitable to grow in Ontario.

PART VIII.

REPORT OF

THE PROFESSOR OF DAIRY HUSBANDRY.

GUELPH, Ont., 23rd Jan., 1890.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to report upon the work of the department under my charge for 1889. Following the style adopted in my reports of previous years, I have gathered into chapters some information bearing on the different branches of dairy practice which has been gleaned from experience during the past and previous years. For the sake of clearness, as well as for the better service of those who may seek guidance, from its pages, it is written under the following heads:

1. Dairy husbandry in Ontario.
2. Farmers' Institute work.
3. Creamery management.
4. Extension of the creamery system into the winter season.
5. Buttermaking.
6. Experimental cheese-making.
7. The cheese factory business of Ontario.
8. The hog as an adjunct to the dairy.
9. Fodder corn and the silo.

1.—DAIRY HUSBANDRY IN ONTARIO.

A common opinion, among even those who usually think clearly and correctly, is that *Dairy Farming* has only to do with milk and its sale or its manufacture into dairy products. The handling of milk is really a minor part of the dairy farmer's business. Its economical production involves thorough cultivation of the soil, the selection and breeding of the animals best adapted for the dairy, the growth of crops that make it possible to obtain the largest net value in dairy products per acre, the rearing and feeding of cattle and hogs upon the by-products (such as skim milk, buttermilk and whey), and the breeding of horses to do the work of the farm as well as to sell. After these come the business and work connected with the handling of milk and its manipulation for the production of such nourishing and appetising articles of diet as butter and cheese. When the principles are well understood, the technical details of practice will be comparatively easy of acquirement and application by the farmers.

While *Dairy Farming* is perhaps the most profitable branch of agriculture in our province, it has only lately received the same relative notice and recognition that have been given to the other departments of animal husbandry and soil cultivation. Until quite recently there has been no general, syetematic or comprehensive effort put forth for the improvement of the methods or the investigation of the principles that underlie those practices that invariably lead to success and profit. This is all the more remarkable when the value of *Dairy Farming*, as a source of the nation's supply of food, as well as a means for the conservation of the fertility of the land, is thoughtfully considered. The true aim of all farm operations that are wisely planned is directed to the attainment of a threefold object: (1) the production from the resources of nature of an abundant supply of wholesome, appetising, nutritious food in such a way as to leave a satisfactory

profit to the owners and tillers of the land ; (2) the preservation, and where practicable, the augmentation of the available fertility of the soil ; and (3) the providing of remunerative occupation for a large population upon the area that is cultivated. In the following up of that aim the intelligent farmer will call to his aid the service of domesticated animals that are able to change into food suitable for his use those parts of most crops which in their natural state are unsuited for his table. During the early stages of human experience upon this continent many tribes subsisted mainly upon roots and the fruits of the forest. These were meagrely supplemented in some cases by the game from the hunter's traps, arrows and spears. But as man emerged into a higher state of civilisation the powers of both mind and body naturally turned to the production of a more varied diet, as well as the establishment of a more controllable and dependable source of supply. Nowadays the nations in the front rank of civilisation and influence subsist upon the most varied and substantial articles of diet procurable. Bread without butter does not satisfy. Flesh-meat of some sort accompanies the dinner vegetables, and throughout the whole of the extensive bill of fare, in even the plainest homes of Canadian and European people, animal products are spread upon the table with the purely vegetable foods. To provide those animal products in the most economical way is the purpose and place of *Dairy Farming*. The more particular and direct products of the dairy, such as milk, cheese and butter, are not the only foods that are provided for human consumption by this kind of husbandry. Since experience has demonstrated that animals of the cow kind must be kept to consume the coarser crops of the farm and elaborate them into such substantial delicacies as milk, butter, cheese and beef, it follows that all these are the special, but not necessarily the only kinds of food from the production of which profits should arise from this branch of agriculture.

Milk is universally recognised as the perfect food, containing all the elements of nutrition required for maintaining life and supplying energy requisite for the demands upon human strength, and all in proportions best suited for assimilation by the organs of the system. As an article of diet for furnishing life-sustaining energy one gallon of ordinary milk may be reckoned as equal to three pounds of flesh meat from well-fed steers. The gallon of milk can be produced at less cost to the farmer, and therefore during the coming years will prevail in the keen competition for popular favor between the different articles obtainable as food by the great masses of wage-earners. One pound of cheese and half a pound of bread will furnish more strength to the eater than two pounds of flesh meat. The cost of the former to the producer is lower than the latter, as also the price at present required from the consumer. It should be the aim of the *dairy farmer* to so cheapen or lessen the cost of production of fancy butter and fine cheese that they will be within the purse-reach of the millions of so-called poor people to whom luxuries, while such, are inaccessible. As an evidence of the trend of popular preference for foods, the fact may be cited that the city and town consumption of milk in both Ontario and Great Britain is now almost five-fold as great per head of the population as it was twenty years ago. The consumption of cheese on this continent has increased almost five-fold per head of the population within the same period. There will be no danger of a lack of market or a lack of consumers for fine articles of dairy products for all time to come. Then the by-products of the dairy, such as buttermilk, skim milk and whey, can be elaborated by pigs into another article of diet highly relished by most people. These by-products may be cheaply supplemented by parts of the same forage crops as are grown for the feeding of cows, and by the cheaper coarse grains that can always be successfully raised upon a dairy farm whose land is enriched by the plentiful supply of barnyard manure.

As farmers produce an increased quantity of superior food per acre they make possible to support a larger population. Population is the element which gives value to property. Hence successful *Dairy Farming* means an increase of value in all the property in a country or section where it is followed. Many parts of plants cultivated by farmers in a rotation of crops are entirely unsuitable for direct consumption by man. By making animals consume such plants or parts of them as are indigestible by the human family there may be obtained from the animals appetising and nourishing products quite suitable for his table. That is the true place of dairy animals in farm economy.

In order that animals may be kept with advantage and consequent profit, the farmer's skill and judgment should provide plants suitable for their maintenance. The sun is the working power that elaborates soil-food, commonly spoken of as manure, into plants—the fit food of animals. The sun is the source of the energy that does the work of the world. It is the veritable working power on all the farms, though too often its value and usefulness are unknown and neglected. Plants are contrivances of nature whereby and wherein the sun stores up his strength and warmth for man's service and comfort. He should be kept at work all day long. When enough suitable material for the sustenance and increase of plants by their growth is present in the soil the sun never fails to exert his energy for the service of man. When the soil is devoid of or deficient in the supply of these substances, simply for the want of the raw material, upon which alone he can work, the sun is kept "loafing" over the fields day after day. A farmer cannot afford to have the hired man "loaf" around the kitchen stove, while he himself toils outside. Much less can he afford to keep the sun idle upon his fields. Hence it is the farmer's duty to see that the soil contains all that is needed for the upbuilding of plants; and then by proper management of the soil and selection of the seed he may in fact harness the sun every morning and make it do his will. His occupation demands a brain, a judgment, a will to rule, in order that he may justify his birthright in being given dominion over the earth and its plant and animal life. The air is the source of a large per cent. of the substances that go to form the structure of plants. From it the sun is able to transpropriate to the plant the very elements wherein he can best accumulate and store his strength for man's benefit. The corn plant is one of the best aids and means whereby this can be done. By the growth of fodder corn and the use of the silo the farmers of Ontario will find it comparatively easy and profitable to attain the second object of skilful agricultural effort, viz., (2) "The preservation and, where practicable, the augmentation of the available fertility of the soil." The matter in its details will be discussed under its proper head in the report.

In order that the plants grown may yield the best return of which they are capable, the husbandman's skill should be exercised to provide animals which can return to him the most in products or service for the food which they consume. It is possible to keep animals which yield so much less in product than they eat, that they are veritable burdens upon the man whose they are. Instead of being his servants, living and laboring for him, he sometimes becomes theirs, and apparently lives to keep and feed cows, hogs and horses. The cow, in all civilised countries, is always a boarder upon some person. She should be made to pay for her board at such remunerative rates as will leave a profit for the boarding-house keeper. If she fails in that, she should be made to render a service which she will not willingly contribute. Her carcass should be made into beef, and her hide into leather. She should not be slyly sent to board upon some other unfortunate man. A cow with the business habit of keeping all her accounts with the world paid up, through the man who owns and feeds her, is a good business cow. That is the kind of cow I recommend. Her powers I will briefly discuss elsewhere in this report.

In the further endeavor to produce large supplies of food without exhausting the fertility of the soil the farmer can best attain this end by the selling of such products as remove from his premises the least amount of valuable plant food. At this stage of discussing the subject a single illustration will suffice to indicate the adaptation of *Dairy Farming* to conserve the fertility of the soil. When 1,000,000 bushels of wheat are exported from any district they carry away in the substance of the grain plant-food to the value of $240,000. In other words, the elements or the substances of fertility removed in the wheat, if replaced by the use of commercial fertilizers, would cost the previously mentioned sum. Whereas, when butter to the value of $1,000,000 is exported it carries away from the place where it was produced less than $850 worth of the substances required in the soil by crops for their growth. It is evident that the production of $1,000,000 worth of butter will give occupation to a larger number of persons than the production of a quantity of wheat equal in value. The difference between the two amounts, which severally represent the value of the fertility removed, can be applied to the payment of the extra labor employed. A larger rural population may certainly be occupied in remunerative work by *Dairy Farming* than by any kind of exclusive grain

growing. The culture of fruit and market gardening alone offer equal facilities and opportunities for the profitable employment of labor in the production of food from nature's storehouse and resources.

These facts have been recognised by many of our leading farmers for the past quarter of a century. A knowledge of the underlying principles upon which they rest is now being systematised and made widely available by means of co-operation and organisation among farmers for this purpose. The Farmers' Institutes, so popular among those living in the most progressive and prosperous districts on the continent, are largely the outgrowth of successful co-operation among dairymen. The cheese factories were the agencies through which this co-operative principle was first made practically useful in a widespread degree for the profit and the improvement of the ordinary farmers. The first one on this continent was erected near Rome, N.Y., in 1851, by Mr. Jesse Williams. The late and deeply lamented H. Farrington, of Norwich, Ont., had the honor of introducing co-operative cheese-making into this province. His factory, which was erected near his home, began operations in 1864. Three years later the Ontario Dairymen's Association was organised. It held an annual convention, and was subsidised by the Provincial Government. Its efforts were directed towards the extension of co-operative dairying, and the giving of information and encouragement to beginners in the erection and equipment of suitable factory buildings. Instructions were given at its conventions by competent persons on the best methods of feeding and rearing stock suitable for dairy purposes. It promoted the organisation of Dairy Boards of Trade, at which the products of the factories could be sold to the best advantage. In 1877 the first Association, by mutual agreement among its members, became divided into the Dairymen's Association of Western Ontario and the Dairymen's Association of Eastern Ontario. Each of these then received an annual grant of $1,000 from the Provincial Government. In 1886 the Ontario Creameries' Association was organised to promote the creamery interests of the province. At first it received a grant of $500. During the past year the Government appropriations to these associations were $2,500 each to the Dairymen's Association of Western Ontario and the Dairymen's Association of Eastern Ontario and $1,500 to the Ontario Creameries' Association. The need for the enlargement of the grants made by the Government arose from the employment of inspectors and instructors by these organisations. Now eight competent and experienced men spend their whole time during the summer months visiting the cheese factories, inspecting the milk, and advising with the cheese-makers as to the best methods for the manufacture of cheese and the management of the factories. The Creameries' Association employ two men to render similar service to the creameries of the province. The work of these inspectors has been extremely valuable to the farmers interested in dairying. The quality of our cheese has been generally improved to such an extent that during this past season market reports reveal the gratifying fact that the cheese of Ontario on the average has sold for more than three-quarters of a cent per pound higher than the cheese of the adjoining States of the same month's make and at the same time. Three-quarters of a cent per pound on the total season's make will represent over $475,000 of increased revenue to the patrons of the cheese factories in this province. The value of the educational work that is being done through this means should not be lost sight of, even in presence of such large and substantial increase to the receipts of the province through its farmers.

Ontario's make of creamery butter has hardly yet found its way into the channels of commerce in sufficient quantity to cause its importance to the farmers and the merchants to be recognised. There is all the more reason why the extension of that industry in every reasonable and prudent way should be encouraged and fostered. But the other day there was sold in the city of Toronto a carload of dairy butter at 10 cents per pound; on the same day, in the same city, creamery butter was sold at 26 cents per pound. When it is considered that, by reason of unsuitable care and ill-adapted utensils and conveniences, more milk is taken on the average to produce a pound of butter from private dairies than in creameries, the enormity of the loss sustained by *somebody* or *somebodies*—citizens of Ontario—through the manufacture of inferior butter becomes more apparent. Of course some dairy butter is as fine as any creamery butter, but t

difference between the market value of that one carload of dairy butter at the price at which it was, with difficulty, sold, and the amount that would have been easily realized for fine creamery butter was over $3,000. That sum might be multiplied five hundred times before it would represent the diminished value of the present butter product of Ontario from the want of co-operative creameries. The Government cannot spend any money that will more quickly and certainly redound to the advantage of every citizen of the province than the amount which may be spent discreetly on behalf of the ever-growing and ever-to-grow dairy interests, which the financial, educational and fostering assistance which it has rendered in the past has done so much to develop and establish upon a basis of substantial prosperity.

2.—FARMERS' INSTITUTE WORK.

The part of my time which was devoted to attending Farmers' Institutes and special meetings held in the interests of the dairy industry of the province was spent, I think, with more immediate and direct advantage to the farmers than that portion given to experimental investigations and educational lectures in the College. Since January 1st, 1889, I had the honor to attend, on behalf of the Dairy Department of the College: conventions of Dairymen's Associations, 7; Farmers' Institute meetings, 62; special meetings, 12; total, 81.

Besides these 81 gatherings of farmers in Ontario, I took the opportunity during the five weeks absence for holidays, which the Minister of Agriculture was good enough to allow me, to accept invitations to be present at three conventions of Dairymen's Associations outside of this province, and ten Farmers' Institutes. I have introduced mention of this to point out that it would be of advantage to the Farmers Institutes of Ontario and of benefit to the Professors that an opportunity should be afforded them of being present occasionally at meetings and conventions held in the interests of agriculture elsewhere.

3.—CREAMERY MANAGEMENT.

The Ontario creamery has now been in operation for parts of six seasons. Passing mention may be made of the purposes for which it was erected and equipped upon the Experimental Farm here. It was intended that it should have educational value for the service of the whole farming community of the province, and especially for those living in districts where no creameries have been established and where the cheese factory system has not been introduced. The farmers may learn from our reports what to expect in the way of cash returns from supporting a co-operative creamery in their own neighborhood. By reason of the area required for supplying milk to the city of Guelph, our patronage is almost wholly from farmers at a distance of from two to seven miles from the college. The important thoroughbred stock interests of the country surrounding Guelph; have prevented a large number of the best farmers in the vicinity from sparing any cream for butter-making. Consequently long roads must be travelled to obtain a load. The collection of the whole milk has been rendered impracticable by the small supply and the scattered nature of the patronage already referred to. The system adopted by the farmer has been that of deep cans, setting in tanks of cold water. Most of the patrons have adopted the use of the shot-gun can, which is a cylinderical pail, 20 inches deep by 8½ inches in diameter, without any tap or faucet. Skimming is done by the use of a cone-shaped skimmer by which the cream is dipped from off the top of the milk. The tanks are usually made in two compartments, each measuring 26 in. x 18 in. x 23 in. deep. The treatment of the milk required for the successful use of these utensils and conveniences is: (1) The straining of the milk immediately after it is drawn, and the setting of the milk at a temperature above 90 degrees; (2) The use of sufficient water or water and ice to gradually cool the milk to between 48 and 44 degrees; and (3) The protection of the milk from contamination by foul air. The patrons are allowed to do the skimming at any time that best suits their own convenience. The cream collector measures the cream in a cylinderical

pail 12 inches in diameter, and credits each person with the number of inches in depth. After the whole quantity of cream from each patron is thoroughly mixed, the collector takes a sample and puts it into one of a number of glass tubes, which he carries for that purpose. These tubes are all numbered, and the number of the tube used is placed opposite the name of the patron in the collector's book. The cream from each patron is collected every second day, and a sample is put each time into one of these test tubes. The test tubes form part of the equipment of an oil-test churn, which is used for the discovery of the *butter-making value* of each sample of cream. A description of the use will be given in a subsequent part of this report. It is thus made possible to pay each patron equitably according to the quantity and quality of the cream furnished. The skim milk is left on the farm for use in the raising of calves or the feeding of pigs.

The creamery has been in a limited sense a school for the practical instruction of students who desire practice in butter making. Butter-makers, and those interested in other creameries, have always been welcome to visit it and to study the modes and details of the practice followed there.

Though entirely under the management and control of the Government, through the Professor of Dairy Husbandry, the creamery affords its patrons no special money returns beyond what may be realised from any joint stock or private concern in any part of Ontario. The patrons who supply the cream are paid for it at the price realised from the sales of the butter manufactured, after all expenses from cream collecting, labor and furnishings, such as tubs, fuel, ice, cloth, salt etc., have been deducted. While these expenses are kept as low as is compatible with obtaining the best qualities of the articles used, the rate of expenses per pound of butter is high. The cost of collecting the cream depends so largely upon the distance to be travelled for the quantity that may be collected, that the number of patrons and cows within a given area determine the cost per pound to a very large degree. In our case the number of patrons and the quantity of cream supplied are still unnecessarily small for the area covered by the creamery wagons. The rate of this expense is correspondingly high. The agreement with the patrons at the beginning of the season was to the effect that they were each to receive, after the end of each month, a cash advance on cream supplied at the following rates per lb of butter :—June, 14 cents ; July, 14 cents ; August, 15 cents ; September, 15 cents. After providing for these prices and paying all expenses out of receipts from the sale of butter and butter-milk, there was a balance of $254.69. That amount was partially accounted for to the patrons by paying 2 cents per lb. above the promised advance on July butter, and one cent per lb on August and September butter, while a balance of $117.91 still remains on hand for distribution among them.

A summary of the season's business is presented herewith.

Receipts.		Disbursements.	
Sales of butter	$2,862 57	Patrons for cream	$2,035 99
" butter-milk	221 66	Labor	223 55
		Cream gathering	367 75
		Salt, tubs, fuel, ice, repairs and sundries	339 03
		Balance on hand	117 91
	$3,084 23		$3,084 23

Butter manufactured	13,104 lb.	
Average price of butter per lb.	21.84	cents.
Number of patrons	42	
Number of days in operation	103	
Routes travelled by cream wagons	2	
Cost of cream gathering	2.80	cents per lb. of butter.
" labor, including delivery of butter-milk	1.70	" " "
" furnishing, etc	2.58	" " "

As already stated the cream only was gathered to the creamery, the skim milk being left on the farms.

In my last annual report I recommended that the number of creamery routes be reduced. This was done and 42 patrons furnished cream to make almost half as much butter as was manufactured the previous year from the cream supplied by 137 patrons. The butter was mostly packed in tin-lined tubs and was sold for consumption in Ontario. The home markets are yearly becoming more active and discriminating in their demand for creamery butter. Salt of Canadian make was used at the rate of from three-quarters of an ounce to one ounce per pound of butter.

The oil-test churn was used to determine the per cent. of churnable fat in each supply of every patron's cream. The requirements for its successful use are :—

(1) Careful sampling of the cream ; it should be poured at least twice from one pail into another before the sample is taken for the test tube.

(2) Accurate measuring ;

(3) Souring of the cream ;—to ensure that all the samples of cream are equally sour, they should be warmed up to 70 degrees and kept at that temperature for 24 hours before being churned ;

(4) Heating after the first churning to a temperature of 135° Fahr.

(5) Subsequent cooling to 65° or 70° ;

(6) Churning and reheating ;

In a case where the butter-oil of any sample does not separate to show a clear line of demarcation between itself and the other constituents of the cream, the cooling to 70° churning and heating should be repeated.

I have taken the liberty to discuss the question of winter dairying in another part of this report. If farmers generally would venture to adopt it gradually, the quickened interest thus directed to dairying would result in cows being more suitably and economically fed ; more milk would be produced at less cost ; the coarse grains would be profitably consumed on the farms, and increased fertility and consequent prosperity would follow.

4.—EXTENSION OF THE CREAMERY SYSTEM INTO THE WINTER SEASON.

As a nation progresses in skilful agricultural methods, so it advances in all the attainments of civilisation. Farmers are called clodhoppers, hayseeds and nobodies, but if one will gauge the progress of farmers in most nations, he will have gauged the progress of that nation itself in most that appertains to good living. As the farm resources are developed, and as farmers are prosperous, so will the whole nation be strong and wealthy. The progress of agricultural operations and their success run parallel with all other kinds of prosperity and desirable achievement in our nation.

The dairy cow is essentially an artificial product of human judgment. The common cow is a creature that comes to us as do other animals—a product of the operation of nature's laws ; but those qualities which make her valuable as a dairy cow are a development of her original inherent functions and the result of the exercise of human intelligence and judgment, founded upon accurate observation and careful study. Then, after man has developed to its utmost the power or capacity of an animal, he must continue to apply skill and judgment in order to preserve that power and prevent its deterioration. A cow has not naturally the power of producing more than two thousand pounds of milk per year, but man, by an enlightened and intelligent management, can so develop that power as to increase the yield of milk to eight or even ten thousand pounds per year. If that

augmented capacity be not carefully preserved the cow will lose her acquired talent, and, if altogether neglected, will lapse into the original state. There are now in this province cows by the score, nay, hundreds, which would produce annually, if their inherent powers were rightly treated and sustained, eight thousand pounds of milk. It is not that we need so many different breeds of cows in our dairies to make them successful and profitable, as that we need a great many different men with directive capacity to enable the cows to apply their powers to advantage. If a farmer will develop, increase and protect the productive powers of the cow he owns, he will have taken one long step towards making his farm more profitable and himself a more intelligent man.

The creameries are in a large measure unsatisfactory and unprofitable because the men who attempt to support them neglect these two points—the proper development and care of their cows and the due preparation and growth of crops suitable to their support. The growth of suitable and adaptable crops is one of the most important factors in the beginning of an extension of the creamery business. The largest returns with the smallest expenditure of labor, money and fertility, are only to be obtained from the best animals, fed on the best food by the best men. That is a rather short way of expressing it, but when rightly applied it covers the whole of successful dairy husbandry as applied to creameries. These two essential preparations of the cow and the plant, of which I have spoken, open the way for the production of milk, and the creamery provides for the manufacture of milk into one of the most wholesome articles of food, which every one wants and likes, and which can be sent from the farm with the largest profit to the man selling it. From the milk yielded by the cows of this province we make in large quantities cheese, a product which is a concentrated and very nourishing food—perhaps more so than butter is. I wish here to show the weakness of our butter-making system. Of the milk yielded by the cows of this province nearly as much is converted into butter as into cheese. Our cheese has won for Canada the reputation of being one of the finest cheese producing countries in the world, while our butter has earned for us the unenviable notoriety of sending to England the strongest butter received there from any part of the world. There must be something wrong in the way we do things when we have not earned as good a reputation for producing butter as we have established in connection with our exports of cheese. There was a time when we had no reputation as a cheese-making people,—when the cheese was made at home in the dairies of the farmers. Now, of all the cheese made in this province 99 4-5 per cent is made in cheese factories, and only one-fifth of one per cent. in home dairies. In my opinion, in that short set of figures is revealed the real reason why our cheese-making business has established such a high reputation, while on the other hand our butter-making operations have secured for us, in market reputation, only that which too frequently characterises the product itself—a bad odor. Of all the butter made in the province from the milk production of nearly as many cows as we used in cheese-making operations, less than three per cent. is made in creameries—less than three per cent. in one case as against 99 4-5 per cent. in the other. If we had this position in regard to butter-making reversed, and only three per cent. of our butter were made at the farm dairies, we should get higher figures for our total product.

Let me examine still further this making of 97 per cent. of our butter product in the farm dairies—mostly small. Is that an economical and profitable way of producing butter? To a man who gives the matter any serious consideration it at once becomes evident that it is not. The total make of butter in the farm dairies of the province is estimated at over 30,000,000 lbs. annually. I have taken some pains to discover what amount of labor is employed in making that quantity of butter, by finding out how long it takes to make ten pounds of butter in the home dairy, and I find that it takes on the average six times as much labor to make a pound of butter in a small dairy as is required to make a pound in the creamery. The amount of labor required to make 30,000,000 pounds of butter in home dairies is equal to 750,000 single days labor, whereas if made in creameries it would take less than 130,000 single days of labor. There would be 620,000 days of ten hours each of labor to spare in the homes of Ontario by having this butter made in creameries. Now, in this province we should be proud above all things of the virtue,

industry, intelligence and beauty of our women; and yet our farmers are crushing the spirit out of their wives and daughters by letting them milk cows, set pans, churn butter, and all the work incidental to that process. This seems to be a small factor in our national prosperity, but it is really a very important one, that the women on our farms should have more leisure for true womanly work, and should spend less of their time in producing butter which sells for twelve or fourteen cents per pound. I haven't a word to say against the butter these ladies make, but I think there is a waste of labor. We must make our methods economical. The difference between the amount of butter produced from a given quantity of milk when handled in creameries, and the product of the same quantity of milk when handled in private dairies, would, if applied to the total milk product of the province, show a loss of a million and a-half pounds of butter by reason of the existing state of affairs. To show how I arrive at that conclusion I may say that I made investigations to ascertain the amount of butter-fat left in the butter-milk after being churned in the way that is all too common, and after being handled in the proper manner at creameries. By the creamery process—the cream being thoroughly ripened by souring—I found buttermilk so poor that it contained less than three per cent. of the total fat of the milk, while buttermilk produced by the too common method of churning practised in home dairies—sometimes sweet, sometimes sour, sometimes these two qualities of cream mixed just before churning—contained upwards of twenty-three per cent. of the total fat of the milk—a difference of twenty per cent. of the total butter-fat. I put the loss accruing from imperfect knowledge and unsuitable practice in farm dairies at five per cent., which is an inside estimate, and that gives a million and a-half pounds of butter run off and fed to pigs or wasted in some other way—a million and a-half pounds of butter that should have been sold at from twenty cents to twenty-five cents per pound, annually fed to animals which could have been better fed with coarse meal at one-sixth the cost. That is one serious loss. The other is that we have not received from the butter we have made in the province the return per pound that we would have received had the butter been made in creameries. Creamery butter, at the very lowest estimate, will bring on the average four cents per pound more than dairy butter made and marketed at the same time. We have lost because the butter made has not been sufficiently fine, and has thus lowered the price in the market for all butter, of both creamery and dairy makes. In this way men have been deterred from keeping cows and have turned their attention to grain growing and grain selling. The whole thing depends upon this creating for what we have to sell, a demand at profitable prices; in other words getting a good market. We have the people to make that market if we can only supply the kind of butter they need and want. Therefore, by the making of butter of that quality, not only may a higher price be realised for it, but a demand may be created; because the man who gets fine butter will eat twice as much, and want butter three times every day. Then the foreign market is open for an unlimited quantity of fancy butter at high price. England imports a good deal of cheese from us; we send her about one-third of all the cheese she gets from all foreign countries; but we send her only about one and a-half per cent. of the butter she imports from abroad. We send her about thirty-three pounds of cheese in every hundred pounds she imports, and less than two pounds in every hundred pounds of butter she buys, and yet she buys two and a-half times as many dollars worth of butter abroad as she buys of cheese. If we have been able to capture the cheese market, I do not see any reason why we should not secure a large share of the butter market, which is much more extensive, and so gain a larger income to ourselves. I think England is patriotic and motherly enough in regard to her colonies to be just as anxious to send her money this way for butter as to send it to Denmark, Sweden, Norway Holland, or even to our friend Uncle Sam, as long as she gets fair value for it.

While I have been recommending improvements in our methods and the adoption of creameries instead of home dairying, and suggesting England as an insatiable market for butter, I do not think that ours is a country which can go successfully into producing butter in the summer time. I have been considering this question for some years and endeavoring to see into it as far as possible, and it is my opinion that no nation can successfully contend against the natural conditions which adapt it for a certain line of labor production. The natural conditions of Canada are not of such a character as to

adapt it for the profitable production of butter for export in the summer time. We should work in harmony with our natural conditions, and not contend against them. We cannot successfully compete with Sweden, Denmark or Ireland, in producing butter in the summer time for the English market. The butter we produce in the summer time should be for our own home trade. If we produce a fancy quality our home market will be doubled in its extent, and if we can double that market it will be found that it is just as large a market as it will pay us to supply. I have no desire to foster the making of butter in summer time for export; I do not think it will pay us. Our country, I think, is adapted for the production of cheese in summer time; it is essentially a country for the production of cheese during those months, and it is admirably adapted for the growth of calves and the manufacture of butter during the winter months. If we will make our cows come in at the proper time, and make butter from their milk, the most profitable part of the dairying season will be from October until April, and not, as now, from April until October. This plan will be found to have many advantages—(some of which I will now try to enumerate)—over the system at present followed in this province. There will be a longer working season. No man can afford to go idle for six months in the year. He should also give his dairy and his cows employment twelve months of the year that they also may produce. Thus he will give himself employment for a long season in a manner which will be highly remunerative to him. Another advantage is, that by making their cows calve in October, the farmers of this province will have better stock than by having them calve in April. An April calf is expensive to rear, and a June calf is often a burden and expense upon the man who owns it. It is usually hard to winter the first year.

A dairyman keeps cows, first to give milk, then to give stock, and then to make beef—milk, stock and beef; and a man who has them in that order will make more money from them all three, than if he had begun the other way about it. Another advantage is that the winter is the period when high prices rule for the product of cows. Butter will bring on the average one-half more per pound from October until April than it will from April until October. A farmer could afford to sell a pound of butter for less between October and April than between April and October. That, then, is the time when he ought to be in the business. In addition to being the period of high prices and cheap production, winter is the period for safe transportation. Butter can be sent to England during the winter without the risk of its being spoiled on the way. Another advantage is that the elements of fertility which exist in the plant food remain on the farm.

Our fathers kept cows that milked in the summer time, and we have been doing the same, and have condemned anything new as a "new-fangled notion," just because it is not something that has been practised from time immemorial. However this is not a new-fangled notion. The people of Denmark, years ago, were a sad, discontented people, against the Government, against the wealthy, against everything in fact but themselves —a poor, unfortunate poverty-stricken people. The Agricultural Society of the Kingdom, and the Dairymen's Association formed afterwards, tried to stir up the farmers of that country to keep cows and make butter during the winter, and to grow the right kind of plant food for animals, and thus work out their own salvation. These men thought it was all moonshine, I am told; but bye-and-bye some thought they would try, and the result was, that when I was in Denmark three years ago I heard no talk of hard times, for the dairy business had completely revolutionised the condition of agriculture. They now send butter to England when it is dear and when transportation is safe and grow steers and send beef over there to such an extent that, although the kingdom of Denmark is only about one-sixteenth the size of Ontario, they send about as much value of fat cattle as we do from the whole Dominion of Canada. In the same manner by keeping abreast of the times and adopting whatever is good, though new, we can increase our export of fat cattle, and at the same time receive larger returns from our dairy products. Some stock breeders think or say that if we go into butter-making winter we must have a cow that is worth nothing for making beef. The Danes have superior butter-making cows, generally lean when milking. More than half of the beef they send to England in the year is in the shape of fattened cows, and by the acti

returns of the Board of Trade I find that these fattened cows bring only eleven shillings a head less than our magnificent steers. That is about the kind of cow we want.

We need, in regard to this matter of creameries, a little more co-operation than we have had in the past, a little more sympathy between the the farmers and the creamery men. If the farmers would co-operate to support their creamery through the winter they would find these advantages, which I have merely hinted at, more than realised. There are one or two points on which I desire to make myself clear. In all I have written I have not uttered a word antagonistic to cheese factories. I recoginise the work they have done and the value they are to this province. Now, I would like to make them even more valuable; I would like to see them made more valuable by being worked all the year round. Good returns are got from the summer work now, but if the equipment were changed during the winter months, which would not take a very great outlay, they might during that season of the year be operated as creameries, and the butter could be made in the best and most approved style without incurring the expense of new buildings, and the returns from them would be greatly enhanced. The cost of a creamery, even if built entirely new, is not a very heavy expenditure. A creamery capable of handling the milk of at least five hundred cows can be built at a cost of $1,300. A cheese factory can be converted into a creamery at an expense of not more than $250. Every farmer has an interest in this subject; every man who wishes his country well has an interest in it, because as the farmers produce more food they have more to spare, and consequently more money to spend or invest, which means more money for the merchant and better times for everyone. It just revolves itself into this, that the man who will study so that he will understand the cow and her requirements, the best methods of producing a large yield of milk, and the most advanced methods of converting that milk into the best butter and cheese, is a man who is doing everything in his power to advance his own interests as a dairyman, and through those interests the interests of the whole nation. I have therefore to say that the creameries of this province are one of the greatest factors in furthering our national growth, a factor which it should be our desire and object to preserve, develop and heartily support.

5.—BUTTER MAKING.

The following is transcribed as the substance of part of an address which I had the honor to deliver before the convention of the Creameries' Association of Ontario:

. . . "While her milk is being elaborated by a cow, the ends of the cells, which line the inside of the milk-ducts and vesicles in her udder, seem to enlarge. Each one forms a small globule, and when that is perfected it drops off into the serum of the milk. Each bud or globule, so formed, is a globule of fat; from them is made all the butter from cow's milk. These tiny buds of fat seem to grow on the surface of the cells, partly by the destruction of the cells, and partly by the conversion of some of the substance of the cow's blood into fat. They trickle down in and with the milk, and are held in suspension in it, not in solution as are the other solids in it. They mostly come during the latter part of the milking, probably because they do not move so quickly or easily as the liquid part of the cow's milk. The fore milk is thinner than the strippings, because the globules of fat do not free themselves from the internal linings of the milk-ducts so quickly as the liquid of the milk. If one finds sending milk to a cheese factory, a man who is of so modest and retiring a disposition that he will not keep at home for table use a quantity of the average milk given by the cow, but always and only the last quart, his modesty should not be respected or trusted too far; such modesty and honesty may not be found compatible. The condition of the cow's blood and her nervous system very largely affect the quality of the milk she gives. Bad feeding, foul water or the absence of salt will induce in the cow a condition in which she will not yield good milk; a similar condition, with its consequent effects, may be caused by neglect, exposure, abuse or excite-

ment. A cow has a peculiarly delicate organization, and must be handled with kindness, and any man who abuses a cow beats out the profit; for she will pay him back by giving less milk, and that of a poorer quality. The globules of fat, before-mentioned, are so numerous that in a thimbleful of milk there will be found millions of them. It is estimated that there are at least one thousand millions of them in every cubic inch of milk. From these specks of fat the butter is made. To get them out of the milk is the task of the butter maker, they are too small to be strained out with the finest sieve; fifteen hundred of the largest of them placed side by side, like a row of marbles, would not measure more than one inch. If milk be left at rest they will rise to the top because they are lighter than the liquid in which they float. The heavier parts of the milk are drawn down by the force of gravitation, and as the serum of the milk, composed of water, casein, sugar, albumen, etc., moves downward, it displaces the cream globules and forces them towards the top. There are two methods of separating these fat globules from the milk; a natural method and a mechanical method. In the natural method, the power of gravitation is used to pull the heavier portion of the milk down, with the effect that the lighter part, the fat globules, are pushed upward. In the mechanical method, centrifugal force is applied to attain a like result. When a quantity of milk is put into a rapidly revolving vessel or cylinder, the heavier parts will be forced outwards against its resisting side or inner surface with sufficient pressure to push the lighter particles, the globules of fat, towards the centre of revolution. In that way the water, casein, sugar, albumen and the other heavier constituents of milk, find their way to the outside of the quantity being treated in a revolving cylinder, while the globules of fat are collected in concentric form on the inside surface of the quantity being treated. This is the law, that the cream, mainly composed of fat-globules, travels in a direction opposite to that of the force exerted upon the milk, whether the force be centrifugal or centripetal.

If ordinary milk be set in a deep-setting pail and be left at a temperature of 60 degrees Fahr., it would take these small specks from three to six days to get to the top at the rate at which they would move. They can be helped to move faster. The milk at a temperature between 90 and 98 degrees is slightly enlarged in bulk, and by putting it into the deep-setting pails at the higher temperature, (90° to 98°), the advantage of a falling temperature from above 90° to 40° or 45° may be gained. That treatment will expedite and facilitate the upward movement of the globule of fat. The rapid cooling of the milk is also believed to prevent the formation of a delicate mesh of lacto-fibrin, which would hinder the globules from rising freely.

The cream itself is only that part of the milk into which the globules of fat have been gathered in large numbers. Cream has no regular or constant per cent. of fat; the range is from 8 per cent. to 75 per cent of fat. In one hundred pounds of cream there may be only eight pounds of butter, or there may be seventy-five pounds according to its quality of richness. The globules of fat have no skins or organic coverings distinct in constitution from their own substance. Like drops of quicksilver that have separated from each other, they have no pellicle. But sometimes the serum of the milk becomes so viscous that a quantity of it will adhere to the surface of the globules and like a coating of gum will prevent their movement upwards when the milk is set, or their movement inwards when the milk is treated in a centrifugal machine. If a quart of warm water be stirrred into every pailful of milk when it reaches the dairy room from the stable, the separation of the cream will be facilitated. The water may be at a temperature anywhere between 150 and 180 degrees Fahr., and should be warm enough to raise the temperature of the milk to above 90 degrees. In the winter season especialiy, difficulty is experienced sometimes in churning the cream. The addition of water at a temperature of 70 degrees to the cream, while it is still sweet, to the extent of 25 per cent. of its bulk, will cause it to yield its butter in less time and more completely. The water should be added before the cream is sour and at least 20 hours before the churning is commenced. The next treatment required is the development of lactic acid. If quantity of sweet cream be churned and an equal quantity of sour cream of the same quality as to composition be also churned, there will be obtained from the sweet cream

only 77 pounds of butter out of every possible 100 pounds, while there may be obtained from the sour cream 97 pounds of every possible 100 pounds. That is to say, by the churning of cream thoroughly soured, one obtains butter in the proportion of 97 pounds, to 77 pounds from the churning of cream in a sweet condition. There are thousands of pounds of butter lost in the province annually from the churning of two qualities of cream in the same churn at one churning. The only safe plan is to have all the cream for each churning thoroughly mix' from twelve to twenty hours before the operation begins. It should be kept at a tempera e of from 60 to 70 degees according to the season of the year, to permit it to become sour. The higher temperature is required during the winter season and also for cream from centrifugal separators during the summer season. The churning is performed for the purpose of causing the globules of fat to strike on to each other and by impaction to unite. If two globules strike each other at a suitable temperature they will stick together; when large numbers of them unite in that way, it is said that the butter has 'come,' and the particles may be washed and removed. All that is required in the churning of cream is that the serum or medium shall be properly treated (by the addition of water if required, as already described) by the development of acid, and by the temperature being kept at from 57 to 59 in the summer time or from 62 to 66 in winter. It is imperative that a thermometer should be used to reveal the temperature. After the butter particles are half as large as wheat grains, the churning may be stopped. The butter-milk may be removed and replaced by pure water at a temperature of from 50 to 55 degrees. It may thus be washed in the granular state. When the water runs off free from a milky appearance, the granular butter should be left in the churn for half an hour to drain. It may then be salted in the churn or removed to the butter worker for that purpose. Pure salt of fine velvety grain only should be used. The rate of salting should be regulated to suit the taste and requirements of the customers. From three-quarters of an ounce to one ounce per pound will be found acceptable to most of those who purchase Canadian butter. The preparation for the market should be made with a view to giving the butter an attractive appearance, whether it be packed in tubs or firkins, or finished in prints or rolls. I advise the making of fine butter on the farms in winter time; then as soon as a number of farmers in any section do that, I recommend the starting of a creamery for operation during the winter and the raising of the best stock."

6.—EXPERIMENTAL CHEESE-MAKING.

During the course of the convention of the Dairyman's Association of Western Ontario, held in London on January 16th and 17th, 1889, the following resolution was unanimously carried.

"Moved by Mr. J. W. Scott, seconded by Jas. Carmichael, and resolved, That this Association express its approval of the suggestion of Mr. Thos. Ballantyne, for the carrying on of experimental work in cheese-making in two factories in the province during the coming season. Resolved further, that we recommend to the Minister of Agriculture the desirability of instructing Professor Robertson to make such provision as he may deem necessary for the proper prosecution of experimental investigations."

In consequence of this recommendation and my own representations to the Minister of Agriculture, he was good enough to make all necessary financial provisions for the undertaking of experiments. A sufficient supply of milk is not available in the vicinity of the College and we have no equipment for cheese-making work. The time at my disposal for beginning and conducting experiments in the manufacture of cheese, was limited to parts of two weeks. One of the factories of the President of the Dairymen's Association of Eastern Ontario, was selected as the place for the work. The preliminary preparations were made at a very small expenditure of money. The ordinary equipment of the factory was deemed sufficient for all practical purposes. One milk vat was divided into three compartments of almost equal capacity, by the soldering of two partitions of

strong tin across it. It was so constructed that three equal quantities, from a vat full of milk which had been previously well stirred, might be treated in similar or different ways. Owing to the short time available for the work, the experimental examinations were confined to four lines :—

1st. The influence and noticeable effects of the use of different quantities of rennet extract in the same milk, when handled under similar conditions of temperature, time, acid and salt.

2nd. The noticeable effects of the use of different rates of salting upon curd that in other respects was treated alike.

3rd. The effect of continuous stirring of the curd after the removal of the whey, compared with the effects resulting from matting of the curd with partial packing, and close packing, piling and covering.

4th. The effect of different setting temperatures upon the same milk when made up under similar conditions of treatment in every other respect.

The experiments were commenced on the 27th day of August, at the factory, as already intimated, of Mr. M. K. Everetts, at Merrickville, Ont. The following I find among my notes made at the time. "The weather during the last week of August has been the warmest of the summer. Most of the milk when heated had a gassy odor similar to what has been much complained of by cheese makers during the summer. With the exception of the milk received on August 31st, it all showed an over-ripe or acidy condition. The presence of acid could be discerned by the hot iron test immediately after or before the cooking temperature was reached. The factory and utensils were creditably clean ; the whey was returned to the patrons in the milk cans, and a bad odor arising from the whey tank and surroundings was the only objectionable feature of the premises."

The cheese were shipped to Guelph within a week after they were made, and were all cured in the same room at an average temperature of about 65°, until Nov. 9th, when they were put in a dry, cool cellar. The result of examinations made by myself, Messrs. R. M. Ballantyne, and A. F. McLaren, as well as by a large number of experts, who examined them during the progress of the dairymen's conventions at Belleville and Stratford in Jan. 1889, are given in the following tables.

1st. On August 28th, 4,000 lbs. of milk were used to test the effect of different quantities of extract of rennet. The milk was thoroughly mixed in one vat and then 1,333 lbs. of it were put into each of the three compartments of the experimental vat. Hansen's extract of rennet was used. The milk in the different compartments was designated as Lots 1, 2 and 3. The following table will show the treatment :

—	Lot 1.	Lot 2.	Lot 3.
Quantity of milk	1,333 lbs.	1,333 lbs.	1,333 lbs.
Quantity of rennet-extract used per 1,000 lbs. of milk.	9 oz.	6 oz.	3 oz.
Set at a temperature of 86° at	10.02 a.m.	9.58 a.m.	9.53 a.m.
Thick at	10.06 "	10.05 "	10.04 "
Cut at	10.18 "	10.20 "	10.16 "
Commenced stirring at	10.40 "	10.40 "	10.40 "
Turned on steam at	11.00 "	11.00 "	11.00 "
Heated to 98° at	11.35 "	11.35 "	11.35 "
Acid discernible by hot iron test	12.05 p.m.	12.05 p.m.	12.05 p.m.
Whey started to run off at	12.05 "	12.05 "	12.05 "
Whey off and curd on strainer on a rack	12.40 "	12.35 "	12.30 "
Temperature of 94° at	2.30 "	2.30 "	2.30 "
Run through curd cutter	2.50 "	2.45 "	2.40 "
Hand-stirred until	3.10 "	3.10 "	3.10 "
Salted at	3.10 "	3.10 "	3.10 "
Curd put to press at temperature of	85°	85°	85°

—	Lot 1.			Lot 2.			Lot 3.		
Three cheese from each lot numbered.....	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.
Rate of salt applied per 1,000 lb. of milk.	2½ lb.	2¾ lb.	3¼ lb.	2½ lb.	2¾ lb.	3¼ lb.	2½ lb.	2¾ lb.	3¼ lb.
Weight of curd put in each hoop	48 "	48 "	48 "	48 "	48 "	48 "	48 "	48 "	48 "
Weight of cheese on August 30th	45½ "	45 "	43 "	45 "	44½ "	44 "	45 "	44½ "	44 "
Weight of cheese on October 18th.....	43 "	42¼ "	40½ "	42½ "	42 "	41¾ "	42½ "	42 "	41½ "
Weight of cheese on January 3rd	41⅜ "	41¼ "	39½ "	41¼ "	40⅜ "	40½ "	40⅜ "	41 "	40⅜ "
Order of merit as judged by myself to discover effects of different rates of salting, Oct. 22nd ..	Third.	Second.	First	Third.	Second.	First.	Second.	Second.	First.
By Messrs. Ballantyne and Maclaren, Nov. 1st.	Third.	Second.	First.	Second.	Third.	First.	Third.	Second.	First.
By myself, Jan. 2nd	Third.	Second.	First.	Second.	Third.	First.	Third.	First.	First.
Order of merit as judged by myself to discover the effects of different quantities of rennet extract, Oct. 22nd.....	Third.			Second.			First.		
By Messrs. Ballantyne and Maclaren, Nov. 1st.	Third.			Second.			First.		
By myself, Jan. 2nd	Third.			First.			First.		
By experts at Belleville Convention who compared only Nos. 2, 5 and 8	Third.			First.			Second.		
By experts at Stratford Convention who compared only Nos. 1, 3, with 4, 6, and 7, 9.....	First.			Third.			Second.		
Average lb. of milk required per lb. of cheese calculated from weight at Jan. 3rd.	Third.			Second.			First.		
	10.88 lbs.			10.88 lbs.			10.88 lbs.		

The average shrinkage of weight by the curing from August 30th to October 18th was from 5.4 to 5.8 per cent.

The average shrinkage of weight by the curing from October 18th to January 2nd was 2.7 per cent.

As far as I was able to discern by close examination there was no difference in the progress of curing; the cheese made by the use of 3 oz. of rennet extract per 1,000 lbs. of milk, cured as quickly as those from 9 oz. Evidently the rennet is not the curing agent. I think the rapidity or the slowness of curing depends upon the proportion of moisture left in the cheese, the quantity of salt added and the temperature at which they are kept. The function of rennet in cheese-making seems to be coagulation. To effect that perfectly, a larger quantity is required in the making of cheese from fodder-milk and milk shortly after the cows have come in, than during the summer and autumn. A cheese of "heavier body" results from the use of a larger quantity of rennet and a larger quantity of salt than from the use of a less quntity of these.

2nd. During the progress of the tests, three cheese in each of eighteen different lots of curd were salted at different rates, to discover the "noticeable effects of the use of different rates of salting upon curd that in other respects was treated alike."

In each lot, one cheese was salted at the rate of 2½ lb. of salt per 1,000 lbs. of milk, another at the rate of 2¾ lb., and a third at the rate of 3 lb. of salt per 1,000 lb. of milk. I do not think that it would serve any good purpose to specify all the details of the manufacture and treatment; hence I state only the results of the examinations by experts and my own conclusions.

In the comparisons as to the order of merit in market value, on November 1st and January 2nd, the following presents a summary of the judging:

Cheese with 3 lb. of salt per 1,000 lb. milk.	Cheese with $2\frac{3}{4}$ lb. of salt per 1,000 lb. milk.	Cheese with $2\frac{1}{2}$ lb. of salt per 1,000 lb. of milk.
1st.—Fifteen times.	1st.—Once.	1st.—Once.
2nd.—Once.	2nd.—Fourteen times.	2nd.—Three times.
3rd.—Once.	3rd.—Twice.	3rd.—Thirteen times.
Equal—Once.	Equal—Once.	Equal—Once.

The cheese with the highest rate of salting had invariably the "heaviest" and "firmest body." The flavor on January 2nd was better in the cheese with 3 lb. of salt than in the others. These conclusions apply mainly to cheese made during the latter half of August and during September and October. The larger the amount of salt used, the drier the curd becomes, and the longer is the time required for curing.

3rd. "The effect of (1) continuous stirring of the curd, after the removal of the whey, was compared with the effects resulting from (2) matting of the curd with partial packing and from (3) close packing, piling and covering."

A series of five tests was instituted. Two of the lots were made up "white" or without coloring, and three were made "colored." 3 oz. of extract of rennet per 1,000 lbs. of milk were used in every lot. The method of procedure was to fill each of the three compartments of the experimental vat with an equal quantity of milk from a vat where it had been previously mixed. The treatment of all was similar, until the whey was drawn off, which was done when the hot-iron-test would show "acid hairs" to the length of from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch.

After the removal of the whey, the curd of Lot 1 was stirred on a rack with a strainer until it was "dry and firm." The condition of being "dry and firm" is reached when no free whey will collect in the curd when it is allowed to mat. The curd was then allowed to mat, was turned frequently, was packed close and ultimately piled seven or eight layers deep.

Meanwhile the curd of Lot 2 was also stirred on a rack with a strainer, until it was "dry and firm." It was then allowed to mat, was frequently turned, but was not packed more than two layers deep.

At the same time the curd of Lot 3 was also stirred on a rack with a strainer until it was "dry and firm." It was afterwards stirred occasionally and not allowed to mat; no piece of it was at any time larger than the size of a hen's egg; most of it was kept in a condition of a separation of the particles, the same as before the removal of the whey.

One cheese of *each lot* was salted at the rate of $2\frac{1}{2}$ lb. of salt per 1,000 lbs. of milk; one at the rate of $2\frac{3}{4}$ lbs., and another at the rate of $\frac{5}{3}$ lb. per 1,000 lbs. of milk.

Another method of procedure was to divide the curd of one large vat into three nearly equal lots immediately after the removal of the whey as before mentioned. The three lots were then treated differently as described above; viz., Lot 1 was stirred until "dry and firm," and afterwards matted, turned frequently, packed and piled seven or eight layers deep; Lot 2 was stirred until "dry and firm," and afterwards matted, turned, and laid two layers deep; Lot 3 was stirred uutil "dry and firm" and afterwards stirred occasionally and kept from matting.

I will in this case also give only a summary of the judging as I do not think that any good end would be served by a publication of all the little details.

Summary of FIVE examinations of the cheese of each of the five tests by other experts and myself as mentioned in the table of the extract of rennet test:

—	Lot 1. (Matted, packed, piled.)	Lot 2. (Matted only).	Lot 3. (Stirred).
First 9 cheese examined.			
By myself, October 22nd	Equal.	Equal.	Equal.
By Messrs. Ballantyne and Maclaren, November 1st	Equal.	Equal.	Equal.
By myself, January 2nd	Equal.	Equal.	Equal.
By experts at Belleville, January 9th	Equal.	Equal.	Equal.
By experts at Stratford, January 16th	First.	Second.	Third.
Second 9 cheese.			
By myself, October 22nd	First.	Second.	Third.
By Messrs. Ballantyne and Maclaren, November 1st	Third.	Second.	First.
By myself, January 2nd	First.	Second.	Third.
By experts at Belleville, January 9th	First.	Second.	Third.
By experts at Stratford, January 16th	Third.	Second.	First.
Third 9 cheese.			
By myself, October 22nd	First.	Second.	Third.
By Messrs. Ballantyne and Maclaren, November 1st	First.	Third.	Second.
By myself, January 2nd	First.	Second.	Third.
By experts at Belleville, January 9th	First.	Second.	Second.
By experts at Stratford, January 16th	First.	Second.	Third.
Fourth 9 cheese.			
By myself, October 22nd	Third.	First.	Second.
By Messrs. Ballantyne and Maclaren, November 1st	Third.	Second.	First.
By myself, January 2nd	First.	Second.	Third.
By experts at Belleville, January 9th	Second.	First.	Third.
By experts at Stratford, January 16th	First.	Second.	Second.
Fifth 9 cheese.			
By myself, October 22nd	First.	Second.	Third.
By Messrs. Ballantyne and Maclaren, November 1st	Third.	Second.	First.
By myself, January 2nd	Equal.	Equal.	Equal.
Summary of the five tests of 9 cheese each	1st—Twelve times. 2nd—Once. 3rd—Five times. Equal—Five times.	1st—Twice. 2nd—Fifteen times. 3rd—Once. Equal—Five times.	1st—Four times. 2nd—Four times. 3rd—Ten times. Equal—Five times.
Average quantity of milk required to make a pound of cheese calculated from the weight of cheese, January 3rd	10.53 lb.	10.60 lb.	10.74 lb.

As between Lots 1, 2 and 3 in each series of 9 cheese, there was no appreciable difference in market value.

4th. The effect of different setting temperatures upon the same milk when made up under similar conditions of treatment in every other respect, was examined by one test only; time was not available for continuing it further.

Each compartment of the experimental vat was filled with an equal quantity of milk which had been previously mixed. The milk in one compartment was set at a temperature of 84° ; in another compartment at 90°, and in the third compartment at 96° Fahr. The treatment and conditions were made and kept as nearly alike as possible throughout the whole process. There was no appreciable difference in the quality of the cheese.

Shrinkage.—The average shrinkage in weight on the cheese from August 30th—(one and two days after the cheese were made)—to October 18th, was 5.08 per cent. ; the shrinkage from October 18th to January 3rd was 1.70 per cent.

General Conclusions.—The quantity of rennet used in cheese-making does not hasten or retard the curing process except as a larger or less proportion of water (or moisture) is retained in the cheese by its use.

For long-keeping cheese the *smallest quantity of rennet* that will perfectly coagulate the milk, fit for cutting, in from 45 to 50 minutes at 86° Fahr. will give the best results.

A proportionately larger quantity of rennet should be used when the milk is over-ripe or acidy.

For "spring" and early summer-made cheese the quantity of salt should not exceed 2¼ lb. per 1,000 lb. of milk ; for midsummer and autumn-made cheese the rate should be increased to 2½, then to 2¾, then to 3 lb. of salt per 1,000 lb. of milk.

The tests with matting and close packing, *versus* matting, *versus* loose stirring, indicate that no one of these treatments is essential to the making of finest cheese ; the main point is that the whey shall be stirred out of the curd until it becomes "dry and firm" before the acid is developed to cause the curd to "draw out" on the hot iron test as far as half an inch. *When that is provided for*, the matting and packing result in giving to the cheese a more flakey and silky texture.

The setting temperature does not seem to exercise any important influence on the quality of the cheese ; in ordinary practice 86° is the most serviceable temperature ; when the milk is acidy or over-ripe a higher temperature will be more conducive to the certain manufacture of cheese of fine texture and body.

BULLETINS FOR CHEESEMAKERS AND PATRONS.

Notes for Cheese-Makers for May.

Factories and their Surroundings.

1. *The present*, not next week, will be fitting time to see that all the drainag facilties are adequate and in good working order.

2. Whey runs, spouts and tanks should be put into such order that leaking will prevented.

3. If there be a leakage anywhere from floors, spouts or tanks, which is n immediately preventible, provision should be made at once for drainage, if only by shall open trenches. A liberal supply of lime and gypsum should be spread around su places. Don't fail to secure a barrel or two of each *some time this month* for use dur the hot weather.

4. If the factory buildings are not painted and will not be painted, get them wh washed this month. If you cannot get that done by the proprietors or managers, permission and do the rest yourself. A whitewashed curing room of imperfect constr tion can be kept 10 degrees cooler in summer than one not whitewashed. If the ch become injured, through excess of heat, neither the buyers nor the patrons will wi wash your reputation then.

5. Make the surroundings of the factory neat and tidy. Plant a few trees a great many flowers.

6. While keeping the outside of the premises as creditable to your taste and neat habits as possible, make the inside to reflect still more your aversion to everything untidy and dirty. Give every part of the factory a thorough cleaning and keep it in a sweet state all summer.

7. Before the curing-room contains any cheese, fumigate it by burning some sulphur in alcohol. That will prevent the growth of mould on the outside of the cheese.

8. The leisure hours of May, before the large flow of milk is received, should be employed putting all the apparatus, appliances, utensils and machinery in the best of working order.

9. Be sure that the making room floor is so well constructed and supported that it will not shake or vibrate *during* the coagulation of the milk.

Milk and Making.

1. Procure a copy of "Milk for Cheese Factories" for each of your patrons by applying to the Dairy Department, Ontario Agricultural College, Guelph, stating the number required and the addresses to which they are to be sent.

2. Look out for "leeky" flavors in the milk. Don't put such milk into the vat with that of the other patrons. If you have time, make it up by itself and send the cheese from it to the patron for his private use.

3. Make provisions for keeping a short record of each day's work, of the exceptional treatment of every vat and of the comparative quality of the cheese from the same before they are shipped.

4. Milk sours readily and rapidly for a number of weeks after the period of lactation begins. Hence milk seldom requires to be ripened for setting during May.

5. Use enough rennet to coagulate the curd into a state fit for cutting in form 17 to 20 minutes, at from 82° to 88° Fahr.

6. Cut it rather early, slowly and very carefully.

7. Use the horizontal knife first.

8. Afterwards allow the curd to settle until whey comes over nearly the whole surface.

9. Then begin to cut with the perpendicular knife.

10. Immediately after the cutting is completed, begin to stir the mass slowly and and continuously, until the curd is cooked.

11. Heat should not be applied until 10 minutes after the stirring is begun.

12. The heating should be effected gradually, at the rate of about 1 degree for every 4 or 5 minutes until 98° Fahr. is reached.

13. Draw most of the whey early, and so guard against being caught unprepared for the rapid development of acid.

14. Don't dip the curd until the presence of acid is discernible by the hot iron test. Sweety flavors result from too early dipping in May.

15. After dipping the curd, stir it gently and keep it at a temperature above 94°.

16. Don't attempt close matting, high piling or packing of the curd. See that the whey is separated from it.

17. When it begins to feel "slippy" and smells like fresh made butter, it should be put through the cutter or grinder.

18. Acid develops so rapidly that care must be taken to keep the treatment well in advance of the change in the curd.

19. After grinding or cutting, stir for 10 or 15 minutes before salting.

20. Apply salt at a rate of about 1½ lb., early in the month, to 2 lb. per 1,000 lb. of milk during the last ten days, varying the quantity slightly according to the condition of the curd as to its moisture.

21. Begin to put the curd in the hoops within 20 minutes after the salt is stirred in.

22. Use only pure water in bandaging.

23. Guard against the formation of edges or shoulders from the hoop-followers being too small. Apply the pressure gradually until the whole power through the long lever is used, after four hours.

24. Leave the press-cloths on, and turn the cheese in the hoops every morning. Let no cheese leave the press-room until the shape is symmetrical and the finish neat.

25. Don't press the scaleboards on the ends of the cheese.

26. When the press-cloths are removed, use hot clean whey-oil or butter, into which has been dissolved a teaspoonful of soda per cupful of oil.

27. Try to keep the temperature of the press-room above 60° Fahr.

28. The curing-room should be kept at a temperature constantly between 65° and 70° Fahr.

29. Provide strong, smooth boxes of the exact size.

30. Stencil the weight of the cheese in neat figures on the side of every box.

Patrons.

1. Try to get each patron to take a personal interest in the care of the milk.

2. Encourage every farmer in your neighborhood to sow a small area of oats and pease or oats and vetches for summer supplementary feed.

3. Persistently endeavor to induce every patron to plant at least 5 acres of fodder corn in rows three feet apart.

4. Send to the Dairy Department, O. A. C., Guelph, for a bulletin of instruction on the planting of fodder corn and the curing of silage.

Milk for Cheese Factories.

Feed.—The milk of cows being a direct elaboration from their blood, whatever interferes with a healthy condition of that fluid will also effect the quality and quantity of the milk secreted. Too much care cannot be exercised in providing feed suitable, succulent, easily digestible, wholesome and nutritious. The grass of early summer is too watery and weak in nutriment for its bulk to be fed alone to the greatest advantage. A judicious allowance of bran, pease and oats, oil-cake or cotton-seed meal will increase the milk supply and fortifythe cow's system for the larger production of milk during mid-summer, fall and winter. Fodder corn, sown broadcast, does not meet the needs of milking cows. Such a fodder is mainly a device of a thoughtless farmer to fool his cows into believing that they have been fed when they have been only filled up. The same plant when grown under conditions favorable to its attainment of mature size and quality—in rows or hills 3 feet apart with from 2 to 6 seeds per foot in the row—yields a fodder by means of which cows are enabled to produce the largest amount of milk, butter or cheese per acre area of the land required for their support. Fodder corn is not a complete ration for the most economical production of the best milk. When supplemented by feed rich in albuminoids, such as these already mentioned, better returns for the feed consumed are realised. Last summer one of our leading Canadian dairymen, feeding 18 cows upon fodder corn to supplement scant pasture, furnished milk to a cheese factory. In course of time he provided a supply of bran, and by the end of the first week thereafter he found by an examination of the factory books that he was credited with enough extra milk to pay for the bran consumed (2½ lb. per cow per day) and to leave him a balance of $2.43 of extra profit for that week.

Water.—Water is nature's vehicle for carrying about most of the matter which she requires to move from place to place. The great boulders were quietly clasped in her arms and without apparent effort brought from the northern ridges to the southern parts of our province. The tiniest specks of nourishing

matter needed to replace the worn-out tissues of the body are likewise carried to their proper places in this wonderful omnibus. The identical water swallowed by a cow to serve as a carrying medium in her blood for the equable distribution of the elements of nutrition throughout her whole body is made to serve a like function in the milk which she yields. If that water be impure in the first place, it is liable to continue so throughout its whole mission, from the drinking by the cow until after its consumption by the creature consuming the cow's product. Water which has been contaminated by decaying animal matter is specially likely to retain its impurities. The milk from cows drinking such water is a menace and danger to the public health, and interferes greatly with the commercial value of all dairy products. There should be an abundant supply of pure water, easily accessible by the cows during hot weather. It should be furnished at a comfortable temperature during the cold weather of winter. I have not found that cows which are denied access to abundance of water will give as much milk or milk of as good quality as when plenty of water is provided with wholesome satisfying feed.

Salt.—Dairy cattle should have access to salt every day, and salt should be added to all their stable feed daily. A series of experiments has convinced me that when cows are denied salt for a period of even one week they will yield from 14½ to 17½ per cent. less milk, and that of an inferior quality. Such milk will on the average turn sour in 24 hours less time than milk drawn from the same or similar cows receiving salt, all other conditions of treatment being equal.

Shelter.—Comfortable quarters are indispensable to the health and well-being of cows. Stables during the winter should have a temperature constantly within the range of from 40° to 55° Fahr. In summer-time a shade should be provided in the pasture fields, or adjacent thereto, to protect against the bristle-making influence of July and August suns. In all the management of cows such conditions should be provided and such care given as will insure excellent health and apparent contentment.

Milking.—When practicable, milking should be done by the same person, and with regularity as to time. He only that hath clean hands should be allowed to milk a cow. I say "he" because I think the men of the farm should do all the milking, at least during the winter months. I have exercised the right of changing my mind on that subject since I left the farm. It is no more difficult to milk with dry hands than with them wet. It is certainly more cleanly, and leaves the milk in a much more desirable condition for table use or manufacture. Pure stable atmosphere is indispensable to prevent contamination from that source. Immediate straining will remove impurities which otherwise might be dissolved to the permanent injury of the whole product.

Aëration.—After the straining is attended to, the milk should be aërated. Too often it is poured into one large can and left there just as the cows have given it. That neglect implies three things that are very injurious to its quality for cheese-making. (1) The peculiar odor which the cow imparts to the milk will be left in it until it becomes fixed in its flavor. (2) The germs of fermentation that come in the milk and from the air have the best conditions for growth and action when the milk is left undisturbed. (3) Then the milk will become almost unfit for thorough coagulation by rennet. Hence it is needful and advantageous to aërate it for three reasons. First, because by pouring, stirring, dipping or by trickling it over an exposed surface there is eliminated from the milk by evaporation any objectionable volatile element that may be in it. Secondly, because as has already been stated the milk contains germs of fermentation. Some of these are called vibriones. A strange peculiarity about these microbes is that they become active only in the absence of free oxygen. When warm new milk is left undisturbed carbonic gas is generated, and that furnishes the best condition for the commencement of action by these almost invisible creatures. After they get started they can keep up their decomposing work even in the presence of oxygen. It is impossible to coagulate such milk so as to yield a fine quality of keeping cheese. Coagulation by rennet of milk that is ripe can never be perfect unless it has been thoroughly aërated immediately after it is taken from the cow. *Neglect of aëration will increase the quantity of milk required to make a pound of fine cheese.* Thirdly, because the airing seems to

give vigor to the germs of fermentation that bring about an acid condition of the milk, without producing the acid. So much is this so that *it has been found impracticable to make strictly first-class Cheddar cheese from milk that has not been aërated.*

Cooling—The subsequent cooling of milk retards the process by which it is turned sour. Certain germs of fermentation exist in milk which in the act of multiplication split one molecule of sugar-of-milk into four molecules of lactic acid. By delaying the operation of these germs the milk is kept sweet for a longer period. The cooling of the milk should never precede the aëration. A temperature of from 65° to 70° Fahr. will be found cold enough for the keeping of milk over night, when it has been previously aired.

Protection.—Milk is a liquid of absorbent proclivities. It should be protected against injury that would result from exposure to impure air. A general purpose milk-standis a device specially adapted for the spoiling of milk in that way. Such a stand serves as a milk-stand and also a carriage stand, both of which are legitimate uses. Sometimes it is also occupied as a hog bivouac for the convenience of these animals, the end of whose whey trough furnishes one step for the stand. Both of these latter extensions of its uses and hospitalities are all wrong.

Honest Milk.—The employment of inspectors promises to improve the quality of the milk furnished by some patrons, whose highest moral aspiration is limited by an effort to keep the self appointed commandment, "Thou shalt not be found out." The adulteration of milk by the addition of water, the removal of any portion of the cream or the keeping back of any part of the strippings is forbidden by both Dominion and Ontario statutes. Any person who is found out so doing will not escape lightly. The inspectors appointed by the Dairymen's Associations have been equipped with suitable and competent testing instruments and have been instructed to render every assistance to cheese-makers, looking towards the prevention of adulteration and the conviction and punishment of those who may be found guilty of the practice.

Matters most needful of Care.—In the following short paragraphs I have ventured to gather helpful advice on the matters most needful of care.

1. Milk from cows in excellent health and apparent contentment only should be used.

2. Until after the eighth milking, the milk should not be offered to a cheese factory.

3. An abundant supply of suitable succulent, easily digestible, wholesome nutritious feed should be provided.

4. Pure cold water should be allowed in quantities limited only by the cow's capacity and desire to drink.

5. A box or trough containing salt to which the cows have access every day is a requisite indispensable in the profitable keeping of cows.

6. Stagnant impure water should be prohibited. The responsibility for the efficacy of that beneficial prohibition rests wholly with the individual farmer.

7. Wild leeks and other weeds common in bush pastures give an offensive odor and flavor to the milk of animals consuming them.

8. All vessels used in handling of milk should be thoroughly cleansed immediately after their use. Washing first in tepid or cold water to which has been added a little soda, and subsequent scalding with boiling water, will prepare them for *airing*, that they may remain perfectly sweet.

9. Cows should be milked *with dry hands*, and only after the udders have been washed or thoroughly brushed.

10. Tin pails only should be used.

11. All milk should be properly strained *immediately* after it is drawn.

12. Milking should be done and milk should be kept only in a place where the surrounding air is pure. Otherwise the presence of the tainting odors will not be neglected by the milk.

13. All milk should be *thoroughly aired* immediately after it has been strained. The treatment is equally beneficial to the evening's and the morning's milk.

14. In warm weather all milk should be cooled to the temperature of the atmosphere after it has been aired, but not before

15. Milk is better for being kept over night in small quantities, rather than in a large quantity in one vessel.

16. Milk-stands should be constructed to shade the cans or vessels containing milk from the sun, as well as to shelter them from rains.

17. Only pure, clean, honest milk should be offered. Any deviation from that will not always go unpunished.

Notes for Cheese-Makers for July.

July cheese, like July butter, has a reputation for being the poorest of the summer. This year it should be exceptionally fine. The abundance of grass in June, with a too plentiful rainfall, will leave the pastures with richer herbage than usual. Suitable conditions for the production, preparation and preservation of the milk in a fit state for the manufacture of fine cheese can be continued by the patrons giving effect to these simple requirements:

1. Cows need the owner's providential care in the following matters, viz.:—

(*a*) An abundant allowance of succulent or other feed;

(*b*) Opportunity to drink pure water at least twice a day;

(*c*) Access to salt every day;

(*d*) Shade in the pasture fields from the "bristly" influence of July suns;

(*e*) Regularity in milking;

(*f*) Management and handling with continuous kindness, having an eye to profits.

2. Cows should be prevented from drinking impure water and should be protected against the attentions of all dogs.

3. (*a*) Milk should be strained immediately after milking.

(*b*) It should be aired by the use of an aërator or by dipping, pouring or stirring.

(*c*) It should be cooled to the temperature of the atmosphere.

(*d*) It should be protected from contamination by the foulness of impure air.

It will be of quick and durable advantage to direct the attention of all patrons to these matters by sending to each a concise, clear and courteous reminder of duty in connection therewith.

When the yield of milk by the cows begins to shrink, the temptation to make up the quantity in some other way is increased. The Act passed by the Dominion Parliament during last session, to provide against frauds in the supplying of milk to cheese, butter and condensed milk manufactories is a piece of wholesome legislation.

It forbids the sending to any such factory milk diluted with water, or in any way adulterated, or milk from which any cream has been taken, or milk commonly known as skimmed milk, or milk from which any portion of that part of the milk known as strippings has been kept back, or any milk that is tainted or partly sour. The penalty for each offence against the provisions of the Act, upon conviction thereof before any justice or justices of the peace, is a fine not exceeding fifty dollars and not less than five dollars, together with the costs of prosecution.

The fine when recovered shall be payable, one-half to the informant or complainant and the other half to the representative of the factory to which the milk was sent, to be distributed among the patrons in proportion to their respective interests in the product thereof.

Let every cheese-maker get a copy of this Bulletin published in the local newspaper, and further, let him see that every patron is furnished with a copy of that issue.

Some of the qualities that are expected and desirable in the cheese of July are :—

1. Rich, clean, creamy flavor ;
2. Solid, firm, buttery body ;
3. Fine, silky, flaky texture ;
4. Bright, uniform color ;
5. Attractive, neat, symmetrical, stylish appearance.

In order that cheese having just these qualities may be manufactured regularly, I make the following notes for guidance.

1. Thorough distribution of the rennet in the milk must be effected by diluting the rennet extract and by vigorous stirring.

2. Sufficient rennet to coagulate the curd into a state fit for cutting in from 35 to 40 minutes at from 86° to 90° should be used. When an extra quantity of rennet is used, a corresponding increase in the weight of salt should be added to the curd.

3. The contents of the vat should be perfectly still when coagulation commences. Vibration of the floor and of the vat during the thickening of the milk causes waste.

4. The horizontal knife should be used first in cutting ; and active stirring should not commence until the cubes of curd becomes slightly healed.

5. The temperature should be raised gradually to 96° or 98° Fahr.

6. The stirring should be continued until the curd particles are so well "cooked" or "dried" that when a handful has been pressed for a few moments they will fall apart again as the result of any slight disturbance.

7. As soon as the presence of acid is discernible by the hot iron test the whey should be removed. In the case of gassy curds, a further development of acid before the drawing of the whey will be beneficial.

8. Hand stirring will be of advantage *until the curd is firm.*

9. The temperature should be maintained at or above 94°.

10. The curd should be allowed to mat into one mass.

11. It should be turned so frequently that whey will not collect or stand in small pools in or on it.

12. If it becomes gassy it should be aired (if need be by grinding and stirring) and afterwards kept at a temperature above 94°.

13. The gas formed in gassy curbs hinders the developement of acid and the presence of acid prevents the formation of gas. The treatment should provide for the removal of the gas by aëration and the maintenance of temperature by the application of hot water to the curd or steam to the vat or sink in which it is.

14. Close matting and packing of the curd are beneficial only after the curd is sufficiently dry and when aëration is provided for.

15. When the texture of the curd becomes stringy in its nature, it should be put through the cutter or grinder.

16. Aëration should be effected by stirring before the addition of salt. Usually 15 minutes of such treatment will suffice.

17. Salt should be added at the rate of from $2\frac{1}{2}$ to $2\frac{3}{4}$ lb. per 1,000 lb. of milk according to the dry or wet condition of the curd. A judicious variation in the quantity of salt should be made in proportion to the moist or dry state of each curd.

18. The "hooping" of the curd should begin when the harsh surface, produced on each piece of curd by the salt, commences to give place to a slippy, mellow quality.

19. Shoulders or projecting edges on cheese are unsightly evidences of careless workmanship, and lessen their value from 2 to 3 shillings per cwt. in the English markets. Careful pressing and bandaging and the turning of the cheese in the hoops in the morning will prevent their formation. The pressure should be continued for at least 20 hours In that way cheese can be finished having an attractive, neat, symmetrical and stylish appearance.

20. The sprinkling of cold water in the curing rooms in the morning and just after noon will reduce the temperature.

21. The curing room should be thoroughly ventilated and should be kept clean. The inspectors report that a good many factories need a general cleaning up.

Notes for Cheese-Makers for August.

A cheese factory's reputation is largely determined by the quality of its August, September and October output. The beginning of August is a fit time for every cheese-maker who has had only partial success during the hot weather to redeem his reputation and that of his factory. A comparison of the prices realized for the summer cheese of Ontario with the figures reported from the United States markets shows that Canadian cheese are in demand at higher rates than American cheese will sell for. That we have gained in reputation and in market favor with British importers and consumers is evident. That this advance and advantage are the result of the applied skill of less than half of our cheese-makers is well known to those who visit the factories and handle their products. To reach and to speedily help those who work in cheese factories without any ambition or aspiration for improvement is well-nigh impracticable.

However, we desire to make helpful information not only attainable but unavoidable to such.

In a short time there will be numerous cable orders from England, calling for "cool August cheese.' That brief description implies a mild, rich flavor that may be preserved for the winter trade, a firm, solid body "full of meatiness," a fine outside finish, with clean, bright rinds, free from cracks, and bandages fresh-looking and not likely to appear mouldy.

To help the cheese-makers in manufacturing a class of goods that may be satisfactorily shipped on such orders, I call attention to some things, both outside and inside of the factories which need their immediate and special personal care.

Around the Premises.—Insufficient or inefficient drainage facilities, unless enlarged or remedied, will show their worst effects during this month. At the cost of only a few hours of labor and a few dollars of expense, the immediate vicinity of every factory can be kept free from the noxious odors that arise from stagnant slop pools. The frequency and foulness of these about the factories in some sections is not only a menace to the permanent prosperity of our cheese manufacturing industry, but a disgrace to the men in charge of the factories.

At factories from which whey is drawn back to the patron's farms in waggons, the leaking and spilling near the whey tank too often leave its vicinity in an almost impassable condition. A few loads of gravel will abate the nuisance and leave the place fit for approach during the succeeding months when the roads become bad.

The shrinkage in the milk supply will leave a shortage in the whey tank. In order that the whey may have more feeding value, the tank should be thoroughly cleaned and washed at least once a week.

At factories where hogs are fed, provision should be made for supplying them with one feed a day of some green fodder, such as clover, oats and vetches, oats and pease, or cornstalks. Salt should be fed liberally during this month.

In the Making-room.—This month seems the one when flies become most numerous and troublesome. Some afternoon after the cheese are in the hoops, it will be a good plan to close up the making-room windows and doors, and to burn a small quantity of sulphur

for the purpose of fumigating the place. If a tablespoonful of alcohol be mixed with the sulphur, it will burn more freely. Care must be taken to prevent the fumes from getting into the curing room. The tins of the milk vats and the insides of the sinks should also be washed afterwards before they are used. All vats, presses and utensils should get a thorough quarterly-cleaning-up early this month. Every cheese-maker should persistently fight untidiness and filth in every form, and he ought to have a woman's passion for cleanliness and a similar antagonism to dirt.

In the Curing-room.—There will be difficulty in curing the cheese made during July at a sufficiently low temperature. Ventilation of the room during the early mornings, as well as during the evenings and nights, will be of benefit. Floors should be sprinkled with cold water morning, noon and evening. While the cheese are being turned on the shelves there should be an abundant admission of light. August is the month when the "skippers" are apt to do damage. A plentiful shaking of fly powder in the room before it is shut up for the day will destroy the cheese flies.

Cheese boxes should not be stored in the curing-room. The odor from the elm wood penetrates the cheese and affects their flavor.

Patrons.—Since the milk is richer and less in quantity, there will be an increased temptation to "even up" by the addition of water, or to "even down" by the removal of cream. You will be doing the community moral service, as well as the cheese trade some good, by reminding the patrons that the Dominion Act of last session is in force and will be enforced against all discovered delinquents.

Patrons are more likely during this month than at other times to forget to provide salt for their cows, and to neglect to supply an abundance of pure cold water. Cool evenings are no excuse for the neglect of aeration. All milk should be most thoroughly aired immediately after it is strained.

The making of cheese for exhibitions is usually undertaken during the first two weeks in this month. Send a circular to every patron, making mention of those matters that are referred to in this bulletin, and inviting their co-operation, in order to aid you in the manufacture of cheese fine enough for exhibition and prize-taking. If some patrons pay no heed, and no improvement results, don't get discouraged. Keep right on insisting on a better state of things in their practice.

Making the Cheese.—When the evenings are cool and the milk needs ripening, don't fail to leave it in the vat until it reaches the proper state of maturity before the rennet is added. Use enough rennet to coagulate mature milk to a state fit for cutting in forty minutes when set at 88° Fahr. Dilute the extract to the extent of one pailful of water for every vatful of milk, and then mix it thoroughly by vigorous, rapid stirring.

When you are troubled with gassy curds, allow a development of acid, such as will be indicated by threads from the hot iron test a quarter of an inch long, before the removal of the whey. It is a good plan to run most of the whey off at an earlier stage, and to leave only enough whey on the curd to permit a free stirring of it. After the whey is drawn, air the curd thoroughly and make provision for keeping it warm. When a curd sink is used, if need be to retain the heat, put the curd back into the vat, but let the temperature be kept above 94°. Frequent turning and aëration will facilitate the development of acid, providing the temperature is maintained. After the curd cutter has been used, the curd should be stirred and aired for fifteen or twenty minutes before the application of salt. From $2\frac{1}{2}$ to $2\frac{3}{4}$ pounds of salt per thousand pounds of milk should be added to curds that are fairly well dried by the previous stirring. They should be put in the hoops within twenty minutes after the salt has been mixed in.

Pressure should be applied very gradually. The cheese should be bandaged neatly when they are turned in the hoops within two hours after they are put in the presses. They should again be turned in the hoops some time in the following morning. When practicable, cheese should be pressed for at least twenty hours.

Endeavor to get everyone who sends milk to your factory, or who is concerned in its management, to try to bring it to the very front in point of reputation for the excel

lent quality of its product. Work conscientiously for that end, then talk your factory up always and wherever you go, and get your patrons to do likewise. In short, think and work to make your factory and its product worthy of a higher reputation, especially for August cheese.

Notes for Cheese-Makers for October.

A few years ago "October cheese" of Canadian make were deservedly in bad repute in the English markets. Their soft, porous body made them liable to go off in flavor quickly; they did not possess the keeping qualities, combined with richness of body and flavor, which are so much desired by English importers and merchants. During the last two years a decided improvement in the quality has been effected, and with the finer quality has come a better name in the markets. By the exercise of due care on the part of the cheese-makers throughout the remainder of this season the reputation of our "October cheese" may be so well established that hereafter they will be counted equal to "September's." Cheese can be made as *firm* and *fine* during October as at any time of the year. Conveniences for controlling the temperature of the curd from the milk vat until the cheese is ripe are required.

Milk.—The milk delivered at factories during October has a higher per cent. of fat and other solids than during the summer months; its flavor will be equally rich and nice, when the cows are stabled during the cold nights and fed liberally on fodder corn or any other suitable succulent nutritious feed. Turnip tops and rape should not be fed to cows whose milk is furnished to a cheese factory. After it is drawn the milk should be strained immediately and forthwith aired as thoroughly as during the hot weather of July. The aëration will improve its flavor and prepare it for the manufacture of a finer quality of cheese than it will be possible to obtain if that treatment is neglected. The milk should not be cooled below 60° Fah. A milk-house or the farm kitchen will be a more suitable place for keeping it over night than the milk-stand when the temperature of the outside air goes below 50°.

The milk inspectors will continue their work until the close of the season; their services, to assist in the detection of adulterated milk, can be secured by application to this Department.

Cheese-making.—The construction and equipment of the making-rooms of some factories are still very defective; but at the cost of a little labor and building paper almost any room can be made so close in its walls that the inside temperature may be regulated at will by the use of a stove. Thorough ventilation once every day should be secured. The following paragraphs will be of service in the refreshment of the experienced cheese-maker's knowledge and in instructing the others in the best practice to follow:

1. Let the milk be ripened by the application of heat before the rennet is put into it; the ripening should be allowed to proceed to such a degree that not more than three hours will be required between the addition of the rennet and the development of acid, perceptible to the taste or discernible by the hot iron test, and sufficient for the removal of the whey.

2. The use of sour whey to hasten the ripening should never be resorted to. Old milk which has become nearly sour to the taste may be added, but loppered or thick milk should never be used.

3. Rennet should be added in quantity sufficient to coagulate the curd into a state firm enough for cutting in from 45 to 35 minutes at temperature of 86° or 88° Fah. It should be diluted with water to the volume of at least one gallon of liquid for every vat.

4. After coagulation is perfect, the curd should be cut finer than during the summer; the application of heat should be delayed for 15 minutes after the stirring is commenced; and the temperature should be raised to 98° and maintained at that point until the whey be drawn off. After the middle of the month a temperatute of 100° will be preferable.

5. Care should be taken to so apply the heat and perform the stirring that the curd particles will be so dry, before the development of acid is perceptible, that after being pressed in the hand they will fall apart by being slightly disturbed.

6. The curd should be stirred before and after the removal of the whey until the whey is so well separated out of combination with its particles that they produce a squeaky sound when bruised between the teeth or otherwise.

7. After the whey is drawn off the curd should be kept at a temperature above 94° Fah. If it becomes colder than 94° the development of acid will be hindered and excessive moisture will be retained in it during the souring process. The presence of such extra moisture in the curd at this stage will leave the cheese with a weak or pasty and tallowy body, according to the degree of acid development permitted.

8. A cover over the vat or a curd sink with steam pipes seems a simple and effective provision for keeping the curd warm ; where no rack is used, the putting of a few pails of hot water in the lowered end of the vat will maintain the temperature.

9. Just after the removal of the whey the curd should be hand-stirred until after the whey that will run has been drained off ; *after the curd is dry and firm* it may be allowed to mat into one mass, *but not before that condition is reached.* All stirring should be performed so as to avoid bruising the grain of the curd.

10. It may then be frequently turned and packed close, till the layers of curd are four or five deep. Whey should never be allowed to collect in small pools on it at this stage. The close packing in layers four or five deep, with frequent turning, prevents the outside of the matted pieces from becoming chilled or more deeply colored by the action of the air than is the rest of the curd.

11. The hot iron test is almost indispensable for determining with certainty, from day to day, the exact stage of acid development at which all the whey should be drawn off ; the filaments—thread-like processes—should be about one-quarter of an inch long. The proper degree of change for the cutting and salting of the curd has taken place when it feels mellow, velvety and "slippy," and shows a texture passing from the flaky or leafy into the stringy and fibrous. If it be too moist or soft it should be cut or ground at a rather earlier stage and hand-stirred until dry enough before the addition of salt. The most of the hand-stirring should precede the salting.

12. Not less than 3lb. of salt per 1,000 lb. of milk should be used, and when the curd is on the soft or moist side 3¼ lb. per 1,000 lb. of milk should be added ; the 3¼ lb. rate is also preferable during the latter part of the month when cold weather prevails.

13. Immediately after the application of salt the pieces of curd become harsh and gritty on the surface ; then in from 15 to 25 minutes the harshness gives place to mellowness. At the second stage—and the temperature should not be under 88°—the curd should be hooped and pressure applied. Delay at this point or coldness of the curd destroys the desirable rosy flavor, and imparts to the cheese the bitter taste of the salty white whey.

14. Particular care should be taken to use only pure warm water when turning the cheese for bandaging, before the rinds are fully formed.

15. Especially in a cold press room, pains should be taken in the applying of pressure to the cheese before they are left for the night.

16. All cheese should be finished in symmetrical shape and kept in the hoops until the rinds are smooth and the edges free from any projecting "shoulders."

Curing the Cheese.—The temperature of the curing room should be kept as nearly regular at 65° as possible. Where the September cheese are kept in the same room with those of October make, the latter should be kept on the warmer shelves. A slight chilling, after a cheese has been curing at 65° for two weeks, does little damage ; but a steady temperature and constant curing give the best results. Bitter-flavored cheese are usually the result of chilling in either the making-room, press-room or curing-room. If the cause be prevented the consequence will be unknown.

To Factory Managers.—As this is the last bulletin of notes for cheese-makers for this season, I desire to counsel the managers of factories to guard against three tendencies that appear to menace the permanent success of our cheese industry :

1. The employment of inexperienced, incompetent men to manage the inside work of the factories.

2. The conscienceless cutting down of the remuneration of the makers, until the able men are leaving the occupation.

3. The inevitably penny-wise and pound-foolish policy of using factory furnishings of poor quality, simply because they happen to be a little lower in price.

So much additional trouble, loss, worry and disappointment result from the putting of men without aptitude or experience in charge of large factories that I strongly urge the proprietors to exercise the utmost care and caution, and invariably to inform themselves as to the fitness of an applicant by enquiry from a reliable expert or cheese buyer. No factory should incur needless risk of a loss of reputation, of patronage, of prestige, of price or of profit.

7.—THE CHEESE-FACTORY BUSINESS OF ONTARIO.

The future of our dairying trade must essentially be an outgrowth of our present conditions—the child of our own judgment and skill. Touching first upon the past, I shall not go back further than the time when the cheese manufacturing industry was first introduced into this province, some twenty-four years ago. It will be observed from the fact I have just stated that our co-operative system of dairying has attained its majority, but like many of ourselves it has grown a long time without gathering very much sense, if we are to judge of that from its present state. Its progress both in the improvement of methods and the occupation of area in our province, was very slow until it was taken in hand by the Dairymen's Association of Ontario ; but as soon as that Association was called into existence and began to guide and foster the industry it received a new impulse. The Association not only deepened and extended the interest manifested by our farmers, but was the means of leading them to increase their profits by engaging in the dairy business. The Dairy Associations of Ontario have been of much more service to the province than even we often give them credit for. The idea has prevailed that in the Dairymen's Associations of Ontario we have organisations the sole duty of which has been to augment the output of our cheese and to increase the number of our cows. In thinking so, a great injustice is done both to the parent association and those which have sprung from it. The first main uses of the Dairymen's Associations to the farmers of this province have been to demonstrate to them the possibility and great value of co-operation ; the necessity of being more self-reliant ; the advantages to be gained by applying intelligence in their own business; and the desirability of that earnest and continuous effort for improvement without which no class of our population can take their true rank among their fellows. To the Dairymen's Associations more than to any other agency we are indebted for our present condition as regards co-operation among farmers. Our Farmers' Institutes, which are accomplishing such admirable work among the agricultural communities, are a direct outgrowth of Dairymen's Associations, and many of their best workers are indebted to these Associations for early training. In reaching the ends I have spoken of I claim for the Associations that they have not merely made it possible for the farmer to make more money, but have made it necessary that he should be a broader-minded and better man before he could be a successful dairyman. In this way they have been a civilising and enlivening agency in our midst. The function of the farmer in society is to produce food and the raw material for clothing for the rest of the race ; and the dairyman is merely a farmer calling to his aid more resources than if he had no dairy. When he produces food from the soil of his fields he is aided by the energy and elements of the sun, air and water. From the action of these in accord with nature's law he is enabled to raise plants as the reward of his labor ; but he is still far from having drawn from his fields by the

aid of these agencies all the good it is possible to get by making animals serve to elaborate food for men's use. To place cattle upon a farm is not to place a tax upon the labor of the farm, but to call into requisition a factor which will increase the available food supply from the whole property; that is the place of cows and all cattle. The cow fills her place as an economical factor when she lives upon those parts of the crops not adapted for human consumption: and living upon them produces food which makes it possible for a larger number of men to be fed from a given number of acres. All the best of our dairymen understand this, and due understanding and appreciation of the fact has resulted in an increase of the available food supply in this province; an increase which has rendered it possible for us to support economically a larger population than we could otherwise sustain, and which at the same time has afforded ample remuneration to the men whose labor has been expended in producing this extra food supply. The farmer who sells direct everything he raises on his land is selling off plant food—the substance of fertility—in large quantities, and if he returns nothing to the soil is in the same course of action as a storekeeper with a limited stock who clears his shelves and counts all his returns as profits. Such a storekeeper would soon be under the necessity of putting up his shutters, and in the same way a man who uses his farm in the way I have mentioned will soon have a poor farm, and being a poor farmer will soon be a poor man. Unless a man will conserve the elements of fertility, his land will not be able to stand the drain incident to producing food. I want to say further that the co-operative system of dairying carried on in cheese factories is restoring fertility to land that has been exhausted, and is repairing the financial health of the farming populations in those sections of the country where it has been carried on with good judgment. I heard this statement made lately by a man of large experience in one of the counties of Ontario. He was a tax collector, and although that functionary is not a gentleman whom we are always delighted to honor, he has excellent opportunities of forming just opinions in regard to a matter of this kind. He said that his experience had always been that when he came into the vicinity of a cheese factory he found the taxpayers ready with their money, whereas when he was in other sections where there was no cheese factory he was constantly being asked to wait till threshing time, or Christmas time, or till the grain was sold, or some other time. That is a proof that dairying on the co-operative plan has had the effect of so increasing the earning power of the farmer that he is in possession of more readily available cash. Then it has saved in other parts large sections of the country from becoming non-productive. We sometime think that, after all, the whole value of dairying to the province is that it has brought back farms from a state of barrenness to a state of high productiveness. I think the farms need never have been exhausted, and we find that in those sections where dairying is most extensively carried on they have the best and most productive farms. I do not think there is any need at all for a man to exhaust his farm and to work it so bare that it will grow nothing but thistles and weeds in order to prove that dairying will restore its fertility. I would not think as much of a man who did that as of one who had the good sense to engage in dairying work, and whose farm was never exhausted. I have no sympathy to waste on the farmer who has so little foresight, intelligence and thrift as to take from his farm its fertility. Ignorance and neglect will entail the penalty which he must pay. I claim that dairying has preserved the fertility of the fields, and increased it beyond their virgin productiveness. Then it has put a capitalized market value into the farms of the province. If a farm, by reason of having more cows and a cheese factory close by, will bring in a larger annual income, it is of correspondingly greater value. Then it has added to the income of the farmer without lessening the production of any saleable crop. If we had merely found a new way of getting money, and in applying and putting it into operation had abandoned the means of getting money from other sources, it might have been no gain or improvement. If the farmers of this province in receiving $6,000,000 a year for their export dairy products, had in that merely taken the money from one pocket and put it into another, and had lessened their receipts from grain growing or any other source, they would not have made themselves any wealthier, but it is capable of proof that no farmer who has increased his income from the sales of milk to a cheese factory has lessened his production of grain by a single bushel. On the other hand, he has so much increased the productive-

ness of his farm that it will grow twenty-five per cent more on the average than it would otherwise. Where a cheese factory is supported, we find that it is an addional source of income which does not operate detrimentally to or in any way lessen the realisation of income from other sources from which we have in the past been accustomed to derive it. So much have I put together by way of referring to the past of our dairying. We all like to be successful and respected at home, but at the same time we also like to be well esteemed abroad, and there is no department of our agricultural, industrial or manufacturing enterprises that has won for us abroad such a splendid reputation as has our immense export of dairy produce. No man in England will ever try to disparage this province as one in which the finest dairy products cannot be manufactured, although many of them think we cannot keep go on growing wheat or beef and pork as has been done in the past. We have given indisputable proof that we can and will continue the production of cheese of the finest quality, which proves that we have a climate and country suitable for calling into advantageous use the best energies of man, suitable for the maintenance of the best kinds of dairy stock and the economical production of food of this kind of the very best quality. In this way our dairy business has advertised us abroad as a solid, substantial, progressive and prosperous people, and beyond this our cheese business has done more than anything else to correct erroneous ideas prevalent among the English in regard to our climate. In a brief three weeks time, four years ago, at the Colonial and Indian Exhibition, it was not difficult to give this province and its resources advertising to the extent of six hundred miles of single columns of newspapers, and that without any expense for advertising bills, but simply by writing about cheese and butter. In that way we have got a most desirable reputation and the most extended information about our province spread abroad through our dairy business. Having said so much in regard to the record of the past, there are some things to be learned from it which we cannot afford to ignore, and in writing of the present I wish to write of it with its weaknesses and defects, and to review them in the light of our past history. I would like to examine the present status of dairying, especially as regard co-operative cheese factory work, in relation to the profits that are and may be derived from it. We have in the province over 780 co-operative cheese factories, supported by over 42,000 patrons, receiving the milk of over 260,000 cows. Now, if these 42,000 patrons were all men of enthusiasm, intelligence and good judgment they could raise our cheese industry to a much higher plane, from which they could realise *twice as much profit* inside of a year and keep up the improvement at the same ratio for the next five years to come. I find in the first place that there are many men halting between two opinions, as to whether it pays to support a factory or not. By sending out circulars and getting returns as far as possible I find that over five thousand, of the forty-two thousand supplying milk, do so for less than three months in the year to the factories of this province. They are the men who are never quite sure whether they will send milk more than one week or not. While attending a dairy convention held in the State of New York I heard a man in a position of authority state that it would pay the farmers of that State to shoot and bury one-half of the dairy cows there. I also heard another gentleman of equal prominence there, and a man occupying an official position, say that not more than one-third of the dairy cows in the State were actually yielding a profit to their owners. I do believe that one-third of our dairy cows are not yielding their owners a profit. The first means of improvement in this respect, I would suggest, would be to eradicate the thoughtless indifference of these men who have never made up their minds as to what a cow is for, and improve them into keeping better cows in a better way. The average yield per cow has often been cited at three thousand pounds of milk per year. I would leave myself upon record as saying that the average yield of the cows of Ontario is over three thousand pounds per annum each, but is under three thousand ponnds per annum when measured by the cheese factory season. I got a large number of returns, which were made by cheese-makers who took some pains to verify their correctness from which I find that the largest yields per head of the best herds supplying milk to eighty factories, through the whole cheese factory season of six months and one day, was 3,500 pounds, and the average of the poorest herds going to the same factories during the same time was 2,235 pounds. What is the matter with our cows? If the cow is a con-

trivance of nature to aid the farmer in producing more food from his fields, it is a very clumsy and inefficacious contrivance that consumes the keep of six months and gives back only that amount of milk—a contrivance which, instead of being a source of profit, is only a burden and expense to the man who has to keep it in running order. I think these cows are made the wrong way. The man makes the cow. The dairy cow has been the product of man's skill, and reflects that. She is an artificial product, and the main operative agency in improvement is the brain of man. The man who refuses to use his brain simply lets nature and the cow do the worst they can for him—that is, the best they can for themselves, but the worst for him. To succeed in moulding the cow we must go back and get a proper male. The man who wants to make a China tea-cup does not go to a brickyard and get his clay, nor does the man who intends building a steam engine go the bush for his piston-rod. We must have the proper material, and the only material that is at our hand which can be worked into the best possible form for the use of man in the dairy cow is the material inherited from cows and bulls that have had milking power and milking records. If we do not begin there we have to refine the material, which is unnecessary labour when we may have our raw material of the right quality to begin with. A man should no more think of using a bull in his dairy herd that has been kept fat from its calfhood up than he would think of using brick clay to make a China tea-cup. Such an animal is not the bull for a dairyman. Let it have a record of eight or ten thousand pounds of milk per year behind it in dams back for two and more generations. Again, a man who wants to buy a bull to head a dairy herd, will go to a stable and find a bull calf that suits his notions as to its points. He will then go into the cow stable of the stock breeder and ask to see the dam of that bull, and find perhaps a lean cow, a large cow, a large milking cow with an angular frame, not rounded and padded with flesh below her skin. "But," he says, "have you got a calf from this other big fat cow?" "Yes." "What do you want for it?" "Fifty dollars more than for the other one." He goes back and buys the calf from the fat cow, and still expects that he is going to succeed in improving his dairy herd. I do not care whether the cow be a Jersey, Holstein, Ayrshire or Shorthorn, the dairyman who buys a bull from a fat cow usually makes a mistake, and if he keeps that bull fat afterwards he destroys what probability there was of getting improved blood into his herd. The man who does not know what kind of a cow he wants will never make a heifer shapen that way; but the man who has the ideal of the cow he wants, will make his heifer grow that way for him. Then the present of our dairying strikes me as being weak in this respect, that even if we had good cows on the average we have not learned to feed them economically. We have 2,235 pound cows, but these same cows are five-acre cows, needing the fodder from five acres to produce that small quantity of milk, viz.: three acres of pasture and two of fodder. There is no adequate return for the labor spent upon such animals. Instead of five-acre cows we want to have a good many of one-acre cows, and instead of 2,235 pounds as a record we want at least a record of 7,000 pounds. A man may feed a cow on one acre which will give him 7,000 pounds of milk a year, and he is making a good deal more food per acre than the man who makes only 2,235 pounds per cow and has to feed her the fodder of five acres. As a man produces food he creates wealth, and will have his own share in the handling thereof. Now, I do not want to denounce an evil without suggesting a remedy for it. Reduced acreage is the thing, and I would recommend the farmers to sow some rye. Two acres of winter rye is enough for a one hundred acre farm, and that will furnish food early in the season before the other crops are fit to use. Then bran should be fed; bran or pease meal, or something like that when early pasturage is rank and not calculated to give the best results. Oats and pease cut in the green state should then be fed; and after they are through there should be a crop of ensilage corn ready, of some variety that will give a large growth of leaf and stalk, full to overflowing with nourishing properties. If he would have that, the farmer must give up the old-fashioned practice of sowing three bushels of corn to the acre. Last year many men who sowed a quarter of a bushel to the acre reaped a most satisfactory crop.

A successful dairyman, whose hairs are grey and whose bank account is heavy, gave me this statement as his experience. He bought bran and fed fodder corn by the most

improved methods, and he found that the supply of milk yielded by his cows was largely augmented thereby. The bran cost him $14 per ton After one week's experimental work he went to the cheese factory and found that at the price cheese was then selling for he had made just $2.41 more in the value of the milk than the extra cost of the bran had been to him. He had got enough milk to pay for his bran and leave him a profit of $2.41 in one week, besides having his cows in better condition, able to give more milk for a longer period that season. The manurial value from feeding the bran was not the least important gain.

Having said so much upon that aspect of the question, I will pass on to the consideration of our factory equipment—buildings, utensils, and so on, in which we are very far behind indeed. Cheese factory buildings are not on the average such as are adapted to the present requirements of dairying. They should be constructed in such a way as to enable those managing them to have perfect control of the temperature. I find from the reports of Instructors in Western and Eastern Ontario that many of them are very imperfectly constructed in this respect. The equipment of utensils is quite inadequate to the needs of the present system of cheese-making, and in some instances these are kept in such a state that the less they are used the better for the cheese. There is also improvement needed in the class of men who are employed in running cheese factories. The men who run our cheese factories to-day are not men of the same ambition as they were ten years ago. In many instances I find the sole ambition of makers is to make a cheese that will pass. Ten or fifteen years ago there was a feeling of rivalry between makers to make cheese that would please—to reach a higher standard that would please everybody, the eater included. That is what is wanted. We want cheese makers who are enthusiastic about their work, and will take the pains to make themselves masters of all the details of their business. I need not refer to prices beyond saying that even during a year of moderate prices such as we have passed through, no part of the farm work has left the same profits as the cheese-making and dairying industry. If that can be said after a year of moderate prices, with 2,235 pound cows that take five acres to feed, what could we not do in a good year with the right kind of cows rightly fed, and with buildings and appliances of improved utility. The future of dairying, to my mind, is bound up with the future of the farmers of this province of Ontario. If by any means the farmers of this province can have their energies awakened into action they will make lots of money out of cheese, but if they cannot be led to think and read and work for themselves they can never, by any extraneous process or method, be helped very much. Therefore let us work at the man who keeps the cow that gives the milk that makes the cheese. In doing so we get these individuals waked up into acting intelligently, and if we do our success is assured The foundations of the business will be established, its field extended, its profits increased, and our reputation will certainly be much higher than it is at present. We want better cows kept by better men, better and yet more economically fed, so as to produce better milk; we need the highest class of men that can be induced to be cheese-makers, for the cost of an extra ten or twenty dollars a month is nothing compared with the desirability of supporting and strengthening our prime industry of cheese-making. We require besides to have a cheaper summer feed for our cattle. It will be found that by carrying ensilage from the winter to the following summer it is possible to get the cheapest food for cows. Then, having this, it will be found possible to make cows milk at least ten months in the year, and the milking season should begin, not in March or April, but from November to January. If the cheese factory is to be made profitable the cows may come in early, and then when the cheese factory closes as a cheese factory it can be opened the next day as a butter factory. One set of buildings and apparatus will do for the whole year. The skim milk can be used for the purpose of raising the best class of calves. When the spring comes the milk will not be needed for the calves, and it can go to the factory for cheese-making. I think winter dairying is full of the greatest promise in Ontario—full of great possibilities. If we only avail ourselves of these new openings for the exercise of intelligence—these starting points for new enterprise and the achievement of new results—we shall have no occasion to be ashamed of either the past, present or future of our dairying industry.

8.—THE HOG AS AN ADJUNCT TO THE DAIRY.

From Bulletin XXX, issued by the Bureau of Industries on "the Swine Industry in Ontario," I quote the following sentences from pages 40-41 : "During the last eight years 60,000,000 lb. of hogs, valued at $3,160,000, have been slaughtered in bond in Canada for exportation. What change is necessary in order to enable the Ontario farmer to supply this pork ?" On page 7 of the same Bulletin it is stated that during the five fiscal years 1884-9, "there were also imported to be slaughtered, in bond, 41,155,383 lb. of hogs, live weight, valued at $2,044,398, which with the imports for home consumption make a total deficit of $9,409,597 in the five years, being an annual average of $1,881,920 ; or, if the duty be added, an annual deficit of $2,167,800."

The facts presented in these quotations indicate that there is a large demand for hogs and their products that might be and ought to be furnished to our own markets with profit, by the dairy farmers of the Province. By way of further introduction of this subject, I will quote some passages from an address which I had the honour to deliver before the Dairymens' Associations in 1889. "Dairymen neglect one of the best servants they can have in the animal creation, when they do not avail themselves of the hog to aid in making money from the by-products of milk. The attitude of farmers towards the pig has been an unfriendly one. It is a popular, though untrue, saying that "the only good Indian is the dead Indian," and farmers seem to cherish a similar belief in regard to the hog. That opinion, however, is in direct opposition to the best interests of the men who keep cows for the manufacture of dairy products. If the man who keeps ten cows will fatten twenty hogs in the summer and half as many in the winter, he will find, perhaps to his amazement, that this little branch of business will bring him in more money and profit than he thought could be made from it. Whey is a valuable hog feed. There are nearly seven pounds in every hundred pounds of whey which the hog can use to advantage. The composition of whey is as follows :—Water, 93 per cent. ; nitrogenous substances, 0.92 ; fat, 0.35 ; milk sugar, 4.65 ; lactic acid, 0.33 ; ash, 0.75.

These elements of food value in whey should produce at least two pounds of live weight in hogs. One hundred pounds of whey, fed in the most judicious manner, should produce two pounds of pork ; it will not do it when fed alone, but fed in combination with other foods it will. Sows, like cows, should be selected for their profit-making powers. A man who knows well enough that unless he has a good dairy cow he need expect no profit from her, often acts as though he believed that anything that grunts and squeals will make money for him out of its feed ; but the squealing and the grunting are the main part of it with some hogs. In selecting a sow, she should be selected first for her length, then for her depth and then for her breadth. The three qualities should be valued in that order of merit—length, depth and breadth. A sow should be made to farrow in March or April and in September. A breeding sow should never be fed upon decayed food. The waste from the kitchen and the table is wholesome feed for pigs when it is fed clean and before it becomes decomposed ; but a never-empty and consequently never-clean swill barrel is a menace to the health of the hogs and a hindrance to profit. A breeding sow should always get as much salt as she likes to take ; her food should be salted and she should have access to salt besides ; she will not thrive without it. The quarters of breeding sows during the winter should be comfortable. They too often lie in and under strawstacks, or out in open sheds, and the other swine which are being wintered lie with them and on them to make more warmth. Dead pigs and sickly pigs from birth are the consequence. Their sleeping places should be well ventilated and dry.

A boar should be selected for length, depth and breadth. He should have proportionately large bones, for small bones are indicative of a weak constitution and a disposition to lay on lard instead of muscular meat. A plentiful supply of hair indicates a strong constitution, and a predisposition to lay on flesh.

Young pigs should be suckled for about three months ; if they are weaned when five or six weeks old they will not do as well. The sow can nurse them as well as not

if properly fed, and the pigs will grow and thrive so much the better. Skim-milk, butter-milk and bran should form some part of a milking sow's ration. It is profitable to scald or boil her feed until after the pigs are weaned.

The little pigs should always have access to cold water for drinking. In feeding and fattening these little pigs, they should have the trough room in length, not in depth. Many of the hog troughs, I see around the country, seem to have been constructed with the object of affording bath accommodation for the pigs, so deep and wide are they that the pigs take headers right into them. The feed room of the trough should be in length and not mainly in depth for all sizes of hogs and it should be kept clean. Pigs have the reputation of being filthy animals, but a pig will keep itself clean if it gets instruction in that way for one week and a good example. The feed for little pigs should be sweet, not sour. In the souring of whey, some of the sugar is converted into acid. Lactic acid has no feeding properties. It has a slightly helpful digestive action, so that whey or milk which is sour will do a pig no harm, but part of the food value has been lost. Thoroughly sour whey is extravagant food and unsuitable for pigs. All meal fed with whey had better be of a mixture of grains: pease, wheat, middlings and bran are suitable. And let me remark in passing, that since a farmer can frequently grow thirty bushels of "goose wheat" to the acre, in this time of cheap wheat, he cannot market that so well any other way as through his hogs. With their mixed feed, pigs should receive a liberal allowance of salt every day; charcoal or wood ashes are very beneficial when hogs are fed mainly on whey. A very small quantity of saltpetre and sulphur once a week would help to keep them thriving when the whey is unavoidably sour, as it will sometimes become in spite of the best of care. A mixture may be made of eight pounds of salt, eight pounds of charcoal, half a pound of saltpetre and one pound of sulphur. The hogs may be allowed to take all they like of the mixture. Pigs should have some green feed in the summer time when penned up; half an acre of clover will yield the best returns in pork when fed to pigs that are also given whey and grain in combination therewith.

The sleeping quarters of pigs that are being fed should be dry, clean and well ventilated. The best weight at which to sell hogs in order to realise the highest price and the best returns for food consumed is from 150 to 200 pounds, live weight."

The following tables give the observed results from five of the pens of hogs that were fattened during the season.

On Aug. 9th sixteen hogs were separated into three pens, containing 6, 5 and 5 respectively. They were divided to be as near alike as possible in age, size and breeding. None of them were pure bred, though most of them showed Berkshire or Chester White points. They were all fed on middlings only, with salt and water, and were allowed as much as they could eat, being fed three times a day. The middlings were mixed with cold water in the troughs immediately before the time of feeding.

		Weight Aug. 9th.	Weight Sept. 13th.	Gain.	Middlings consumed.	Middlings consumed per lb. of increase live weight.
Pen 1	6 hogs.	586 lb.	924 lb.	338 lb.	950 lb.	2.81 lb.
2	5 "	465 "	726 "	261 "	836 "	3.20 "
5	5 "	399 "	673 "	274 "	908 "	3.31 "
	16 hogs.	1450 lb.	2323 lb.	873 lb.	2694 lb.	3.08 lb.

The average live weight of the hogs on Aug. 9th was 96.6 lb. each.
" " " Sept. 13th " 145.2 "

The object in feeding the middlings was to prepare the three lots for an experiment in the feeding of corn meal alone, pease meal alone and a mixture of barley meal and middlings alone in the fattening of these 16 hogs. The hogs of each of the three lots in pens 1, 2 and 5 were weighed every week. The meal in each case was fed, as were the middlings, mixed with cold water in the trough, immediately before the hogs had access to it. They were fed three times a day and each pen was allowed as much as the hogs would eat. In the tables I have arranged the figures under *four* feeding periods of four, four, four and three weeks each.

Pen 1—Six hogs fed on cornmeal only with water and salt, Sept. 13th to Dec. 28th.

Feeding period.	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Cornmeal consumed.	Cornmeal consumed per lb. of increase live weight.
Sept. 13th to Oct. 12th	924 lb.	1184 lb.	260 lb.	1111 lb.	4.27 lb.
Oct. 12th to Nov. 9th	1184 "	1447 "	263 "	1174 "	4.46 "
Nov. 9th to Dec. 7th	1447 "	1666 "	219 "	1161 "	5.30 "
Dec. 7th to Dec. 28th	1666 "	1842 "	176 "	911 "	5.17 "
Sept. 13th to Dec. 28th	924 lb.	1842 lb.	918 lb.	4357 lb.	4.74 lb.

Pen 2—Five hogs fed on pease meal only with water and salt, Sept. 13th to Dec. 28th.

Feeding period.	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Pease meal consumed.	Pease meal consumed per lb. of increase live weight.
Sept. 13th to Oct. 12th	726 lb.	945 lb.	219 lb.	1049 lb.	4.79 lb.
Oct. 12th to Nov. 9th	945 "	1140 "	195 "	931 "	4.77 "
Nov. 9th to Dec. 7th	1140 "	1390 "	250 "	1126 "	4.50 "
Dec. 7th to Dec. 28th	1390 "	1534 "	144 "	815 "	5.66 "
Sept. 13th to Dec. 28th	726 lb.	1534 lb.	808 lb.	3921 lb.	4.85 lb.

Pen 5—Five hogs fed on a mixture of barley meal and middlings alone with water and salt, from Sept. 13th to Dec. 28th.

Feeding period.	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Feed consumed.		Mixture of barley meal and middlings consumed per lb. of increase live weight.
				Barley.	Middlings.	
Sept. 13th to Oct. 12th	673 lb.	877 lb.	204 lb.	399 lb.	399 lb.	3.91 lb.
Oct. 12th to Nov. 9th	877 "	1070 "	193 "	436 "	419 "	4.43 "
Nov. 9th to Dec. 7th	1070 "	1275 "	205 "	486 "	489 "	4.75 "
Dec. 7th to Dec. 28th	1275 "	1403 "	128 "	351 "	361 "	5.56 "
Sept. 13th to Dec. 28th	673 lb.	1403 lb.	730 lb.	1672 lb.	1668 lb.	4.57 lb.

The following table is arranged for comparison of the quantities of feed consumed per lb. of increase live weight :—

Feeding period.	Corn meal consumed per lb. of increase live weight.	Pease meal consumed per lb. of increase live weight.	Mixture of barley meal and middlings consumed per lb. of increase live weight.
Sept. 13th to Oct. 12th	4.27 lb.	4.79 lb.	3.91 lb.
Oct. 12th to Nov. 9th	4.46 "	4.77 "	4.43 "
Nov. 9th to Dec. 7th	5.30 "	4.50 "	4.75 "
Dec. 7th to Dec. 28th	5.17 "	5.60 "	5.5. "
Sept. 13th to Dec. 28th.....	4.74 lb.	4.85 lb.	4.57 lb.

On November 9th, after a period of preparatory feeding, eight hogs of similar age and breeding were weighed, and left four in each of two pens. They were not pure bred, but in appearance would have passed for Berkshire hogs. A test was undertaken with them to obtain some information on the value of rape ensilage for fattening purposes. The four hogs in pen 6 were fed on middlings only, with water and salt mixed in the trough before the hogs were allowed access to it. They were fed three times a day, and were fed as much as they would eat. The four hogs in pen 7 were fed on about one-third the quantity of middlings consumed by the hogs in pen 6, and were allowed as much rape ensilage as they would eat. The treatment otherwise was alike. The feeding lasted from November 9th to December 21st, when the supply of rape ensilage was exhausted.

The following table shows the comparative quantities of middlings and rape ensilage consumed :—

	Feeding period.	Weight at beginning of feeding period.	Weight at end of feeding period.	Gain.	Middlings and rape ensilage consumed.		Middlings consumed per lb. of increase live weight.
					Middlings.	Rape ensilage.	
Pen 6: 4 hogs	Nov. 9th to Dec. 21st	905 lb.	1164 lb.	259 lb.	1491 lb.	.....	5.75 lb.
" 7: 4 "	" "	905 "	1084 "	181 "	487 "	2840 lb.	.....

According to this one test one pound of middlings is equal to 5.12 lbs. of rape ensilage for the production of pork. The *cost* of the rape ensilage in this case could not be correctly calculated.

I desire here to call attention to the fact that in the feeding of the hogs in Pens 1, 2 and 5 from August 9th to September 13th on middlings only, from an average weight of 90.6 lbs. each up to 145.2 lbs. each, *only 3.08 lb.* of middlings were consumed for each pound of increase live weight, whereas in feeding the hogs in Pen 6, on middlings only, from an average weight of 226.2 lbs. each up to 291 lbs. each, *5.75 lbs.* of middlings were consumed for each pound of increase live weight.

The twenty-four hogs of Pens 1, 2, 5, 6 and 7 were killed on December 31st and January 1st. The last feed was given to all the hogs on the morning of 30th December. The hogs of Pen 1, and numbers 4 and 5 of Pen 2, were killed on January 1st. The following table will give some interesting and probably useful information. The live weight of each hog was taken immediately before it was killed, and the dead weight was

taken immediately after it had ceased to bleed. The hogs were all scalded, scraped, dressed and hung up where they would not freeze. On January 6th the dressed weight was taken :

Pen.	No. of animal.	Fed on	Live Weight	Dead Weight.	Dressed Weight.	Weight of lard on guts.	Per cent. of shrinkage from live weight to dressed weight.
7	1	Middlings and rape Ensilage.	.....	.....	218½ lb.	5 lb. 9 oz.	14.3 per cent.
	2		.....	.....	254½ "	5 " 10 "	
	3		260 lb.	254 lb.	224 "	6 " 2 "	
	4		249 "	242½ "	212 "	4 " 14 "	
6	1	Middlings.	298 "	292 "	257 "	7 lb. 0 oz.	13.3 per cent.
	2		282 "	273 "	245 "	6 " 11 "	
	3		259 "	252 "	225 "	6 " 2 "	
	4		305 "	300 "	264½ "	6 " 11 "	
5	1	Barley-meal and Middlings.	273½ "	266½ "	229½ "	7 lb. 9 oz.	15.6 per cent.
	2		283 "	277 "	242½ "	10 " 1 "	
	3		238 "	232 "	201½ "	7 " 14 "	
	4		298 "	291 "	251 "	6 " 4 "	
	5		253½ "	246½ "	211 "	6 " 0 "	
2	1	Pease-meal.	289½ "	282½ "	238½ "	7 lb. 14 oz.	17.0 per cent.
	2		288 "	282½ "	242 "	9 " 12 "	
	3		301 "	293½ "	246 "	9 " 0 "	
	4		279½ "	273½ "	232½ "	7 " 12 "	
	5		312½ "	305½ "	261½ "	6 " 15 "	
1	1	Corn-meal.	295 "	290½ "	257½ "	6 lb. 2 oz.	14.1 per cent.
	2		342½ "	336½ "	293½ "	9 " 0 "	
	3		241 "	235½ "	206½ "	6 " 10 "	
	4		332½ "	326 "	287½ "	5 " 13 "	
	5		283 "	276½ "	238½ "	8 " 11 "	
	6		277½ "	271½ "	237 "	7 " 4 "	

One hog of each lot was cut through in front of the shoulders, behind the shoulders and in front of the hams. It was intended to photograph these sections had the difference between the proportions of fat and lean from the different kinds of feed been decidedly apparent. The difference would not have been evident to the eye from an exact photograph. A few of the notes made on the spot are transcribed here :—

Corn-Meal Fed.—Lean meat rather brighter in the color than the others ; equal to the pease-meal fed in firmness and proportion of fat and lean ; lard more chalky in shade than others.

Pease-Meal Fed.—The color of the lean meat hardly so bright as the corn-meal fed.

Barley-Meal and Middlings Fed.—Color of the lean meat rather pale ; larger proportion of lean to fat than in the corn and pease-meal fed ; flesh and fat softer in body than in the two other lots.

In the following table is shown the order of quality under the three heads of "color," "largest proportion of lean to fat," and "firmness of flesh and lard."

Order.	Color.	Largest proportion of lean to fat.	Firmness of flesh and lard.
First	Corn-meal	Middlings and rape ensilage.	Equal { Corn-meal / Pease-meal
Second	Pease-meal	Middlings	Barley-meal and middlings
Third	Barley-meal and middlings	Barley-meal and middlings	Middlings
Fourth	Middings	Equal { Corn-meal / Pease-meal	Middlings and rape ensilage.
Fifth	Middlings and rape ensilage.		

Other hog-feeding has been in progress. From the data given in these tables, and from conclusions safely reached by observation, I desire to point out that as a hog becomes older and heavier there is a gradual increase in the quantity of food consumed per pound of increase live weight. It is not prudent to base a scale of the per cent. of increased consumption of feed upon these few tests, but I may mention that in the case of feeding hogs upon middlings only from 226.2 lb. each up to 291 lb. each (pen 6), they consumed EIGHTY-SIX PER CENT. more feed for every pound of increase live weight than did the hogs from 90.6 lb. each up to 145.2 lb. each.

By comparing the quantities of feed consumed per pound of increase live weight by the hogs in pens 1, 2 and 5 on corn-meal, pease-meal and barley-meal and middlings respectively during the first eight and the last seven weeks the following results appear:—

Feeding period.	Corn-meal consumed per lb. of increae live weight.	Pease-meal consumed per lb. of increase live weight.	Mixture of barley-meal and middlings consumed per lb. of increase live weight.
Sept. 13th to Nov. 9th.	4.36 lb.	4.78 lb.	4.16 lb.
Nov. 9th to Dec. 28th.	5.24 "	4.92 "	5.06 "

The increased per cent. of the consumption of feed per lb. of increase live weight in the hogs in the second period from Nov. 9th to Dec. 28th over the rate of consumption during the period from Sept. 13th to Nov. 9th is as follows:—

In corn-meal fed hogs, 20 per cent. more feed per lb. of increase live weight.

In pease-meal fed hogs, 3 per cent. more feed per lb. of increase live weight.

In barley-meal and middlings mixture fed hogs, 21 per cent. more feed per lb. of increase live weight.

I consider that it is possible by a judicious mixture of grain in hog-feeding to obtain one pound of increase live weight up to 200 lb. for every four pounds of grain fed.

The floors of our feeding pens all have their fall towards the trough; that arrangement leaves the back part of the pen always dry for a sleeping place.

Hog manure is one of the best fertilisers; in feeding hogs little is taken off the farm, much is left on it of manurial value, and satisfactory money returns may be realised in addition. For these reasons I believe the hogs of this province are an unrecognised and undeveloped source of wealth for the men who will endeavor to understand and use them well.

9.—FODDER CORN AND THE SILO.

Indian corn (Zea Mays) is cultivated in every quarter of the globe. The plant is believed to be indigenous to South America, though the origin of its use as an agricultural product is still obscure. The remains of charred cobs have been dug from Indian mounds; and the Spaniards in the course of their conquering inroads found it growing as a holy ornament upon the graves of Mexicans. Mention is made of the discovery of cultivated corn fields about the mouth of the Kennebec river, Maine, in 1605. Cartier found waving corn fields at Hochelaga in 1635. Its spread into Europe is believed to have been from America by the ships and hands of the Norsemen long before the adventures of Columbus. From Mediterranean ports it was spread through Europe, and as everything foreign in those days was called "Turkish," it carries the name of "Turkish corn" to this day in many of the kingdoms there. As an agricultural product it is of vast commercial importance to the farmers of this continent, and its enormous yields, without serious exhaustion of the fertility of the soil, have made it the means of rapidly enriching the districts and countries where it has been grown successfully. Contrary to the belief of many farmers in Ontario, it can be grown to advantage for fodder purposes in every section of the province. In the counties in Ontario where it is valued for its grain producing qualities, the average yield per acre in 1888 was 78.2 bushels in the ear against the officially stated yield of 26.3 bushels (shelled corn) in the corn-growing States. With this crop, as with the more commonly grown cereals, the several varieties attain their maximum of service and value in the most northernly limits within which they can be grown to maturity. In the season of 1889 corn was ripened successfully as far north as Minden, Haliburton. It can be grown for fodder purposes profitably in every part of the whole province.

While a loose loamy soil is thought to be best adapted for its growth, large crops can be obtained from clay lands as well as from sandy soils. The varieties are practically innumerable. They are due to climatic conditions, selection, cross-fertilisation and cultivation. Attention to the controllable treatment will doubtless enable the farmers of this province to develop varieties more suitable and serviceable to themselves than any that are yet known. The height, attained by the plants of different varieties, ranges from two feet to fourteen feet. The number of nodes or joints on each stalk is irregular. The leaves vary in size and number. Ears may be carried at any node; sometimes two or three are borne on one node; occasionally as many as ten ears form on one stalk. In our climate, varieties that carry more than two or three ears per stalk have not been ripened. The number of rows of kernels on each cob may always be evenly divided by two; they range from eight rows up to thirty-six. The kernels vary in shape, size and color. Sixty-eight varieties were grown during the season experimentally. The valuable and essential pecularities of most of them will be presented in tabular form. A bulletin of instruction on the methods of cultivation that should be adopted was issued early in the season. A second edition was called for in November. The following is the bulletin which contains simple cuts to illustrate the way of constructing silos adapted for the economical preservation of green crops in their most digestible state.

Fodder Corn and the Silo.

No single subject connected with agriculture is to-day creating so much discussion or receiving so much thoughtful attention from the farmers of Ontario as that of ensilage. And it deserves more attention than has yet been given to it. A lingering prejudice still exists in the minds of a few farmers against the construction and use of silos. That feeling, which is unworthy to be called a judgment, had its origin in the partial failures of some of the first efforts to introduce the ensilage system of preserving fodders into this country. But as the causes of such failures, (or, at the best, only partial successes), have been discovered and can be always guarded against, remedied or removed, satisfactory results may now be relied on with certainty.

In the handling of any perishable commodity, hap-hazard treatment will give hap-hazard results. Occasionally no loss may be sustained, but generally the damage and

loss will be proportionate to the absence of applied knowledge and skill. A clear knowledge of "how to do it" and "the doing of it" just that way will enable farmers as well as other men to successfully cope with the things most difficult to do well. The simplest and easiest jobs need similar preparatory equipment and performing ability in the men who undertake them. The curing of a crop of fodder corn in a silo is now an easy and invariably satisfactory task to the farmer who follows right directions with reasonable prudence.

Let me make clear the use of the new names. A *silo* (from the French) is simply an air-tight building, box, tank, compartment, trench or pit into which fodders in a succulent state are put for preservation and curing. *Silage*, or as it is sometimes written *ensilage*, is the feeding substance after it has been so preserved and cured. Hence there are corn silage, clover silage, oats and pease silage, etc.

Former Results.—It used to be stated that there was a loss on the feeding value of fodders when put into and taken from a silo. When the silage was partially rotten, of course that was the case, but a similar depreciation of quality and consequent loss in feeding value would result if hay, grain or straw were allowed to become rotten in the mows or granary. The rotting was and always is resultant from unsuitable conditions. These the silo is intended to guard against and remove. Then came the period when scientific (?) men and others loudly advertised the presumption of those who stated that they found the feeding value of the fodder increased by the heating in a silo. However, the cows agreed with the statement, and in estimating the feeding value of a fodder the verdict of the animal that consumes it is always worth more than the opinion of the analyst. "You cannot take anything out of a silo you did not put into it," was the bravado used as a silencer. But the fact still contradicts the assertion. Would a dairyman pay any heed to "a book scientist" who told him with scholarly dignity and unbecoming contempt for facts that he could not take anything out of his cheese curing room which he did not put into it? He knows he puts in green, uncured cheese, almost wholly indigestible, and that he takes out cured cheese almost wholly digestible. In the same way, to some extent, cured silage has a higher feeding value than the dried fodder.

Growing the Crop.—The manner in which the crop is grown has very important influence on the possibility of its advantageous curing. In Ontario the corn crop is the most suitable for ensilage uses. It should be grown to near maturity. Thereby the several plants will contain the largest amount of nourishment, and will also be capable of long preservation without loss. The feeding value per acre is also highest when the crop is almost mature when cut. The conditions requisite for securing that degree of growth in the corn plants in our province are: (1) early planting, (2) thin seeding, (3) frequent cultivation.

(1) *Planting.*—The land for a corn crop should be drained, either naturally or by artificial underdrainage. It should be worked into a fine seed-bed. To attain that I recommend for most Ontario soils deep fall plowing, and only surface cultivation in the spring. Early planting should be shallow, that the sun may warm the seed-bed and seed and so prevent rotting. A liberal quantity of barnyard manure worked into the soil will be profitably applied. Phosphate fertilisers are said to be valuable.

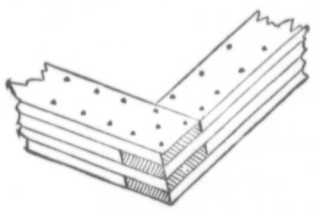
(2) *Seed.*—The crop should be grown in rows. If the land be very weedy it can perhaps be cleaned more economically by planting in hills. The largest variety of corn that will grow to near maturity in the locality is the sort that should be used. Three seeds to the hill three feet apart both ways will be enough. The rows should be from 3 ft. to 3 ft. 6 in. apart. The seed should be put in not thicker than one grain every six inches in each row. A common force-feed seed drill may be used, all the spouts except two or three being stopped up.

(3) *Cultivation.*—Level cultivation is preferable to "hilling up" or "moulding up." As soon as the corn appears two inches above ground it should be harrowed over with light harrows. That treatment will keep down any growth of grass and destroy tender weeds. The harrowing should be repeated twice before the corn is six inches high. Frequent cultivation between the rows or hills afterwards will keep down weeds and promote growth. The cultivation should be continued, but after the corn grows to be two

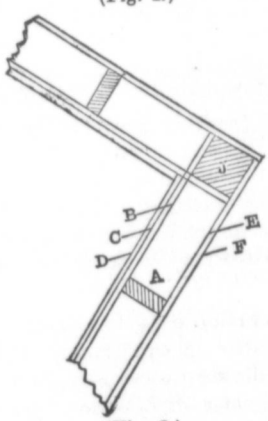
feet high it should be shallower. That may be kept up until the stalks are higher than the man and the horse. When the lower leaves begin to turn yellow and the ears of corn are in the milky stage, and quite fit for boiling for table use, the crop should be cut.

Theory of Curing.—It is possible to cure silage to advantage, and in such a way that it may be preserved indefinitely, mainly because the cells of plants continue to live after the stalks are severed from the roots. It is the function of plants while growing to deoxidise carbon and accumulate the energy of the sun for the future service of lower animals and man. It is the function of animals to oxidise and so expend the energy previously stored in the plants and which the animals have appropriated in the form of food. The cells of plants in the stalks, leaves and grain, after these parts are separated from the root or whole plant which bore them, simulate the action of living animals so far that they begin to absorb oxygen and evolve carbonic acid. In this manner is heat generated. And if these cells be robust from sufficient maturity, the temperature will be considerably increased. Robust cells from plants almost mature are also much less liable to become the prey of minute bacteria. They are able to resist their attacks. If confined in bulk in the presence of ordinary atmospheric air, they will raise the temperature to a point between 125° and 150° Fahr. When the temperature is maintained anywhere between these points for some days the life of the cells is destroyed, as are also the spores of mould, etc., which will have been deposited from the air on the plants or parts of the plants These spores are practically everywhere disseminated. Hence in building and filling a silo the observation of a few simple requirements are indespensible to success.

Building a Silo.—If a silo be erected as a separate structure, its foundation had better be a low stone or concrete wall. A clay floor raised above the outside level to prevent dampness will be cheapest and best. A sill of planks may be bedded on the top of the foundation wall. A common balloon frame may be erected by using as studs 16 ft. or 18 ft. planks, 2 in. x 10., or 2 in. x 12 in., placed 2 or 2½ feet apart. To secure them safely at the bottom against lateral pressure while the silo is being filled, they should be mortised and toe nailed, or cut so that the heels will extend down in front of the sills as shown in Fig. 2. To give additional security, the planks for the sills may be cross-lapped at the corners as shown in Fig. 1.



(Fig. 1.)

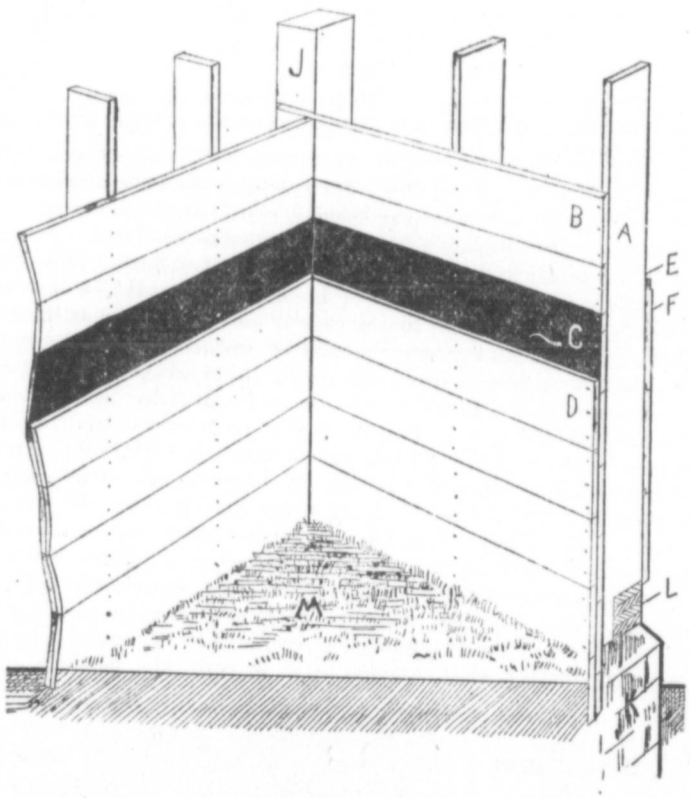


(Fig. 2.)

(A) Studs. (B) Inch lumber. (C) Tar paper. (D) Matched or planed lumber. (E) Tar paper. (F) Outside siding. (J) Post.

The roof will give additional strength to the sides for resistance to outward pressure if it be made after the truss pattern. Instead of ties or joints running straight across from the tops of the studs or the plates, where they would be in the way during the filling, they should extend like false rafters from the top of each stud to the rafter opposite, being spiked to it at about one-third of its length from the ridge. On the inside of the studs should be first nailed a lining of inch lumber running horizontally. It should be so put on as to make lock-joints at each corner, as shown in Fig. 2.

A covering of tar paper, with the edges lapped four inches, should then be tacked on. Over that should be put inch lumber running horizontally, planed on the exposed side and all the better for being tongued and grooved. That will make a practically air-tight building. To make it also frost proof, the outside of the studs may be covered in a similar way. A single thickness of lumber can be made to do, but the double boarding, with paper between, is preferable, since the tar paper is thus kept close against the outside boards.

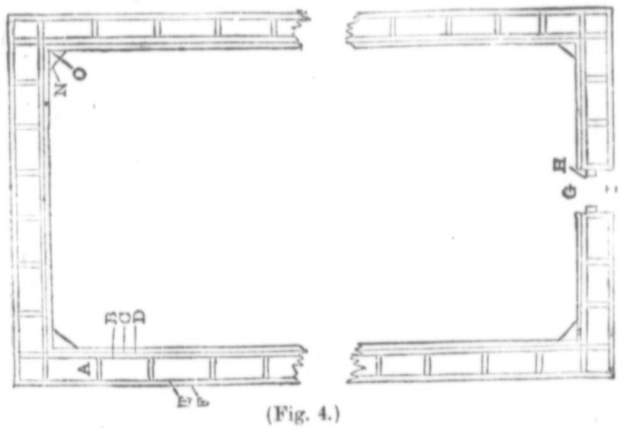


(Fig. 3.)

(A) Studs. (B) Inch lumber. (C) Tar paper. (D) Matched or planed lumber. (E) Tar paper. (F) Outside siding. (J) Post. (K) Stone foundation. (L) Sill. (M) Clay floor covered with cut straw.

The door should be of the ice-house style. A space between two studs may be left unboarded, or may be sawn out flush with their sides. Cleats may then be nailed on and the short boards fitted in. Care should be taken to so place strips of tar paper that they will make the joints at both sides of the door air-tight. A 10 or 12 inch board should be fastened into each corner to extend from the bottom to the top, and the space behind should be filled with sawdust. To preserve the inside lumber it should receive a

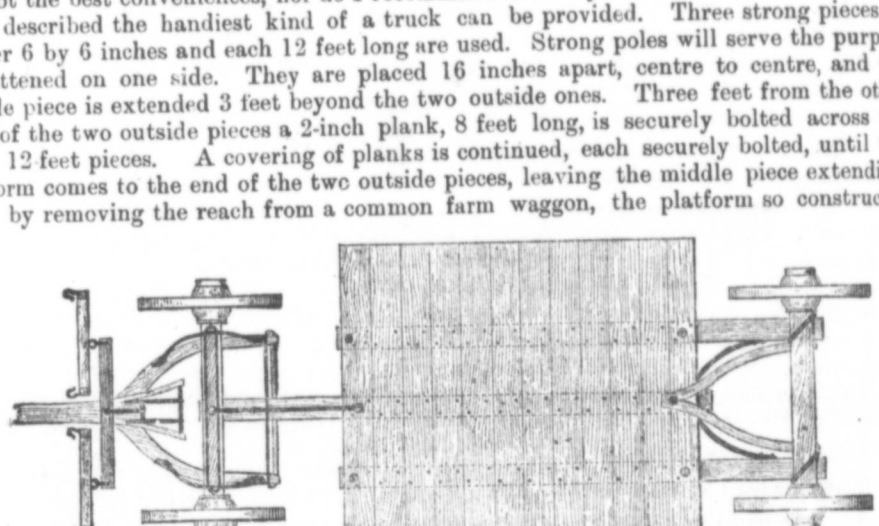
coating of coal tar, mixed with a few ounces of rosin, applied hot and liberally. Where a mow of a barn or part of some other building is to be fitted up for silage uses, the inside finish of the silo should be the same as for a separate structure.



(Fig. 4.)

(A) Studs. (B) Inch lumber. (C) Tar paper. (D) Matched or planed lumber. (E) Tar paper. (F) Outside siding. (G) Door. (H) Cleats. (I) Outside door on hinges, and in two or three pieces. (N) Corner board. (O) Sawdust.

Filling the Silo.—For economical filling the tools, implements and conveniences should as far as possible, be adapted to the cheap and easy performance of the work. That implies the making the best use of the machinery already owned on the farm. For the cutting of the corn in the field I prefer and recommend a common corn knife, or an old-fashioned sickle. A strong reaper may do the work by horse power, but if the crop be heavy and the corn from ten to twelve feet high the rakes will not clean the board, and stalks will be dragged behind. For a hauling convenience an ordinary waggon may be made to serve by putting the wheels from a front axle on the hind axle. A truck or a waggon with low wheels and a large flat platform may be used. In either of these cases, by trailing a gangway behind the persons loading the fodder may carry it up in armfuls. These are not the best conveniences, nor do I recommend that way of loading. In the way now to be described the handiest kind of a truck can be provided. Three strong pieces of timber 6 by 6 inches and each 12 feet long are used. Strong poles will serve the purpose if flattened on one side. They are placed 16 inches apart, centre to centre, and the middle piece is extended 3 feet beyond the two outside ones. Three feet from the other ends of the two outside pieces a 2-inch plank, 8 feet long, is securely bolted across the three 12 feet pieces. A covering of planks is continued, each securely bolted, until the platform comes to the end of the two outside pieces, leaving the middle piece extending. Then by removing the reach from a common farm waggon, the platform so constructed



(Fig. 5.)

can be attached to the under side of the axles. The middle piece will serve the double purpose of a reach and front support. It can best be attached to the front axle by a long king-bolt passing down through it. A large flat washer and a screw nut with a key under it will make a strong, suitable and safe connection. A brace passing back from the top of the king-bolt to the front plank of the platform, will improve the attachment. The two pieces extending beyond the platform at the other end are to be attached to the hind axle on the under side. Two clamps passing over the axle with a bar and nuts beneath the six by six pieces will fasten them securely to the under side. The "hounds" can be used as a brace by attaching the end of it to the middle piece through the hinder plank of the platform. A rough sketch accompanies this to make my description more easily and clearly understood.

The stalks may be filled into the silo without cutting, but more labor is involved and the work of emptying for feeding is rendered doubly difficult. Any strong cutter, with capacity for a large quantity per day, will serve the purpose. Carriers should be attached unless the cutter stands on a level with the top of the silo, which ordinarily is neither practicable nor desirable. Horse power or engine may be used. Everything in the way of machinery equipment being ready, the filling may be commenced. From six inches to a foot of cut or uncut straw should be placed evenly over the bottom of the silo. Every farmer with a large crop should provide two of the carrying platforms already described. If the corn field be near the silo, one team will do the hauling. The stalks can be loaded most economically direct from the roof. If the crop be as ripe as it should be, wilting will be unnecessary. The person cutting the corn might as well throw it on the low platform as on the ground, and thus avoid the double handling. The teamster might at the same time be loading on the same platform the corn which will have been cut and laid in armfuls on the ground during his absence from the field with the previous load. At the silo the corn can be fed into the cutter from the waggon platform. The horses may be changed from the loaded to the empty waggon. At the cutting box two men will be required. A 2-inch cut is as good as an inch and a half, and both are better than one inch or less. During the filling, care should be taken to occasionally level the heavier parts of the stalks out against the sides of the silo. The filling may proceed every day, every second day or every third day as may be found convenient. In either case the contents should be tramped around the sides and in the corners just before the addition of a new layer. When the silo is full, after the lapse of two days the sides and corners should be again thoroughly tramped, and afterwards covered with a layer from two to three feet thick of any kind of straw, cut or uncut. It should be laid on close, and for that reason cut stray is rather preferable. It should also be closely tucked around the sides and into the corners. The silage may be thus left to cure and to keep until wanted, be that time four weeks or ten months.

Size and Cost of Silos.—A silo 10 feet wide by 50 feet long by 16 feet deep, inside measurement, will hold about 125 tons of settled corn silage. That is a desirable and convenient shape and should not have any partitions. Every 100-acre farm should have one of at least of that capacity. From the foregoing data the probable cost may be easily calculated. Where lumber is cheap and the farmer does most of the teaming work, the necessary cash outlay need not exceed $1 per ton of capacity. It will vary according to the finish of the building, the quality of lumber used, the price of material, etc. Tar paper can be purchased and put on at an expense of from 2½ to 3 cents per square yard. Fifteen tons of silage per acre may safely be reckoned on. Every two tons of well cured corn silage has a feeding value equal to one ton of ordinary hay for the production of milk or the maintenance of cattle, horses and sheep; and 100 tons of silage can be grown and cured at a total cost for rent, seed, labor, ect., not exceeding $150.

Summary. To sum up the whole matter—

1. It seems to be essential that the silo be air-tight.

2. The crop to be ensiled must be grown to a stage when the several plants will be almost mature.

3. The crop to be ensiled should be put in loosely at first, to permit of quick and sufficient heating ; only the sides and corners should be tramped.

4. The filling may proceed every day, every second day or every third day with equally satisfactory results.

5. The silage may be covered with cut straw to a depth of two feet ; or it may be left uncovered altogether at the expense of wasting only the top six inches or less.

Conditions and Results.—In the following four sets of conditions and results, I have tried to put the whole theory. By "life" I mean life as in the cells or life in the spores, which would be destroyed by a temperature above 125° Fahr. If air finds admission through a knot-hole or crack or, down the sides from neglect of tramping, it will carry spores with it and so introduce new life.

Silo Conditions.	*Results.*
A. Life in the cells in the presence of air.	Oxidation generating heat.
B. Life in the spores in the presence of air.	Mould.
C. Life in the cells with no air.	Fermentation.
D. No life in cells or spores with no air.	Preservation.

Growing a Corn Crop for the Silo.

The field set apart for growing corn was one of twenty acres of area ; its soil was a clay loam, apparently nearly uniform in quality on the surface ; the land lay almost level; the inclination towards the north-east was not sufficient to call for more than passing mention. The intention was entertained to clean the field from thistles and to provide a crop for the filling of the silos. The land was plowed in the fall, one-half only of the field received a dressing of manure, which had been hauled out during the winter. Part of it was plowed under in the spring and part was cultivated on the top by the use of the disc harrow and spring-tooth harrow. There was no apparent difference in the crop from these two different treatments of the manure.

Each variety of corn was planted across the field, running across both the part that was not manured and the part that was manured. There was a marked difference between the two sides of the field, in the appearance of each variety, during the whole period of the growth of the crop.

A force-feed seed drill was used to do most of the planting. It was found to be in every way as serviceable as the corn planter. The rate of seeding was gauged by driving the seed-drill for a distance of 100 feet on the bare lane; the number of grains that dropped from each spout, that was allowed to run, were then counted ; the gauge was varied until only the number desired would pass through within 100 feet. When 150 grains of the large ensilage varieties were dropped per 100 feet in each row, from 15 to 18 lb. of seed were required per acre, with the rows three feet apart. The drill was set to plant as shallow as possible ; the seeds were put in at an average depth of two-and-a half inches.

As the crop on the part of the field that was not manured, came up and continued to grow, it was seen that it was altogether too irregular to afford any useful data, for comparison with the yield of the same varieties on the manured land, or for comparison between the yield of the different varieties on the unmanured land. Within a few feet of each other in the same row, the height and weight of the plants would vary as three is to one, on the part of the field where no manure had been put; there was a generally uniform height, during all stages of the growth in the plants in the same row, on the part where manure had been applied. For that reason mainly, no weighings or analyses were made of the corn from the parts of the rows where no manure had been put.

The following may be mentioned as OBSERVED DIFFERENCES RESULTING FROM THE APPLICATION OF BARNYARD MANURE:

(1) The corn on the manured half of the field was on the average from 2½ to 3 feet taller than on the other half when both were cut in September.

(2) It tasselled out from a week to ten days earlier.

(3) The varieties which carried an average of ten ears or nubbins to every ten stalks on the manured part of the field, bore an average of only three small nubbins per ten stalks on the unmanured land.

Over a large portion of the field either "sulphate of ammonia" or "superphosphate" was applied with the seed in every second row of corn, across both the manured and unmanured parts. The use of these commercial fertilisers produced no observable effect on the rapidity of the growth or the weight or quality of the crop. The absence of noticeable results from the application of concentrated fertilisers may have been due to conditions of soil or season which eluded observation.

After the corn-planting was commenced the weather was exceptionally unfavorable. On the morning of 23rd May, a light frost hurt slightly the plots that were up; and on the morning of 29th May, the frost was so severe as to cut back to the ground all the corn plants that were above it. These frosts were followed by heavy rainfalls, which left the field too wet to permit the planting to be resumed before June 11th. After the planting was finished, frequent and heavy rains came and almost entirely prevented cultivation or hoeing. Until the first week of July, the corn had a very poor chance to grow, while the weeds had to be left in undisturbed possession of the field. That state of matters very much increased the labor required to clean the field afterwards. The following was the method of cultivation: (1) light harrows were used after the corn was about four or five inches high; (2) as the long-continued rains had caused the soil to become very hard, a two-horse cultivator, that stirred the ground on both sides of one row at a time, was improvised to loosen it to a depth of three or four inches; (3) shallow cultivation with a one-horse scuffler was then continued; (4) hand-hoeing between the plants in the rows was done twice, and in places oftener, to complete the task of exterminating the thistles.

Although it has been practically decided by the judgment of those who have had the longest and most successful experience, that corn for ensilage should be grown in hills or rows, it was considered desirable to plant some at different rates of seed per acre, to gain further information on the comparative quantities and values of the yield per acre. Some useful knowledge may also be gleaned by a comparison of the yields from the same variety when planted at different dates. The unusually cold and wet weather, which prevailed until the end of June, hindered the early-planted corn from having the advantage which ordinarily would accrue to it from the longer period of growth.

I have gathered the most of the information gained from these comparisons and examinations into a number of tables.

Table I shows the quantity of seed per acre, the mode and time of planting, the date of the various stages of growth, and the yield in green weight of the several varieties tested.

Varieties.	Field lot.	Mode of planting.—Rows apart.	Seed per acre.	Date of— Planting.	Tasselling.	Silking.	Blossoming.	Out of bloom.	No. of ears per 10 stalks.	Yield per acre in green weight.
			lb.							lb.
Mammoth Southern Sweet.	1a & b	3 ft.	15	May. 7	Aug.26	Aug.30	Aug.30	Sep. 7	7	.....
	1c	"	28	"	.....	.....	.....	.....	.....	.....
	2c	"	18	22	22	29	29	7	6	22,045
Red Cob Ensilage ...	2d	"	18	"	"	"	"	.....	10	25,389
	3	"	28½	8	21	"	"	7	5	29,356
	4	"	15	"	"	27	27	.....	4	31,233
Mammoth S. S.	5	7 in.	196	"	20	28	28	7	0	44,719
Red Cob Ensilage	6	"	152	22	22	"	"	...	0	44,126
Giant Prolific S.	7	3 ft.	15	June 11	"	29	29	7	7	34,043
	8	"	15	May 8	21	26	26	"	8	31,929
Ensilage...	9	"	28	"	"	27	27	"	7	29,910
	10	7 in.	165	"	"	"	28	"	0	41,582
Pearce's Prolific	11	"	180	"	2	5	8	22	.....	27,228
Sibley's Pride of the North....	12	3 ft.	18	June 18	21	25	25	7	5	29,701
Pearce's Prolific	13	"	20	13	8	19	21	.....	10	32,828
Red Cob Ensilage	14b	"	56	May 22	24	27	27	7	6	42,932
	14c	"	31	"	"	"	"	7	5	37,710
	15b	"	28	June 11	28	Sep. 5	Sep. 5	.....	0	28,726
	15c	"	15	"	"	"	"	.....	7	23,642
Giant Prolific S, ...	16b	"	30	"	26	Aug.30	Aug.30	.....	7	34,158
Ensilage..	16c	"	16	"	"	"	"	.....	9	24,757

NOTE.—Lots 1a, b and c badly injured by frost May 29; lots 5, 6, 10 and 11 were virtually broadcast and not cultivated.

TABLE II.—Showing average result of analyses of Corn in Table I.

—	Per cent. of water.	Per cent. of crude protein.	Per cent. of soluble carbo-hydrates.	Per cent. of crude fibre.	Per cent. of fat (ether extract.)	Per cent. of ash.
Corn in rows 3 ft. apart.....	80.421	1.391	11.841	5.331	.425	.591
Corn in rows 7 inches apart....	74.768	1.038	16.040	6.854	.507	.793

The low per cent. of water in the "corn in rows 7 inches apart" (broadcast), is doubtless due to the fact that the stalks had become somewhat withered and dry at the lower end before they were cut.

The weights per acre were calculated from weighing of 250 ft. of the crop, from two rows of each lot planted 3 ft. apart; a larger area of the broadcast corn was weighed.

Table III shows the results of the analyses of the ears (husk, grain and cob), stalks and leaves separately, from 160 corn plants, which were 10 average plants taken

from each lot grown in rows 3 feet apart, and reported on in Table I. The plants were cut on September 18th and cured in bundles in the field for 10 days, after which they were put in a dry loft in the barn until the middle of November, when they were weighed and sampled for analyses. The green weight was 300.75 lb. and the cured weight was 169.18 lb. which was made up of

103 ears (husk, grain and cob)	32.40 lb.
160 stalks	102.30 "
Leaves	34.48 "
Total	169.18 lb.

Division of Plants.	Per cent. of water.	Per cent. of crude protein.	Per cent. of soluble carbo-hydrates.	Per cent. of crude fibre.	Per cent. of fat (ether extract.)	Per cent. of ash.
Ears (husk, grain and cob)	80.82	1.63	13.98	2.97	.49	.11
Stalks	72.87	1.25	16.69	8.35	.58	.26
Leaves	28.14	6.87	40.37	18.82	1.52	4.28

Table IV shows the results of the analyses of the leaves and stalks separately, from 10 stalks from each of the lots of broadcast corn reported on in table I.

Division of Plants.	Per cent. of water.	Per cent. of crude protein.	Per cent. of soluble carbo-hydrates.	Per cent. of crude fibre.	Per cent. of fat (ether extract.)	Per cent. of ash.
Stalks	65.49	.97	23.66	8.86	.65	.37
Leaves	26.15	4.48	42.08	21.85	1.65	3.79

Table V shows *the per cent. of the total quantity* of dry matter in the plant, which were found in the ears (husk, grain and cob), stalks and leaves respectively.

Division of Plants	Crude protein.	Soluble carbo-hydrates.	Crude fibre.	Fat (ether extract.)	Ash.
Ears (husks, grain and cob)	12.6	12.7	6.1	12.4	2
Stalks	30.6	48.	53.3	46.5	15.
Leaves	56.8	39.3	40.6	41.1	83.

It will be seen, in the case of these 160 corn plants, representative of the bulk of the crop on the whole field, and none of which had reached maturity, that *over 42 per cent. of the total dry matter and over 56 per cent. of the total crude protein* was contained in the leaves.

Table VI shows the results from growing different varieties of corn side by side—two rows of each—to discover the comparative degrees of maturity attained in 100 days' growth, and also for comparison of the yields per acre. All the varieties were planted in rows 3 feet apart, and the rate of seeding was as nearly as possible one grain every six inches in the row. The stages of growth were termed,—"Tasselling," "Silking," "Blossoming," "Out of Bloom," "Early Milk," "Late Milk." The weight per acre was calculated from the actual weighing of the crop of 250 feet of two rows of each variety. The dates of planting were from June 12th to June 13th and of cutting from September 20th to September 23rd.

Name of Variety.	Class.	Green weight per acre in lbs.	Stage of growth reached.
Sheep Tooth	White Dent	41,220	Silking.
Hickory King	do	40,530	do
Wisconsin White Flint	White Flint	37,468	Early milk.
Egyptian Sweet	White Dent	37,300	Blossoming.
Wisconsin Yellow Dent	Yellow Dent	37,149	Early milk.
South Western	White Dent	37,140	Blossoming.
Cranberry White Dent	do	36,508	Early milk.
Brazilian Flour	White Flint	35,583	Tasselling.
Sibley's Pride of the North	Yellow Dent	34,530	Early Milk.
Edmunds Prim Dent	do	34,481	do
Mammoth Southern Sweet	White Dent	33,870	Silking.
Parrish White Dent	do	33,666	do
Horse Tooth	Yellow Dent	33,379	Blossoming.
Wisconsin White Dent	White Dent	33,205	Early milk.
Angel of Midnight	Yellow Flint	33,150	do
Pearce's Prolific	do	32,828	Late milk.
Compton's Early	do	32,490	Early milk.
King Philip Flint	Reddish Flint	31,987	Late milk.
Early White Flint	White Flint	31,560	Early milk.
Pride of the North No. 23	Yellow Dent	31,494	Late milk.
Longfellow	Yellow Flint	31,320	do
Red Cob Ensilage	White Dent	30,900	Silking.
Asylum Sweet	Sweet	30,810	Early milk.
Golden Dewdrop	Yellow Flint	30,585	do
Calico Dent	Striped Dent	30,508	Out of bloom.
White Flint	White Flint	30,343	Early milk.
Longfellow	Yellow Flint	29,754	do
North Star Yellow Dent No. 21	Yellow Dent	29,522	do
Woodworth's Yellow Dent	do	29,087	do
Horse Tooth	do	29,070	do
Leaming Dent No. 9	do	28,333	do
Canada Yellow	Yellow Flint	28,170	do
Longfellow Flint	do	27,656	do
Early Adams	White Dent	27,347	Late milk.
Golden Dewdrop	Yellow Flint	27,135	Early milk.
Hickox	White Dent	26,280	Out of bloom.
Evergreen Sweet	do	26,115	Silking.
Self-Husking	Reddish Flint	25,260	Late milk.
White Western	White Dent	25,230	Blossoming.
Giant Prolific Sweet Ensilage	do	25,230	Silking.
Tuscarora	White Flint	23,954	Early milk.
100 Day Corn	Yellow Flint	23,775	do
Chester County Mammoth	Yellow Dent	22,823	do
Sweet Fodder	Sweet	22,395	do
Crosby	White Dent	21,375	Late milk.
Old Colony	do	19,285	Early milk.

Table VII shows the analyses of average corn stalks, taken from the several varieties in Table VI; they were cured from September 18th for 10 days in the field, and remained in the barn loft afterwards until November 14th, when they were again weighed

and sampled for analyses; they were divided into three classes, according to the height of the plants, the separate analyses of which will be found under the heads—"large," "medium," "small."

Division of plant.	Analyses.	Reached "Silking Stage."			Reached "Out of bloom" and "early milk stage."		
		Large.	Medium.	Small.	Large.	Medium.	Small.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
Ears ...	Water	78.90	78.68	72.25	75.01	66.23	67.58
	Crude protein	17.96	18.92	23.77	2.03	2.79	2.53
	Soluble carbohydrates				18.25	25.17	24.08
	Crude fibre	2.27	1.70	2.77	3.75	4.39	4.41
	Fat (ether extract)	0.70	0.53	0.99	0.77	1.13	1.14
	Ash	0.17	0.17	0.22	0.19	0.29	0.26
Stalks..	Water	71.65	69.32	73.90	75.86	70.71	73.38
	Crude protein	18.70	21.11	18.03	1.19	1.28	1.79
	Soluable carbohydrates				15.11	20.40	16.42
	Crude fibre	8.43	7.92	7.13	6.98	6.32	7.46
	Fat (ether extract)	0.93	1.30	0.62	0.61	0.95	0.57
	Ash	0.29	0.35	0.32	0.25	0.34	0.38
Leaves .	Water	32.34	33.03	25.73	26.17	31.53	33.02
	Crude protein	46.07	44.27	46.67	7.38	5.60	5.53
	Soluble carbohydrates				41.44	38.87	37.18
	Crude fibre	16.07	18.01	21.32	18.65	18.49	18.78
	Fat (ether extract)	1.92	1.49	1.89	1.81	1.66	1.75
	Ash	3·60	3.20	4.29	4.55	3.85	3.74

Table VIII shows the composition of these corn stalks in the green state, as calculated from the analyses recorded in Table VII.

Water	81.006	per cent.
Crude protein	1.370	"
Soluble carbohydrates	12.124	"
Crude fibre	4.395	"
Fat (ether extract)	0.530	"
Ash	0.575	"

Table IX shows the *per cent. of the total quantity* of dry matter in the plant, which were found in the ears (husk, grain and cob), stalks and leaves respectively, of the sample plants taken from the lots named in Table VI.

Division of Plants.	Crude protein.	Soluble carbohydrates.	Crude fibre.	Fat (ether extract).	Ash.
Ears (husk, grain and cob).....	25.6 p.c.	27.0 p.c.	13.4 p.c.	27.8 p.c.	6.2 p.c.
Stalks.....	24.1 "	35.2 "	36.8 "	33.9 "	13.4 "
Leaves.....	50.3 "	37.8 "	49.8 "	38.3 "	80.4 "

This table in the main agrees with the conclusions drawn from Table V, viz.: that nearly if not quite half the total dry matter, valuable for feeding purposes is found in the leaf of the corn plants, which have not passed the stage of growth termed "early or late milk."

Since a stage of growth near maturity is on all sides acknowledged to be advantageous for the preservation of the crop in a silo, the following varieties are named as the best adapted of any that we have tested, for growth in those districts where the corn-growing season does not exceed 100 days.

Pearce's Prolific, King Philip Flint, Pride of the North No. 23 and Longfellow.

Where a longer growing season or a favorable one may be depended upon, the following varieties have shown that they are worthy of commendation :

Wisconsin White Flint.	Angel of Midnight.
Wisconsin Yellow Dent	Golden Dew Drop.
Sibley's Pride of the North.	Canada Yellow.
Wisconsin White Dent.	Horse Tooth, and others.

In sections of the province where larger varieties of corn will mature—enough to carry ears to the glazing or roasting period—the following varieties may be expected to return larger yields than those already mentioned :

Mammoth Southern Sweet.	Sheep Tooth.
Red Cob Ensilage.	Hickory King.
Giant Prolific Sweet Ensilage.	Parish White Dent, and others.

Silo Construction.

Besides the silo, built in the new main-barn buildings, one was constructed in the corner of an old frame barn-all above ground, which was being remodelled for cows for the Experimental Dairy. The plan of its construction was made to differ in some particulars, from the directions given in the Bulletin XLII on Building a Silo. The finish on the inside of the studs was different on each of the four sides of the silo.

On one side of the silo, a lining of inch lumber dressed on one side, was nailed on the studs ; this was covered with a sheeting of tar-paper ; on the tar-paper was put a lining of inch lumber dressed on one side, tongued and grooved.

On another side of the silo, the construction on the inside of the studs was similar, with only the difference, that the inside lining of lumber was not tongued and grooved.

On the third side of the silo, the studs were lined on the inside with tar-paper ; on that was nailed horizontally, a sheeting of inch lumber tongued and grooved and dressed on the side next the inside of the silo.

On the fourth side of the silo, the finish on the inside of the studs was made by the use of only one thickness of inch lumber neither dressed nor tongued and grooved ; it was nailed on the studs horizontally.

The following concise statement may help to make the differences of inside finish, clear to the minds of the readers who have had no experience in silo building :

First side ; studs $2'' \times 10''$; inch lumber dressed on on one side ; tar-paper ; inch lumber dressed on one side, tongued and grooved.

Second side ; $2'' \times 10''$; inch lumber dressed on one side ; tar-paper ; inch lumber dressed on one side but *not* tongued and grooved.

Third side ; studs $2'' \times 10''$; tar-paper ; inch lumber dressed on one side and tongued and grooved.

Fourth side ; studs $2'' \times 10''$; inch lumber as it came from the saw.

The lumber on all the sides was put on horizontally. The purpose of the differences in the construction of the sides was to discover the cheapest way of building one that would preserve the silage.

I may here anticipate by reporting that up to the time of writing, with the exception of a short distance from the top of the silage there was practically no waste or spoiling against the *first*, *second* and *third* sides. Against the *fourth* side, the silage was decayed

er moulded for a space of from 4 to 6 inches in from the side, for the first six feet from the top of the silage; below that the waste was confined to a space of about 4 inches around the seam between each two boards.

No particular statement of the expense of the construction of this silo is here made, as it formed a part of the general remodelling of the barn. The expenses charged to remodelling the barn were also augmented by the remodelling of a stone root-house into an experimental piggery, and by making the necessary changes in the water supply, etc., to the creamery to fit it for winter butter-making in connection with the Experimental Dairy, etc., etc.

Sections of the inside of the silo were covered with a painting of coal-tar applied hot; other sections were painted with crude petroleum; other parts were left with the lumber on the inside bare. Since the two substances were applied with a view to the preservation of the lumber, nothing can be said yet, concerning their efficacy in that regard. However the parts, where the crude petroleum was applied, left the silage immediately adjacent to them in a more natural state and with a more agreeable odor, than did those parts that were covered with the painting of tar.

I have no changes to make in the recommendations of the Bulletin in the part on BUILDING A SILO, except to say that it is evidently unnecessary and without apparent advantage to have the lumber tongued and grooved.

FILLING THE SILO.

Two carrying platforms, almost similar in construction to the description in the Bulletin, were provided. They were found to answer the purpose admirably. The three main pieces of timber used as the carriers of the platform need not be heavier than 3″ x 6″ instead of 6″ x 6″ as previously recommended. The platform need not be constructed of planks heavier than 1½″ instead of 2″. In the Bulletin th statement is made,—"The stalks can be loaded most economically direct from the root. If the crop be as ripe as it should be, wilting will be unnecessary." Further experience has shown us that in the districts, having only a short season for the growth of corn, it is difficult to obtain a crop sufficiently ripe to obviate the need for wilting in the field. Part of the silo was filled direct from the root,—the plants were in the silo within an hour from the time when they were cut in the field; part of it was filled with corn that had been wilted for from one to three days. No analyses of the silage has been made as yet, but an examination of it reveals the fact that to the smell and taste, the silage from the wilted plants contains less acid and is better preserved. *Three conditions or treatments seem to be essential to the obtaining of the best quality of silage without waste from moulding or decay.*

1. The plants shoud be grown to a stage almost mature.
2. They should be wilted in the sunlight, until the water which they contain is less than 75 per cent of the total weight.
3. The silage around the sides and in the corners of the silo should be tramped and packed thoroughly while it is being filled.

COVERING THE SILAGE.

On the top of the corn silage, a layer of millet silage was put for preservation; on top of that a layer of rape silage was preserved for feeding to hogs as mentioned in another part of this report. The covering of the silage was a layer of straw about two feet deep. This is quite adequate when put on within two days after the last silage has been put in.

FEEDING THE SILAGE.

The silage from the silo at the dairy barn is being fed to milking cows. None of the tests or examinations into its feeding value are yet in a forward enough state to be reported upon here. When the silage is uncovered for feeding, unless the silo be frost proof above, it becomes chilled and is thus not in the best condition for offering to cattle. This may be guarded against by the putting of movable poles across the top of the silo and the placing of a layer of straw upon them.

Cost of the Crop.

I have not thought it best to introduce here a statement of the cost of raising the corn crop and putting it into the silos. The work on the whole was experimental, and involved more than twice the usual labor for planting, weighing, etc. It has been my humble opinion in all my work in connection with the college and experimental farm, that those in charge are always justified in causing a judicious expenditure of public money to obtain and disseminate information of value to the farmers, but not in growing corn or anything else for only direct profit or pay by the acre.

Correspondence on Corn and Silos.

The correspondence with farmers about the growth of Fodder Corn and the Building of a Silo has become increasingly larger. I copy here extracts from three out of the many grateful and appreciative letters received.

From Mr. Robert Murray, Avening P.O., Simcoe Co., Ont. . . . "Perhaps you "may remember me stating in a letter to you last spring, that I had planted two acres "of corn in the way you directed when here: I cultivated it the same way. Now that I "have got the crop cut and see what a large amount of first-class food I have, I wish to "thank you and to tell you that my expectations have been far more than realised. A "good deal of it was from 10 to 12 feet high. Wishing to know how many tons there "were to the acre, I measured off a piece and weighed the corn and the result was 27⅓ "tons. To be sure there was no mistake, I measured a second piece, which proved to be "a trifle more. I never had the like of it before. I am sorry I have no silo to put it in."

From Mr. John S. Read, Bayview P.O., Grey County, Ont. . . . "I write to "inform you about the silo you gave me some advice about. I sowed the corn June 18th, "which was a month too late; I could not sow sooner on account of wet weather, I "commenced cutting corn October 7th. I let it lie a couple of days to wilt, put it into "silo and left it 3½ days, then levelled it down and tramped the sides and corners well. "I did not put in more than 10 tons at a time. It heated from 120 degrees at 6 inches "to 135 degrees at 15 inches from the top of the heap. It got slightly cooler toward the "bottom. I covered with tar-paper and put a couple of feet of straw on top. I opened at "the end of six weeks; about 4 inches of top were bad, and four inches wide of the sides "were also bad for 2 feet down. Do you think it would be any improvement to put a "few inches of chaff under the tar paper? The stock are very fond of it and are doing "well. The silage is pretty sour, probably more than it would have been if the corn had "been more matured. The silo is built inside of barn; it is double boarded with rough "lumber with tar-paper between.

From Mr. W. M. Mills, Arden P.O., Frontenac Co., Ont. . . . "I write to "inform you of the complete success of my silo. We have been feeding it over a week "and my cows eat it greedily, so much so that they never appear to have enough of it. ". . . I did not commence with my corn until June, I then sowed broadcast about "six acres. I then planted in drills four acres. We next planted in hills up to June "12th eight acres, the latter on old June grass sod, dry upland, no manure. The most of "the first ten acres was well manured and a part not at all, but it made no difference. It "was all about as good as it could well be. The broadcast was as stout as possible. I lost "about half an acre by lodging and rotting; the drills were superb, the hills were grand. "Riding through it on horseback I could not reach the top with my hand in the most of "it, and it was neither cultivated nor hoed. . . ."

JAS. W. ROBERTSON.