THIRTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

EXPERIMENTAL FARM,

1887.

Printed by Order of the Legislative Assembly.

Toronto:
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1888.

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Executive Committee—John I. Hobson, John McMillan, M.P., and Edward Jeffs.

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1. James Mills, M.A., *President*.
English Literature and Political Economy.

2. William Brown, C.E., P.L.S.
Agriculture, Live Stock and Arboriculture.

3. C. C. James, B.A.
Inorganic, Organic, Agricultural and Analytical Chemistry.

4. J. Hoyes Panton, M.A., F.G.S.
Geology, Botany, Zoology, Meteorology and Horticulture.

5. F. C. Grenside, V.S.
Veterinary Anatomy, Pathology, Materia Medica and Obstetrics; Practical Handling and Judging of Horses.

6. J. W. Robertson.
Dairying.

7. E. L. Hunt, Fourth Year Undergraduate, University of Toronto.
Arithmetic, Mensuration, Mechanics, Levelling, Elementary Surveying and Book-keeping.

8. Captain Walter Clarke.
Instructor in Drill and Gymnastics.

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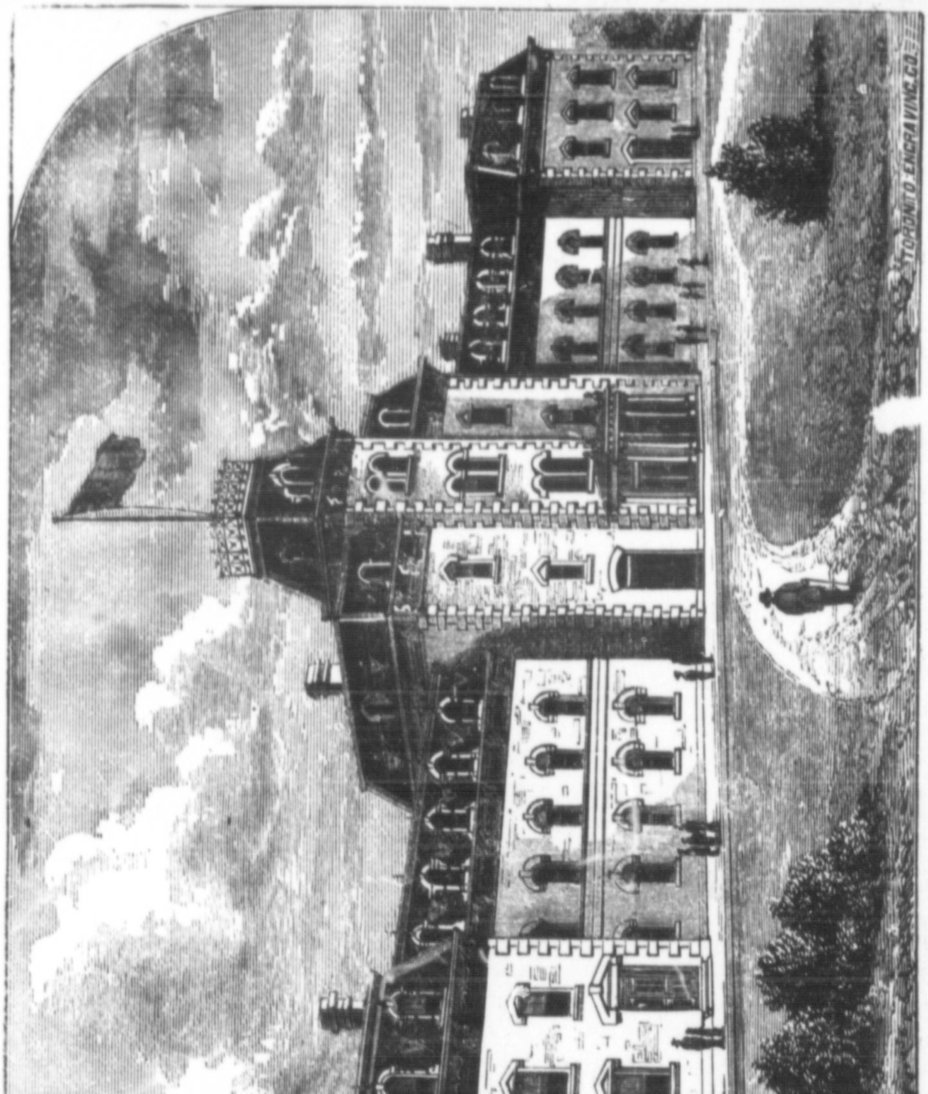

Ontario Agricultural College, Guelph, Ontario.

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To the Honorabl

DEAR SIR,—
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Ontario Agricultural College, Guelph, Ontario.

THIRTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM.

GUELPH, January 3, 1888.

To the Honorable A. M. ROSS,
Commissioner of Agriculture:

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

In this Report we have reviewed briefly the work of the year 1887, under seven heads, as follows:—

PART I.—THE REPORT OF THE PRESIDENT.

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

PART III.—THE REPORT OF THE PROFESSOR OF CHEMISTRY.

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

PART V.—THE REPORT OF THE PROFESSOR OF AGRICULTURE.

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

PART VII.—THE REPORT OF THE PHYSICIAN.

I have the honour to be, sir,

Your obedient Servant,

JAMES MILLS,
President.

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PART I

REPORT OF THE PRESIDENT.

Early in this century Thomas Robert Malthus, an eminent English political economist, endeavored to show the tendency of population to increase faster than the means of subsistence; and his reasoning caused some to fear lest the earth might, in the course of time, fail to produce enough to feed the hungry millions that would be found upon it. So far, the facts appear to be against this Malthusian theory. Population has rapidly increased; but the produce of the earth is relatively more and more abundant. Taking one part of the earth with another, there seems to be more bread, meat and other kinds of food than are really needed; and hence the low price of agricultural products everywhere.

DIFFICULTIES.

In this country, the price of farm produce is exceptionally low; and we have coupled with it the comparatively high price of manufactured articles. Generally speaking, we may say that what the farmer has to sell is cheap, and what he has to buy is dear. Therefore the agricultural atmosphere is disturbed. A feeling of unrest and dissatisfaction is abroad. The farmer finds it increasingly difficult to make a comfortable living; and something must be done to remove the difficulty, or the whole community will suffer.

Farmers often get credit for grumbling without any very well defined reason: but in this case the trouble is real and serious—so much so that no one can question its existence, and wise men will not minify its gravity. What shall we do? What can we do?

REMEDIES.

So far as we see just now, there are three remedies, and only three: (1) an increased yield of farm produce, (2) better markets, (3) a reduction in the cost of living.

First, *an increased yield of farm produce.*—This can be secured only by greater skill, the application of better methods, and closer attention to business. Those who would now succeed in farming must study the principles of agriculture, and learn the best methods, and give the same close attention to business as is given by successful merchants and manufacturers. Merely scraping the soil once over and sowing crops three or four, or perhaps ten days after the proper time, will no longer serve the purpose. Such a course can lead only to disappointment and financial ruin. There are many advanced farmers in this Province who plough, harrow and cultivate their land enough to keep it thoroughly clean; who understand the principles of stock-breeding and feeding; who take good care of all their manure; who do everything thoroughly and at the best time: but it is not so with the great majority. Very different language would describe the rank and file of Ontario farmers, not to speak of the worst in the list. Now, if the many could be induced to imitate the few first-class men who are engaged in this honourable profession, we should have good reason to expect a large increase in the annual yield of farm produce, without much addition to the capital and labour now expended on our farms.

Secondly, *better markets.*—The farmer requires a small amonnt of the produce of his farm for his own use; but all that he has over and above this amount is no benefit to him, unless there is a demand for it. Even a very limited demand for his surplus produce makes it of some use to him; but there must be a sufficient demand at a price which will cover the cost of production and pay a fair rate of interest on the capital invested, or continuance in the business will soon lead to bankruptcy. Hence Canadian farmers have imposed upon themselves heavy taxes for the building of railroads, in order to reach or create markets for their produce; but, after all, the demand for farm produce in the Dominion is limited and the prices are exceptionally low.

Now, in view to these facts, nothing can be clearer than that the farmers have reason on their side when they demand that no restriction on trade, which this Dominion has power to remove, shall be allowed to interfere with the price of grain, fruit, live stock, or dairy products in this country.

Not having studied the pros and cons of Commercial Union, we have nothing to say on that question, but simply lay it down as fundamental, that we should seek the best trade relations which we can possibly get, whether it be by negotiation with England, the United States, or any other country.

Ontario farmers, at least, seem to understand the situation and are waking up to the necessity of united action in a matter of so much importance. Let them get a clear understanding of what their interests under this head really are: then unitedly indicate their wish, and it must be granted. If, however, they allow interested men of any class to divide their ranks and play them off one against another, they will undoubtedly fail and bring upon themselves the well-deserved contempt of every other class.

Thirdly, *a reduction in the cost of living.*—This can be secured in two ways: by the practice of greater economy, and by cheapening the means of subsistence. As regards the former, I may say that I am not one of those who think that Canadian farmers are extravagant livers. As a rule they are extremely economical. For the most part, their houses are very plain and scantily furnished; they spend but little under the head of pleasure or recreation; they wear cheap clothing; and too often they sell the best and use the worst of their own produce. I think, therefore, that there is not much room for the practice of greater economy. There is no doubt, however, that a real reduction in the cost of living would be made by reducing the price of tea, sugar, boots, shoes, clothing, iron and other articles of daily consumption in the homes of rich and poor alike; but how to accomplish this object is a difficult question. Many interests are involved, and good men hold very different views as to what is best. Some would allow foreigners to trade freely in our markets, even while they exclude us from theirs; some want a revenue tariff; and others believe in high protective duties. The diversity of opinion is bewildering, and plain men are perplexed; nevertheless it is the duty of farmers, as representing the most important industry in the country, to consider the question in all its bearings and, having done so, to insist on such tariff laws and regulations as seem most likely to benefit the country as a whole.

COLLEGES IN HARD TIMES.

A large proportion of the college students in this Province come from the farm, and any serious reduction in the income of farmers is felt more or less in all our colleges, but especially in such an institution as the Ontario Agricultural College. Hard times affect the attendance at an arts college to some extent, but not nearly so much as at an agricultural college. This may seem strange, but it is nevertheless true, and the reason is this: When a farmer sends his son to an arts college, or a medical school, he generally expects him to get an education which, without anything else, will enable him to make his way in life. Hence he will struggle hard to get what is necessary to put that son through college. But with the son that is to remain on the farm it is quite different. The father may be willing and even anxious to give him a good and thoroughly practical education; but no matter what the education may be, it will not take the place of a farm. If the boy is going to make his living by farming, he must have land in addition to his education; and the father, being unable to provide both, decides to keep the boy at home and do what he can to get him some land. Thus the attendance at an agricultural college is directly and materially affected by hard times amongst farmers.

NUMBER OF STUDENTS.

Of purely agricultural students we have, I believe, as large an attendance as any other college on this continent, except, perhaps, two; but we must candidly admit that we have not so large a number as we should have. The attendance during the past year has not been what we could have wished. Seven Associates of the College returned for the third year, and we have a much larger class of second year students than we ever had before; but the number of new students who entered in October last is exceptionally small. On the whole, we have an excellent class of students, and I think most, if not all, of them are well satisfied with the College, otherwise we should not have so many back for the second and third years. But why have we not a larger number of new students? One reason is because I have admitted scarcely any from the old country during the year. Within the last nine months I have sent between fifteen and twenty English applicants for admission away to seek work with farmers, simply because I thought it was better both for them and for the college that they should learn some of the realities of farming before coming to us. But why have we not a larger number from Ontario? Is it because of the hard times? because farmers think it does not pay to educate boys for the farm? because we are not doing our work properly? or because the farmers have mistaken notions of what our work really is? I confess my inability to give a satisfactory answer.

CHANGES AND PROGRESS DURING THE YEAR.

For eight or nine years the members of the staff and some of the ex-students have been discussing more or less the advisability of adding a year to our course of study, and at length the pressure from students and ex-students became so strong that we decided to add a third year and grant the degree of B.S.A., Bachelor of Science in Agriculture.

Our course of study for an Associate Diploma is one of two years, and embraces agriculture, live stock, dairying, arboriculture, horticulture, veterinary science, chemistry, geology, botany, entomology, English literature, political economy, book-keeping and elementary mathematics. During these two years we lay most stress on agriculture, live stock, veterinary science and chemistry. Those who complete this course get a diploma admitting them to the status of associates; and those associates who rank high in the theory and practice of the first two years and take not less than sixty per cent. of the aggregate number of marks in English grammar, literature and composition may now remain for a third year and take the following course for the degree of B.S.A., (Bachelor of Science in Agriculture):—

THIRD YEAR.

Fixed Work

Chemistry.—A course of advanced lectures and reading on organic and agricultural chemistry, and an extended course in laboratory practice.

Natural History.—Microscopy—Physiology of plants and study of the fungi, with special reference to those which are most injurious to fruit and grain; the grasses and economic botany continued from the second year; practical work in greenhouse, garden and orchard. Further study of insects and experiments with insecticides.

Reading of works and reports to be prescribed by the Professor of Natural History.

Mechanical Drawing.—One hour per week.

English.—(1) Grammar (Whitney). (2) Composition and Rhetoric (Bain). (3) Outlines of English Literature (Lectures with Spalding and Craik). (4) Themes. (5) Critical reading of the following selections:—

Shakespeare—Richard II.

Bacon—Essays: Of Studies, Great Place, Boldness, Goodness and Goodness of Nature, Youth and Age, Discourse, Friendship.

Milton—Lycidas and Paradise Lost, Bk. I.

Pope—Essay on Criticism.
Addison—Spectator, Nos 23, 26, 47, 93, 115, 162, 225, 381, 387, 483, 583, 598.
Wordsworth—The Solitary Reaper; Intimations of Immortality; Resolution and Independence.
Macaulay—Essay on Lord Bacon.
DeQuincey—William Wordsworth.
Tennyson—Locksley Hall; In Memoriam, i.—xxvii.

Note.—In order to pass in this department it is necessary, above everything else, that the candidate know how to spell correctly and be able to write good English.

Options (5 hours per week).

1.—Agriculture and Live Stock.
2.—Dairying.
3.—Canadian Geology.
4.—Algebra or Euclid.
5.—Latin, (Principia Latina, part 1) with a view to learn the pronunciation of scientific terms and those Latin roots from which a large number of English words are derived.

The examinations on this work will all be conducted at the end of the year by outside examiners of recognized ability and experience, and none will receive degrees but those that are fairly passed and recommended by the examiners.

We have further arranged that in case an associate does not rank high enough in the work of the first two years to admit him to the third year classes, or does not care to spend the time necessary to complete the third year, but wishes to continue his studies in certain departments for a few months longer than the regular course permits, with the intention of preparing himself more fully for farm management, or for any particular work he may have in view, he may return to the college, on approval of the college staff, and spend a few months on any portion or portions of the work embraced in the curriculum.

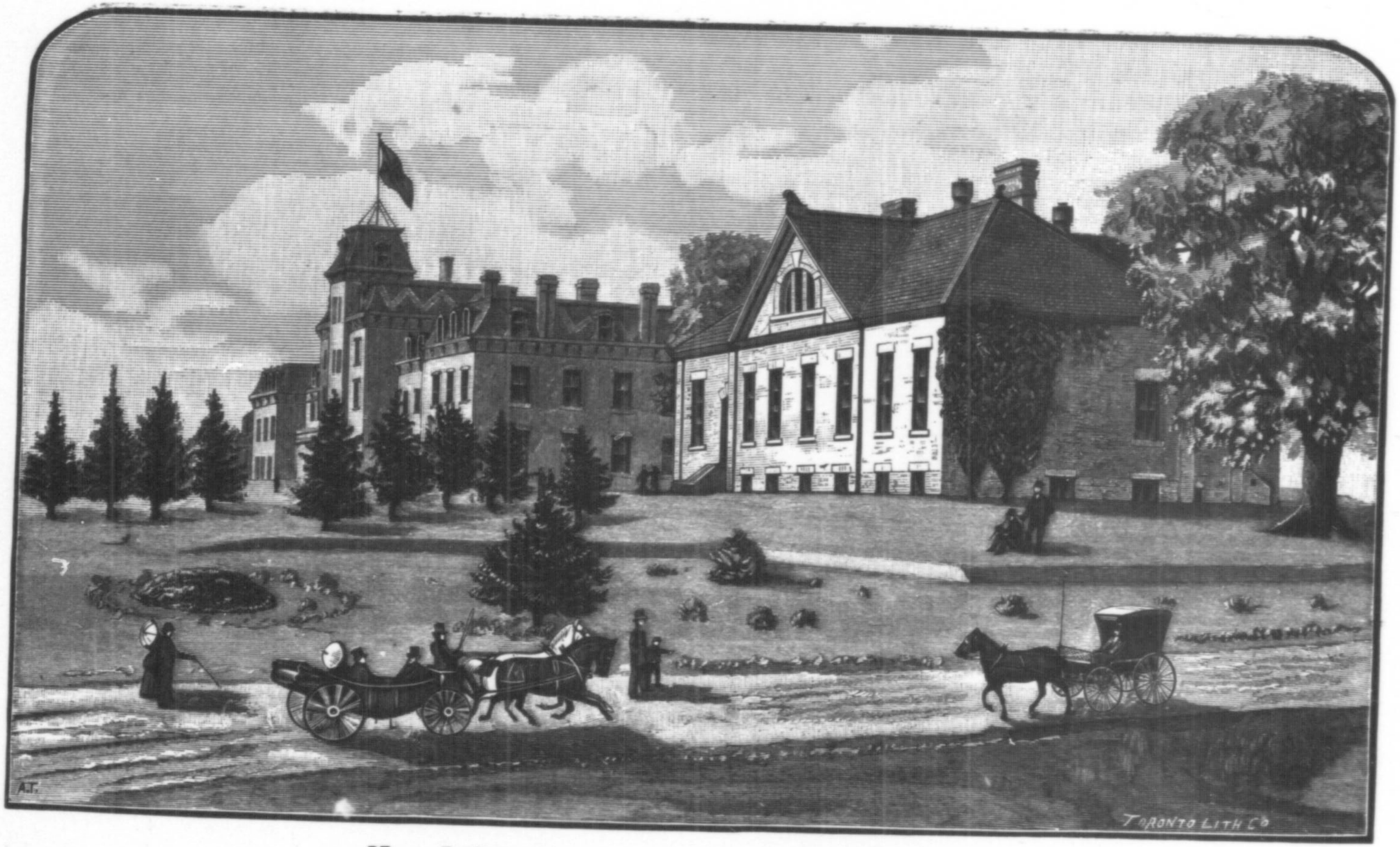
The terms for third-year men and associates doing special work are the same as for other students, except that they pay $5.00 a term for chemicals and are exempt from tuition fees.

New Laboratory.

At last, after many years of pleading and waiting, we are able to boast of a good chemical laboratory. The building is plain, but large and commodious, consisting of an office for the chemist, a private laboratory for special analytical work, a large lecture-room, a room 21 by 53 feet for qualitative and quantitative analysis by students, a room for the assistant chemist, and one for the balances—all furnished with hardwood cases, working tables, etc., and provided with the latest and best apparatus for work in every department of chemistry. The basement also is well suited for the manufacture of superphosphates and for experimental work in dairying. The building was erected by F. W. Swendiman, of Drayton, and is well heated by the Boulton hot water furnace. All considered, I think we may say that we have nearly everything that we need for the most extensive and thorough work in every department of chemistry. For this we are grateful.

Repairs and Alterations in College.

Extensive repairs and alterations have been made in the college during the past year. The outside woodwork and the greater part of the inside have been repainted; the room formerly occupied by the classes in chemistry has been converted into a beautiful reading room; the old reading-room and library have been altered so as to give us a large, new



New Laboratory, Agricultural College, Guelph.

Agricultural College, Guelph,

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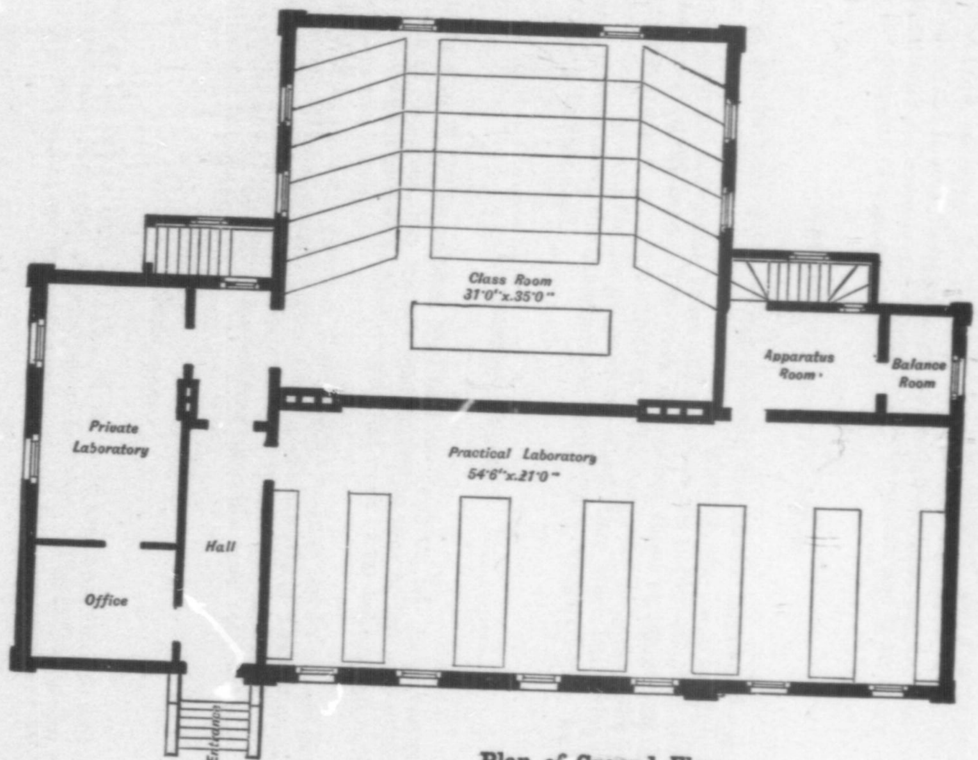
Agricultural College, Guelph,

NEW LABORATORY.

Scale: 6 ft. = 1 inch.



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Department of Public Works. Ont

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Fee, J. J........
Paterson, B. E........
Raynor, T........
Sharman, H. B........
Zavitz, C. A........
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Associates doing Speci

Calvert, S........
Lehmann, A........
Muir, J. B........
—3

library and a commodious botanical laboratory. The museum also has undergone great changes. The room set apart for the purpose has been re-floored, a gallery has been constructed all round it, and five additional windows have been put in. In consequence of these alterations, the room is more cheerful, looks better, and is in every way better adapted to the purposes of a museum.

Removal of Farm Buildings.

According to the plan of the college grounds, five of the farm buildings had to be moved some distance. These are the farm foreman's stable, the large building known as the implement shed, the old engine house and annex to the implement shed, the carpenter shop, and the experimental barn The work of moving these buildings was undertaken about two months ago and is now completed. The carpenter shop and the implement shed will continue to be used for the purposes for which they were built, the stable will be changed into a scale room, the experimental barn into a waggon house, and the old engine house into a lumber shed.

Changes in Staff.

Early in the year J. W. Robertson, Professor of Dairying, left us to engage in the produce business in Montreal; but we are glad to report that he has just returned and will henceforth devote his undivided attention to the work of the college and to the dairy interest throughout the Province.

Mr. P. J. Woods, our farm foreman, also resigned in June last to engage in farming on his own account. He has bought a good farm in the suburbs of Brampton, and hopes to do better than he could by remaining with us. Mr. Woods' successor is Mr. J. E. Story, of the County of Carleton. Mr. Story has entered upon his work with much zeal, and I have no doubt he will be successful.

Attendance.

The number on the roll in 1887 is 110; of these 78 are from Ontario and 32 from other places, as indicated in the list and analysis given below. Thirty-four of the counties of Ontario are represented, and the largest representation is from the County of Middlesex.

COLLEGE ROLL FOR 1887.

NAMES.	P. O. ADDRESSES.	COUNTIES, Etc.
Third Year Students.		
Craig, J. A.	Russell	Russell, Ont.
Creelman, G. C.	Collingwood P. O.	Grey, Ont.
Fee, J. J.	Toronto	Toronto, Ont.
Paterson, B. E.	Ottawa	Ottawa, Ont.
Raynor, T.	Rose Hall	Prince Edward, Ont.
Sharman, H. B	Stratford	Perth, Ont.
Zavitz, C. A.	Coldstream	Middlesex, Ont.
—7		
Associates doing Special Work.		
Calvert, S	Rochdale	England.
Lehmann, A.	Orillia	Simcoe, Ont.
Muir, J. B.	North Bruce	Bruce, Ont.
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COLLEGE ROLL.—*Continued.*

NAMES.	P. O. ADDRESSES.	COUNTIES, Etc.
Second Year Students.		
Acres, A. G	Ottawa	Ottawa, Ont.
Austin, A. M	Thornholm, Sunderland	England.
Bayne, S. R	Lee, Kent	England
Birdsall, W. G	Birdsall's	Peterborough, Ont.
Bishop, W. R	Brussels	Huron, Ont.
Budd, W	Delhi	Norfolk, Ont.
Brown, S. P	Whitby	Ontario, Ont.
Carpenter, W. S	Simcoe	Norfolk, Ont.
Dean, H. H	Harley	Brant, Ont.
De Mauritz, R. C	Belleville	Hastings, Ont.
*Donald, G. C	St. George	Brant, Ont.
*Donaldson, F. N	Tipperary	Ireland.
Elton, C. W. S	Pincher Creek	North-West Teoritory.
Elton, R. F	Pincher Creek	North-West Territory.
*Ewing, W	Mulmur	Dufferin, Ont.
*Gilbert, W. J	Shediac	New Brunswick.
*Hart, J. A	Berwick	Nova Scotia.
*Hart, J. W	Bridgetown	Nova Scotia.
*Harkness, A. D	Irene	Dundas, Ont.
Harcourt, G	St. Ann's	Lincoln, Ont.
Harrison, R. S. C	Stirton, Nottinghamshire	England.
Heacock, F. W	Kettleby	York, Ont.
Horrocks, T. J	Toronto	Toronto, Ont.
*Howes, J. S	Harriston	Wellington, Ont.
King, R. E	Decewsville	Haldimand, Ont.
Knowlton, S. M	Newboro'	Leeds, Ont.
*Leavens, D. H	Belleville	Hastings, Ont.
*Lick, E	Oshawa	Ontario, Ont.
*Livesey, E. M	London	England.
*McCallum, E. G	Martintown	Glengarry, Ont.
*Morgan, H. A	Kerwood	Middlesex, Ont.
McKenzie, A. G	Fairview	Oxford, Ont.
Morrison, W. S	Minden	Haliburton, Ont.
Nelles, S. W	York	Haldimand, Ont.
*Orsman, C. P	Bathurst	Lanark, Ont.
Palmer, W. J	Charlottetown	Prince Edward Island.
Price, V	Selby Oak, near Birmingham	England.
Ritchie, H	Toronto	Toronto, Ont.
Rayden, J. S	Charlottetown	Prince Edward Island.
Rennie, E. A	Hamilton	Wentworth, Ont.
Robson, J. W	Liverpool	England.
Rowen, M. B	Holt	York, Ont.
*Scrugham, J. G	Toronto	Toronto, Ont.
Scott, J. A	Stoke, Devenport	England.
Serson, W. E	Antrim	Carleton, Ont.
Shantz, A	Waterloo	Waterloo, Ont.
Shirreffs, G. G	Clarence	Russell. Ont.
Sinclair, J. J	Ridgetown	Kent, Ont.
*Sleightholm, F. J	Humber	Peel, Ont.
Somerville, A. R	Huntingdon	Quebec.
Soule, R. M	South End	Welland, Ont.
Steacy, M. W	Warburton	Leeds, Ont.
Thompson, T. F	Uxbridge	Ontario, Ont.
Valance, R	Osnabruck Centre	Stormont, Ont.
Willans, T. B	Leeds	England.
Willans, N	Leeds	England.
Wilmot, A. B	Oromocto	New Brunswick.
—57		

* Took an Associate Diploma in June.

College Roll.—*Concluded.*

NAMES.	P. O. ADDRESSES.	COUNTIES, Etc.
First Year Students.		
Asbury, E.	Delaware	Middlesex, Ont.
Boyd, W. C.	London	Middlesex, Ont.
Brodie, G. A.	Bethesda	York, Ont.
Campbell, W.	Elphin.	Lanark, Ont.
Carlaw, G.	Warkworth	Northumberland, Ont.
Cleugh, H. H.	Sarginson	Northumberland, Ont.
Culshaw, C.	Ashton on Ribble	England.
Denison, D.	Selby	Lennox, Ont.
Drysdale, W. P.	Liverpool	England.
Esplen, J. H.	Burgoyne	Bruce, Ont.
Gardiner, R. J.	Guelph	Wellington, Ont.
Gaunt, E.	Whitechurch	Bruce, Ont,
Globensky, E. A.	A Saint Eustache	Quebec.
Graham, G. M.	Penzance, Cornwall	England.
Jackson, F. A.	Lyme Regis, Dorset	England.
Jarvis, E. M.	Toronto	Toronto, Ont.
Lea, H. F.	Toronto	Toronto, Ont.
Linfield, F. B.	Dunlop	Huron, Ont.
Lyster, G. R.	Guelph	Wellington, Ont.
McEvoy, T. A.	London	Middlesex, Ont.
McCallum, W.	Ailsa Craig	Middlesex, Ont.
Marsack, F.	Tunbridge Wells	England.
Marsack, H.	Tunbridge Wells	England.
Maynard, A. K.	Toronto	Toronto, Ont.
Monk, W. D.	South March	Carleton, Ont.
Monteith, N.	Farview	Perth, Ont.
Mott, C. J.	London	England.
Musgrave, J.	Cowichan	British Columbia.
Mutton, F. A.	Toronto	Toronto, Ont.
Pike, S.	Locust Hill	York, Ont.
Rendall, W.	Thornbury	Grey, Ont.
Routhier, J. A.	Ottawa	Ottawa, Ont.
Seabrook, P. S.	Delaware	Middlesex, Ont.
Shipley, L. J. W.	Denfield	Middlesex, Ons-
Smith, D.	Montreal	Quebec.
Stewart, A. W.	Lanark	Lanark, Ont.
Stewart, J. B.	Peterboro'	Peterborough, Ont.
Stubbs, H. C. W.	Liverpool	England.
Sullivan, R.	Dublin	Ireland.
Tuck, H. F.	Orangeville	Dufferin, Ont.
Van Luven, R. M.	Murvale	Frontenac, Ont.
Warner, F. C.	Decewsville	Haldimand, Ont.
White, S. A. K.	Ottawa	Ottawa, Ont.
—43		

Analysis of Roll.

Counties, etc.	No. of Students.	Counties, etc.	No. of Students.
Brant	2	Haliburton	1
British Columbia	1	Hastings	2
Bruce	3	Huron	2
Carleton	2	Ireland	2
Dufferin	2	Kent	1
Dundas	1	Lanark	3
England	18	Leeds	2
Frontenac	1	Lennox	1
Glengarry	1	Lincoln	1
Grey	2	Middlesex	8
Haldimand	3	New Brunswick	2

Analysis of Roll.—*Concluded.*

Counties, etc.	No. of Students.	Counties, etc.	No. of Students.
Norfolk	2	Quebec	3
Northumberland	2	Russell	2
North-West Territory	2	Simcoe	1
Nova Scotia	2	Stormont	1
Ontario (County)	3	Toronto	8
Ottawa	4	Waterloo	1
Oxford	1	Welland	1
Peel	1	Wellington	3
Perth	2	Wentworth	1
Peterborough	2	York	4
Prince Edward (County)	1		
Prince Edward Island	2		110

Religious Denominations.

Episcopalians	44	Friends	2
Presbyterians	26	Catholics	2
Methodists	21	Brethren	1
Congregationalists	5	Menonites	1
Baptists	4		
Christians	4		110

Age of Students.

7	16 years of age	7	23 years of age
10	17 "	7	24 "
13	18 "	2	25 "
20	19 "	1	26 "
25	20 "	1	27 "
8	21 "	1	28 "
8	21 "		

Average age, 19 years.

COUNTY STUDENTS.

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

Brant, Bruce, Carleton, Dufferin, Elgin, Frontenac, Glengarry, Grey, Haldimand, Haliburton, Huron, Kent, Lanark, Leeds, Lennox and Addington, Lincoln, Middlesex, Norfolk, Nothumberland and Durham, Ontario, Oxford, Peel, Peterborough, Russell, Stormont, Waterloo, Welland, Wellington and York.

WORK DURING THE YEAR.

Nothing specially noteworthy in the work of the college has occurred during the year. The regular routine of lectures, recitations and examinations has been gone through as usual. The syllabus of lectures given in Appendix 1 will convey some idea of the class-room work, and the class-lists in Appendix 4 indicate the standing of each student more than anything I could say.

The work in the College is divided into five departments, and those students who get an aggregate of 75% of all the marks allotted to the subjects in any department are ranked as first-class men in that department.

The examiners last year were the professors of the College and two other gentlemen, to whom we are much indebted, viz.: S. C. Smoke, B.A., of Toronto, examiner in English literature, and W. A. Douglas. B.A., of the same place, examiner in political economy.

We would like to see a larger number of first-class men; but we are determined that none shall be ranked first-class unless they really deserve it. The following list contains the names of those who gained first-class rank in the different departments at the examinations of last year.

First Class Men.

(Ranked according to standing in general proficiency.)

First Year.

1. *Harcourt, G.*, Welland, Ont.—In five departments: Agriculture, Natural Science, Veterinary Science, English Literature, Mathematics and Book-keeping.
2. *Robson, J. W.*, Liverpool, England.—In four departments: Agriculture, Natural Science, Veterinary Science, English Literature.
3. *McKenzie, A. G.*, Fairview, (Oxford), Ont.—In five departments: Agriculture, Natural Science, Veterinary Science, English Literature, Mathematics and Book-keeping.
4. *Dean, H. H.*, Harley, (Brant), Ont.—In three departments: Agriculture, Veterinary Science, English Literature.
5. *Shantz, A.*, Waterloo, Ont.—In one department: Veterinary Science.
6. *Rayden, J. S.*, Charlottetown, P. E. I.—In one department: Natural Science.
7. *Stewart, R.*, Ottawa.—In one department: Mathematics and Book-keeping.
8. *Sinclair, J. J.*, Ridgetown, (Kent), Ont.—In one department: Mathematics and Book-keeping.

Second Year.

1. *Scrugham, J. G.*, Toronto.—In five departments.
2. *Sleightholm, F. J.*, Humber, (Peel), Ont.—In five departments.
3. *Lick, E.*, Oshawa, (Ontario), Ont.—In five departments.
4. *Hart, J. W.*, Bridgetown, Nova Scotia.—In five departments.
5. *Craig, J. A.*, Russell, (Russell), Ont.—In two departments: Agriculture and Natural Science.
6. *Morgan, H. A.*, Kerwood, (Middlesex), Ont.—In one department: Agriculture.
7. *Donaldson, F. N.*, Tipperary, Ireland.—In one department: English Literature.

Medallists.

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

Gold Medallist.—F. J. Sleightholm, Humber, Ont.
Lansdowne Silver Medallist.—J. G. Scrugham, B.A., Toronto.
Second Silver Medallist.—Elmer Lick, Oshawa, Ont.

Valedictory Addresses.

The Valedictory Addresses on behalf of their fellow students, were delivered by G. C. Donald, of St. George, and Mr. Sleightholm.

Diplomas.

Twenty 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. A. M. Ross, Commissioner of Agriculture, and the names of the recipients are as follows :—

Craig, John A.	Russell, County of Russell, Ont.
Creelman, G. C	Collingwood P.O., Grey, Ont.
Donald, G. C.	St. George, Brant, Ont.
Donaldson, F. N.	Mobarnane, Tipperary, Ireland.
Ewing, William	Mulmur, Dufferin, Ont.
Gilbert, W. J	Dorchester, N. B.
Hart, J. A	Berwick, N. S.
Hart, J. W.	Bridgetown, N. S.
Harkness, A. D	Irene, Dundas, Ont.
Howes, J. S.	Harriston, Wellington, Ont.
Leavens, D. H.	Belleville, Hastings, Ont.
Lick, Elmer	Oshawa, (Ontario County), Ont.
Livesey, E. M,	London, England.
McCallum, E. G.	Martintown, Glengarry, Ont.
Morgan, J. H. A	Kerwood, Middlesex, Ont.
Orsman, C. P.	Bathurst, Lanark, Ont.
Paterson, B. E	Ottawa, Ont.
Scrugham, J G	Toronto, Ont.
Sleightholm, F. J	Brampton, Peel, Ont.
Sharman, H. B	Stratford, Perth, Ont.

Associates.

The total number of associates up to the present time is 137; and the list is as follows :—

Date. **A**

1880—Anderson J.
1880—Ash, G. E.

B.

1881—Ballantyne, W. W.
1884—Black, P. C.
1882—Blanchard, M. G.
1879—Bannard, E. L.
1886—Broome, A. H.
1886—‡Brown, C. R.
1885—‡Butler, G. C.

C.

1886—Calvert, S.
1877—Campbell, J. A.
1880—Campbell, D. P. L.
1884—*Carpenter, P. A.
1880—Chapman, R. K.
1882—Charlton, G. H.
1882—Chase, O.
1879—Clark, J.

Date. **C.**

1879—Clinton, N. J.
1880—Clutton, A. H.
1886—Cobb, C.
1887—Craig, J. A.
1887—Creelman, G. C.
1878—Crompton, E.

D.

1878—Davis, C. J.
1880—Dawes, M. A.
1882—Dawson, J. J.
1882—Dennis, J.
1881—Dickinson, C. S.
1887—Donald, G. C.
1887—Donaldson, F. N.
1877—Douglas, J. D.
1877—Dunlop, S.

E.

1882—Elworthy, R. H.
1887—Ewing, W.

* Gold Medallist. ‡ Second Silver Medallist.

Associates.—*Continued.*

Date.

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.
1887—Gilbert, W. J.
1879—Gillespie, G. H.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindley, A. W.

H.

1882—Hallesy, F.
1887—Harkness, A. D.
1887—Hart, J. A.
1887—Hart, J. W.
1886—Holtby, R. M.
1880—Holterman, R. F.
1882—Horne, W. H.
1887—Howes, J. S.
1882—Howitt, W.

I.

1886—Idington, P. S.

J.

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

L.

1882—Landsborough, J.
1887—Leavens, D. H.
1884—‡Lehmann, A.
1887—‡Lick, E.
1877—Lindsay, A. J.
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.

Date.

M.

1884—Major, C. H.
1877—Mason, T. H.
1887—McCallum, E. G.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.
1883—McPherson, D.
1877—Meyer, G. W.
1887—Morgan, J. H. A.
1881—Motherwell, W. R.
1885—†Muir, J. B.

N.

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

O.

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

P.

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.
1883—*Robertson, W.
1879—Robertson, J.
1881—Robins, W. P.
1879—Robinson, C. B.
1881—Ross, J. G.

S.

1884—Saxton, E. A.
1883—Schwartz, J. A.
1887—†Scrugham, J. G.
1887—Sharman, H. B.
1877—Shaw, G, H.

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

Associates.—*Continued.*

Date. **S.**

1882—†Shuttleworth, A.
1882—Silverthorne, N.
1884—†Slater, H. (ob.)
1887—*Sleightholm, F. J.
1885—Smith, E. P.
1884—Steers, O.
1878—Stewart, W.
1882—Stover, J. W.
1886—†Sturge, E.
1877—Sykes, W. J.

T.

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

Date. **W.**

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

Z.

1886—Zavitz, C. A.

SMOKERS AND NON-SMOKERS.

I am sorry to say that a number of our students have still to be gazetted as smokers; but it is true now, as it was three years ago, that our best students are nearly all non-smokers. The first year students of 1887 won 131 first-class honors. Of these 19 were taken by smokers and 112 by non-smokers. The second year students won 114—4 going to smokers and 110 to non-smokers. Of the 15 first-class men in departments, whose names are given above, 2 were smokers and 13 non-smokers; and of the 20 medallists, whose names will be found in the list of associates, 3 were smokers and 17 non-smokers.

FARMERS' INSTITUTES.

The work of arranging for and helping at Farmers' Institute meetings has greatly increased during the last two years. In 1887 we assisted in holding no less than 40 such meetings, and the demand for help at the present time is greater than ever. The farmers themselves prepare papers, and all the professors of the college go out to assist during the winter vacation, speaking in day time and travelling at night. In this way much work has been done for a very trifling expenditure. In fact it is doubtful whether any other province or state on the continent has held so many successful meetings and has done so much good work for so small an outlay.

The correspondence and other work necessary in arranging for so many meetings at different points throughout the province occupy a great deal of time, so much, in fact, that some states of the Union have men called superintendents of Farmers' Institutes, who are employed at large salaries for that work alone.

The calls for assistance from the College have become so numerous and urgent that, as a rule, we cannot send more than one professor to each institute; but we are arranging for a few of the leading farmers of the province to accompany the professors. Last year we received very valuable assistance from John McMillan, M.P., and John I. Hobson, chairman of the College Board.

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

Time to Apply for Help.

Just here I would like to say a word to Secretaries of Farmers' Institutes. The Commissioner of Agriculture is anxious that we should do all in our power to assist you at your institute meetings, and it is our wish to do so; but the only time we can spare for such work is from the 1st to the 23rd January each year, and our programme for that time should be made out and announced early in December. Hence, if you wish assistance from the College you should always send me a written application not later than the middle of November.

We can arrange so as to let the Professor of Dairying go at other times, say February, the first half of March, November, and December, and occasionally in July, August, September, and October.

Work on Farm.

A full account of the work on the Farm will be found in the reports of Professor Brown, Mr. Story and Mr. McIntosh, and the work in the Horticultural Department is described in Mr. Forsyth's report. So far as I know, there is nothing specially noteworthy, except a determined effort to destroy all thistles and other noxious weeds by a more thorough cultivation of our stubble ground in the fall, by gang-ploughing and harrowing immediately after the removal of the crop, cultivating once or twice, if possible, and then ploughing thoroughly later in the fall. In this way, with proper cultivation at other times, we hope before long to make the farm a model as regards its freedom from every kind of troublesome weed. We are bound to do so, or publicly acknowledge our failure.

Other Departments.

Very valuable work is now being done in the departments of Chemistry and Natural History; and, for a detailed account of the year's operations in these departments, I need only refer to the reports of Professors James and Panton.

Professor Panton, as librarian and curator of the museum, has said all that it is necessary to say regarding our reading-room, library and museum; and Professor Grenside has reported not only our work but our losses in the Live Stock department during the year: so it is not necessary that I should do more than make the financial statement and refer to one or two items, for which I think money should be voted at as early a date as possible.

FINANCIAL STATEMENT.

I.—College.

Expenditure.—No. 1—College Maintenance.

1. Salaries and Wages	$12,368 73
2. Food—	
Meat, fish and fowl	3,178 11½
Bread and biscuits	579 66
Groceries, butter and fruit	3,475 15½
3. Household Expenses—	
Laundry, soap and cleaning	117 28
Women servants' wages	1,495 90
4. Buisness Department—	
Advertising, printing, postage and stationery	719 33
5. Miscellaneous—	
Chemicals, apparatus, etc	85 07
Library and reading-room (books, papers, and periodicals)	301 83
Unenumerated	571 58
	$22,892 65

No. 2.—Maintenance and Repairs of Government Buildings.

Furniture and furnishings	$ 596 15	
Repairs and alterations	432 53	
Fuel	3,138 14	
Light	807 80	
Water	412 50	
		$5,387 12
		$28,279 77

Revenue.

1. Tuition fees	$1,661 70	
2. Balances paid for board, after deducting allowances for work	4,043 31	
3. Chemicals used by associates	50 00	
4. Fines and breakage	32 90	
5. Sheets, blankets, etc. (sold to students after change in regulations)	16 08	
6. Supplemental examinations	2 50	
		$5,806 49
Net cash expenditure		$22,473 28

The net sum voted by the Legislature for the expenditure of the College was $25,815, consequently the unexpended balance for the year is $3,341.72.

Adjustment of College Expenditure.

Net cash expenditure, as above		$22,473 28
Produce, etc., from farm and garden, (see Appendix 5)		1,331 85
		$23,805 13
Amount paid by College for labour of students on farm and garden	$3,192 05	
Half-salary farm superintendent	1,000 00	
Other payments on account of farm officers	820 00	
		$5,012 05
Total net expenditure of College		$18,793 08

II.—Farm.

Expenditure.

1. Salaries (farm foreman, and foreman of mechanical department	$1,289 47
2. Wages of men	2,626 41
3. Implements, feed, hardware, repairs, etc	3,745 28
4. Permanent improvements (new engine house, shafting and pulleys, draining, moving and altering buildings, etc.)	1,551 82
	$9,212 98

Revenue.

Cash for stock, service of animals, etc	$2,440 78
Net cash expenditure of farm	$6,772 20

Adjustment of Farm Expenditure.

Net cash expenditure, as above	$6,772	20
Less amount supplied to College, (see Appendix 5)	683	36
Entire net expenditure (apart from student labor)	$6,088	84

III.—Experimental Department.

Expenditure.

1. Salary of assistant superintendent	$ 500	00		
2. Wages	568	58		
3. Laboratory expenses, experimental dairy, feed, seeds, manure, etc	$1,424	15		
Total cost for experiments			$2,492	73

IV.—Horticultural Department.

Expenditure.

1. Salary of foreman	$ 700	00
2. Wages of men	2,059	63
3. Seed, repairs, etc.	764	64
	$3,524	27

Revenue.

Berries, grapes, etc	$ 296	69		
Net cash expenditure of Horticultural Department			$3,227	58

Adjustment of Expenditure of the Horticultural Department.

Net cash expenditure, as above			$ 3,227	58
Amount supplied to College (see Appendix 5)....	$ 648	49		
Supplied to Prof. Brown (see Report, Part VI.)..	48	27		
			696	76
Total net expenditure of Horticultural Department			$2,530	82

Total net Expenditure of all Departments in 1887.

College				
Farm	$22,473	18		
Experiments	6,772	20		
Horticultural Department	2,492	73		
	3,227	58		
Total			$34,965	69

The net sum voted by the Legislature for all Departments was $40,011. So the unexpended balance for the year is $5,045.31.

Notes on Financial Statement.

In this financial statement I have not included the amount expended on capital account by the Public Works Department for the new Chemical Laboratory, and for alterations in library, museum, reading-room and barns.

In judging of the College expenditure, it is necessary to bear in mind that $3,192.05 of it is for student labour, a great portion of which is worth very little to the Institution, and would not be paid for on an ordinary farm.

In the farm expenditure, you will notice $1,289.47 salaries paid to two foremen. These foremen devote most of their time to instruction of students, and would not be required on any but a college farm.

Other items might be mentioned, but these two are sufficient to show that there are things connected with a teaching and experimental institution which necessitate a larger expenditure than would be required to do the same work on any ordinary farm.

Conclusion.

In order to equip us completely for years to come, we still need the following buildings:

1. A building to be used as a gymnasium and convocation hall.
2. New green and propagating houses.
3. Two cottages for Professors of Chemistry and Natural History.
4. A building near the College to be used as stable and carriage house.
5. A small experimental barn in the experimental field.
6. A piggery.

As we spent a considerable sum on new buildings and alterations last year, I ask only the carriage house, the experimental barn, and the piggery this year. These, taken together, will not amount to much. Our own carpenter, with the help of students, can build the piggery and the experimental barn and the carriage house should not cost more than $1,000.

Hoping that these items may receive your favourable consideration,

I am,

Your obedient servant,

JAMES MILLS,
President.

APPENDIX 1.

SYLLABUS OF LECTURES.

Lectures began, as usual, on the 1st October, 1886, and continued till the 30th June, 1887, which latter date was the end of the scholastic year, 1886-7.

The following syllabus of lectures will convey some idea of the field covered 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.

Rotation 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.

Deepartment 2.—Natural Science.

Chemical Physics.—Matter; accessory and essential properties of mattter; 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; distinctions 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 Thomson's "Seasons"—Autumn.

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.—(Continued.)

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; magnetism; 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," "tapeworm," "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 Southey's "Life of Nelson."

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.—(Continued).

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; subsoiling; 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.
Stephenson

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 deposition; 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 diagrams.

Botany.—Full description of the seed, roots, stem, leaves and flower. Plants are 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 also 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.—Mason and Williams.

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, subsoiling, 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 for the purpose of 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 Shakespeare's "Julius Cæsar."

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—(*Continued*).

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.

Arboriculture.—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 proportions 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 treatments 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, symptoms and treatment of the diseases of the eye and ear.

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

Tegumental System.—Nature, causes, symptoms and 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 "Macbeth."

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—(Continued).

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 in analysis—solution, filtration, precipitation, evaporation, distillation, sublimation, ignition and the use of the blow-pipe; testing of substances by reagents; impurities in water; adulteration 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 illustrated by a large collection of plants in the college herbarium; and also by analysis of several plants collected in the fields and woods of the farm.

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

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 sperial 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 2.

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.	Agriculture.	Agriculture.	1. Bookkeeping. 2. Arithmetic.	Agriculture.
9.45	English Literature.	Physiology and Hygiene.	English Literature.	3. Physiology and Hygiene.	Chemistry.
10.45	Chemistry.	Veterinary Anatomy.	Chemistry.	Veterinary Anatomy.	Arithmetic.

SECOND YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
8.45	Mathematics.	English Literature.	Mathematics.	English Literature.	Horticulture.
9.45	Agriculture.	Agriculture.	Horticulture.	Drawing.	Agriculture.
10.45	Veterinary Pathology.	Agricultural Chemistry.	Veterinary Pathology.	Agricultural Chemistry	Agricultural Chemistry.

APPENDIX 3.

EXAMINATION PAPERS.

I. PAPERS SET AT THE EXAMINATIONS, EASTER, 1887.

FIRST YEAR.

LIVE STOCK, (CATTLE.)

Examiner: WM. BROWN.

1. Classify the breeds at this farm into the strictly dairy and beef, and say which can be taken as part of both.

2. Name those breeds that have been specially improved, and indicate how the improvements were carried out.

3. Compare the form and characteristics of the Devon and Durham.

4. In what respects does the Ayrshire cow differ from the model cow that we have studied, without reference to breed.

5. What would guide you in the choice of store cattle to be put up in October, and sold in May for exportation?

6. Feeding for beef includes other considerations; specify the other principal ones in order of importance. Explain fully.

7. What is a "Ration?" Explain the general one at the Ontario Experimental Farm this winter.

FIRST YEAR.

LIVE STOCK, (SHEEP.)

Examiner: WM. BROWN.

1. Compare the points and characteristics of the Oxford and Cotswold.

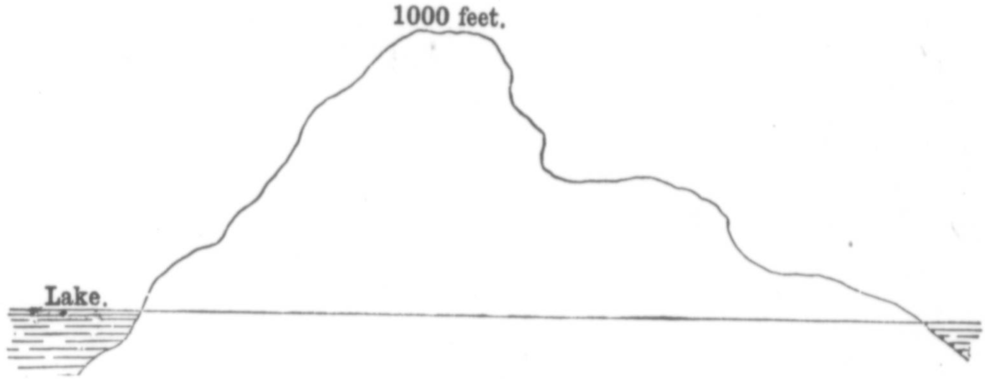
2. Report on the accompanying sample of wool.

3. What think you of the Southdown and Cheviot for average Ontario conditions? Explain fully.

4. Make a table shewing the *Maturing*, *Flesh Value*, *Wool Texture*, and *Weight*, of the Leicesters, Hamps and Shrops.

EASTER EXAMINATIONS, 1887.—Continued.

5. Required a breed to do best on natural pasture on a 1,000 acre island of this form in Lake Nipissing. Give full reasoning, and supply any omissions in the information given.



FIRST YEAR.

LIVE STOCK, (PIGS.)

Examiner : P. J. WOODS.

1. Describe the standard points of beef steers, and what would guide you in selecting store steers.

2. Write fully on the following questions :—
General principle of breeding.
General points of excellence in a good flock of sheep.

3. How would you keep up fertility in sows ?

4. Name the three best breeds of pigs suitable for our Canadian markets. Give reasons for your answers.

5. How would you prepare a pen for a sow about to pig ? Give treatment of sow and pigs until weaning time.

FIRST YEAR.

ORAL EXAMINATION, (CATTLE.)

Examiner : WM. BROWN.

1. Without reference to breed, describe the general appearance of the cows, and show the prominently *good* and *poor* points of each as *milkers*, indicating which is likely to be the *best one all over*.

2. Quality, fleshing, and form, in a fattening steer. Give prize for these only, after a full explanation of them on each animal.

FIRST YEAR.

ORAL EXAMINATION, (SHEEP.)

Examiner : WM. BROWN.

1. What are the two principal differences between the Oxford rams ?

2. Allowing for age, which is the best Shrops ram ?

3. What objections have you to the Oxford ewes as a pair for exhibition purposes ?

EASTER EXAMINATIONS, 1887.—*Continued.*

FIRST YEAR.

DAIRYING.

Examiner : J. W. Robertson.

1. Give details of most economical method of rearing calves.
2. Describe the points of an ideal dairy cow.
3. What effects are observed when salt is withheld from milking cows?
4. What are the churning temperatures at different seasons, and why is variation necessary?
5. Name and describe the preparation of butter packages best suited for creamery use.
6. State what butter is, and describe its commercial qualities with their comparative values.
7. Give a scale of points for use in judging at competitions for milking cows.
8. Describe the lactoscope.
9. What is rennet, and what is known of its action in cheese making?

FIRST YEAR.

INORGANIC CHEMISTRY.

Examiner: C. C. James, M. A.

1. Sketch the apparatus you have seen used in the making of any gas. Give properties of the gas and equation representing the reaction taking place.
2. Define Valence, Chemism, Combustion, Heat, Force, Reduction, Radical, Triad, Molcule, Matter.
3. Define and give two examples of Potential Energy.
4. Define Acid, Base, Alkali, Salt. Give the names and symbols of four acids, and the salts of K, Ca, and Fe derived from same.
5. Name and give composition of the ordinary forms of coal.
6. Distinguish between the setting of ordinary Mortar and of Plaster of Paris. Give equations.
7. State the chemical composition of Marble, Graphite, Steel, Chalk, Pig-iron, Calcite, Apatite, Land-plaster, Superphosphate, Gypsum. Give names and symbols.
8. Give the method of making Carbonic Acid Gas. State its properties.
9. Determine the No. of lbs. of water that can be made from H of 25 lbs. of H Cl, and the O of 25 lbs. of $K\,Cl\,O_3$.

FIRST YEAR.

ORGANIC CHEMISTRY.

Examiner: C. C. James, M.A.

1. Give Chemical symbols and names of Wood Spirit, common Alcohol, common Ether, Firedamp, Chloroform, Milk, Sugar, Stearin, Vinegar.
2. *Alcohol*—State the process for the formation of spirits from barley. Give chemical equations wherever possible.

EASTER EXAMINATIONS 1887—Continued

3. *Fats*—Name the most important. Explain the rancidness of Butter.

4. *Carbohydrates*—Define and name the most important and give symbols for same.

5. *Albuminoids*—What are they? Name three. State the foods containing them in excess.

6. *Alkaloid*—Name five, giving source of the same.

7. Explain, as far as possible, Souring of Milk, Curdling of Milk, the formation of White Wine Vinegar, Fermenting of Wine, Digestion of Starch. Give equations where possible.

FIRST YEAR.

ZOOLOGY.

Examiner: J. HOYES PANTON, M.A., F.G.S.

1. Contrast organic with inorganic bodies, and give the chief characteristics of living bodies.

2. Name the different forms of asexual reproduction observed in the animal kingdom, and give examples stating the sub-kingdoms to which they belong.

3. Give the character of the class *Aves*, and name the song birds of Ontario.

4. Describe the different modes by which the blood is purified in animals, and give examples of each.

5. Show in what respects man differs largely from the lower animals, and give some of the chief objections to the theory of Evolution.

6. Name some interesting extinct forms of animal life and the classes to which they belong.

7. Describe fully the life-history of the animal which causes "rot" in sheep.

8. Explain the term "Metamorphosis" as applied to insects, and illustrate it by referring to the Crane fly.

9. Identify the specimens before you.

FIRST YEAR.

VETERINARY ANATOMY.

Examiner: F. C. GRENSIDE, V. S.

1. Describe how the walls of the thorax and abdomen are formed.

2. Name the organs of prehension in the horse, ox and sheep; and explain why the ox can breathe through his mouth and the horse cannot.

3. Give the number and arrangement of temporary and permanent teeth in the horse, ox, and sheep.

4. Describe the windpipe, bronchi, and bronchial tubes.

5. Describe the arrangement and appearance of the mucous coat of the stomach of the horse.

6. Name the secretions that convert the chyme into chyle.

7. Describe the forces that accomplish defoccation, urination, and parturition.

8. Describe how rumination is believed to be effected.

9. Describe the ventricles of the heart.

10. Explain the course of the circulation of the blood

EASTER EXAMINATIONS, 1887.—Continued.

FIRST YEAR.

ENGLISH LITERATURE.

SOUTHEY'S "LIFE OF NELSON."

Examiners : S. C. SMOKE, B.A., AND JAS. MILLS, M.A.

1. Sketch briefly the life of Nelson, and state definitely your estimate of his character as a man and as a naval officer, giving specific reasons for your conclusions regarding him.

2. Account for the demonstration in honor of Nelson at Yarmouth, Ipswich and London, in the year 1801.

3. Name the rulers of England, France, Denmark, Sweden and Russia in the year 1801.

4. What led to the battle of Copenhagen?

5. The battles of Copenhagen and Trafalgar: Give the date, the locality, the parties engaged, and a brief account of each. (*a*) What did Nelson say is necessary in order "to negotiate with effect?" (*b*) What kind of measures did he say "are the safest?" (*c*) How did he settle the quarrel between Collingwood and Rotherham? (*d*) What famous signal did he make to his fleet just before the battle of Trafalgar?

6. What English poet has celebrated the battle of Copenhagen?

7. What are Elsinore and Cronenburg Castles noted for?

8. Write a biographical note on Tyco Brahe.

9. Give the rules for paragraphing, and criticise the first paragraph in Chapter VII. of Southey's "Life of Nelson."

10. Criticise the English of the following passages and rewrite each of them in better form:

(*a*) "Denmark had profited with all activity, of the leisure which had impolitically been given her."

(*b*) "Here you are, with almost the safety—certainly the honor—of England more entrusted to you than ever yet fell to the lot of any other British Officer."

(*c*) "It was liable to long delays and to accidents of ships grounding."

(*d*) "Upon the nearest point of land to the Swedish coast."

(*e*) "The Danish shores consist partly of ridges of sand, but more frequently their slopes are covered with rich wood."

11. Write a summary of the life of Southey, naming his principal works, and the most marked peculiarities of his style.

12. Note a few of the leading characteristics of the period of English literature to which Southey belonged; name the principal contemporary writers; and account for the period being so productive in literary work.

FIRST YEAR.

ARITHMETIC.

Examiner : E. LAWRENCE HUNT.

1. If a cow gives 6,000 lbs. of milk in a year, and ten quarts of milk makes one lb. of butter worth 20c. a lb., and skim milk and buttermilk are worth $2\frac{1}{2}$c. a gallon, find the value of the milk and the butter from the cow in one year.

EASTER EXAMINATIONS, 1887.—Continued.

2. If a steer is fed each day 8lbs. hay at $8 a ton, 4lbs. oats at 35c. a bushel, 3lbs. pease at 55c. a bushel, 2 lbs. barley at 60c. a bushel, with some cut straw, and if it gains $2\frac{1}{2}$ lbs. in weight each day, and sells for $6\frac{1}{2}$c. a lb. (live weight,) find the daily profit.

3. If a farm of 160 acres is worth $85 an acre, including buildings, and the stock and implements worth $1,100, what must be the farmer's yearly profits to allow him a salary of $850 a year, and 7 per cent. interest on his money?

4. For what purpose are taxes levied? In a school section there are forty families, each with an average farm of 150 acres, valued at $50 an acre. If the annual cost of school maintenance is $420, find the rate of taxation (in mills) for school support; also, the yearly fee A pays for each of three children, if his farm of 125 acres is valued at $40 an acre.

5. Why are duties imposed on imported goods? Distinguish *ad valorem* and *specific* duties. If the selling price of an article is $95 when there is a duty of 30 per cent., what would be the selling price if there was a duty of only 12 per cent., the merchant's profit in each case being 25 per cent. on his outlay, and the freight being $5.

6. A sends wheat to B, which he sells on a commission of 2%. He deducts his commission and sends A his note for balance, drawn Jan. 1st, '87, and due one month hence, which A gets discounted at the bank, January 15th, at 8%, receiving $90.85 for the note: if B sold the wheat for $76\frac{26}{49}$c. a bushel, find the number of bushels A sent him.

FIRST YEAR.

BOOK-KEEPING.

Examiner: E. LAWRENCE HUNT.

1. Explain the terms (a) Promissory Note; (b) Payee; (c) Draft. Write the form of (a), also receipt given in the case of VI. (c).

2. Enumerate the accounts you would open on an ordinary farm of 150 acres.

3. What does Loss and Gain account contain when completed?

4. Explain how the following are closed—*Cash, Cows, Farm Produce, Loss and Gain, Balance.*

5. Make out and close an account with *pigs.*

6. State how the several accounts would be affected by the following:—

(*a*) Sold P. Black 100 bushels wheat @ 80c. a bushel,
(*b*) Bought a cow from S. Thomas, $35.
(*c*) Paid S. Harvey (permanent hand,) $40.
(*d*) Sold S. White 80 lbs. butter @ 20c., taking in payment 10 lbs. tea @ 75c., and balance cash.
(*e*) Built an addition to the barn at a cost of $600 cash, and twenty days labour of myself and two permanent hands.
(*f*) Sowed 20 bushels fall wheat, for which I paid $1.10 a bushel.

N.B.—Fifteen marks given for excellence of arrangement and writing.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. In the general management and economy of an Ontario farm, why do we say that banking money is not necessarily a sign of well doing?

EASTER EXAMINATIONS, 1887.—*Continued.*

2. What is implied in the following statements :—
   (*a*) The reasonableness of some mortgages.
   (*b*) The danger of too much land.
   (*c*) The necessity of better co-operation.
   (*d*) The burying of money in fences and homes.
   (*e*) Appreciating the importance of so-called "little things."
3. Criticise the *arrangement* of our new Farm Buildings.

SECOND YEAR.

CATTLE AND SHEEP.

Examiner: Wm. Brown.

1. What are the different methods of breeding, and specify the known principles of the art.

2. Report on the general character of the following pedigree; shew all its connections, and say why it is or is not admissible to the Dominion Herd Book.

3. Make comparative notes on the adaptability of the Hereford and Galloway for our North West ranches.

4. What are the economical and scientific features of our 1886-7 feeding ration for all cattle?

5. Compare the Oxford and Shrops breeds of sheep.

6. Lambing time in March and April with us: what does this imply for the best results?

SECOND YEAR.

LIVE STOCK.

Examiner: P. J. Woods.

1. Describe what a beef steer fit for the shambles should be, and name *five* principal points in a beef steer that a butcher would expect to realize a profit from. Give reasons for your answers.

2. Give the essential points in a well bred Berkshire pig.

3. How were the following original breeds of pigs improved: Suffolk, Essex, and large Yorkshire?

4. Write fully on the management of a sow and her pigs, from two weeks before she is expected to farrow, until the pigs are two weeks old.

5. Give management of a ram and flock of ewes from rutting season until the lambs are weaned.

SECOND YEAR.

ORAL EXAMINATION (CATTLE.)

Examiner: Wm. Brown.

1. Show five actually distinct differences in the one cow from the other, as evidence of a machine better adapted to milk production.

2. Exemplify with the steer the terms (1) irregular fleshing, (2) hard handling, (3) firm handling, (4) well filled, and (5) ripeness.

EASTER EXAMINATIONS, 1887.—Continued.

SECOND YEAR.

ORAL EXAMINATION, (SHEEP.)

Examiner: WM. BROWN.

1. Point out and compare all the evidences of *Quality* in the two Rams.
2. Compare the Leicester and Cheviot as regards *Form* and *Wool.*

SECOND YEAR.

DAIRYING.

Examiner: J. W. ROBERTSON.

1. Describe "the points" of an ideal dairy cow.
2. What is milk?
3. State the best method and conditions for the separation of cream by the natural method.
4. For what purposes are the Ayrshire, Jersey, Holstein, and Short Horn breeds of cows respectively best adapted?
5. What is the method of preparation and use of a "fermentation starter" in butter making.
6. What are the distinctive features in the process of making Cheddar cheese.?
7. Describe the qualities in a perfect cheese.
8. What steps need be taken to establish satisfactorily a Joint Stock Cheese Factory or Creamery?
9. What are the characteristics of salt suitable for dairy use?

SECOND YEAR.

AGRICULTURAL CHEMISTRY.—PART I.

Examiner: C. C. JAMES, M.A.

1. *Humus*—Discuss its origin, composition, uses, treatment and value.
2. *Nitrification*—Summarize as far as possible the experiments that determined its nature.
3. *Drainage Water*—Brief notes on its composition.
4. *Lime*—State the sources of lime as a fertilizer; also give directions for the application of lime fertilizers.
5. How will the nitrogen in a soil be affected by a Norfolk rotation (average crops and average manuring)?
6. Give reasons for rotation of crops and general principles for guidance in same.
7. Turnips, peas, barley, wheat, clover, oats; (*a*) criticise this rotation; (*b*) rearrange, if preferred, giving reasons for so doing.
8. With what and in what manner would you fertilize *each* of the crops in 7?

EASTER EXAMINATIONS, 1887.—Continued.

SECOND YEAR.

AGRICULTURAL CHEMISTRY.—PART II.

Examiner: C. C. JAMES, M.A.

1. Give the water % and N. R. of ten common Ontario fodders.
2. Distinguish amides, albuminoids and alkaloids.
3. Discuss the chemical composition of hay and show how it is affected.
4. *Fermentation*—Define; state the principal forms, and represent by chemical equations those taking place in milk.
5. Brief notes on feeding for milk, for beef, for wool, for work.
6. Specific gravities of two samples of milk are 1.038 and 1.025. What conclusions do you draw? Why?
7. Distinguish colostrum and milk, sour milk and koumis.
8. State how butter, cheese and lard are adulterated.
9. Trace carefully the cause of change from the free nitrogen of the air to *butyrate of Ammonia.*

SECOND YEAR.

ENTOMOLOGY.

Examiner: J. HOYES PANTON, M.A., F.G.S.

1. Define an insect. Describe the circulating and respiratory systems of such, and compare the pupa condition in at least four different orders of insects.
2. Name the orders embracing insects characterized by having masticatory mouths.
3. Give brief notes on arsenical compounds used as insecticides; the mode of application.
4. Mention the best preventives against insect injury.
5. Describe fully, as illustrated in the museum cases, the development of *Pieris Rapae and Danais Archippi.*
6. Give a remedy for canker worm, codling moth and notes on the crane fly.
7. Arrange the insects which we have considered in the orders to which they belong.
8. Give remedies for the Anthomigian flies. Name the plants affected and describe the pupa condition.
9. Name the four largest larvæ we have discussed and give characters which distinguish them from each other both in the larval and pupa condition.
10. Identify the specimens before you, name the plants they affect, and give remedies for Nos. 2, 4, 6, 8, 10.

SECOND YEAR.

VETERINARY PATHOLOGY.

Examiner: F. C. GRENSIDE, V.S.

1. Give the symptoms of bruised feet, gathered nails, and corns in the horse.
2. State how to determine the difference between foot and shoulder lameness.

EASTER EXAMINATIONS, 1887.—Continued.

3. Give the symptoms of foul in the foot of cattle and foot-rot in sheep, and the treatment and means of precaution.

4. Mention the forms of hernia that are often congenital, and the course that should be pursued with regard to them.

5. Give the cause of lymphangitis and the proper treatment.

6. Describe the nature of eczema, mange and ringworms, and the treatment of the former and latter conditions.

7. Give the causes, treatment and results of mamumitis in the cow and sheep.

8. Describe the preventible causes of digestive disorders in the horse.

9. Give the causes, symptoms and treatment of bloating in the ox and sheep.

10. Give the symptoms and treatment of spasmodic colic.

SECOND YEAR.

PRACTICAL HORSE.

Examiner : F. C. Grenside, V.S.

1. Explain the ill effects of leaving a horse's shoes on too long.

2. Describe how to prepare a horse's foot for the reception of the shoe.

3. Give an explanation of the circumstances under which it is advisable to place an animal in slings, and the advantages to be attained by slinging.

4. Name and describe the malformations to which the horse's mouth is subject.

5. State the causes of imperfect mastication in the horse.

SECOND YEAR.

PRACTICAL HORSE (Oral).

Examiner : F. C. Grenside, V.S.

1. Name the different methods of restraining a horse.

2. Locate curb, spavin, and thoroughpin.

3. Tell what is the desirable conformation of the fore extremity below the knee.

4. Say what conformation of the middle piece is desired, not mentioning the back or underline.

SECOND YEAR.

ENGLISH LITERATURE.

I. Shakespeare's "Macbeth."

Examiner : S. C. Smoke, B.A.

1. State briefly the argument of the play, pointing out particularly the part which the witches are made to play.

2. Compare the prevalence of the belief in witchcraft of the time of Shakespeare, with that of our own time, and shew the influence of that belief on this play. Comment on Dr. Johnson's remark that "the greatest part of mankind have no other reason for their opinions than that they are in fashion."

EASTER EXAMINATIONS, 1887.—Continued.

3. In speaking of the appearance of Banquo's ghost, Taine says, "This phantom which Shakespeare summons is not a mere stage trick; we feel that here the supernatural is unnecessary, and that Macbeth would create it even if hell would not send it." Explain Taine's meaning here.

4. "As whence the sun gives his reflection,
Shipwrecking storms and direful thunders break,
So from that spring whence comfort seemed to come
Discomfort swells."

Name the principal figure employed here, and shew its full force. Quote from this play any other example of the same figure.

5. "Till he disbursed . . . . .
Ten thousand dollars to our general use."

Is the dollar an English coin?
Account for its mention here.

6. Quote the passage ending—

"And nothing is but what is not,"

and comment fully upon the meaning of this sentence. What is a paradox?

7. Analyze syntactically—

"More is thy due than more than all can pay."

8. "And his great love, sharp as his spear, hath *holp* him." What is the modern form of *holp?* Give any other example of a similar difference between old and modern forms.

9. Define, as used in this play, the words *fantastical*, *illness*, *ecstasy*, *owe*, *missives*, and *minutely*.

10. "Come, sisters, cheer we up his sprights." Give the different forms and meanings of the word *sprights*.

11. Explain fully what is meant by the following expression—

"Keep thy word of promise to our ear and break it to our hope."

12. State by whom and under what circumstances the following passages are spoken, and explain the meaning of each passage:—

(*a*) Nothing in his life
Became him like the leaving it.

(*b*) That is a step
On which I must fall down, or else o'erleap,
For in my way it lies.

(*c*) What would'st thou highly
That would'st thou holily.

(*d*) This even handed justice
Commends the ingredients of our poisoned chalice
To our own lips.

(*e*) I dare do all that may become a man,
Who dares do more is none.

(*f*) Where we are, there's daggers in men's smiles;
Nought's had, all's spent.

(*g*) Where our desire is got without content.

(*h*) Thou hast no speculation in those eyes.

13. Parse the words *there's* and *men's* in extract (*f*), question 12.

EASTER EXAMINATIONS, 1887.—Continued.

14. Quote the passages in which occur the following expressions :—
  (*a*) He wants the natural touch.
  (*b*) The seer, the yellow leaf.
  (*c*) Cans't thou not minister to a mind diseased ?

II. HAMLET AND RICHARD II.

1. Quote from Hamlet the passages beginning—"Who would fardels bear," and ending "The pale cast of thought;" and explain carefully the meaning of the last two lines of the passage.

2. Quote from Richard II. the passage beginning—"This blessed plot, this earth," and ending "Rotten parchment bonds."

SECOND YEAR.

POLITICAL ECONOMY.

Examiner : W. A. DOUGLAS, B.A.

☞ Give brief answers.

1. The four parts of Political Economy are Nature, Consumption, Production and Distribution of Wealth. To which class do the following facts belong ?
  (*a*) Work in the best manner.
  (*b*) "Rents rise from the fact that different pieces of land are not equally fertile."
  (*c*) "Wealth is anything which is actually useful to us."
  (*d*) "The slaveholder appropriated all the product except enough to keep the slave alive."
  (*e*) "Wages are increased by increasing the product."

2. *Production of Wealth* :—
  (*a*) Name the elements necessary for production, distinguishing primary and secondary.
  (*b*) In production there is always a certain ratio between product and effort that may be thus expressed $\frac{\text{product}}{\text{effort.}}$ Name three ways in which we try to increase the value of this ratio.
  (*c*) What legislation is necessary to compel people to resort to the best methods, the best places, or the best time to produce wealth ?

3. *Division of Labour* :—
  (*a*) Shew by an illustration that two men can make each other richer.
  (*b*) Name a condition without which division of labour would be utterly impossible.
  (*c*) Shew how division of labour may take place between nations.
  (*d*) Give an illustration shewing how the labour of one man may save the labour of a hundred.

4. *Capital* :—
  (*a*) Shew by a simple illustration how capital aids labour.
  (*b*) Distinguish fixed from circulating. Can this distinction be clearly drawn ?

EASTER EXAMINATIONS, 1887.—Concluded.

5. *Distribution of Wealth* :—
   (*a*) Name and distinguish the divisions.
   (*b*) Which share continually increases in countries where population is increasing? Which for a number of years has declined? Which is disputed as to increase or decrease?
   (*c*) Which would be increased merely by increased density of population?
   (*d*) Which differs little, if anything, in location? Which differs enormously in different locations?
   (*e*) What is the current rate of interest? What the current rate of wages for unskilled labour? What is the rental per acre for farms in Wellington County?
6. *Values* :—
   (*a*) Shew that the measure of wealth by value is quite defective.
   (*b*) "In New South Wales water has been sold for three shillings a bucketful." Did this increased value indicate increased wealth?
   (*c*) Give examples of the following values—
      1. One that is permanent.
      2. One that may last for some years.
      3. One that vanishes almost instantaneously.
      4. One that is produced by labour.
      5. One that is produced by scarcity.
   (*d*) Can labour produce a value that will last forever?

SECOND YEAR.

MECHANICS.

Examiner : E. LAWRENCE HUNT.

1. Explain the terms—*momentum, work, force of gravitation, centre of gravity mechanical advantage.*

Mention two machines which work at a mechanical disadvantage.

Why is a fly-wheel used on some machines? What is the condition with reference to the centre of gravity that a body resting on a horizontal plane will stand? Give the reason.

2. Enunciate (*a*) the second law of motion, and (*b*) the parallelogram of forces.
   (*c*) and shew clearly that (*b*) follows from (*a*.)
   (*d*) Two forces of 220 lbs. and 280 lbs. act on a body at an angle of 45°, find the magnitude and direction of their resultant.

3. What fact in nature is taken advantage of in the (*a*) hydrostatic press, (*b*) common pump, (*c*) hydraulic ram, (*d*) siphon; and mention one case in which (*d*) might be used on a farm.

4. In the hydraulic ram what proportion of the water that flows through the supply pipe is driven through the discharge pipe? (*b*) Clearly explain the mechanical principle.
   (*c*) If a spring supplies one gallon a minute, how long will it take to fill a cylindrical vessel in the barn, if the diameter is two feet and height seven feet? Supply the necessary data on which you base your calculation.

5. Find the atmospheric pressure in pounds, to the square inch, if it sustains a column of water thirty-three feet high, (a cubic foot of water weighs 1,000 oz.)

6. In the second system of pulleys, find the power necessary to raise a weight of 500 lbs., if there are three pulleys in the lever block.

II. PAPERS SET AT THE MIDSUMMER EXAMINATIONS, JUNE, 1887.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN, ESQ.

1. What is the importance of a proper physical condition of a soil?

2. To what extent can we follow a certain rotation of cropping? Give an example and shew in what way it may properly be departed from.

3. Name and criticise the accompanying sample of grain.

4. Specify the advantages of tillage; indicate its value relatively to manures, and say to what crops it is specially important.

5. What is a manure? Name the principal Canadian special fertilizers, and briefly sketch the best management of farm yard manure.

6. What are the principal circumstances that regulate the kind and character of farm implements and machinery.

7. Specify the advantages of underdrainage and explain the meaning of "lateral," "sole."

8. Describe the management of No. 6 field this year; say what have probably been the crops during the last three years and what they are likely to be for the next three.

9. What is your opinion of the importance of pasture and green fodders in the present farm practice of the province.

10. Name the essential features of modern butter making.

FIRST YEAR.

GEOLOGY.

Examiner: J. HOYES PANTON, M.A., F.G.S.

1. Give the characters of the metamorphic rocks, their economic products, and their distribution with reference to Ontario.

2. Describe the formation of a fossil by replacement and illustrate by examples.

3. Name the geological system represented in Ontario.

4. Explain the effects of rain as a denudating agent.

5. How is the system to which a rock belongs determined? Name the systems of the mesozoic age.

6. Give proofs for a glacial period in Ontario, and state its influence on the physical features of the country.

7. Outline LaPlace's theory regarding the origin of the earth.

8. Account for the absence of whole systems and formations from certain localities, and state which are missing in Manitoba.

9. Identify the specimen before you.

FIRST YEAR.

BOTANY.

Examiner: W. NICOL, B.A.

1. State the points of *similarity* and *difference* between the natural orders *cruciferæ* and *rosaceæ*.

2. Give the process of germination of an ordinary dicotyledenous seed.
3. Explain, with examples, the following botanical terms: (*a*) Monadelphous, (*b*) didynamous, (*c*) hypogynous, (*d*) rizome, (*e*) glomerule, (*f*) legume, (*g*) drupe, (*h*) pappus.
4. Give, with examples, the various forms of "Indefinite Inflorescence."
5. Shew the various adaptations for cross fertilization of flowers.
6. Describe a perfect flower, shewing the importance of the various organs.
7. Classify the indehiscent fruits, giving examples.
8. Analyze the plant before you.

FIRST YEAR.

VETERINARY MATERIA MEDICA.

Examiner: F. C. GRENSIDE, V.S.

1. Give an explanation of the theories, with regard to the manner in which medicines establish their actions.
2. Describe the principles upon which the practice of allopathy is based.
3. Give a definition of the terms *anæsthetic*, *diuretic*, *sudorific* and *ecbolic*.
4. Describe the different forms in which medicinal agents are used for animals.
5. Name the physiological actions of aconite, and explain the indications for its use
6. Describe the best means of purging a horse.
8. What are the indications for the use of stimulants, and in what quantities are the different alcoholic preparations prescribed?
8. Which is the cheapest and most convenient preparation of belladonna for veterinary use? Give its actions and uses, and name its active principle.
9. What is carbonate of lime commonly called? Give a prescription for diarrhœa containing it.
10. Which is the most important alkaloid of cinchona bark? Give the actions and uses of cinchona and proper dose for horse.

FIRST YEAR.

ENGLISH GRAMMAR—THE NOUN.

Examiner: JAS. MILLS, M.A.

1. Give a classification of nouns with a concise definition of each class and sub-class
2. What is meant by the term *inflexion* in grammar? Explain its application to the noun.
3. Distinguish sex and gender.
4. Enumerate the modes of denoting gender in English and give an example of each mode.

   (*a*) Write out a list of the endings which are used to denote the feminine gender, with an example of each.
5. State the different ways in which we form the plural of nouns and give an example of each.

6. Write down the plural of *hero, canto, roof, fife, scarf, day, soliloquy, sheep, genus, radius, datum, cherub, brother, phenomenon*, and *die*.

7. Comment on modern English usage in regard to the number of the words: *Classics, means, news, riches, tongs, silks, wines*, and *folk*.

8. Give the rule for forming the plural of compound nouns.

9. Define *case*.

10. Give and illustrate the rules for forming *the possessive case*.

(*a*) What restriction does our present usage place on the use of the inflexion to denote possession?

FIRST YEAR.

ENGLISH COMPOSITION.

Examiner: E. Lawrence Hunt.

1. Clearness, strength and unity are three essentials of a good sentence.

(*i*) What are the faults opposed to clearness? Give examples.
(*ii*) State, with examples, the different ways strength is gained.
(*iii*) What is meant by the unity of a sentence?

2. What is a *loose sentence?* A *periodic sentence?* Give an example of each. Which is the stronger? Why?

3. In a composition "there should be a judicious intermixture of short and long sentences." Why? State the advantages of each.

4. Enumerate, with examples, the ways of changing adverbial clauses, in order to secure variety of expression.

5. Write a letter from Montreal asking for information regarding the course of study etc., at the Agricultural College.

6. Criticise the following sentences and re-write them when necessary:

(*a*) They preferred death rather than live thus.
(*b*) He forgets the gratitude he owes to those that helped all his companions when he was poor, and John Smith in particular.
(*c*) He had the entire monopoly of the whole salt trade.
(*d*) He lives in a stone house.
(*e*) There were a great quantity of students at the camp.
(*f*) If the formation of character is one of the aims of the teacher, as we have often insisted, let him be excessively cautious how he ridicules.

7. Write an essay on "The Improvement of Spare Time," with special reference to the life of a farmer.

FIRST YEAR.

MENSURATION.

Examiner: E. Lawrence Hunt.

1. A barn is 65 ft. long and 40 ft. wide. Find how many shingles are required to roof it, if each has an exposed surface of 8 ins. by 11 ins.; the length of each rafter being $\frac{3}{4}$ of the width of the barn. Also the cost @ $6 for 10 ft. square.

MIDSUMMER EXAMINATIONS, 1887.—*Continued.*

2. If the rain from the roof is collected into a cistern 7 ft. in diameter and 10 ft. deep, find the amount of rainfall required to fill the cistern.

3. A mow of hay is 30 ft. long, 20 ft. wide, and 12 ft. high. If a cubic yard weighs 196 lbs., find approximately the number of tons.

4. A stick of timber 35 ft. long tapers regularly, the circumference of one end is 11 ft. and of the other 18 ft. Find the volume by the approximate rule and by the exact rule.

5. The bottom of a vessel is 6 ft. long and 6 ft. wide, the top is 9 ft. long and 9 ft. wide. If the vessel is 5 ft. deep find the number of gallons it contains, also the number of square yards of zinc required to line the sides and bottom.

6. A B C D is a four-sided figure, A D and B C are parallel, the angle at A is 30° and the angle at B is 60°. Find the area and length of A B when A D is 100 ft. and B C 40 ft.

7. Explain clearly how the breadth of a stream may be found without crossing it.

The following two are for those who fail to do *three* of the above questions:

1. The radius of a circle is 35 ft. Find the circumference and the area. Also find the diameter and area when the circumference is 26.4 ft.

2. Form and solve a question similar to any you have done through the term concerning the excavation of trenches.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Apportion crops upon the average farm of 150 acres in Ontario as applicable to (1) a dairy district and (2) general farming.

2. In view of the increasing importance of dairying in Ontario, in what respects would you advise improvements in the summer and winter feeding of cows?

3. Pasture and green fodder in relation to cheapness of products; in what other respects are they conducive to *good husbandry* in these times?

4. Experimentation is a prominent feature of Canadian rural economy to-day. Name the principal rules that should guide us in such work.

SECOND YEAR.

CHEMISTRY.

Examiner: C. C. JAMES, M.A.

PART I.—THEORETICAL.

1. Give the chemical composition of *Paris green, white lead, bleaching powder, apatite, wood ashes, coal ashes, dolomite, marl, clay.*

2. Explain chemically the dissolving and precipitation of limestone in the soil.

3. Name and state the principal chemical law in wet qualitative analysis.

4. Give the flame tests.

5. Distinguish mercurous and mercuric salts. Ferrous and Ferric salts (*a*) according to chemical composition, (*b*) practically by chemical tests.

MIDSUMMER EXAMINATIONS, 1887.—Continued.

PART II.—PRACTICAL.

Analyze the two samples. State on paper—

1. The elements or compounds found, with method of determining.
2. The chemical equations representing the reactions (as far as possible).
3. Your conclusions as to the nature of the samples.
4. What you can determine from a physical examination of the samples.

Every reaction obtained must be shown to the examiner and, if required, explained orally.

Write down a full statement of all breakages during the term's work.

SECOND YEAR.

METEOROLOGY.

Examiner: J. HOYES PANTON, M.A., F.G.S.

1. Account for the barrenness which characterizes the interior of some countries and give examples.

2. Explain what is meant by the dewpoint, and show the value of its determination to the horticulturist. How is it determined?

3. Explain the influence of forests on climate.

4. How do you explain the more common occurrence of summer frosts in newly settled countries than in older?

5. Give the mean of the following readings of a thermometer: 28°,—16°,—54°, 36°, and reduce—42 C. to F., and 40 F. to C.

6. What is meant by the specific heat of water? Show its practical bearing on the climate in some localities in Ontario?

7. What is meant by terrestrial radiation? State conditions which affect it.

8. Name the conditions likely to affect the rainfall of a locality.

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

Examiner: J. HOYES PANTON, M.A., F.G.S.

1. Show in what respects an artificial classification surpasses a natural.

2. Distinguish between a fungus and a grass. Outline the life-history of *Sphæria Morbaca.*

3. Classify the following plants, stating the order to which they belong: Penny grass, blueweed, purslane, trillium, fruge tree, deutzia, waterlily, chickweed, turnip, spruce, bindweed, amaranth, rust, liverwort, lettuce.

4. Give the characters of the orders: *Leguminoseæ, solicaceæ, labiatæ*, and give three examples in each order.

5. Name the economic plants found in the orders: *Cruciferæ, cupuliferæ*, and *gramineæ.*

MIDSUMMER EXAMINATIONS, 1887.—Continued.

6. State the peculiarities observed in the flowers of the orders: *Compositæ* and *cucurbitaceæ.*

7. Identify the weed seeds in the samples of wheat before you.

8. Analyze the plant before you according to the accompanying schedule.

SECOND YEAR.

PRACTICAL HORTICULTURE.

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

1. Name what you consider the ten best shrubs for ornamental purposes, referring to their size, hardiness, and time of flowering.

2. Describe fully the pruning of a raspberry bush, and compare the pruning of the red currant with that of the black currant.

3. Give some points to be observed in planting flowers in a garden.

4. Describe the most economical way to lay out a vegetable garden.

5. Distinguish the germander-leaved spiræa from the elm-leaved, and give the character of the flowering shrubs found in the order *leguminosæ.*

6. Identify the plants before you.

7. For what purpose is a *cold-frame* used and how made? Give the general characters of soil used in potting.

SECOND YEAR.

VETERINARY OBSTETRICS AND BREEDS OF HORSES.

Examiner: F. C. Grenside, V.S.

1. Describe the placenta, and compare that of solipeds wlth that of ruminants.

2. Mention the most reliable signs of pregnancy and give the average period of gestation in the different domesticated animals.

3. Describe how parturition is brought about, and give the time occupied in the act by the mare, the cow and the ewe.

4. Describe how the attendant should act during the course of parturition, and state what should be found as representing a normal state on a manual examination.

5. Explain how to effect delivery in the following cases, viz. when all four legs are presented, when head and four legs, when one foreleg is completely retained.

6. Describe how to eviscerate a fœtus in case of breech presentation.

7. Explain how to treat a case of everted uterus.

8. Give the nature and symptoms of parturient apoplexy.

9. Give the strong points of the Clyde and Shire in each case. Give the characteristics of the Suffolk Punch.

10. Give a definition of the term "quality," as applied to horses, and an opinion as to the most suitable class of mares to which to breed Cleveland Bays and Thoroughbreds respectively, in order to produce good carriage horses.

MIDSUMMER EXAMINATIONS, 1887.—Continued.

SECOND YEAR.

ENGLISH LITERATURE.

Examiner: S. C. Smoke, B.A.

Milton's "L'Allegro" and "Il Penseroso."

1. "Hence loathed melancholy,
Of Cerberus, and blackest midnight born,
In Stygian cave forlorn,
'Mongst horrid shapes, and shrieks, and sights unholy;
Find out some uncouth cell,
Where brooding darkness spreads his jealous wings,
And the night-raven sings:
There under ebon shades and low-brow'd rocks,
As ragged as thy locks,
In dark Cimmerian desert ever dwell."

(*a*) Scan the first four lines.

(*b*) Write explanatory notes on *Cerberus, Stygian, Cimmerian.*

(*c*) What figures are employed in the fourth and sixth lines?

(*d*) Express the thought of the passage in your own words.

(*e*) Explain the meaning of *uncouth, brooding, jealous.*

(*f*) Quote the corresponding passage from Il Penseroso, and compare the passages (*a*) as to thought (*b*) as to the construction.

2. "Bright eyes rain influence." Explain the meaning and point out the figure employed.

3. Quote the passages in which occur the following expressions: *Immortal verse, mute silence, fleecy clouds, prophetic strain.*

4. "And when the sun begins to fling
His flaring beams, me goddess bring
To arched walks of twilight groves,
And shadows brown that Sylvian loves;
Of pine or monumental oak,
Where the rude axe with heaved stroke
Was never heard the nymphs to daunt,
Or fright them from their hallowed haunt.
There in close covert by some brook
Where no profaner eye may look,
Hide me from day's garish eye."

(*a*) If you had come across this extract, not knowing its source or its connection, state how you could determine its right to rank as poetry.

(*b*) What is the force of *flaring, twilight, monumental, garish.*

5. Quote your favourite passage, and state wherein you think the beauty consists.

6. With which of these poems was Milton himself more in sympathy? Give reasons for your answer.

MIDSUMMER EXAMINATIONS, 1887.—Concluded.

SECOND YEAR.

ROAD-MAKING, LEVELLING AND SURVEYING.

Examiner: E. Lawrence Hunt.

1. Write fully and minutely on the drainage of roads.
2. Give full directions for the construction of gravel roads.
3. Find the power required to draw a wheel over a stone five inches high, when the diameter of the wheel is $4\frac{1}{2}$ ft., and the total weight 800 lbs., the line of draught horizontal.
4. Determine by the resolution of forces the power required to draw a load of 3500 lbs. up a slope of 1 in 25 when the force on the level is 150 lbs.
5. Complete the following table, indicate the highest and lowest points in the line, and between which two stations the grade is steepest; draw a sketch of the line.

Stations.	Distances.	Back-Sights.	Fore-Sights.	Ascents.	Descents.	Total Heights.
A		5.20	2.00			
B	120	4.75	3.20			
C	130	1.70	4.85			
D	80	2.65	6.37			
E	180	7.14	1.55			
F	150	1.25	5.45			
G	50					

6. Draw a plan of the field (scale 1 inch to the chain) and find the area from the following measurement.

Left Offsets.	Chain Line.	Right Offsets.
60	500 to O	
125	425	
75	300	
	100	
	From O_2 turn to the right.	
230	675 to O_2	
	525	
175	275	
	150	
	From O_1	300 to O_3

APPENDIX 4.

CLASS LISTS :

I.—EASTER EXAMINATIONS, 887.
II.—MIDSUMMER EXAMINATIONS, 1887.

I.—EASTER EXAMINATIONS, 1887.

FIRST YEAR.

Classes.		Live Stock. (Cattle.)	Live Stock. (Sheep.)	Live Stock. (Pigs and Sheep.)	Dairying.	Judging Cattle. (Oral. Exam.)
Honours.	I.	1 Harcourt, G. 2 Dean, H. H. Mckenzie, A. G. Nelles, S. W. 5 Soule, R. M. 6 Sinclair, J. J. 7 Robson, J. W. 8 Palmer, W. J. Rayden, J. S. Bayne, S. R.	1 Harcourt. Robson. McKenzie. 4 Dean. 5 Soule.	1 Robson. 2 Harcourt. 3 Dean. Shantz.	1 Robson. 2 Harrison. 3 Harcourt. 4 McKenzie. 5 Rayden. 6 Bayne. Elton, C. W. 8 Thompson. 9 Stewart, R. Elton, R. F. 11 de Mauritz. 12 Palmer. 13 Dean. 14 Nelles. 15 Rowen.	1 Harcourt.
	II.	1 Thompson, T. F. 2 Carlaw, G. 3 Wilmot, A. B. 4 Sweet, H. R. Willians, T. B. 6 Shantz, A. Scott, J. A. Harrison, R. S. Stewart, J. B. 10 Brown, S. P. 11 Steacy, M. W.	1 Nelles. 2 Brown. Palmer. Willans, T. B. Sinclair. Shirreffs. 7 Scott. Harrison. Rayden. Cleugh. Hoacock. Thompson. 13 Bayne. Carpenter. Shantz. Somerville.	1 Rowen. 2 Brown. 3 Harrison. 4 Carlaw. 5 Rayden. Austin. Palmer. 8 Serson. Boyd. 10 Vallance. Nelles. 12 VanLuven. Bayne. Scott. Cleugh. Morrison. Steacy. Shirreffs, Soule. Heacock.	1 Shantz. Willans, T. B. 3 Price. Sinclair. 5 Horrocks. Denison. 7 Shirreffs. 8 Wilmot. 9 Soule. 10 Brown. Scott. 12 Budd. 13 Esplen. Steacy. 15 Willans, N. Gardiner. 17 Heacock. 18 Cleugh.	1 McKenzie. 2 Robson. 3 Nelles. 4 Budd. Dean- 6 Shantz. Sweet. 8 Cleugh. 9 Sinclair. 10 Palmer. Serson. Brown. Thompson. 14 Stewart, R. 15 Rayden. Rowen. 17 Harrison. Heacock. Steacy. Somerville. Soule. Valance. Elton, R. F. Denison. Carlaw. Bayne.

Class Lists (Easter Examinations)—*Continued.*

FIRST YEAR.

Classes.	Live Stock. (Cattle.)	Live Stock. (Sheep.)	Live Stock. (Sheep and Pigs.)	Dairying.	Judging Cattle. (Oral Exam.)
Pass. III.	1 Heacock, F. W.	1 de Mauritz.	1 Somerville.	1 VanLuven.	1 Scott.
	Shirreffs, G. G.	2 Sweet.	2 Horrocks.	Morrison.	Price.
	3 Somerville, J. R.	Stewart, J. B.	3 Carpenter.	Austin.	3 Esplen.
	4 Serson, W. E.	4 Austin.	Wilmot.	Mutton.	VanLuven.
	Cleugh, H. H.	5 Budd.	5 Denison.	5 Sweet.	Willans, T. B
	Budd, W.	Mutton.	6 Budd.	6 Valance.	6 Austin.
	Carpenter, W. S	Boyd.	7 Willans, T. B.	7 Carpenter.	Stewart, J.B.
	Rowen, M. B.	Rowen.	8 McKenzie.	8 Boyd.	de Mauritz.
	9 Elton, R. F.	Elton, R. F.	Stewart, R.	9 Serson.	Morrison.
	Stewart, R.	Stewart, R.	10 Thompson.	Carlaw.	Shirreffs.
	11 Esplen, J. H.	11 Horrocks.	11 Elton, R. F.	11 Globensky.	Sullivan.
	Boyd, W. C.	12 Willans, N.	12 Sinclair.	12 Somerville.	12 Carpenter.
	13 Austin, A. M.	13 Drysdale.	Esplen.	13 Sullivan.	13 Horrocks.
	14 Mutton, F. A.	Morrison.	14 Willans, N.	14 Stubbs.	Willans, N.
	15 Denison, D.	15 Carlaw.	15 Stewart, J. B	15 Routhier.	Wilmot.
	16 Morrison, W. S.	16 Esplen.	Drysdale.	Stewart, J. B.	Stubbs.
	17 de Mauritz, R. C.	Wilmot.	17 Sweet.	17 Drysdale.	Boyd.
	18 Drysdale, W. P	Steacy.	18 Sullivan.		18 Drysdale.
	Horrocks, T. J.	19 Serson.	19 de Mauritz.		19 Mutton.
	Willans, N.	Globensky.	20 Price.		20 Globensky.
	Valance, R.	21 Denison.	21 Globensky.		21 Routhier.
	Sullivan, R.	Valance.	Routhier.		
	23 VanLuven, R. M.				Gardiner.
	24 Globensky, E. A	Price.	Stubbs.		
	Gardiner, R. J.	Routhier.	Mutton.		
		Sullivan.	Gardiner.		
	Routhier, J. A.	Stubbs.			
	Price, V.	Gardiner.			
	Stubbs, H. C.	VanLuven.			

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 Examinations)—*Continued.*

FIRST YEAR.

Classes.		Judging Sheep. (Oral Exam.)	Inorganic Chemistry.	Organic Chemistry.	Natural History.	English Literature.
Honours.	I.	1 Sweet. 2 { Robson. Harcourt. Nelles.	1 Harcourt. 2 Rayden. 3 Stewart, R. 4 Robson. 5 Harrison. 6 Rowen. 8 Soule. 7 Austin. 9 Palmer.	1 Rayden. 2 Harcourt. 3 Dean. 4 Harrison. 5 Shirreffs. 6 { Robson. McKenzie. 8 { Palmer. Elton, R. F.	1 Harcourt. 2 Robson. 3 Harrison. 4 McKenzie. 5 Dean.	1 Harcourt. 2 Robson. 3 Willans, T. B. 4 Dean. 5 Soule. 6 Harrison. 7 Shantz. 8 McKenzie.
	II.	1 { Soule. Thompson. 3 Somerville. 4 de Mauritz. 5 { Sinclair. Rowen. 7 { Rayden. Palmer. Brown. 10 Shirreffs. 11 { Esplen. Willans, T. B. Van Lusen. Stewart, R. 15 { Shantz. Scott. Harrison. 18 Dean. 19 { Price. McKenzie. Mutton. Cleugh. Carlaw.	1 Bayne. 2 Shantz. 3 Dean. 4 McKenzie.	1 Willans, T. B. 2 Shantz. 3 Bayne. 4 Soule. 5 Austin. 6. de Mauritz. 7 Morrison. 8 Sweet.	1 Palmer. 2 Rayden. 3 Soule. 4 Bayne. 5 { Shantz. Willans, T. B. 7 Austin. 8 { de Mauritz. Elton, R. F. 10 Carpenter. 11 Willans, N.	1 Price. 2 Wilmot. 3 { de Mauritz. Bayne. 5 { Austin. Stewart, R. 7 Palmer. 8 Elton, R. F. 9 Sinclair. 10 Rayden. 11 Rowen.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

Classes.	Judging Sheep. (Oral Exam.)	Inorganic Chemistry.	Organic Chemistry.	Natural History.	English Literature.
Pass. III.	1 Horrocks. 1 Wilmot. 1 Willans, N. 1 Stewart, J. B. 5 Bayne. 5 Budd. 7 Denison. 7 Valance. 7 Elton, R. F. 10 Serson. 10 Heacock. 10 Carpenter. 13 Austin. 13 Boyd. 15 Steacy. 15 Stubbs. 17 Gardiner. 18 Morrison. 19 Globensky. 20 Drysdale. 21 Routhier. 21 Sullivan.	1 Steacy. 2 Brown. 3 Morrison. 4 Esplen. 5 Serson. 6 Elton, R. F. 7 Heacock. 8 Shirreffs. 9 Nelles. 10 Sinclair. 11 Budd. 12 Willans, T. B. 13 Thompson. 14 de Mauritz. 15 Carlaw. 16 Denison. 17 Willans, N. 18 Horrocks. 19 Wilmot. 20 Sweet. 21 Carpenter. 22 Price. 23 Scott. 24 Boyd. VanLuven. Cleugh. Valance. Somerville. Gardiner. Mutton. Drysdale. Globensky. Sullivan. Stubbs. Stewart, J. B. Routhier.	1 Esplen. 2 Brown. 2 Willans, N. 2 Stewart, R. 5 Thompson. 6 Budd. 6 Carlaw. 8 Price. 9 Serson. 10 Rowen. 11 Sinclair. 12 Heacock. 13 Steacy. 14 Nelles. 15 Carpenter. 16 Denison. 17 Valance. 17 Globensky. 19 Wilmot. 20 VanLuven. Boyd. Mutton. Horrocks. Cleugh. Drysdale. Scott. Sullivan. Gardiner. Somerville. Stewart, J. B. Stubbs. Routhier.	1 Steacy. 2 Shirreffs. 3 Sinclair. 4 Thompson. 4 Heacock. 6 Serson. 7 Stewart, R. 8 Rowen. 9 Denison. 10 Brown. 11 Morrison. 12 Wilmot. 13 Budd. 14 Esplen. 15 Cleugh. 16 Horrocks. 17 Nelles. 18 Sweet. 19 Price. 20 Carlaw. 21 Scott. 22 Mutton. 23 Sullivan. 24 Gardiner. 25 Stewart, J. B. 26 Drysdale. Routhier. Valance. VanLuven. Somerville. Boyd. Globensky. Stubbs.	1 Cleugh. 2 Serson. 3 Scott. 4 Shirreffs. 5 Brown. 6 Sullivan. 7 Carpenter. 7 Nelles. 9 Steacy. 10 Morrison. 11 Carlaw. 12 Heacock. 13 Boyd. 13 Drysdale. 15 Thompson. 16 Willans, N. 17 Horrocks. 17 Mutton. 17 Sweet. 20 Esplen. Gardiner. Somerville. VanLuven. Denison. Budd. Stewart, J. B. Valance. Globensky. Stubbs. Routhier.

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 Examinations)—*Coutinued.*

FIRST YEAR.

Classes.		Veterinary Anatomy.	Arithmetic.	Book-keeping.	General Proficiency.
Honours.	I.	1 Harcourt. 2 Robson. 3 Brown. Shantz. 5 Bayne. 6 Dean.	1 Harcourt. 2 Stewart, R. 3 McKenzie. Sinclair. 5 Shantz.	1 Shantz. 2 Stewart. 3 Harcourt. 4 Robson. 5 Dean. Van Luven. 7 Carlaw. 8 McKenzie. 9 Brown. 10 Soule. 11 Shirreffs.	1 Harcourt. 2 Robson. 3 McKenzie. 4 Dean.
	II.	1 Rowen. Harrison. 3 Elton, R. F. 4 McKenzie. 5 Soule. 6 Steacy.	1 Shirreffs. 2 de Mauritz. 3 Rayden. 4 Rowen. 5 Dean. 6 Van Luven. 7 Robson. Austin. Serson. Budd. 11 Cleugh. Thompson. Harrison.	1 Rowen. 2 Palmer. 3 Morrison. 4 Serson. 5 Sinclair. 6 Rayden. 7 Austin.	1 Shantz. 2 Harrison. 3 Soule. 4 Rayden. 5. Bayne. 6 Palmer. 7 Stewart, R. 8 Rowen. 9 Sinclair. 10 Brown. 11 Shirreffs.
Pass.	III.	1 Esplen. 2 Palmer. 3 Shirreffs. 4 Sinclair. 5 Thompson. 6 Nelles. 7 Stewart, R. 8 Serson. Rayden. 10 Cleugh. 11 Willans, T. B. Morrison. 13 Valance. Sweet. 15 Carpenter. Budd. 17 Austin. 18 Carlaw. Heacock. 20 Denison. Horrocks. de Mauritz. Somerville. Willans, N. Wilmot. Stott. Routhier. Boyd. Drysdale. Stewart, J. B. Sullivan. Gardiner. Van Luven. Price. Stubbs. Mutton. Globensky.	1 Bayne. 2 Heacock. 3 Esplen. 4 Brown. 5 Steacy. 6 Soule. 7 Nelles. 8 Denison. 9 Carlaw. Palmer. Horrocks. Price. 13 Wilmot. 14 Gardiner. 15 Carpenter. 16 Elton, R. F. 17 Sweet. 18 Scott. 19 Morrison. Globensky. Stewart, J. B. Sullivan. Valance. Somerville. Willans, T. B. Boyd. Willans, N. Drysdale. Mutton. Stubbs. Routhier.	1 Horrocks. 2 Heacock. 3 Bayne. 4 Budd. 5 Steacy. 6 Valance. 7 Somerville. 8 Harrison. 9 Sweet. 10 Willans, T. B. 11 Price. Nelles. 13 Mutton. 14 Thompson. 15 Denison. 16 Cleugh. 17 Esplen. 18 Elton, R. F. Scott. 20 de Mauritz. Carpenter. Wilmot. Boyd. Willans, N. Stewart, J. B. Drysdale. Routhier. Sullivan. Stubbs. Globensky. Gardiner.	1 Willans, T. B. Austin. 3 Elton, R. F. 4 Nelles. 5 Thompson. 6 Steacy. 7 de Mauritz. 8 Serson. 9 Heacock. 10 Esplen. 11 Morrison. 12 Carlaw. 13 Sweet. 14 Carpenter.

☞ 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 is 60 per cent.; for pass, 3 per cent.

Class Lists (Easter Examinations)—*Continued.*

SECOND YEAR.

Classes.		Agriculture.	Live Stock.	Live Stock., (Pigs and Sheep).	Dairying.	Agriculture.
Honours.	I.	1 Morgan, H. A. 2 Scrugham, J. G. 3 Sleightholm, F. J. 4 Lick, E. 5 Craig, J. A. McCallum, E. G. Hart, J. W.	1 Sleightholm. 2 Scrugham. 3 Lick. Hart, J. W. 5 Creelman.	1 Hart, J. W. 2 Lick. 3 Sleightholm. 4 Craig. 5 Morgan. Hart, J. A. 7 Donald. 8 Scrugham. 9 Gilbert.	1 Lick. 2 Scrugham. 3 Morgan. 4 Hart, J. W. Sleightholm. 6 Craig. Ewing. 8 Howes. Donaldson.	1 Sleightholm.
	II.	1 Donald, J. C. Creelman, G. C. 3 Howes, J. S. Gilbert, W. J. 5 Donaldson, F. N. Harkness, A. D. 7 Leavens, D. H. Ewing, W. 9 Hart, J. A. Paterson, B. E. Orsman, C. P.	1 McCallum. Morgan. 3 Craig. Paterson. Gilbert. 6 Leavens. Howes. 8 Donaldson. Ewing. 10 Donald.	1 Leavens. 2 Ewing. 3 McCallum. 4 Creelman. 5 Howes. 6 Paterson. Donaldson.	1 Orsman. Acres. 3 McCallum. 4 Hart, J. A. 5 Paterson. 6 Leavens. 7 Harkness. 8 Donald. Livesey. 10 Gilbert.	1 Craig. 2 Scrugham. Lick. 4 McCallum. Hart, J. A. 6 Creelman. Morgan. 8 Ewing. Howes. 10 Paterson. Donaldson. Donald.
Pass.	III.	1 Livesey, E. M.	1 Hart, J. A. 2 Orsman. 3 Harkness. Livesey.	1 Livesey. 2 Harkness. 3 Orsman.	Creelman. Ritchie.	Gilbert. Leavens. Harkness. Livesey. Hart, J. A. Orsman.

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 EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Judging Cattle. (Oral Exam.)	Judging Sheep. (Oral Exam.)	Agricultural Chemistry.	Entomology.	Veterinary Pathology.
Honours.	I.	1 Scrugham. Sleightholm. 3 Creelman.	1 Scrugham. 2 Sleightholm. 3 Lick. Hart, J. A. Morgan.	1 Scrugham. 2 Lick. 3 Sleightholm. 4 Hart, J. W. 5 Craig. 6 Morgan.	Scrugham. Sleightholm. Lick. Hart, J. W. McCallum.	Scrugham. Sleightholm. Lick. Hart, J. W.
	II.	1 Gilbert. Craig. 3 Hart, J. A. Ewing. Donald. 6 Morgan. Lick. 8 Hart, J. W. 9 Paterson. McCallum. Leavens. Howes. Donaldson. 14 Orsman.	1 Hart, J. W. 2 Ewing. 3 Donald. Gilbert. McCallum. 6 Creelman. 7 Orsman. 8 Craig. Paterson. Donaldson.	1 Donaldson. 2 McCallum. 3 Ewing.	1 Ewing. 2 Morgan. 3 Craig. 4 Donaldson. 5 Paterson. 6 Livesey. 7 Sharman. 8 Donald. 9 Creelman.	Paterson. McCallum. Hart, J. A. Morgan.
Pass.	III.	1 Livesey. Harkness.	1 Leavens. 2 Harkness. 3 Howes. Livesey.	1 Paterson. 2 Sharman. 3 Hart, J. A. 4 Orsman. 5 Donald. 6 Howes. 7 Creelman. 8 Gilbert. 9 Harkness. 10 Livesey. 11 Leavens.	1 Harkness. 2 Leavens. 3 Howes. 4 Gilbert. 5 Hart, J. A. 6 Orsman.	1 Leavens. 2 Craig. 3 Donaldson. 4 Gilbert. 5 Ewing. 6 Harkness. 7 Howes. Livesey. 9 Orsman. Creelman. 11 Donald.

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 EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Practical Horse.	English Literature.	Political Economy.	Mechanics.	General Proficiency.
Honours.	I.	1 Scrugham. 2 Lick. 3 McCallum. 4 Sleightholm. 5 Gilbert.	1 Sleightholm. 2 Lick. 3 Donaldson.	1 Scrugham. 2 Hart, J. W. 3 Lick. 4 Creelman. 5 Donald. 6 Paterson. 7 Donaldson. 8 Sleightholm.	1 Lick.	1 Scrugham. 2 Sleightholm. 3 Lick. 4 Hart, J. W.
	II.	1 Morgan. 2 Craig. 3 Donaldson. 4 Hart, J. W. 5 Creelman. 6 Ewing. 7 Hart, J. A.	1 Scrugham. 2 Hart, J. W. 3 Sharman.	1 McCallum. 2 Gilbert. 3 Morgan. 4 Ewing. 5 Sharman. 6 Orsman. 7 Howes. 8 Harkness.	1 Gilbert. 2 Sleightholm. 3 Scrugham. 4 Hart, J. W. 5 Harkness. Hart, J. A. 7 Orsman.	Morgan. McCallum. Craig. Donaldson. Ewing. Gilbert.
Pass.	III.	1 Livesey. 2 Paterson. 3 Howes. Leavens. 5 Harkness. 6 Orsman. 7 Donald.	1 Morgan. 2 Creelman. 3 Gilbert. 4 Howes, 5 Ewing. McCallum. 7 Donald. 8 Craig. 9 Livesey. 10 Paterson. 11 Hart, J. A. 12 Orsman. 13 Harkness. Leavens.	1 Hart, J A. 2 Craig. 3 Leavens. 4 Livesey.	1 Ewing, 2 McCallum. 3 Donaldson. 4 Craig. 5 Howes. Livesey. 7 Paterson. 8 Creelman. 9 Morgan. Sharman. 11 Leavens. Donald.	1 Creelman. 2 Paterson. 3 Hart, J. A. 4 Howes. 5 Orsman. 6 Harkness. 7 Livesey.

Only those who pass in every subject are ranked in General Proficiency.

First-class men in General Proficiency must obtain at least 75 per cent. of the total number of marks second-class men, at least 60 per cent. of the total number of marks.

Class Lists.

II.—MIDSUMMER EXAMINATIONS, 1887.

FIRST YEAR.

Classes.		Agriculture.	Geology.	Botany.	Veterinary Materia Medica.	English Grammar.
Honours.	I.	1 Harcourt, G. Robson, J. W. 3 Dean, H. H. 4 McKenzie, A. G. 5 Soule, R. M. Rayden, J. S. 7 Carlaw, G. 8 Brown, S. P. Nelles, S. W.	1 Robson. 2 Rayden. 3 Harcourt. 4 McKenzie. 5 Soule. Dean.	1 Jackson. 2 Harcourt. 3 McKenzie. Robson.	1 Robson. 2 Harcourt. 3 McKenzie. 4 Dean.	1 Robson. 2 McKenzie. Jackson. 4 Harcourt. 5 Dean. 6 Shantz. 7 Rowen.
	II.	1 Carpenter, W. S. 2 Palmer, W. G. 3 Esplen, J. H. 4 Thompson, T. F. Sinclair, J. J. Shantz, A. 7 Budd, W. 8 Jackson, F. A. Morrison, W. S. 10 Heacock, F. W. 11 Austin, A. M. Shirreffs, G. G. 13 Serson, W. E. Cleugh, H. H. 15 Valance, R. Knowlton, S. M. Sweet, H. B. Rowen, M. B.	1 Jackson. 2 Shantz. 3 Shirreffs. 4 Austin. 5 Thompson. 6 Marsack, H. Knowlton. 8 Willans, T. B. 9 Cleugh. 10 Palmer. 11 Brown. Rowen. 13 Elton, R. F. Stewart, R. 15 Sweet.	1 Soule. 2 Shantz. Brown. 4 Dean. 5 Elton, R. F. 6 Palmer. 7 Rowell. 8 Shirreffs.	1 Soule. 2 Shantz. 3 Jackson. 4 Esplen. 5 Palmer.	1 Stewart, R. 2 Soule. 3 Marsack, H. 4 Willans, T. B. 5 Shirreffs. 6 Brown. Nelles. 8 Thompson. 9 Steacy. 10 Sinclair. Sweet. 12 Willans, N.
Pass.	III.	1 Stewart, R. 2 Campbell, W. Willans, T. B. 4 Steacy, M. W. 5 Somerville, A. R. Stewart, J. B. Boyd, W. C. 8 Horrocks, T. J. 9 Willans, N. 10 Elton, R. F. 11 Marsack, H. 12 Goblensky, C. A. Drysdale, W. P. Mutton, F. A. 15 Wilmot, A. B. 16 Marsack, F.	1 Somerville. 2 Esplen. 3 Steacy. 4 Carpenter. 5 Marsack, F. Budd. 7 Carlaw. 8 Serson. 9 Nelles. 10 Sinclair. 11 Willans, N. 12 Heacock. 13 Horrocks. 14 Morrison. 15 Wilmot. 16 Mutton. 17 Campbell. 18 Valance. Stewart, J. B. Drysdale. Globensky. Boyd.	1 Esplen. 2 Steacy. Rayden. 4 Knowlton. Sweet. 6 Thompson. Austin. 8 Morrison. 9 Nelles. Willans, T. B. 11 Marsack, H. 12 Carpenter. 13 Stewart, R. 14 Sinclair. Marsack, F. Budd. 17 Willans, N. 18 Serson. 19 Valance. 20 Wilmot. 21 Heacock. Cleugh. 23 Carlaw. Mutton. Boyd. Campbell. Drysdale. Horrocks. Somerville. Stewart, J. B. Globensky.	1 Rayden. 2 Willans, T. B. Elton. Sweet. 5 Stewart, R. 6 Nelles. Marsack, H. 8 Heacock. Steacy. 10 Shirreffs. 11 Austin. Rowen. 13 Willans, N. 14 Cleugh. Serson. Brown. 17 Wilmot. Carpenter. 19 Budd. 20 Somerville. 21 Sinclair. Knowlton. 23 Drysdale. Horrocks. Marsack, F. Valance. Morrison. Carlaw. Boyd. Thompson. Mutton. Campbell. Globensky. Stewart, J. B.	1 Rayden. 2 Horrocks. 3 Knowlton. 4 Morrison. 5 Esplen. 6 Elton. 7 Wilmot. 8 Somerville. 9 Valance. 10 Marsack, F. 11 Serson. 12 Budd. 13 Palmer. 14 Carpenter. 15 Mutton. 16 Heacock. 17 Carlaw. Cleugh. Austin. Globensky. Drysdale. Campbell. Boyd. Stewart, J. B.

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 (MIDSUMMER EXAMINATIONS).—*Continued.*

FIRST YEAR.

Classes.		English Composition.	Mensuration.	General Proficiency.
Honours.	I.	1 Dean. 2 Robson. 3 Harcourt.	1 Stewart, R. 2 Jackson. 3 Dean. 4 Thompson.	1 Robson. 2 Harcourt. 3 Dean. 4 McKenzie.
	II.	1 McKenzie. 2 Willans, T. B. 3 Rowen. 4 Stewart, R.	1 Shantz. 2 Sinclair. 3 Shirreffs. 4 Harcourt. 5 McKenzie. 6 Soule. 7 Rowen.	1 Jackson. 2 Shantz. 3 Soule. 4 Stewart, R. 5 Rowen.
Pass.	III.	1 Morrison. 2 Serson. 3 Jackson. 4 Rayden. 5 Sinclair. 6 Shirreffs. 7 Thompson. 8 Brown. 9 Marsack, H. 10 Shantz. 11 Willans, N. 12 { Budd. Wilmot. 14 Soule. 15 { Knowlton. Sweet. 17 { Steacy. Austin. Palmer. Carlaw. 21 { Nelles. Cleugh. Valance. Esplen. Horrocks. Somerville. Marsack, F. Heacock.	1 Carlaw. 2 Robson. 3 Knowlton. 4 Elton. 5 { Steacy. Palmer. 7 Brown. 8 Esplen. 9 Budd. 10 Rayden. 11 Morrison. 12 Wilmot. 13 { Cleugh. Heacock. Somerville. Sweet. 17 { Nelles. Serson. Horrocks. Marsack, F. Campbell. Valance.	1 Shirreffs. 2 Rayden. 3 Brown. 4 Palmer. 5 Sinclair. 6 Esplen. 7 Sweet. 8 Nelles. 9 Knowlton. 10 Steacy. 11 Morrison. 12 Serson. 13 Budd. 14 Heacock. 15 Valance. 16 { Wilmot. Marsack, F.
		Elton, R. F. Mutton. Carpenter. Campbell. Drysdale. Stewart, J. B. Boyd. Globensky.		

Departments.		Men ranked First-Class on the total work of the year.
I.	Agriculture and Live Stock.	1 Harcourt. 2 Robson. 3 Dean. 4 McKenzie.
II.	Natural Science.	1 Harcourt. 2 Robson. 3 Rayden. 4 McKenzie.
III.	Veterinary Science.	1 Harcourt. 2 Robson. 3 McKenzie. 4 Shantz. 5 Dean.
IV.	English Literature.	1 Robson. 2 Dean. 3 Harcourt. 4 McKenzie.
V.	Mathematics and Book-keeping.	1 Stewart, R. 2 Harcourt. 3 McKenzie. 4 Sinclair. 5 Shantz.

Names unnumbered are those of students who failed to pass in the subject.
Only those who pass in every subject are ranked in General Proficiency.
First-class men in General Proficiency must obtain at least 75 per cent. of the total number of marks; second class men, at least 60 per cent. of the total number of marks.
First-class men in any department must obtain at least 75 per cent. of the marks allotted to the subjects in that department.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Agriculture.	Analytical Chemistry.	Meteorology.	Systematic and Economic Botany.	Practical Horticulture.
Honours.	I.	1 Sleightholm F.J	1 Lick.	1 Scrugham.	1 Scrugham.	Lick.
		Scrugham, J.G.	2 Sleightholm.	2 Elton.	2 Sleightholm.	Sleightholm.
		3 Lick, E.	3 Scrugham.	3 Sleightholm.	3 Craig.	Scrugham.
		4 Craig, J. A.	4 Hart, J. W.	4 Lick.	4 Lick.	Hart, J. W.
		5 Morgan, H. A.		5 Hart, J. W.	5 Hart, J. W.	Morgan.
		6 McCallum, E. G.		6 McCallum.	6 Ewing.	Sharman.
		7 Hart, J. W.		7 Sharman.		Craig.
		Creelman, G. C.				
		9 Ewing, W.				
	II.	1 Paterson, B. E.		1 Morgan.	1 McCallum.	McCallum.
		Howes, J. S.		Craig.	2 Elton, C. W.	Creelman.
		Leavens, D. H.		3 Donaldson.	3 Morgan.	Ewing.
		4 Bayne, S. R.		4 Bayne.	4 Paterson.	Elton.
		5 Donald, J. C.		Gilbert.	5 Gilbert.	Howes.
		6 Gilbert, W. J.		6 Creelman.	6 Howes.	Livesey.
		Scott, J. A.		7 Livesey.	7 Creelman.	Hart, J. A.
		8 Hart, J. A.		8 Ewing.	8 Sharman.	Paterson.
		Harkness, A.D.		9 Howes.		Donaldson.
		10 Orsman, C. P.		10 Harkness.		Bayne.
		11 Elton, C. W.				
		Livesey, E. M.				
Pass.	III.	1 Price, V.	1 Sharman.	1 Paterson.	1 Donaldson.	1 Donald.
		2 Donaldson, F. N.	2 Elton.	2 Hart, J. A.	2 Bayne.	2 Gilbert.
		3 de Mauritz, R. C.	3 Morgan.	3 Donald.	3 Hart, J. A.	Leavens.
			4 Craig.	4 Orsman.	4 Orsman.	4 Price.
			5 Orsman.	5 Scott.	5 Leavens.	5 Harkness.
			6 Howes.	6 Leavens.	6 Harkness.	6 Scott.
			7 Donaldson.	7 Price.	7 Donald.	7 Orsman.
			8 Livesey.	8 de Mauritz.	8 Livesey.	
			9 Ewing.		9 Price.	de Mauritz.
			10 McCallum.			
			11 Gilbert.		Scott.	
			12 Paterson.		de Mauritz.	
			13 Donald.			
			14 Creelman.			
			15 Harkness.			
			16 Bayne.			
			17 Leavens.			
			18 Hart, J. A.			
			Price.			
			Scott.			
			de Mauritz.			

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

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Veterinary Obstetrics and Breeds of Horses	English Literature.	Road-making.	General Proficiency.
Honours.	I.	1 Scrugham. 2 Sleightholm. 3 Lick.	1 Sleightholm. 2 Scrugham. 3 Sharman. 4 Elton, C.W. Lick. Gilbert. 7 Donaldson. 8 Donald.	1 Lick. 2 Sleightholm Scrugham. 4 Bayne. 5 Elton, C. W. 6 Howes. 7 Harkness. 8 Hart, J. W. Ewing.	1 Scrugham. 2 Sleightholm. 3 Lick. 4 Hart, J. W.
	II.	1 Hart, J. W. 2 Elton, C. W. 3 Donaldson. 4 Ewing.	1 Creelman. 2 Craig. Ewing. Hart, J. W. 5 Morgan. 6 Paterson.	1 McCallum. 2 Gilbert. Craig. 4 Morgan. 5 Sharman. 6 Hart, J. A. 7 Orsman. Donald.	1 Craig. 2 Elton, C. W. 3 Morgan. 4 Ewing. 5 McCallum. 6 Howes. 7 Gilbert.
Pass.	III.	1 Morgan. Craig. 3 Livesey. 4 Bayne. 5 Gilbert. McCallum. 7 Howes. 8 Paterson. 9 Orsman. 10 Leavens. 11 Donald. 12 Harkness. 13 de Mauritz. 14 Creelman. 15 Hart, J. A. 16 Scott. Price.	1 Hart, J. A. Howes. McCallum. 4 Price. 5 Leavens. 6 Orsman. 7 de Mauritz 8 Livesey. 9 Harkness. 10 Bayne. Scott.	1 Creelman. 2 Donaldson. 3 Paterson. 4 Leavens. 5 Livesey. 6 Scott. de Mauritz. Price.	1 Creelman. 2 Paterson. 3 Donaldson. 4 Bayne. 5 Donald. 6 Orsman. 7 Hart, J. A. 8 Livesey. 9 Harkness. 10 Leavens. 11 Sharman.

Department.		Men ranked First-Class on the total work of the year.
I.	Agriculture and Live Stock.	1 Sleightholm. 2 Scrugham. 3 Lick. 4 Morgan. 5 Hart, J. W. 6 Craig.
II.	Natural Science.	1 Scrugham. 2 Lick. 3 Sleightholm 4 Hart, J. W. 5 Craig.
III.	Veterinary Science.	1 Scrugham. 2 Sleightholm. 3 Lick. 4 Hart, J. W.
IV.	English Literature and Political Economy.	1 Sleightholm. 2 Scrugham. 3 Hart, J. W. Lick. 5 Donaldson.
V.	Mathematics and Book-keeping.	Lick. Scrugham. Sleightholm. Hart, J. W.

APPENDIX 5.

COLLEGE IN ACCOUNT WITH FARM AND GARDEN.

(*a*) With Farm.

To 106 bags potatoes, at 90c	$ 95.40
" 3,358 gallons milk, at 12c	402.96
" Cartage for College	20.00
" Feed for College horse (without attendance)	75.00
" Feed for Bursar's horse (without attendance)	75.00
" Carpenter work by students, etc.	15.00
	$683.36

(*b*) With Garden.

To fruit and vegetables (for items and prices, see Mr. Forsyth's Report, Part VI.)	$648.49
Total receipts	$1,331.85
By amounts paid by College Student labour on farm and garden	3,192.05
Balance to credit of College	$1,860.20

PART II.

REPORT OF THE PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December 31st, 1887.

To the President of the Ontario Agricultural College:

SIR,—In submittimg 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.
5. Lectures.

1. COLLEGE MUSEUM.

In my report of last year, I took occasion to remark upon the propriety of making our museum largely of an instructive nature, and suggested some improvements, which I am glad to say are now being carried on, and will be completed ere long. It is to be hoped that some allowance will be made for the addition of new cases, instead of the somewhat antiquated ones which formerly occupied a great deal of space and showed but few objects.

During the year we have been indebted to the following for important donations to this department:—

1. W. M. Ramsay, Esq., Galt Coal Co. Fragment of coal from Lethbridge, N. W. T.
2. Mr. Elliot, Kingsville. Specimens of corn in the ear.
3. Master Ross, Chatham. 9 cocoons of several species of moths.
4. D. K. Erb, Esq., Sebringville. A living flying-squirrel.
5. S, Harkness, student. Nerves from a horse, and a portion of an artery.
6. D. H. Leavens, student. Specimen illustrating grafting.
7. John Morrison, Jr., Mandaumin. Specimens of wireworms.
8. W. L. Smith, Esq., Manitoulin Island. 3 specimens of coral.
9. E. Newton, Esq., Guelph. Fossils from Utica slate.
10. Prof. James, Agricultural College. Specimens illustrating raindrops and ripple marks upon rocks.
11. T. J. Day, Guelph. Heather and misletoe.
12. W. R. Bishop, student. Fossils from corniferous formation.
13. Messrs. Craig, Sharman, Raynor and Paterson, students. Stalactites and stalagmites from caves at Rockwood, and rounded stones from the potholes near them.
14. Prof. J. Hoyes Panton. Specimens of rock from Giant's Causway, Fingal's Cave, Ben Nevis and Mt. Rigi, in the Alps.
15. G. B. Boyce, Esq., Norham. Foot of a beaver, and a piece of wood gnawed by a beaver.

Our students are showing a greater interest each year in donating specimens to the Museum, and we may reasonably expect some valuable additions as soon as the new Museum is ready.

We shall always be pleased to receive from any one, specimens that will assist in illustrating facts in connection with Agricultural science.

2. Library.

Among other changes in the building during this year, is the enlargement of the Library, which had become too small. At present it is exceedingly convenient and affords excellent facilities for the arrangement of books, and in many respects for the accomodation of advanced students taking a third year course.

It contains 5,274 volumes of which 204 have been added this year. The latter may be grouped as follows:—

Reports, chiefly agricultural	76
Natural History, including Botany	15
Veterinary	1
Agriculture	18
Chemistry	5
Literature	14
Encyclopædias	5
Horticulture	13
Arboriculture	1
Dairying	6
Geology	4
History	11
Entomology	2
Stock	12
General Science	4
Pamphlets	17
	204

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.

It is a pleasure to report that the students take an interest in keeping this room in order, and not turning it into a place for general discussion.

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. Journal of Agriculture	"
3. Christian Guardian	Toronto.
4. Canada Presbyterian	"
5. Mechanical and Milling News	"
6. Monthly Weather Review	"
7. Presbyterian Review	"
8. Canadian Lumberman	Peterboro'.
9. Manitoba Weekly Free Press	Winnipeg.
10. Canadian Horticulturist	St. Catharines.
11. Canadian Entomologist	London, Ont.
12. Farm and Home	Springfield, Mass.
13. Bee Journal	Beeton.
14. North York Reformer	Newmarket.
15. Acton Free Press	Acton.

(b) *Furnished by the College.*

1.	The Daily Globe	
2.	" Mail	Toronto.
3.	" Mercury	"
4.	" Herald	Guelph.
5.	Rural Canadian	"
6.	Grip	Toronto.
7.	The Week	"
8.	Farmers' Advocate	"
9.	Canadian Dairyman	London, Ont.
10.	Canadian Stock-Raisers' Journal	Montreal.
11.	Nor'-West Farmer	Hamilton.
12.	Popular Science News	Winnipeg.
13.	Rural New Yorker	Boston.
14.	Gardener's Monthly	New York.
15.	North British Agriculturist	Philadelphia.
16.	Farmers' Gazette	Edinburgh (Scotland).
17.	Mark Lane Express	Dublin (Ireland).
18.	American Garden	London (England).
19.	American Naturalist	Greenfield (Mass.)
20.	Veterinary Journal	Philadelphia.
21.	Veterinarian	London (England).
22.	Cultivator and Country Gentleman	"
23.	Scientific American	Albany, N. Y.
24.	" Supplement	New York.
25.	Live Stock Journal and Fanciers' Gazette	"
26.	Live Stock Journal	England.
27.	American Agriculturist	Chicago.
28.	American Dairyman	New York.
29.	Nature	"
30.	Botanical Gazette	London (England).
31.	Agricultural Science	Crawfordsville, Indiana.
32.	American Bee Journal	Geneva, N. Y.
33.	Canadian Honey Producer	Chicago.
		Brantford.

4. Practical Work.

When opportunity was afforded, my efforts in the line of practical work were employed in collecting data of use in the preparation of bulletins, and in trying to improve facilities for the purpose of rendering instructions in science of a thoroughly practical nature.

During the past year a portion of the garden was selected and set out with plants, representing the most common species, genera and orders discussed in lectures on Botany. The beds were so arranged that the students could take their note-books to the garden, and there find the plants referred to, labelled and arranged in regular order, as they were discussed in the lecture room.

Thirty-two orders, 150 genera and 250 species were thus arranged, and it is intended to increase the number next year. Visitors were much pleased with this collection of herbaceous plants, for here, on examination, they found some beautiful flowers associated with some much less attractive. The cabbage and mustard grew side by side, the heliotrope and the detested burr, and other striking examples of plants related in structure, though widely separated in form. Students found this a great aid in the study of Botany.

During the year the following bulletins have been prepared on Apples, Weeds, and the Crane Fly.

Weeds.

At a period in Canadian farming when much interchange of seed is taking place, I have thought it expedient to say something about weeds, with special reference to two which came under my notice last season, and were reported as being new in the districts from which they were sent for identification.

Any plant out of place is really a weed, even if it does possess considerable beauty. Some plants are so frequently out of place that they have been always known as weeds, such as the thistle, chickweed, bindweed, etc.

In Ontario we have somewhere about 150 species of plants commonly known as weeds,, and of these nearly 100 have been introduced from Europe. Every year adds a few more foreigners, and if farmers are not more vigilant in watching against these unpleasant invaders our Province will soon be overrun.

There is no doubt that weeds are on the increase in Ontario, both in numbers and species. This may be accounted for by the comparative indifference of many farmers to the growth of weeds on the roadside, as well as to the practice which now prevails of procuring a change of seed from other districts. The productive power of these pernicious plants will be better understood when the reader examines the results of observations on their seed-bearing capabilities.

In each case following, the seeds are from a single plant: purslane, 500,000; burdock, 400,328; cockle, 3,200; mustard, 31,000; Canadian thistle, 42,000; ox-eye daisy, 9,600; chess, 3,500; mallow, 16,500. When we consider this productive power and the vitality some possess, together with the peculiar mode by which many are distributed, the surprise is that we are not more overrun than we are, especially when unfortunately located near careless or indifferent farmers.

Weeds are largely distributed by the following means:

1. Along with grain obtained from other districts.
2. Animals carrying seeds attached to their bodies.
3. By the wind, where seeds are supplied with structures which enable them to be blown about.
4. Threshing machines carrying seeds from farm to farm.
5. Renting farm for a short time to men who are indifferent to the condition in which they leave the place, better or worse, and usually worse, than they found it.
6. Manure from city stables.

With such odds against him a farmer who desires to keep his fields clean must be vigilant, industrious and painstaking. However, if he observes the following hints he will succeed in destroying weeds:

1. Cultivate the land thoroughly.
2. Watch the roadsides and fence-corners.
3. Never allow the weeds to seed.
4. If possible, never allow weeds to have the benefit of sunlight; this can be effected by constant and thorough cultivation, and will soon result in a clean farm.
5. Secure the co-operation of fellow-farmers.

A knowledge of the nature of weeds becomes of importance in destroying them. Annuals live but a year, bear many seeds and when young are weak and tender, such as shepherd's purse, mustard, cockle, pennycress, wild oats, chess, ragweed, chickweed, sow thistle.

Biennials continue two years, and usually have a tap-root. Unless these plants are cut below the surface, cutting increases their vigor. Wild carrot, blueweed, burdock and mullein are biennials.

Simple perennials continue from year to year and will reappear till the root is utterly destroyed, of which are the ox-eye daisy, mallow, chicory, bindweed, sorrel and campion.

Creeping perennials are more or less jointed in the roots, each joint capable of growing if separated. Continued cultivation and smothering from light are necessary to kill these, among which are Canadian thistle, couch grass, toadflax, milkweed and sow thistle (perennial).

Sonchus arvensis. (perennial sow thistle) has made its appearance in the neighbourhood of Stratford, from which the specimen sent to the college came. It is considered a troublesome weed in the old country, and belongs to a class the representatives of which are very difficult to destroy on account of the creeping rootstock already referred to. Like all members of the order *Compositæ* it produces many seeds. It bears a close resemblance to the common sow thistle, having a flower not unlike that of the dandelion, but the flower stalk, especially near the flower, is quite hairy. This weed being a perennial is likely to prove far more troublesome than the annual sow thistle and consequently should be kept under.

Thlaspi arvense (pennycress) has appeared in the vicinity of Almonte. It belongs to the order *Cruciferæ* and is closely allied to the mustard. It is well known along the Red River as French-weed and in that country has become a nuisance, having in some cases almost completely overrun the fields. No doubt it has reached Ontario in seed wheat from Manitoba; it should be destroyed at once before it gets a foothold. The following description may be of service to identify it: pods round, flat, with broad wings and a deep notch; leaves oblong, arrow-shaped at the base, toothed, smooth; flowers white and very small; plant about a foot high. It derives its name, pennycress, from the size and shape of its seed vessels, which resemble silver pennies. Though found to some extent in Quebec, it is rarely seen in Ontario. Its introduction should be looked upon with suspicion, for (bearing many seeds) it will soon spread if not kept under and prove here as troublesome a weed as it has in Manitoba.

Apples.

In a former Bulletin attention was directed to results in grape growing at the College. I purpose in this giving our own experience in fruit trees, and it will be observed that our severe climatic conditions are as disastrous to the orchard as to the vineyard.

The site for an orchard was selected by a committee of the Fruit Growers' Association in 1880; it embraced seventeen acres which, owing to the failure of many trees, has been restricted lately to an area of twelve acres. This was planted with a great variety of fruit trees, the apples thirty feet apart, and equi-distant from each other, according to what is usually called the *hexagonal* method.

In the first year nearly every tree grew, indicating that the planting had been successfully done.

The following data are important factors in accounting for failures:

Location: Latitude north 43° 38', height above the sea level 1,100 feet, above Lake Ontario 858 feet.

Exposure: Westerly inclined to north; no shelter of any account as yet.

Soil: Clay loam and somewhat gravelly on the north and west sides; partially drained.

Meteorology: Mean annual temperature of 1880-6 42.2°; 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, southwest 43 per cent., northwest 31 per cent.

Crops have been grown each year in the orchard, chiefly roots, and a strip of land three feet on each side of the line of trees on which nothing is grown, but the soil is kept well cultivated. About five or six acres have been planted with raspberries, currants, gooseberries and strawberries, which are intended to be kept until the trees mature; this portion is also thoroughly cultivated. In autumn the trees are usually banked nine or ten inches. So far we have been but little troubled by insects or mice. The whole was thoroughly manured the third year with farmyard manure, and the portion on which the small fruits are grown has been manured a second time—1886.

At the time the trees were set out a wind-break was planted on the north and west sides. This consists of two rows of Norway spruce, eight feet between the rows and twelve feet between the trees, the trees of each row alternating. These trees are doing well, and will soon be a great protection from the westerly winds which prevail here.

In the following record of results the figures in brackets are the total of each variety planted.

Pears.—55 varieties were planted, and all have failed to reach the seventh year; the few that led a precarious existence for a few years have been rooted out.

Plums.—28 varieties; the surviving ones being Lombard 4 [6], Bradshaw 2 [5], Purple Egg 3 [5].

Cherries.—18 varieties; Olivet 1 [2], May Duke 6 [7].

Apples..—54 varieties; Swazie Pomme Grise 20 [50], Golden Russett 31 [50], Rhode Island Greening 7 [22], Roxbury Russett 6 [20], Grimes' Golden Pippin 7 [25], Wagner 20 [25], Yellow Bellflower 27 [35], Baldwin 6 [40], Swaar 5 [12], Pomme Royal 13 [22] Fameuse 10 [12], Lady 2 [2], King of Tompkins County 1 [12], Beauty 2 [2], Maiden's, Blush 2 [2], Ella 1 [2], Wealthy 2 [2], Tallman Sweet 22 [22], Northern Spy 32 [50], Ben Davis 6 [6], Mother 2 [2], Pewaukee 2 [2], Twenty-Ounce 10 [12], Beauty of Kent 7 [5], Rambo 2 [2], Fall Pippin 12 [12], Chicago 4 [12], Lady Sweet 2 [5], Alexander 34 [35], American Golden Russett 11 [25], Dora 1 [2], Ribston Pippin 22 [35], Gravenstein 2 [27], St. Lawrence 2 [2], Crabs 5 [5], Keswick Codlin 2 [2], Early Harvest 2 [2], Summer Rose 2 [2], Duchess of Oldenburg 35 [37], Benoni 4 [4], English Russet 2 [8], Red Astrachan 6 [5], Mann 8 [10], Shiawasse 9 [10]: 737 planted, 406 living, 331 dead.

In all cases where the trees have become sickly and have died the bark on the south side turned dark colored; as soon as this condition was attained a marked change occurred in the vitality of the tree, growth seemed retarded and in a short time the tree ceased to live. This condition appears to result from the effects of the warm spring sun before the frost has left the roots and a proper circulation has commenced throughout the whole tree.

1. The climate in this vicinity is too severe for raising any but the *very* hardiest of fruit trees. Our ex erience is borne out by several in this neighbourhood whose orchards are yearly becoming hinned out.

2. The varieties which have withstood our adverse surroundings best are: Ben Davis, Alexander, Tallman Sweet, Fall Pippin, Duchess of Oldenburg, Red Astrachan, Benoni, Wealthy, Maiden's Blush, Pewaukee, St. Lawrence, Earl Harvest.

3. The small fruit have done excellently; to these reference will be made in another Bulletin.

4. All orchards exposed to winds continuing largely from one direction throughout the year should have a wind-break for shelter on the side from which the prevailing wind comes, and this should be planted as soon as possible. Few trees are better suited for this than the Norway Spruce, but it is not advisable to have them planted in one row close together, for in such cases the trees become a harbor for insects. A better way is to plant two or three rows in the manner already referred to.

5. The hexagonal plan of planting, in which the trees are in every case the same distance apart, is preferable, because—

(1) More trees can be planted on the same space;
(2) You can cultivate between the trees in three ways;
(3) The trees have more light and air.

6. Orchards should be well drained, especially where the climate is severe.

The Crane Fly: Tipula Oleracea Order Dipera.

Some time ago there was brought to my notice an insect which has on different occasions proved injurious in the low-lying districts on the western side of our province. A farmer who had suffered considerable loss from the larval form of the insect wrote, asking information regarding its nature and suggestions for its destruction. On being requested to send some of the grubs for identification and study, he forwarded several, which in the course of time developed into the perfect insect, and I was enabled to suggest a course of action which resulted in a good crop, where, had the seed been sown as formerly, it is likely the grain would have been completely destroyed, as it had been some time before. On ploughing the field he observed the grub that had destroyed his former crop, and thus was led to seek information, feeling that he must pursue a different course, if he desired satisfactory results.

The cause of this trouble is an insect called the Crane Fly, or Daddy Long-legs. It seems to be confined chiefly to our low-lying land in the west, but is very common in England, and often proves very destructive.

The flies (not unlike very large mosquitoes) are seen especially in autumn, in neglected grassy spots, meadows, and on marshy ground, where they deposit their eggs, which in due time produce grubs that destroy grass and grain crops by gnawing the young plants just below the surface of the ground.

The female lays her eggs chiefly in autumn in the ground, or on its surface, or on damp grass close to the ground. These eggs are very small, black and shiny, and as many as three hundred have been found in one female,

In spring the grubs or worms hatched from the eggs appear, and begin to feed upon the plants at hand. They are legless, cylindrical, of a dirty greyish colour, wrinkled across, and when full-grown about an inch to an inch and a-half in length. The tail of the grub ends abruptly, as if cut off; the head is protruded as a blunt point, armed with two strong black jaws. Though legless, the grub has such power of contracting and expanding in length that it can readily pierce the ground or wriggle itself forward. It is often found at night on the surface of the ground. From the toughness of its skin the grub is sometimes known as "Leather Jackets." Having reached full size about the middle of May, it becomes exceedingly destructive for a time. Those which were sent to the College passed into the pupa stage about the third week in May. The larva is exceedingly hardy. It can be frozen till quite brittle, and yet, when thawed, be active; it can be immersed in water 100 hours, and can do without food for over three weeks.

The resting or quiescent state, usually called pupa, is undergone below the surface but sometimes under the protection of weeds. The pupa (containing the future fly) is furnished with short stout spines, pointing backwards, by means of which, when the proper stage of development is reached, it can raise itself upward through the ground. As soon as it reaches the surface and rises a little above it, the horny-like pupa case splits, and leaving the empty case standing upright the Crane Fly comes forth and spreads its legs and two wings. The specimens developed at the College completed their pupa stage about the 29th of May. This is important to remember, because a crop sown after that date will in all likelihood escape injury by the grub. Our instructions to the correspondent were based on this observation, and, on inquiry, we found he had succeeded in getting an excellent crop of beans which had been planted on the 11th of June.

The perfect insect resembles very much in external appearance the mosquito, but is about four times as large. It has one pair of wings, and behind them a couple of slender structures, one on each side, with a knob at the end. These delicate rodlike structures are about the tenth of an inch in length. The body of the insect has a tawny brownish appearance.

1. Prevent as far as possible the depositing of eggs. The female seeks damp meadows, neglected herbage, and shady spots found at the sides of cultivated fields and under the shade of trees in open fields. Remove such conditions by drainage, mowing the neglected ground and burning the mixed grass and tops of weeds. The pasturing of sheep on affected places is good, as they eat the grass well down and trample the ground a good deal.

2. Many birds are of great help both in destroying the larva and the full grown insect; consequently, a method of cultivation calculated to expose the grubs for the birds will result beneficially.

3. Deep ploughing of infected pasture is a good practice, as it prevents the hatching of the eggs and places the grubs where many are likely to perish for want of food. Rolling the land, especially late in the evening or at night, has been followed with good results, for many are crushed and others are impeded in their progress through the soil.

4. The application of certain fertilizers, such as guano, salt and nitrate of soda, are beneficial in promoting a quick and healthy growth, thus enabling the plants to withstand an attack. Some have found an application of gas lime on the fields before breaking up serviceable.

5. Sow as soon as the larval condition is past,—in the case under consideration about the first week in June. As soon as the pupa cases are seen sticking up in the soil the grub stage has ended, and the insect is fully developed. A well drained soil, thoroughly worked and pulverized ground, and plenty of manure are very likely to keep off an attack.

In Bulletin v. of 1886, referring to shrubs, I remarked: "Where shrubs are planted in clumps, they grow better by having all the land between them cultivated." This season we followed this out with all our clumps, and notwithstanding the extreme drought, a marked improvement in growth resulted.

In Bulletin VIII., 1886, referring to grapes, some notes were given, relating to the ripening of the varieties in our vineyard. Owing to the warm summer of this year, followed by a delightful fall, a great advance was made in the ripening of our grapes.

The following notes may prove of interest to some readers. The dates indicate when the varieties were cut:—

September 5th, Champion, Janesville, Maxim, Brant.

September 7th, Moore's Early, Cottage, Early Dawn, Ives' Seedling, Alvey, Croton.

September 10th, Hartford, Prolific, Massasoit, Agawam, Cornucopia, Black Hawk, Black Eagle.

September 15th, Eldorado, Brighton, Advance, Aulochon.

September 17th, Salem, Delaware, Concord, Wilder, Gaertner, Warden, Lady, Jessica.

September 20th, Draucut's Amber, Herbert, Lindley, Merrimac, Enmelan.

September 24th, Amber Queen, Barry, Clinton, Martha, Rogers' 41.

September 26th, Dempsey 4, 18, 25, Poklington, Prentiss, Transparent, Walter.

September 28th, Elvira, Eva, Green's Golden, Iowa, Lady Washington, Maxatawny, Naomi, Noah.

September 30th, all varieties gathered in; while in 1886 a note says, October 2nd, "the best were cut viz: Lindley, Delaware, Moore, Salem, Massasoit, Wilder, Herbert, Merrimac, Enmelan, Concord." October 7th, "Clinton, Brighton, Agawam, and Martha Ripe.

Concerning this department, I need only say that much attention has been given to make the study of science popular and practical. Excursions have been made from time to time with the students, for the purpose of studying botany and geology in the field. Elora, Galt, Rockwood and Niagara Falls were thus visited, and through the kindness of the Grand Trunk Railway authorities our students were able to travel at reduced rates on scientific trips; the expenses of which are borne by themselves. The result of these trips is a greater interest in agricultural science; travelling as they do from place to place, they observe the condition of farms, etc. in the different localities, and cannot fail to have their practical knowledge greatly increased.

Reference has already been made to the plants set out in a part of the garden to illustrate lectures on botany. The purchase of a superior magic lantern, by which excellent views of objects discussed in the lectures can be exhibited, will also do much to impress scientific facts upon the minds of our students. Already its usefulness has been shown in the vivid way it illustrates sections of plants, microscopic organisms and other objects connected with the study of agricultural science. No half hour is more popular among the students than that in which these magnified views are projected upon canvas before the class.

To make the lectures on horticulture as practical as possible, the chief points discussed theoretically in the lecture-room were written out, numbered and given to Mr. Forsyth, superintendent of the garden, so as to enable him to see, what he might be expected to show the students practically. Experience had taught us that owing to the method of sending our students to the various departments, instances occurred where some had not seen a practical demonstration of these things. To overcome this liability to overlook some and repeat work to others, the form below was prepared. The practical instructor repeatedly consulted this, and was thus at a glance able to see whom he had instructed and what had been taught.

Blank form illustrating the method of keeping a record of practical instruction:

Names of Students.	1.	2.	3.	4.	5.	6.	7.	8.	Etc., to 20.
....		X		X	X		X		
....									
....	X			X	X		X		
....			X			X			
....	X			X				X	

Nos. 1, 2, 3, etc., to 20, represent points to be illustrated in practical horticulture; these are written out in full in the instructions referred to, so that a number indicates at once the subject *e. g.* 5 is grafting, 8, pruning grape vines. As each student is taught, the space opposite his name and under the number is marked X, and thus the instructor sees at once the work accomplished from week to week.

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1877.

Observations are regularly taken at the hours of 7 a.m., 2 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.

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 thermometers, 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 given to the Guelph papers for publication. From these monthly summaries the condensed statement of the year's meteorology is made out.

In my course of lectures on Meteorology, the practical method of teaching is adopted. The instruments named above are fully described, and the students taught not only how to read them, but also to epitomize the observations taken in such a way as to make them interesting and instructive.

Form of Monthly Summary.

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 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.
- Mean velocity per month.

Clouds—
- Cloudy days.
- Clear days.
- Mean cloudiness for the month.

MEAN METEOROLOGICAL RESULTS FOR THE YEAR 1887.

—	1887. — GUELPH.	Average of 40 Years. — TORONTO.
BAROMETER.		
Month of highest mean pressure	November.	September.
Highest mean monthly	29.632	29.664
Lowest " "	28.170	29.572
Month of the lowest mean	February.	June.
Highest pressure	29.708	30.358
Lowest "	28.006	28.692
THERMOMETER.		
Mean temperature of the year	44.03	44.17°
Warmest month	July.	July.
Mean temperature of the warmest month	73.2°	67.64°
Coldest month	January.	February.
Mean temperature of the coldest month	15.3°	22.73°
Highest temperature	July 16, 96°	91°
Lowest temperature	Jan. 8—14.1°	11.9°
Range of the year	110.1°	102°
PLUVIAMETER.		
Total depth of *rain* in inches	16.28	28.30
Number of days on which *rain* fell	77	110
Month in which the greatest depth of *rain* fell	August.	September.
Greatest depth of *rain* in one month	1.75	3.55
Month with most *rainy* days	October.	October.
Greatest number of *rainy* days in one month	12	13
Total depth of *snow* in inches	63.5	....
Number of days on which *snow* fell	56	....
Month in which the greatest depth of *snow* fell	February.	....
Greatest depth of *snow* in one month	16.0	....
Month with most *snowy* days	January.	....
Greatest number of *snowy* days in one month	14	....
Total precipitation in inches	22.63	....

Diagram Illustrating the Mean Meteorological Results for 1887.

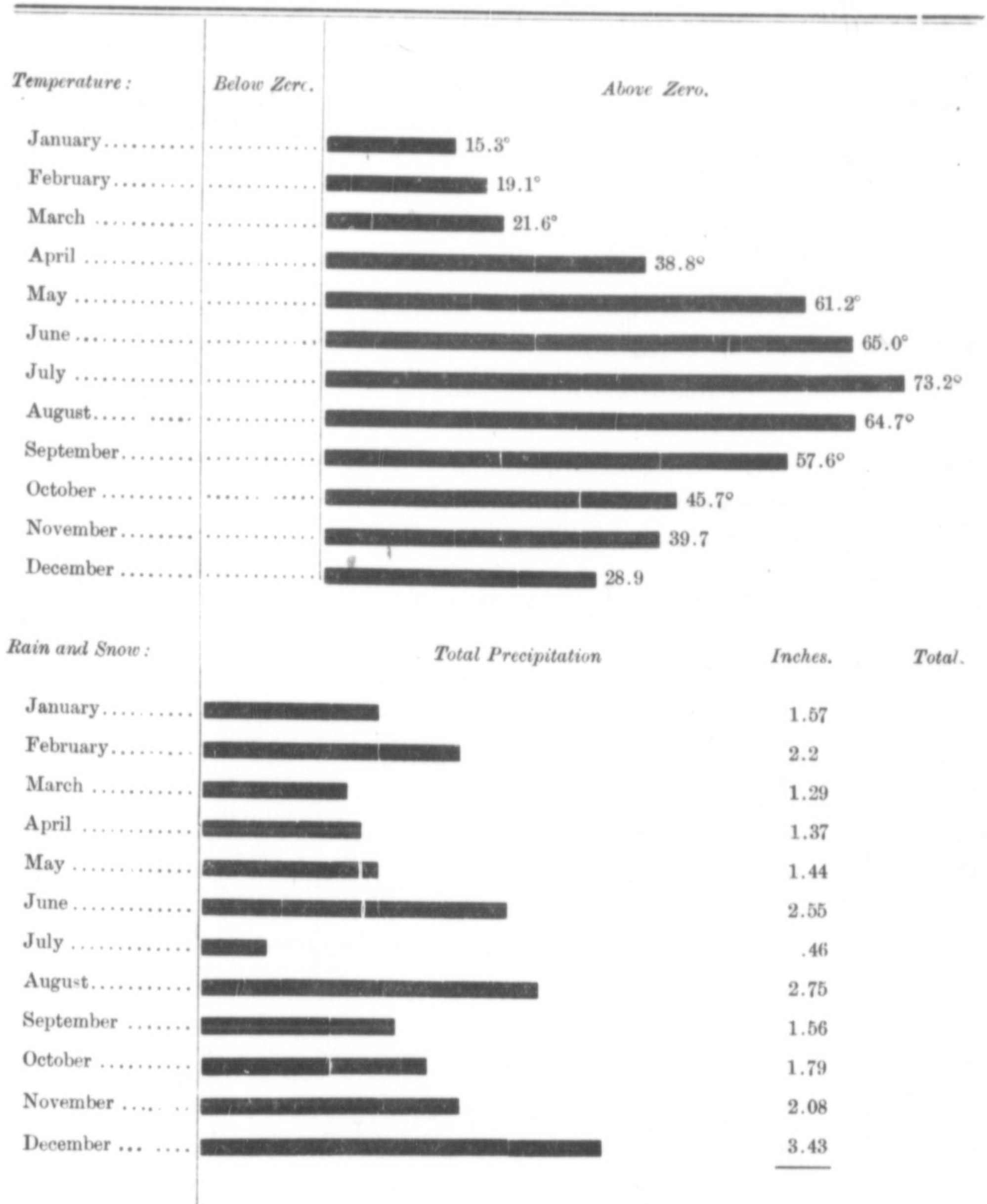
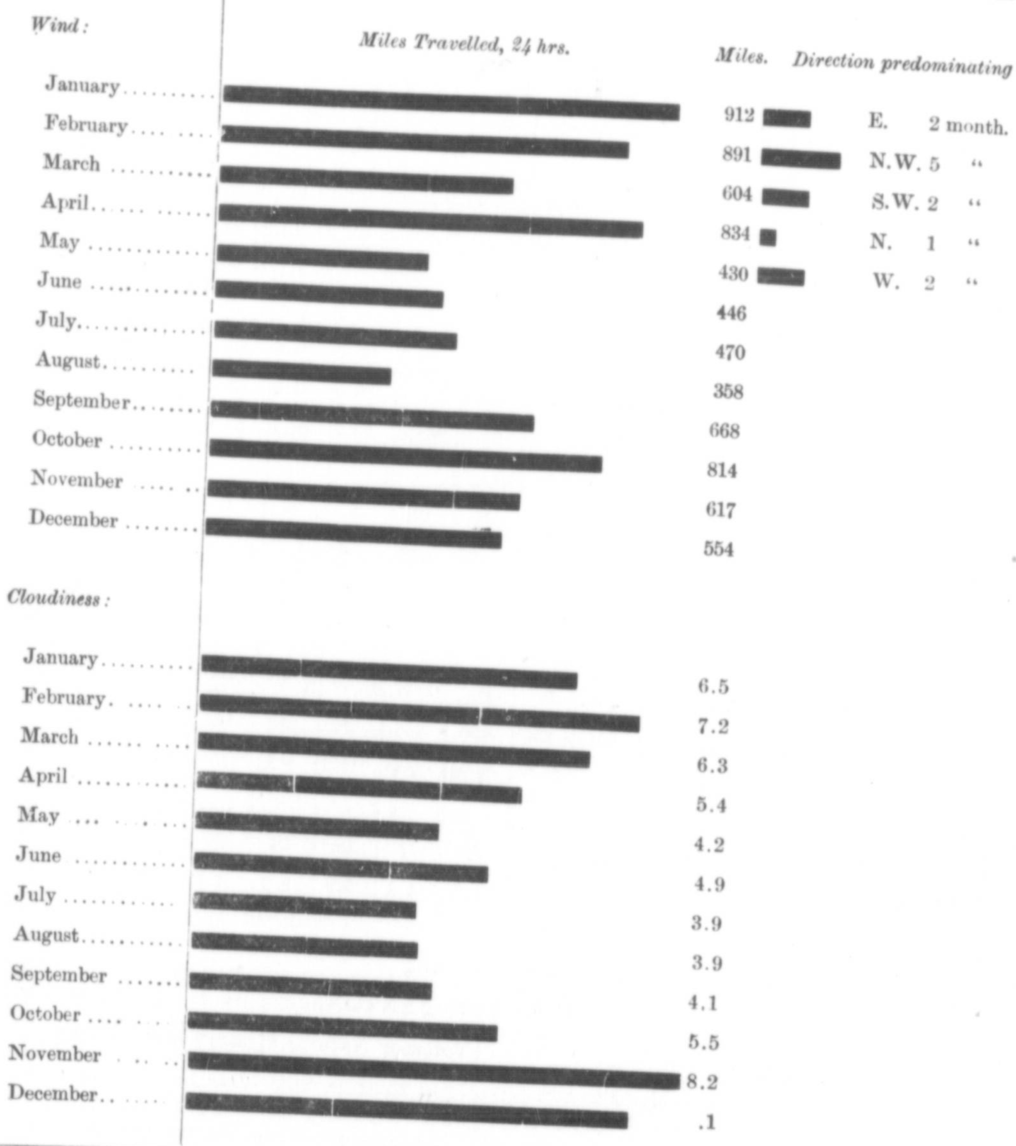


Diagram Illustrating the Mean Meteorological Results.—*Continued.*



Summary of Meteorological Results for 1887.

—	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	29.234	29.600	29.498	29.344	29.188	29.248	29.078	29.152	29.254	29.238	29.708	29.584
Lowest "	28.078	28.006	28.144	28.030	28.490	28.516	28.500	28.630	28.408	28.130	28.174	28.368
Highest mean barom'er	29.218	29.488	29.348	29.264	29.163	29.225	29.057	29.101	29.207	29.200	29.632	29.570
Lowest " "	28.185	28.170	28.283	28.254	28.498	28.555	28.581	28.669	28.482	28.237	28.261	28.462
Monthly " "	28.701	28.899	28.814	28.771	28.877	28.865	28.876	28.871	28.992	28.718	28.963	28.912
Monthly range	1.156	1.594	1.354	1.314	.698	.732	.578	.522	.846	1.108	1.534	1.316
Thermometer—	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.
Highest temperature ..	44.2	47.0	45.5	72.5	89.0	88.2	96.0	95.6	82.3	76.2	66.4	53.0
Lowest " ..	-14.1	-3.5	2.2	6.0	37.0	42.0	70.0	38.1	28.8	14.2	1.5	-3.0
Highest mean " ..	40	39.7	34.6	48.0	71.0	75.3	80.0	81.0	68.2	61.2	52.5	39.6
Lowest " " ..	-.2	3.8	9.4	17.6	52.6	52.7	60.7	51.4	41.0	28.1	9.8	3.4
Monthly " " ..	15.3	19.1	21.6	38.8	61.2	65.0	73.2	64.7	57.6	45.7	39.7	26.5
Monthly range	58.3	50.5	43.3	66.5	52.0	46.2	46.0	57.3	59.4	62.0	65.4	56.0
Pluviameter—												
Number days rain fell.	2	4	3	8	8	10	5	6	8	12	7	4
" snow fell.	14	11	8	2	0	0	0	0	0	5	6	10
Greatest rainfall, inches	.77	.3	.24	.73	.67	.57	.38	1.75	.45	.36	.42	.96
Rainfall for month, in.	.10	.6	.42	1.28	1.44	2.5	.46	2.75	1.56	1.79	1.51	1.87
Greatest snowfall, in.	.3	.4	.25	8.	0	0	0	0	0	1.0	2.0	4,0
Snowfall for month, in.	14.7	16.0	8.7	.9	0	0	0	0	0	2.04	5.7	15.6
Total precipitation ...	1.57	2.2	1.29	1.37	1.44	2.5	.46	2.75	1.56	1.99	2.08	3.43
Anemometer—												
Predominating wind...	S. W.	N. W.	N. W.	E.	E.	N. W.	N. W.	N. W.	N.	W.	S. W.	W.
Greatest No. of miles in 24 hours........	912	891	604	834	430	446	470	358	668	814	617	554
Mean velocity for the month	18.1	17.0	14.6	15.5	8.92	8.41	10.1	8.32	10.7	13.4	15.9	14.1
Clouds—												
Cloudy days	18	17	18	11	6	12	9	10	8	12	21	23
Clear "	9	3	12	11	16	17	18	18	16	11	8	7
Mean cloudiness for month	6.5	7.2	6.3	5.4	4.2	4.9	3.9	3.9	4.1	5.5	8.2	7.1

Your obedient servant,

J. HOYES PANTON,

Professor Natural History and Geology.

PART III.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December, 1887.

To the President of the Ontario Agricultural College:

DEAR SIR,—I beg herewith to submit my report for the year 1886. In doing so, I have to congratulate myself on the improved condition of affairs in connection with the Chemical department of the College and Farm. The dingy, dirty and unsuitable room into which was crowded lecture room, laboratory, office, storeroom, etc., has been superseded by the new Chemical laboratory wherein convenience, cleanliness and comfort have been well considered. Through you, I desire to convey my thanks to the Commissioner of Agriculture, and to all others interested, for the improved state of affairs. I trust that the Chemical department will show its gratitude by the work of the future. I consider the building well adapted for our purposes, and when the new apparatus is in place it will compare favourably with other laboratories of a similar nature. Everything will be in good working order by the beginning of the new year. Good results are already apparent; the work in practical chemistry is much expedited, and the experiments illustrative of lectures are more complete and satisfactory than formerly. The benefits fully warrant the outlay by the Government. To be brief in reference to this matter, I may say that the principal benefits will be: the more thorough and more intelligible treatment of all lecture work; the investigation of subjects of a more advanced nature; the enlargement of our practical and experimental work; the inculcation of habits of cleanliness and accuracy; and, last but not least, the performance of work in an atmosphere and amid surroundings not depressive or hurtful to health.

Since our work embodies instruction, as well as practice and experiment, such voluminous reports are not to be expected from us as emanate from experimental stations wherein the work is purely analytical and experimental.

LECTURES.

Full courses of lectures have been delivered to the first and second year students. Since the inaugural of the third year, I have commenced a course of advanced lectures with them, more fully treating of subjects in Agricultural Chemistry and in the History and Philosophy of Chemistry. The subjects discussed with them during the first term have been:—The valuation of fertilizers; the Canadian laws regarding fertilizers, oleomargarine, and adulteration; the manufacture and nature of oleomargarine; the laws of the United States, England, France and Germany, regarding the manufacture, importation, and sale of butter substitutes; the origin of Chemistry as a Science; the development of the great Chemical laws; the application of Mathematics to Chemistry; the Periodic Law of Mendelejeff, and the possibilities of future research. The lectures will be continued during the coming terms. The reading assigned for examination for the third year is Roscoe's Manual on Metals, Non-metals, and the Carbon Compounds, (without any omissions), and Dr. Armsby's manual of Scientific Feeding. In practical work this fall, the third year has been considerably retarded owing to delay in completing the laboratory, but they are now making good progress. In the winter and spring term of the year, six ex-students returned for special work. Some were compelled to cut short their stay. To give some idea of the work done by advanced students, I shall quote two cases. First, a sample of salt used in experiment by the Experimental Union was analyzed by Mr J. J. Fee, and gave the following results:—

SALT.

Sodium Chloride—pure salt	89.42	per cent.
Calcium Sulphate—gypsum	1.45	"
Calcium Chloride	0.11	"
Magnesium Chloride	2.01	"
Water	6.75	"
Insoluble matter	0.18	"
	99.92	per cent.

Second, an experiment in feeding was inaugurated by Mr. J. J. Fee, Mr. A. T. Raynor and Mr. S. C. Calvert. The bulk of the work was performed, the analyses carried on in the laboratory, and the experiment successfully completed by Mr. S. C. Calvert. Being conducted most carefully by third year men under the constant supervision of members of the staff, this experiment not only was the means of teaching methods of advanced work of a most practical and important nature, but also may be referred to as reliable in its conclusions. In view of this, I deem a condensation of the winter report submitted to me, worthy of a place here. It will also show one very important line of work that may be undertaken by specialists or advanced students.

The experiment was on the question of milk production. The object was to ascertain, as far as possible, the comparative value of bran and oil cake as milk producers, quantity and quality. It was decided to take the Ontario Experimental Farm ration (as an example of a good milk producing ration) and to add to it a given amount of bran in the first division of the experiment; in the second, to substitute such an amount of oil meal as should equal in nutritive value the amount of bran added to the original ration, and which ought therefore presumably to give a similar quantity and quality of milk.

Two cows, a Quebec Jersey and a Guernsey, were handed over by Prof. Brown.

The daily allowance was 10 lbs. of hay, 24 lbs. roots, 2 lbs. bran, to which was added 9 lbs. of bran for two weeks (April 5th to 18th,) and then 3 lbs. of oil meal for two weeks (April 19th to May 1st). It was contrasting, therefore, bran with oil meal over and above a maintenance diet, as a milk-producing diet.

The feeding, milking and analysis, were all done by the students.

The milk from each cow was weighed and tested twice a day with lactometer and Feser's lactoscope. It was also chemically analyzed in the laboratory *eighteen times* during the four weeks.

Giving the animals one week in each case to get settled down to the new kind of food, the last week in each division of the experiment must be taken as shewing the true relative positions of the competing foods. The average yield per day of the two cows was in the last week of the bran 17.08 lbs., in that of the oil meal 18.45 lbs., or 1.37 lbs. per day more than the bran. The total gain per week on the two cows was 20 lbs. of milk.

The general average of the fats shewed the milk from the oil-meal ration to be *a trifle richer* than that from the bran.

Cost :—Allowing $10 per ton for hay, 8c. per bush. for roots, $12 per ton for bran, and $30 for oil meal, and estimating the cost of the food *actually eaten*, the bran ration cost $2.26 for two weeks, and the oil-meal ration $2.09.

There was, therefore, an increase of milk, a decrease of cost, and a slight increase of quality.

Finally, Mr. Calvert analyzed the bran and oil-meal used, and here are his results :—

	Bran.	Oil-meal.
Water	14.30	12.87
Fat	3.50	8.71
Protein (Nitrogenous)	12.75	24.02
Crude Fibre	11.45	13.25
Nitrogen—Free Extract, (Starch, etc)	51.88	35.20
Ash	6.12	5.95

I shall make but one more extract from the very complete report presented :—"As the first attempt, the experiment was naturally not of a very complicated character, but great care was taken throughout to make it as exact and precisely accurate as was possible. Simple as it was, it has nevertheless been of no little practical benefit, and the more so as it has taught us the importance of being *scrupulously exact*—a characteristic so absolutely necessary and of so great importance in the detail management of any reliable experiment, great or small."

The above carries its own commendation. I submit, sir, that if we can foster such work we are doing our duty to the country.

On July 20th, 1877, the following bulletin was issued :—

BRAN—ITS CHEMICAL COMPOSITION.

The aim and tendency of modern milling is to produce as much *white* flour as possible from the wheat grain. The demand of the public stimulates this, regardless of the fact that the whiteness is not a proof of richness. To produce a white flour, the germ or embryo, which is very rich in nitrogen, is removed and sold as germ flour; the husk or covering is removed and sold as bran. A description of a grain of wheat will aid in understanding the composition of bran. At one end is the *brush*, or hairy covering; at the other end the *germ*. Commencing at the outside of the grain, we find the husk or bran coatings, sometimes given as three, sometimes as five, in number. These are fibrous in nature. Next comes a coating of gluten cells (the *perisperm*). The gluten is the nitrogenous compound of the wheat, and is of the highest nutritive value. Within these lie enclosed the starch or flour cells (the *endosperm*), containing also gluten cells intermingled with them. To separate these dark fibrous coatings, to sift out by themselves the greyish germs, and to retain as much of the white starch as possible, is the aim of the miller. In doing so he leaves behind most of the gluten coating with the bran. The old milling process left behind also with the bran a considerable quantity of starch. The roller process tends to remove all this starch; the result is that most of the bran produced by the roller process is richer in nitrogen (gluten) and poorer in starch than the bran produced under the old process, and is therefore of a higher nutritive value.

The relation of the bran and the germ to the whole wheat can be clearly seen in the following table from the Washington Report of 1886 (Mill products from Kansas):

——	Water.	Gluten.	Fat.	Starch & Sugar.	Fibre.	Ash.
Whole Wheat	9.55	12.25	1.27	72.97	1.88	1.78
Bran	8.45	15.75	4.64	58.28	6.60	6.30
Finished Germ	8.70	20.13	7.47	54.91	3.59	5.20
Patent Flour	11.02	9.63	1.01	77.80	0.19	0.35

From this table it is at once seen that by the roller process the bran is richer in nitrogen and fat than either the whole wheat or the flour. It is, however, also to be noted that the nitrogen of the bran is not all in form suitable for muscle-building, but it is available for fat-production. The nitrogen of the flour is *albuminoid* in composition; some of that in the bran is *amide* in composition.

The ash will, of course, be found in excess in the bran coatings. Its composition will average about as follows:

Phosphoric acid	54	per cent.
Potash	27	"
Magnesia	9	"
Lime, etc	10	"

The chemical composition of bran varies greatly, depending partly upon the composition of the grain, but principally upon the process of separation. I append a table gathered from several sources. No. 1 is the analysis of bran made by myself, and is the bran used and referred to by Prof. Brown in his late bulletins on feeding. No. 2 is another sample of Guelph bran analyzed here:

	——	Water.	Gluten.	Fat.	Starch & Sugar.	Fibre.	Ash.
1	Ontario Agricultural College, 1887	12.28	13.20	4.30	54.84	9.24	6.14
2	" " " 1887	14.30	12.75	3.50	51.49	11.83	6.13
3	Wheat bran (Armsby)	13.00	14.50	3.50	53.60	9.40	6.00
4	Coarse bran (Stewart)	11.40	12.90	3.50	59.10	8.10	5.10
5	Massachusetts, U.S., Report, 1887	12.20	19.79	2.80	59.16	10.92	7.33
6	Wisconsin bran (Armsby)	14.13	15.19	3.36	50.96	10.31	6.05
7	Virginia bran (Washington Report	8.24	16.45	5.52	56.77	6.13	6.89
8	Ohio bran (Washington Report)	7.74	15.40	4.99	64.88		6.99
9	Minimum % (Armsby)	7.60	10.10	1.70	28.50	4.10	....
10	Maximum " "	16.50	27.00	6.60	61.55	34.60	....
11	Average bran	13.00	15.00	3.50	52.50	10.00	6.00

As a comparison between old process and roller bran one quotation will serve (Wisconsin Report); added to which is a comparison of spring and winter bran (Jenkins).

——	Water.	Gluten.	Fat.	Starch & Sugar.	Fibre.	Ash.
Roller (water free)	....	17.52	5.02	60.79	9.76	6.91
Old process "	....	14.79	4.27	66.12	9.23	5.59
Spring wheat bran	11.3	15.30	4.30	54.40	8.80	5.90
Winter wheat bran	12.3	16.00	4.00	53.70	8.10	5.90

Experiments have established the following as the digestible co-efficients or percentages for the various constituents of bran: Gluten, 88 per cent.; fat, 80 per cent.;

starch and sugar, 80 per cent.; fibre, 20 per cent. Using these values in the above tables, it will be seen that the nutritive ratio of bran varies from about 1:3 to 1:4.5.

Considered as a direct fertilizer, a ton of bran will give about as follows, reckoning from the 1887 rates:

Nitrogen	48 lbs. @ 16c	$7 68
Phosphoric acid	65 lbs. @ 6c	3 90
Potash	30 lbs. @ $4\frac{1}{2}$c	1 28
Total value per ton		$12 86

These values are low. Dr. Jenkins gives for the same, $13.03, and Sir J. B. Lawes, $16.15, but the latter's estimate was made when rates were higher.

In conclusion, I add a table of analysis of brans other than wheat, which may prove of value:

——	Water	Nitrogen Compounds.	Fat.	Starch & Sugar.	Fibre.	Ash.
Rye bran	11.6	14.7	2.4	64.8	3.3	3.2
Buckwheat bran	14.0	17.1	4.4	46.4	14.7	3.4
Barley bran	12.0	14.8	4.1	45.6	19.4	4.1
Oat bran	9.7	7.1	2.3	57.9	19.3	3.7

Practical Conclusions.

1. Bran is a concentrated food, which, though variable in composition, possesses high nutritive value.
2. Roller-process bran is, on the average, richer than old-process bran.
3. Its excess of ash or mineral matters eminently fits it for bone-building in growing animals, and for supplementing the lack of mineral matters in roots.
4. Its chemical composition points to the conclusion that it is somewhat better adapted to the formation of fat and production of heat, than to the formation of muscle or of milk.
5. Both its chemical composition and its physical form adapt it admirably as a supplementary food to be used in connection with poor and bulky fodder, such as straw and roots.
6. Its manurial or fertilizing value alone repays its cost.
7. By retaining and feeding the bran upon the farm, the objection to selling the grain is partly overcome, viz., the exhaustion of the soil, since the bran retains most of the mineral matters which cannot be derived from the air.

Drainage Experiments.

We have no satisfactory results this year from our lysimeter experiments on account of the intense dryness of the past season. The total rainfall to November 1st was 8.783 inches or 1,986,937 pounds (nearly 1,000 tons) per acre; for 1886 it was 15.574 inches, while the average in England for ten years was 31.451 inches. During such a dry season, therefore, little drainage was to be expected, and the present year has been practically barren of results. For the six months, May to November, drainage water was received from only four lysimeters, the permanent pasture, the fallow, clay under oats, and sand under oats, and for *only one month*, the month of May. The quantity was so small that we do not consider the results of any importance.

The following bulletin was issued May 2nd, 1887 :

Drainage Water.

In estimating the worth of a fertilizer, commercial values are set only upon the nitrogen, phosphoric acid and potash ; sometimes the lime is considered. The three first mentioned are of most importance, since nearly all soils contain sufficient of the other plant food to sustain ordinary crops. To grow crops it is necessary, therefore, to supply nitrogen, otherwise the land will become exhausted. The ordinary crops annually remove from the soil the following quantities of nitrogen per acre :

				Total.
Wheat	(30 bushels.)	Grain 33 lbs.	Straw....12 lbs.	45 lbs.
Barley	(40 ")	Grain 35 "	Straw....12 "	47 "
Oats	(45 ")	Grain 38 "	Straw....14 "	52 "
Hay	(1½ tons.)	....	45 "	45 "
Red Clover	(2 ")	....	70 "	70 "
Turnips	(17 ")	Roots 63 lbs.	Tops.....45 "	108 "
Mangels	(22 ")	Roots 85 "	Tops.....46.5 "	131.5 "
Potatoes	(6 ")	Roots 42 "	Tops, etc. 18 "	60 "

The rain carries into the soil from the atmosphere every year from five to ten pounds ; other sources of supply besides that of direct applications of a nitrogenous fertilizer are, as yet, somewhat uncertain.

The nitrogen, however, before it is in form available for cereals must be converted into a *nitrate*, a compound resulting from the union of nitric acid with some such substance as lime. This formation of nitrates in the soil is called *nitrification*, and every farmer should be thoroughly familiar with the conditions under which it proceeds.

The process is one of fermentation in the soil. The work is done by a very minute organism or vegetable cell (called *bacterium*), similar to the yeast cell and other vegetable organized bodies producing the various fermentations. It is found in all fertile soils, and for its development and work demands a supply of air and water. Tillage therefore assists in the process. The presence of too much water excludes the air and hinders the work, even undoing it. Drainage therefore increases the range of nitrification and deepens the fertility. A proper degree of heat is also most important. Nitrification ceases below and near the freezing point. As the temperature rises to 98° Fahrenheit (37°C) activity increases. From that point it again diminishes to about 131° (55°C), when it ceases. Under these conditions nitrification proceeds most actively during the summer, and continues even into the autumn. The nitric acid thus formed unites with lime principally, forming nitrate of lime, or *calcium nitrate*.

In the spring there are few, if any, nitrates to be washed out of the soil ; in the summer there is but little, if any, drainage to wash out the nitrates ; in the autumn, therefore, when nitrates have accumulated and drainage is also abundant, we may expect the greatest loss.

In the Experimental Department of our farm we have a set of drainage measures, or lysimeters ; also a large rain gauge. The area of each drain gauge is $\frac{1}{10,000}$ of an acre, and that of the rain gauge $\frac{1}{1,000}$ of an acre. The former are 36 inches deep, and contain the soil preserved in its natural condition and position. The soil in three of them is eight inches sandy loam, ten inches reddish clay, fourteen inches of gravelly loam, and four inches pure building sand.

One has been covered with permanent pasture, manured in 1884 with farmyard manure, 14 tons to the acre. A two year's rotation, bare fallow and fall wheat, has been kept up on two of the others, containing similar soil. These two are manured every other fall, before seeding, at the rate of 14 tons per acre. Thus the same soil is treated each year as pasture, fallow and fall wheat, and we can compare results.

In this table are given the total rainfall for seven months (May to December), the drainage from each, the soluble matter washed out from each, and the quantity of nitrogen, principally in the form of nitrates.

Month.	Crops or fallow.	Rainfall, lbs. per acre.	Drainage, lbs. per acre.	Solids, lbs. per acre.	Nitrogen, lbs. per acre.
May	Permanent pasture .	29.0870	12.1220	1922	.6340
May	Bare fallow........	....	17.1600	2705	.9455
May	Fall wheat........	....	6.2920	1031	.1534
June	....	53.6172	....	....	....
July	....	17.7061	....	....	....
August........	Bare fallow........	97.4857	3.1900	561	.0828
September........	Bare fallow........	43.0751	4.4220	814	.1243
October	Bare fallow........	53.5038	15.1360	2866	.5028
November	Bare fallow........	58.3781	10.0300	3930	2.4300
December	Fall wheat	....	1.2584	205	.3505
May to December	Permanent pasture .	352.8530	12.1220	1922	.6840
May to December	Bare fallow.	....	58.9380	10876	4.0854
May to December	Fall wheat	....	7.5504	1236	.5039

The above rainfall represents a fall of 15.574 inches. The drainage from the permanent pasture was 3.4 per cent. of the total rainfall, that from the bare fallow 16.4 per cent., and from the fall wheat 2.1 per cent.

In England for ten years the rainfall amounted to an average of 31.451 inches, and the drainage to about 45 per cent. Under such conditions there is greater loss of nitrates by drainage, since the period of nitrification is much longer and the washing continues summer and winter. From a wheat field, unmanured, the average annual loss was ten to twelve pounds; from unmanured and uncropped land as high as 41.81 pounds per annum (Lawes and Gilbert).

From a glance at our table we draw conclusions similar to those elsewhere obtained, viz.:

The loss of soluble ingredients from a bare fallow exceeds that from a field under crop.

There is loss from a wheat field after maturity.

The advantages gained by fallowing may be greatly modified by loss in drainage water.

A growing crop tends to hold the nitrogen in the soil.

The fall washings are greater than those of summer.

The following may be practised either to clean dirty land or to rest exhausted land: In the former case, to avoid excessive loss by drainage, recourse may be had to roots *thoroughly cultivated*. To improve an exhausted land, instead of allowing the land to lie fallow a whole year, a green crop might be ploughed under, thus keeping all the nourishment in the soil, increasing it by drawing on the air and subsoil, and by decreasing the drainage. For green manure, red clover, rye and buckwheat are specially recommended; other crops such as rape, white mustard, scarlet clover, etc., are also used. These should be ploughed under just before full blossom.

On the whole most soils will improve best under a combined treatment of green manuring and fallowing, where resort is necessary to such treatment.

During 1887 the three lysimeters above mentioned (sand, loam, clay) were sown with white cluster oats, and the results were as follows: 272 heads from the loam, 234 from the sand, and 139 from the clay.

The Temperature of the Soil.

Heretofore it has been the custom here as in a few other places, to give the results of observations in tabular form. For a better understanding of the subject and as a step toward more practical results, I shall condense the report and place a few of the most interesting facts in more intelligible form.

The importance of making daily obesrvations of soil temperature is, I think, not fully appreciated by the farming community. That proper temperature has much to do with plant growth and development, no one will deny ; but that it is wise to follow day by day, almost hour by hour, the changes of temperature in the soil at various depths, few will admit. Before laws and principles can be deduced, and before these can be profitably applied, facts have to be tabulated—this seems to be the tabulative period in the development of the science of soil heat. We must first understand exactly the causes of variation of temperature. Heat is a most potent factor in the preparation of available plant food in the soil, it is as potent in the germination and complete development of the plant. Independently of the quantity and quality of sunlight and the state of the atmosphere, the soil itself has a temperature dependent on three factors.

(1) *Composition :* the constituents of the soil differ in their power of *conducting* heat; sand heats up more rapidly than limestone.

(2) *Colour :* the darker a soil is the more heat it will absorb. Dark coloured soils often have a longer season than light colored.

(3) *Wetness :* wet soils are cold for two reasons ; water requires more heat (specific heat) to raise its temperature than does the solid soil, and if it should evaporate from the surface it will take up heat (latent heat) from the soil, thereby cooling it.

The first table I append is one giving the average temperature of soil at different depths for each month and for the whole period of observation (May to October).

The soil thermometers are placed in uncovered soil at depths of 1, 3, 6, 9, 12, 24, 48 inches, and also at 3 and 9 inches in sand, clay and loam, which this year bore oats as a crop. The readings were taken three times a day (morning, noon and night); the averages are here given.

It must be remembered that the season was warm and very dry.

The 24 inch thermometer broken in 1886 was not replaced until late in June.

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

Instruments.	May.	June.	July.	August.	September.	Average for the whole period.
Barometer	28.880	28.859	28.892	28.864	28.936	28.886
Attached Thermometer	63.97	68.99	77.36	67.61	58.31	67.25
Temperature of air	60.49	65.02	72.87	65.58	55.83	63.96
" wet bulb	55.54	61.39	67.49	60.06	52.24	59.34
Temperature, maximum	70.14	74.54	85.41	77.27	67.57	74.99
" minimum	46.93	53.06	58.20	50.14	41.75	50.01
Soil temperature at 1 inch in depth	61.53	68.35	77.53	69.24	58.28	66.99
" " 3 inches "	60.38	68.25	77.39	68.93	58.48	66.69
" " 6 " "	59.17	66.73	75.69	68.52	58.84	65.79
" " 9 " "	57.61	65.25	73.74	67.75	58.90	64.61
" " 12 " "	55.86	63.88	72.13	67.25	59.04	63.63
" " 24 " "	......	......	66.61	65.28	59.01	63.56
" " 36 " "	49.29	57.39	64.81	64.96	59.37	59.16
" " 48 " "	46.11	54.77	61.74	63.22	58.68	56.90
" " 3 " " in sand	62.68	65.99	73.03	69.06	57.75	66.50
" " 3 " " in clay	62.66	67.59	76.85	69.73	58.48	67.10
" " 3 " " in loam	61.92	65.08	78.15	10.12	57.95	66.64
" " 9 " " in sand	59.48	65.02	74.12	68.25	58 40	65.05
" " 9 " " in clay	58.45	64.62	76.85	68.50	58.48	64.38
" " 9 " " in loam	59.48	64.03	74.60	68.73	57.83	64.93

Conclusions.

(*a*) The average temperature of the soil, to the depth of nearly 12 inches, was greater than the average temperature of the air. The soil is heated principally by the direct rays of the sun; the air is heated principally by contact with the warmer soil.

(*b*) The average temperature of the soil diminishes with the depth.

(*c*) July was the month of greatest average heat of air and soil.

(*d*) In increasimg from May to July the soil gains in heat more rapidly than the air; it has a greater *conserving* or storing power for heat.

(*e*) The average increase from May to June was in air 4.53°, at 1 in. 6.82°, at 3 in. 7.87°, at 6 in. 7.56°, at 9 in. 7.64°, at 12 in. 8.02°, at 36 in. 8.10°, and 48 in. in 8.66°—the increase was greatest at the greatest depth.

(*f*) The average increase from June to July was: air, 7.85; 1 inch, 8.18; 3 in., 9.14; 6 in., 8.96; 9 in., 8.49; 12 in., 8.25; 36 in., 7.42; 48 in., 6.97. The increase noticed from May to June in regard to depth does not hold here. To the depth of 3 inches the increase varies directly with the depth, below that it varies inversely as the depth. Here, then, seems to be the place and the time of maximum heat in the soil, at 3 inches during July. By consulting the subsequent table of highest readings, it will be seen that on July 8th, at 2 p.m., at one inch the thermometer shewed 96°, and at 3 inches, 95.8°. Taking individual and average readings, then, at about 3 inches depth, about July 8th the maximum heat of the soil was attained during the summer of 1887. This applies to a sandy soil uncovered, lying fallow. By consulting the subsequent table it will be seen that in the case of the three soils covered with vegetation, the day of maximum heat was in August, and corresponded more closely with the day of greatest atmospheric heat.

(*g*) From July to August the air decreased in temperature by 7.29°; the decreases in the soil were as follows:—at 1 inch, 8.29°; at 3 in., 8.46°; at 6 in., 7.17°; at 9 in., 5.99°; at 12 in., 4.88°; at 24 in., 1.33°; at 36 in., *the increase* 0.15°; at 48 in., *the increase* 1.48°. As before, the greatest variation was at 3 inches. The decrease varies directly with the depth to 3 inches; it varies indirectly with the depth below 3 inches.

(*h*) From August to September the air decreased in temperature by 9.65°; the decreases in the soil were as follows:—at 1 inch, 10.96°; at 3 in., 10.45°; at 6 in., 9.68°; at 9 in., 8.95°; at 12 in., 8.21°; at 24 in., 6.27°; at 36 in., 5.59°; at 48 in., 4.54°. During this month the decrease in temperature varies indirectly as the depth.

The above facts may be more clearly seen from a table as follows, representing the increase and decrease. * represents increase; — represents decrease.

	——	May to June.	June to July.	July to August.	August to September.
	Air	* 4.53	* 7.87	—7.29	— 9.65
1	Inch	* 6.82	* 8.18	—8.29	—10.96
3	"	* 7.87	* 9.14	—8.46	—10.45
6	"	* 7.56	* 8.96	—7.17	— 9.68
9	"	* 7.64	* 8.49	—5.99	— 8.95
12	"	* 8.02	* 8.25	—4.88	— 8.21
24	"			—1.33	— 6.27
36	"	* 8.10	* 7.42	* 0.15	— 5.59
48	"	* 8.66	* 6.97	* 1.48	— 4.54

(*i*) The difference in the readings of the thermometer at 3 and 9 inches in the open soil, and those in the sand, clay and loam, will present some difficulties. In the case of the latter the oats were sown on April 30th, and cut on sand July 16th; on loam, July 25th; on clay, July 27th. The stubble was ploughed August 3rd. The general tendency of the crop was to postpone the period of maximum heat. Comparisons should be instituted for the months May, June and July.

(*k*) From different daily observations, the hourly variation of temperature increased as the surface was approached.

To show the variation of temperature at different depths I give the following table of records, wherein are seen the variations between two successive readings, that is the greatest rise and the greatest fall during a period of seven hours.

GREATEST VARIATION IN TEMPERATURE of each thermometer in seven hours.
(*a*) Increase. (*b*) Decrease.

—	Increase.				Decrease.			
	Date.	From.	To.	Variation.	Date.	From.	To.	Variation.
Temp. air	May 19	44.1	75.4	31.3	July 16	88	94	26
	Aug. 31	46.5	77.8	31.3				
Temp. soil 1 inch deep	July 8	63.2	96	27.2	May 20	64	84	20
" 3 inches deep	May 20	52	81.7	29.7	June 14	71.5	90.8	19.3
" 6 "	May 20	53.5	68	14.5	May 19, 20	53.5	64.5	11.0
" 9 "	May 17	56.7	68	11.3	May 17	58.8	68	9.2
" 12 "	May 20	57	61.3	4.3	Aug. 10	69.2	73.8	4.6
" 24 "	July 8	65.8	67	1.2	June 8	56.7	58.2	1.5
" 36 "	June 30	60	60.6	.6	July 26	56.5	57.2	.7
" 48 "	July 4	63	64	1.0	July 4	63.3	64	.7
" 3 sand	Aug. 30	49.8	81.6	31.8	May 13	48.8	75.4	26.6
" 3 clay	Sept. 5	52.7	85.7	33.0	Aug. 2	76	102	26
" 3 loam	July 29	59.9	10.2	42.1	Aug. 5	71.2	100.7	29.5
" 9 sand	June 27	64.8	79.6	14.8	June 27	64.9	79.6	14.7
" 9 clay	June 21	60.4	66.5	6.1	July 29	74	80	16
" 9 loam	Aug. 29	55.7	64.7	9.0	Sept. 2, 3	57.7	66.3	9.1

TABLE OF HIGHEST SINGLE READINGS OF THERMOMETERS at different depths with date of same (for air also).

Situation of Thermometer.	Date of Maximum Temperature.			Maximum Temperature.
	Month.	Day.	Hour.	
Thermometer in air	August	4th	....	93.7°
Thermometer in soil at depth of 1 inch	July	8th	2 p.m.	96
" " 3 inches	July	8th	2 p.m.	95.8
" " 6 "	July	8th	2 p.m.	83.9
" " 9 "	July	8th	9 p.m.	80.7
" " 12 "	July	29th	9 p.m.	76.1
" " 24 "	August	6th	7 a.m.	69.4
" " 36 "	August	5th	9 p.m.	68
" " 48 "	August	5th	2 p.m.	64.9
Thermometer in sand at depth of 3 inches	August	2nd	2 p.m.	99.5
" clay " 3 "	August	2nd	2 p.m.	102.0
" loam " 3 "	August	2nd	2 p.m.	106.0
" sand " 9 "	July	29th	9 p.m.	81.0
" clay " 9 "	July	29th	9 p.m.	80.4
" loam " 9 "	July	27th	9 p.m.	81.7

Conclusion.

(*a*) The highest single readings do not correspond exactly with the highest average readings. The average is, of course, of more importance than single readings.

I shall now quote the average daily temperature observed on every day of rain and the day following:—

III.—Table of Readings for each day of Recorded Rain; also of following day.

Inches of Rain.	Date.	Barometer.	Attached Thermometer.	Air.	Hygrometer.	1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	3 inches in Sand.	3 inches in Clay.	3 inches in Loam.	9 inches in Sand.	9 inches in Clay.	9 inches in Loam.
.13	May 1st (Sunday)	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
.01	" 2nd	8.834	66.1	64.96	59.4	56.83	56.53	52.46	49.3	46.96	......	40.73	38.6	57.2	49.7	57.9	49.0	58.9	49.3
	" 3rd	9.009	65.7	62.13	55.46	57.9	57.73	55.1	52.53	50.02	......	41.3	39.2	60.7	54.3	60.1	53.2	61.7	53.9
.336	" 6th	8.859	60.8	57.4	54.3	55.7	55.7	53.8	51.7	49.9	......	43.9	41.2	56.0	53.4	56.1	52.5	56.73	52.7
	" 7th	8.915	61.1	57.7	56.2	56.7	56.3	54.4	52.3	50.8	......	45.3	41.9	56.7	53.7	56.8	52.53	56.77	52.5
.007	" 17th	8.823	61.8	59.7	55.3	58 8	58.9	57.6	61.2	57.0	......	50.2	47.1	60.8	60.2	60.6	59.3	56.3	58.4
	" 18th	8.859	61.7	55.0	51.9	62.5	61.8	60.2	58.6	57.1	......	50.5	47.4	63.8	60.9	62.1	59.4	62.9	59.2
.67	" 24th	8.531	63.2	62.2	61.3	64.8	64.5	64.4	60.0	62.3	......	53.3	49.8	65.4	65.8	65.1	65.2	64.9	64.1
	" 25th	8.511	62.3	58.4	54.6	59.2	61.5	61.6	61.1	59.9	......	53.8	53.7	63.1	63.2	62.6	62.6	59.9	65.0
.17	" 27th	8.581	54.6	53.5	52.5	52.2	53.8	55.8	55.7	56.1	......	53.7	50.7	55.6	57.3	55.6	57.1	55.1	56.5
	" 28th	8.782	63.5	59.3	53.8	62.5	61.8	59.8	58.0	56.6	......	53.2	50.7	62.8	59.5	62.6	58.6	60.9	61.9
.19	" 31st	8.842	59.4	57.7	55.7	58.6	58.3	59.1	58.7	58.4	......	53.4	50.8	58.4	59.9	57.6	59.1	57.3	58 6
.044	June 1st	8.766	55.6	53.1	52.5	56.7	56.4	57.3	56.7	56.8	......	53.6	51.0	56.2	58.0	55.9	57.2	55.0	56.6
.392	" 2nd	8.936	59.2	57.5	57.1	59.6	59.2	58.7	57.5	56.9	......	53.6	51.0	59.2	58.0	59.1	57.9	58.5	57.1
	" 3rd	8.673	64.0	61.3	59.7	62.0	61.6	59.2	57.8	56 9	......	53.23	51.0	61.1	58.3	63.1	58.2	60.4	60.7
.61	" 4th	8.848	73.5	69.3	64.7	69.7	68.9	64.7	59.3	59.6	......	53.2	51.03	68.3	67.9	71.9	62.7	65.8	60.4
	" 5th (Sunday)	8.945	65.0	63.8	63.0	63.0	62.8	62.8	62.2	61.7	......	53.5	51.1	63.2	67.9	64.0	63.0	62.8	62.0
.386	" 17th	8.665	62.6	60.5	59.6	65.9	63.1	68.5	68.6	68.1	61.7	59.6	56.0	65.2	68.5	65.1	68.2	64.0	67.5
.18	" 18th	8.597	67.7	63.4	60.9	68.2	67.7	67.3	65.2	65.0	60.7	59.7	56.5	64.8	65.0	65.7	64.7	63.3	63.5
	" 19th (Sunday)	8.580	59.1	59.2	58.2	60.7	59.8	62.0	63.1	64.2	61.0	59.7	56.5	59.6	64.0	60.0	64.0	59.2	63.1
.304	" 21st	8.621	69.4	64.6	63.2	66.9	66.4	67.1	66.9	66.3	61.6	59.6	56.7	66.3	65.4	66.1	66.5	65.5	66.3
.441	" 22nd	8.547	69.7	65.1	60.1	66.5	65.9	65.4	64.7	64.4	60.9	59.9	56.9	63.0	64.7	63.9	64.5	62.7	64.4
	" 23rd	8.609	60.5	58.2	54.9	61.4	60.8	62.3	62.3	62.7	60.4	59.6	56.9	58.5	61.8	59.3	62.1	57.9	61.4
.022	July 3rd (Sunday)	8.944	82.0	80.0	72.3	76.1	77.0	72.0	71.3	71.1	64.7	62.4	59.0	74.8	72.3	78.0	71.8	75.8	73.0
.01	" 4th	8.903	82.7	79.2	72.2	81.1	81.2	77.9	75.1	72.7	65.3	63.4	59.7	78.3	74.3	79.2	73.8	79.2	74.3
	" 5th	8.841	75.7	71.7	68.4	76.5	76.6	75.5	73.8	72.3	65.6	63.6	60.0	75.2	73.6	74.9	73.1	75.8	74.2
.115	" 9th	8.578	74.9	71.3	68.4	73.1	73.2	73.2	72.8	72.3	70.0	64.4	61.0	72.7	73.7	73.1	73.3	71.8	74.3
	" 10th (Sunday)	......	61.1	60.0	56.6	64.3	64.2	67.3	68.6	69.5	66.2	64.7	61.2	64.7	70.7	64.2	70.1	63.8	71.2
.424	" 21st	8.779	75.0	71.7	69.1	73.7	73.5	74.0	73.1	72.3	67.4	65.9	62.8	74.1	74.2	73.5	73.9	74.5	76.0
.017	" 22nd	8.628	73.4	71.0	67.2	74.7	74.3	73.0	71.9	70.9	67.2	65.9	63.0	73.9	72.5	73.8	72.4	76.6	73.9
	" 23rd	8.957	65.2	63.0	63.2	69,7	69.9	71.7	71.6	71.5	66.9	65.7	63.0	69.0	72.6	75.4	72.1	71.9	74.4

III.—TABLE of Readings for each day of Recorded Rain.—*Continued.*

Inches of Rain.	Date.	Barometer.	Attached Thermometer.	Air.	Hygrometer.	1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	3 inches in Sand.	3 inches in Clay.	3 inches in Loam.	9 inches in Sand.	9 inches in Clay.	9 inches in Loam.
.045	July 30th	8.853	77.8	76.0	70.7	76.5	76.1	75.5	74.5	73.4	68.0	66.8	63.8	77.5	76.6	77.7	75.9	79.5	77.6
	" 31st (Sunday)	8.882	68.8	67.0	63.1	68.2	68.0	70.0	70.9	71.6	68.2	66.8	63.9	68.8	74.0	70.9	73.0	69.5	74.9
1.71	August 5th	8.733	81.7	78.6	72.0	79.9	79.6	77.7	74.6	74.7	69.0	67.7	64.8	81.9	77.4	80.3	76.5	83.6	77.8
	" 6th	8.844	63.8	62.3	56.5	66.3	65.3	68.8	70.0	71.0	69.1	67.7	64.8	63.8	72.2	66.0	71.9	61.0	70.6
.46	" 11th	8.925	74.3	71.8	68.8	71.3	70.7	71.5	70.5	63.4	66.7	66.1	64.2	70.2	72.2	71.5	71.9	71.5	72.2
	" 12th	8.972	64.8	63.1	55.9	68.3	66.8	67.9	68.2	69.1	66.8	66.2	64.1	67.4	69.9	68.2	70.3	69.8	70.3
.182	" 17th	8.741	66.0	62.4	59.2	66.8	66.6	67.4	67.2	67.3	65.8	65.2	63.7	65.6	68.2	66.2	68.0	66.0	68.0
.082	" 18th	8.752	68.3	65.3	57.6	68.7	68.6	67.8	66.8	66.5	65.7	65.1	63.5	68.8	67.5	68.7	67.4	69.3	67.7
	" 19th	8.845	60.7	57.5	55.1	64.3	65.4	66.1	65.9	66.1	65.1	64.8	63.2	64.2	66.7	64.5	66.8	65.6	66.6
.09	" 21st (Sunday)	8.816	55.0	55.0	43.8	57.0	56.7	59.8	61.6	63.7	64.4	64.3	63.7	55.8	62.2	56.0	63.8	56.0	61.2
	" 22nd	8.695	64.9	61.7	62.0	64.1	64.1	64.0	63.4	63.5	63.4	63.7	62.6	63.6	63.8	64.2	63.7	63.8	63.6
.19	" 23rd	8.683	63.7	60.8	59.3	63.5	62.9	64.1	63.6	63.8	63.1	63.2	62.3	62.4	63.8	62.7	63.9	62.3	62.3
	" 24th	8.816	60.8	54.8	55.4	63.4	62.9	63.5	63.3	63.3	62.9	63.0	62.0	62.1	63.6	62.5	63.8	63.0	63.7
.132	September 2nd	8.836	65.2	63.6	59.4	65.9	65.9	65.4	64.3	63.6	61.4	61.3	60.3	65.7	64.4	68.6	63.8	66.4	64.8
	" 3rd	9.028	59.9	59.5	52.2	62.9	63.2	62.9	64.0	62.5	61.4	61.4	60.3	64.0	62.2	63.1	62.3	63.4	62.3
.040	" 6th	8.641	70.5	67.5	64.6	64.5	64.6	64.7	63.6	63.6	61.5	61.3	60.1	65.0	64.6	65.6	64.2	66.0	64.6
	" 7th	8.509	62.6	61.6	56.5	65.4	65.4	65.9	63.8	63.8	61.6	61.5	60.2	66.6	65.3	67.0	64.5	67.3	64.9
.194	" 9th	8.739	57.8	57.5	54.6	56.8	56.2	60.4	59.9	60.2	61.4	61.3	60.1	58.6	59.9	58.9	60.3	58.9	60.2
	" 10th	9.112	51.6	48.7	45.5	56.9	56.4	58.7	58.7	59.9	60.5	60.9	60.0	54.2	57.8	54.4	58.9	53.9	57.9
.45	" 13th	8.765	75.8	74.5	69.3	70.2	69.8	67.1	64.5	63.0	60.0	60.0	59.2	69.8	64.2	70.6	63.4	70.5	65.2
	" 14th	8.973	62.9	61.1	55.4	64.0	63.8	64.0	63.8	63.6	60.6	60.2	59.3	62.4	64.4	63.6	64.1	62.0	63.6
.022	" 15th	9.031	53.1	50.8	48.2	47.8	53.9	58.1	59.3	60.6	61.0	60.5	59.3	52.0	59.9	56.2	60.4	51.9	58.7
	" 16th	9.211	51.5	47.8	44.8	54.4	54.2	55.3	55.8	57.3	59.9	60.2	58.8	56.3	57.0	54.2	56.7	50.9	54.7
.450	" 21st	8.841	63.7	61.1	59.2	58.9	56.9	59.3	58.1	57.8	58.4	58.8	58.2	54.2	56.2	56.6	56.6	56.0	56.1
	" 22nd	8.755	52.7	51.5	48.3	53.4	53.1	55.7	56.5	57.6	58.2	58.5	58.0	52.6	56.7	52.9	56.9	52.7	55.6
.19	" 30th	8.772	59.1	57.5	57.4	58.7	58.2	57.4	56.2	56.1	55.2	55.9	55.5	57.1	55.9	57.7	55.2	57.9	55.9

Wood Ashes.

The subject of wood ashes was dealt with in the following bulletin issued August 25th, 1887:

"The use of Canada ashes has of late steadily increased, and the cost gradually declined to 24 to 25 cents per bushel of 45 to 50 lbs. These are prices by the carload at Amherst and its vicinity." This is from the Massachusetts Experimental Station bulletin issued January, 1887. The prices in the Eastern States are based upon chemical analysis, 6 per cent. of potash and 1½ or 2 per cent. phosphoric acid being the standard. Upon that standard fresh ashes will often exceed the above value.

Government returns state that in 1885 ashes were exported from Ontario to the value of \$18,298, in 1886 to the value of \$27,506. From Quebec, however, in 1885, ashes (pot, pearl and leached) were exported in value to \$161,444; in 1886 in value \$133,784. Since shipments are made almost entirely to Great Britain and the New England States, most of the Ontario ashes will be handled through Montreal.

In view of the above exportation, and of the great waste of ashes in Ontario, it is worth while for the farmer to consider whether it pays to waste, or to sell for five or ten cents in cash or barter, a bushel of ashes for which the enterprising New England farmer offers 25 cents by the carload.

Plants draw upon the air and soil for their nourishment. From the former they can obtain water, carbon, oxygen and nitrogen, either directly through their leaves, or indirectly through their roots from the washing of the rains. These build up starch, sugar, cellulose, woody fibre, fat and much of the nitrogen compounds (*albuminoids*, etc.) The ash or mineral matter, however, which is just as necessary for the vegetable and animal life, is derived from mineral salts of the soil. Hence it is of importance that the quantity of mineral matter in the soil be not decreased or exhausted. Products in the form of starch, sugar, fat and albuminoids can be sold without exhausting a soil, but the removal of ash, or mineral matter without compensation is a sure and certain method of deterioration. A farm will be less exhausted by the sale of its produce in the form of beef than in the form of grain, less exhausted in the sale of cream or butter than of milk, etc. The return of the ashes to the soil, whence they have come, is economical, just, necessary.

Unleached ashes are valued for the potash (K_2O), phosphoric acid (P_2O_5), and lime (CaO.) which they contain. In addition, magnesia (3 per cent.), iron (1.5 per cent.), soda (0.5 per cent.), and sulphuric acid (0.15 per cent.) are found.

Leaching removes the salts which are soluble in water; these are the potash salts. The leached ashes contain from one to two per cent of potash—all the other ingredients of the fresh ashes remain in about the same proportions. A bushel of fresh ashes averages 48 lbs., of leached ashes 55 lbs. The latter contain more moisture. Two samples of ashes have lately been submitted to me for analysis. The first was a little impure, evidently mixed with sifted coal ashes and perhaps slightly leached. I give the analyses so far as they are of value:

	—	Potash.	Phosphoric acid.	Lime.	Value per bush.	Value per ton.
					c.	\$ c.
1	Guelph ashes	5.43	1.20	36.83	20	8 33
2	London ashes, fresh	7.15	1.89	37.33	26	10 83

The above values are from reckoning potash at five cents per lb., phosphoric acid at 5 cents per lb., and lime at one-fourth of a cent per lb., the same values that are used in all commercial fertilizers.

For further reference I shall give a few late analyses from other sources :

	—	Potash.	Phosphoric acid.	Lime.	Value per bush.	Value per ton.
					c.	$ c.
3	Canada ashes—New Jersey report	5.02	1.56	36.10	21	8 80
4	Canada ashes—Mass. report (average)	5.76	2.51	36.77	19	8 11
5	Dried hardwood, fresh—Michigan report	11.25	6.00	40.00	48	20 00
6	Dried hardwood, leach—Michigan report	1.60	6.80	42.00	25	10 40
7	Canada unleached ashes—New Jersey report	6.25	1.87	37.24	24	9 98
8	Hard coal ashes—Michigan report	0.10	0.05	1.50	00	0 16

The more complete analysis of ashes No. 2 I found to be as follows. It may be taken as a fair average of fresh ashes :

Water	2.07	per cent.
Insoluble matters	7.68	"
Potash	7.15	"
Phosphoric acid	1.89	"
Lime	37.33	"
Magnesia	3.02	"
Iron and alumina	1.53	"

Practical Conclusions.

1. Ashes are very beneficial to all soils more or less impoverished, especially to sandy soils.

2. Ashes are adapted to every crop of a woody nature, especially fruit trees and vines.

3. Hardwood ashes are worth to the farmer unleached about 20 cents per bushel, leached about ten cents per bushel. Softwood ashes are a little less valuable.

4. Coal ashes contain little or no plant food. They are a good absorbent, make first-rate road beds, and are well adapted for filling in hollow walls.

5. Apply from one-half to one ton of fresh ashes per acre, three to four tons of leached ashes.

6. All wood ashes should be kept under cover, in a dry place.

As an addition to the above I may add an analysis of charred bone or "bone char" made by myself, as follows :—

Insoluble matters	5.45
Water	1.38
Iron oxide	1.79
Phosphoric acid	28.50
Magnesia	2.40
Lime	28.28

Soils.

Several samples of soil have been investigated. I quote two, one of red sand from Niagara district, and the other a marl :—

	Sand.	Marl.
Water	1.44	4.07
Insoluble matter	90.71	0.37
Organic matter	2.98	
Oxide of iron and alumina	3.88	3.93
Lime	0.35	50.69
Magnesia	0.07	0.52
Phosphoric acid	0.32	0.01

The marl sample is valuable solely for its lime. Since analyzing the above I have examined four other samples from different localities. Of all the Ontario marls I have so far examined, none contain phosphoric acid in any considerable quantity; they are valuable solely for their *lime*.

The sand shows what a small percentage of fertile soil is soluble or available material. When we consider the great weight of an acre of such soil, however, we can understand how it is possible for crops to develop in a soil almost wholly insoluble.

Dairy Products.

As the analyses of milk, etc., were part of experiments conducted in other departments, and are doubtless quoted there, I shall not quote them. One interesting case, however, from an outside source, came under my notice. Two samples of butter, salted and unsalted, and a sample of cream from which the butter was made, were sent from a creamery. The objection to them was that the butter soon lost flavour and degenerated. A partial analysis shewed as follows. Side by side I give Kœnig's average of 89 analyses of genuine butter:—

	Unsalted Sample.	Kœnig's Average.
Fat	72.23	83.11
Water	14.77	14.14
Casein—Curd	12.75	0.86
Lactose—Sugar		0.70
Ash	0.25	1.19

The fault was that the butter contained too much curd, approached too nearly to cream cheese in composition, which it somewhat resembled in appearance. Genuine butter should not fall below 80% in fat. The presence of curd would hasten decomposition and the imparting of a rank flavour and odor.

The presence of the curd was very apparent on melting the butter. A simple test for curd in butter is to place some of the butter in a test tube or tall glass; stand this in a dish of warm water and allow the butter to melt. The curd is seen floating in the clear fat or oil.

Water, etc.

Several samples of well water and other substances have been examined during the year and been reported upon. This department of the work has been steadily increasing for the past year and a half, and with the increased accommodation will, doubtless, still further increase. Having lectures to prepare and deliver to students of three different years and practical instruction at least three afternoons every week, it is easily seen that I have not much time left for investigation outside of my regular work. So far as I can I answer all such enquiries, and trust that any delay sometimes resulting will not be set down to negligence. The work now resting upon the chemical department precludes all possibility of its being considered a sinecure. With new equipment and increased accommodation, however, this is not the time for complaint.

Trusting this will meet with your approval,

I remain,

Your obedient servant,

C. C. JAMES,

Professor of Chemistry.

PROFE

To the Presiden

SIR,—Unl
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PART IV.

REPORT OF THE

PROFESSOR OF VETERINARY SCIENCE.

GUELPH, December 31st, 1887.

To the President of Ontario Agricultural College:

SIR,—Unlike my report of last year, it is my duty in this year's one to explain a somewhat heavy loss, fro the death of some valuable animals.

Although it sounds somewhat paradoxical, after the above statement, I may say that the general health of the live stock on the farm has been good; for we have had comparatively few casualties of a mild type.

Unfortunately, some of the diseases have been of that class usually included amongst the malignant. About the only disease of the urinary organs that I meet with in private practice, or at the College, among sheep, is what is technically called

URETHRAL CALCULUS,

or the presence of stone in the tube leading from the bladder to the end of the penis.

I have seen it both in wethers and rams. Sheep are naturally predisposed to this trouble, both on account of the small size of the urethra and the existence of the peculiar worm-like appendix at the end of this tube, commonly called the feeler, as the sediment from the urine would be much more likely to clog, under these conditions than in the horse, in which animal the urethra is comparatively straight and large in calibre.

The stone is sometimes lodged above the S-shaped curve in the urethra, but I have generally found it in the feeler, plugging that worm-like tube, so that it is impossible for urine to be voided.

Unfortunately there are seldom, if ever, any symptoms to warn one of approaching danger until complete obstruction is present; and even then, in a large flock, it is easy to overlook a suffering animal for some hours, or until it is too late to give remedial aid.

The symptoms of suffering are not continuous or pronounced until the bladder becomes surcharged with urine, and then rupture of that organ will take place after a few hours.

When rupture has taken place, and the urine has escaped into the abdominal cavity, the evidence of pain is continuous and distressing.

The animal begins to breathe very rapidly, grinds his teeth, and grunts audibly after each expiration of air. After several hurried respirations breathing is suspended for a few moments, to be resumed as rapidly as ever.

It was evidently after rupture had occurred that our attention was drawn to an imported ram that died in the beginning of the year.

On holding a *post mortem* before the students the obstruction was pointed out in the "feeler," and, as was expected, the belly (abdomen) was found full of fluid, and a tear in the bladder. In rams and wethers that show pain, the urethra should always be examined for the presence of an obstruction. If it is in the "feeler" it is hardly possible to remove it without cutting off this appendage, as manipulation tears and bruises it, it being very frail. It is the generally accepted impression that it renders a ram sterile if this appendix is removed. My experience doesn't warrant my giving an opinion as to this; but if it is the case, such an alternative as its removal in a valuable ram is serious, and reduces him to mutton value in the event of a recovery.

If the obstruction is higher up, cutting down on it is the only remedy. In doing this the penis should be pulled out to some extent, so that the incision through the skin and that into the urethra will not be opposite when the penis retracts; thus sufficient closure of the urethral incision will result in order to admit of the urine flowing through its proper channel after removal of the stone. It is caused by undue quantities of the salts of lime and magnesia in the drinking water. High feeding on grain, containing salts, particularly if the supply of water is insufficient, which should be soft water if the supply of hard water contains too much lime.

Parturient Apoplexy.

This affection is sometimes, but erroneously, termed "Milk Fever." Another much more appropriate term is used to designate it, viz.,—"Dropping after Calving," which is more significant, as it indicates the fact that the malady occurs soon after calving, and that its characteristic sign is loss of ability to stand.

But the real nature of the trouble consists in a congested state of the blood vessels of the brain, with effusion from them, which presses on the brain matter and impairs its function of providing the muscles with nervous influence, and thus giving them ability to contract, which ability enables an animal to stand and move.

This supply of nervous influence being cut off through the apopletic condition of the brain, and possibly of the spinal cord also, the voluntary muscles become flaccid and the animal paralysed.

There is no affection of common occurrence in the cow that is so fatal. Veternarians are unanimous in asserting that four cases out of five terminate fatally.

It is not only the primary trouble that has to be contended with, but there are a number of sequels which, under the circumstances, prove even more obstinate to control than the primary condition in connection with the brain.

A marked symptom of the disease is the profound state of stupor, or coma, into which the animal sinks. She becomes so insensitive that the finger can be run against the eye without causing any resistance.

Now in some cases this lethargic condition passes off, and the subject may even gain control of its muscles and rise, but in some other instances paralysis remains obstinately.

Inflammation of the lungs and bronchitis frequently follow; very often the result of pouring down medicine, as the animal is unable to swallow, and the liquid passes down the wind-pipe into the lungs, there setting up inflammation of a serious character.

This would be serious at any time, but occurring after the nervous system has become depleted by disease, it leaves very little chance for recovery.

Another result of the nervous derangement is that digestion is suspended, very palpable evidence of which is shown, sometimes, by attacks of bloating. But abdominal pain is sometimes manifested by great uneasiness, grunting, frequent breathing, escape of a small quantity of liquid fæces, and progressive exhaustion resulting in death; when a *post mortem* reveals nothing to account for it but a very full and impacted "manyplies," with evidence of inflammatory action, in the third and fourth stomachs.

An imported Jersey cow sickened some twelve hours after calving, with parturient apoplexy. The coma disappeared in about twenty-four hours, during which time ice was kept on the head, the patient was kept in a comfortable position, and the action of the skin encouraged by warm blanketing. It was during the intensely warm weather of July, but the case appeared a most encouraging one, for the cow regained consciousness and partial control of her limbs; but she gradually sank, having shown evidence of much pain and exhaustion, which we were unable to overcome by the liberal use of anodyne and stimulants. A *post mortem* showed exactly the condition already described in connection with the third stomach. A purgative of Epsom salts was given her at the onset. No evidence of irritation of the bowels was noticeable *post mortem*, so that the abdominal pain could not reasonably be referred to intestinal derangement. This cow was in fair flesh, but had nothing to eat except what she picked up at pasture.

Tuberculor Consumption.

I have further to report two cases of tubercular consumption, one occurring in a Polled Angus bull, and the other in a Polled Angus cow; both, of course, terminated fatally. My attention was not drawn to the bull until a few weeks previous to his death. The herdsman had noticed that he was not quite so thrifty as he had been for a few months, but thought there was nothing of any importance wrong, as he had no cough and ate fairly well. Towards the autumn the failing condition was more apparent, and it was thought better to turn him out, as it was imagined that his long confinement in his box was perhaps the cause. But after being out some three or four weeks he came up looking almost like a skeleton, and continued to fail very rapidly until his death, which occurred in a couple of weeks.

The cow had proved barren for a number of months, although she had been served regularly every time she came in heat. It was thought advisable to send her away to another bull, and she remained away some months. She was in good condition when she went away, but on her return presented a very emaciated appearance; in fact, her case was a typical one of tuberculosis.

In addition to a very low state of flesh, she coughed frequently, breathed somewhat rapidly, had very little appetite, and suffered from diarrhœa occasionally, the discharge having a very offensive odour. Her skin presented a dirty, scurvy, dry appearance. She gradually became weaker, until she was unstable in her movements, and at last hardly able to rise from the recumbent position, when it was thought more humane to destroy her and hold an examination for the benefit of the students.

More extensive deposits it would hardly be possible to find. The lung tissue itself was not very much involved, but in the covering of the lungs—pleura—there was a very extensive deposit. The liver was fully three times its normal size, having immense deposits in it. In the membrane that covers the bowels, and attaches one portion of them to another, etc., were numerous and large masses of confluent tubercles or tumours containing considerable quantities of curdy matter.

One ovary and a horn of the womb was also extensively involved, which accounts for the animal not conceiving.

I have in former reports endeavoured to explain the nature, etc., of this disease, so it will not be necessary to go into any further details.

I may say, since my connection with the College, that we have been very unfortunate with Polled Angus cattle, in the way of having some half-dozen victims of tuberculosis amongst them, while we have had three amongst the Durhams, or Durham grades, one Devon, one Ayrshire, and one Hereford.

Comments have been made upon the number of cases, reported in former years, of tuberculosis at the Experimental Farm.

To a breeder of ordinary grades it may seem somewhat strange, for it must be admitted that this scourge is comparatively rare amongst the unimproved breeds.

Some raisers of pure-bred cattle who are fortunate enough to possess strains that are untainted, or whose range of experience is small amongst pure-breds, would naturally be astonished at the fatality we have experienced.

But one who gets a look behind the scenes, occasionally, at what transpires amongst some of the valuable herds of this country, will realize that the Experimental Farm does not occupy a peculiar position with regard to the occurrence of tuberculosis.

Rather a remarkable case occurred in connection with the Guernsey bull. A casual observer would certainy have thought that he was a victim of tuberculosis, for during last winter he kept getting thinner and thinner, until he presented a most emaciated appearance by the spring.

I was frequently asked to do something for him, but could never determine the presence of any organic or even functional disease unless mal-nutrition be classed under the latter head, or also impaired appetite.

He is a very nervons and excitable animal, and appeared to chafe under the enforced restraint of prolonged confinement in a box stall, although for a couple of years he had done very well there. I suggested turning him out to pasture with a cow, and the freedom had a magical effect in restoring his appetite and improving his condition, so that when he was taken up again he had regained most of his former condition, and has remained thrifty since.

SPAYING.

In my last year's report I promised to be in a position to give an account, this year, of some systematic experiments with regard to the effects of spaying on the production of milk.

Unfortunately a change took place in the management of the creamery last spring, and I was unable to gain permission to institute any such experiment, but I am promised an opportunity next spring to do so.

As was explained in last year's report, two heifers and two cows were spayed, chiefly with the object of testing how they would stand the operation. Its effect upon them was then explained. The heifers are thriving wonderfully well, and show by the progress they are making a marked advantage over the unspayed ones that stand beside them, and which lose considerably by their fretfulness and loss of appetite during the twenty-four or forty-eight hours they are in heat every three weeks.

I think there can be no question that when heifers are intended for the block spaying is a great gain; in fact, this may be considered established, by the practice having become very general in grazing countries.

Of course it is of greater benefit in large herds where no attempt is made at housing, and where rutting heifers cannot be separated from the rest of the herd, as in some ranches.

It was explained in last year's report that we were unfortunate with one of the milking cows that was altered.

She was a bad subject, as she was suffering from a sore teat that became blind before she was operated upon, and the remainder of the quarters were subsequently lost, so that she was fattened and sold.

The other cow is still milking pretty freely, and it is now about twenty months since she calved. She is giving about twenty pounds of milk per day, and has varied very little from that amount during the last year.

Respectfully submitted,

F. C. GRENSIDE, V.S.

PART V.

REPORT OF

THE PROFESSOR OF AGRICULTURE,

FARM MANAGER, AND EXPERIMENTAL SUPERINTENDENT.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,
31st December, 1887.

To the President :

SIR,—I beg to submit my reports upon the Farm, the Live Stock, the Experimental and the Mechanical Departments of this Institution for the year 1887. Following the practice in previous years of giving, in an introduction, some material directly connected with our work here, I make no excuse in offering notes on the correspondence of my departments, as they cannot fail in showing how our arms are extending and what is expected of us year by year.

My annual correspondence is in the neighbourhood of 2,000 letters, thus averaging seven letters per day. Of these, one-third is from all parts of Canada, asking for advice in regard to some speciality in farming, and particularly as to adaptability of live stock. Many ask so much as to necessitate referring them to a text book. One of the most interesting of my lines of correspondence is with ex-students, who hold me in keeping with their progress in the world. I find a large proportion of our associates, that is our A 1 men, have not forsaken the profession. Taking those up to 1886 inclusive, the following gives a close idea of what they are doing :

Farming in Canada		56
Farming in United States		3
Veterinary profession		8
Professor of Agriculture		1
Nurseryman		1
Farm managers for others		2
Preparing as Experts in Agriculture		7
		78
Medicals	3	
Commercial pursuits	5	
The Church	1	
Bankers	2	
In Europe	3	
Not known at present	25	
		39
Total Associates		117

Of these, 33 are non-residents of Ontario, and outsiders hold 5 of the 17 medals that have been given during the twelve years. In connection with this subject, I am much gratified at the arrangements of a third year's course for those who desire either to make a speciality of one branch, or to extend their general knowledge with us. The appliances in chemistry especially should enable us to make experts for the profession, and I respectfully submit that we should not delay in letting it be known that the Ontario Agricultural College is preparing young men for other Colleges and Experimental Stations.

The issue of Bulletins has added considerably to my correspondence, not alone among our own people, but as nearly every agricultural journal of the States and Britain give these brief notes a good place, explanations and further information are often called for.

This brings up the subject of experimentation, and as I anticipated in reporting last year, we have calls for a reprint of the most important of our work in this direction. These were summarised in my 1886 report, and I again beg to draw the attention of the Commissioner to the importance of this proposal. It was no spurious notice in the public press recently that an American agricultural journal had asked for 20,000 copies of our Annual Report for distribution among its subscribers. The letter was sent to the Commissioner, and I have authority to name if necessary. As further evidence of the general good feeling towards our labours, I am in regular gratuitous receipt of the following papers —in addition to those sent the Librarian: *N. B. Agriculturist*, Scotland; *Bell's Weekly Messenger*, England; *Farm and Home*, Mass., U. S.; *The Jersey Bulletin*, Ind., U. S.; *National Live Stock Journal*, Chicago; *Breeder's Gazette*, Chicago; *The Farmer*, St. Paul; and *Hoard's Dairyman*, Wis. I take and appreciate the compliment most highly for all concerned.

I am as much as ever kept up to time in regard to any new varieties of wheat and oats that may come under our experience. On this valuable question I have reported in these pages with my assistant, Mr. Zavitz, and all needed to be said now is that, even though Provincial only in our immediate interests, and not demanding so much attention as a Dominion does, we should keep up a full practical enquiry about better cereals for Ontario.

Having taken particular interest in the undeveloped pasture lands of Canada, many enquiries are made about sheep grazing—particularly in the N. W. Territory and the Eastern Provinces. I am prepared to reply fairly well as to the latter, but not having been west, am unable to place the country, even to our students, as a teacher ought to be able to do.

It is known I took an interest in the experiment of shipping store cattle to Aberdeen, Scotland. The report of the three cargoes sent to date is not highly satisfactory financially. I understand that the importing company does not ask for an immediate selling profit, and would be satisfied were a simple clearance made—desiring only to put the country in possession of some good stores that will keep up the long standing of Aberdeen for finished beef. I ask, then, that no prejudgment be made, but to wait until next year's market tells of weight and quality on the London shambles, when also, may be, better shipping facilities will settle the question of Canadian stores for Britain.

As representing Ontario, I had the honour of judging live stock at the Quebec Dominion Exhibition this year, where I gathered information of considerable importance to myself as a teacher, and to others, I trust, as time may allow me to develope some points of interprovincial interest. On the question of judging at such exhibitions, I beg to give herewith a plan and explanation of what I have adopted for private use, or when I am asked to act as sole judge of one or all classes of live stock as I did at Barrie, last year.

BARRIE AGRICULTURAL SOCIETY.

SUMMARY OF CATTLE JUDGING.

Class 2. Section 3.

October 6, 1886.

	Prominently or Moderately.				Remarks.
	Superior in		Deficient in		
Animal numbers	1	2	1	2	
Head and neck	P. S.	M. S.	....	....	
Fore quarters	M. S.	M. S.	....	....	
Barrel, including crops and loins	....	....	M. D.	M. D.	
Hind quarters, including flank and twist	....	P. S.	M. D.	....	
Legs, including arms and thighs	M. S.	....	....	P. D.	No. 2 broader and fuller
Size, according to age	P. S.	M. S.	....	....	
Quality (hair, skin, flesh, and bone)	P. S.	M. S.	....	....	
Character	M. S.	M. S.	....	....	No. 1 very sup'rior skin
Markings	P. S.	M. S.	....	....	No. 1 somewhat better.
Milking indications	M. S.	M. S.	....	....	No. 1 very superior.

Explanations.—P. S.=10, M. S.=8, M. D.=5, P. D.=3. Maximum value, 100.
Awarded No. 1=82, first prize; No. 2=74, second prize.

I am much in favour of the one-judge system once we have experts enough for each class or breed. In addition, I said a few words to the public in closing the judging of some of the more special prizes, while animals were in the ring, giving reasons for preferences. I think every competitor is entitled to an abstract report upon his animals.

I am not yet clear as to using a scale of points with a view only for points. I think we want to express or explain the valuation of a point by some words such as I have used in the foregong form.

In the case where I used the card I had only two cows (Jerseys) in competition. This plan has only ten divisions or points for any animal of any breed, and each of these divisions or points is subject to four valuations, viz.: "Prominently Superior" (P. S.), or "Moderately Superior" (M. S.), and "Prominently Deficient" (P. D.), or "Moderately Deficient" (M. D.) Each of these points has a fixed valuation, as will be seen by the card, the maximum value being 100. I find it easier and more natural to judge and speak of points by a name than by a number, as in the usual scale of points, and I think the four names used here meet all. I systematically go over each animal by the ten abstract points named, putting down the inital letters only, and then give the letters their value in figures afterwards. It takes about five minutes to each animal. With this explanation a brief study of the plan will make it clear.

Is Ontario—I should say Canada, properly—to remain much longer unrepresented by *practical work in Arboriculture?* We have surely talked and written enough on the subject; delay now will be more than dangerous; it will reasonably be called national suicide.

I am not satisfied that our own institution is doing all it could or should in respect of matters within its own lines. On 28th July last I drew your attention to the value that may be given the Province by enquiries through the winter action of the faculty here, with reference to several scientific and practical subjects effecting the farming of the Province.

We have, to some extent, thrown light upon some of them, but not full enough to be of direct public benefit.

Many enquiries have been made in regard to creamery work here and over the Province; men want facts not yet gathered in their own experience, and many desire a full account of the whole business. In the absence of a special professor of dairying, —now, however, again well filled by Professor Robertson—I have done my best to meet this demand, and have even issued a bulletin on one of the butter making problems of the time.

II.—THE FARM.

It is year by year growing more difficult to say much new about farm work, and as Mr. Story has entered pretty fully into delails of the year's operations as given herewith, I shall confine myself to some notes on the yield of crops during the last twelve years.

CROP.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
W. Wheat	......	......	22	21	27	......	38	15	24	36	24	......
S. Wheat	10	18	13	20	18	18	23	21	......	......	......	......
Barley	30	35	27	36	26	23	30	35	42	40	42	27
Oats	39	38	49	36	17	34	41	55	40	42	50	30
Peas	32	25	31	27	27	23	35	22	35	22	35	30
Hay	1.35	1.30	2.40	1.60	2.20	1.25	1.42	2.50	1.75	1.81	1.85	1.75
Mangolds	350	770	1,030	718	790	1,006	1,000	650	953	1,020	795	450
Turnips	553	760	550	630	725	390	700	450	775	900	700	510
Carrots	270	......	910	315	580	......	800	500	900	750	450	500
Potatoes	110	150	250	77	126	190	103	100	202	174	170	80
Corn fodder	25	27	35	13	......	......	25	20	......	40	20	15

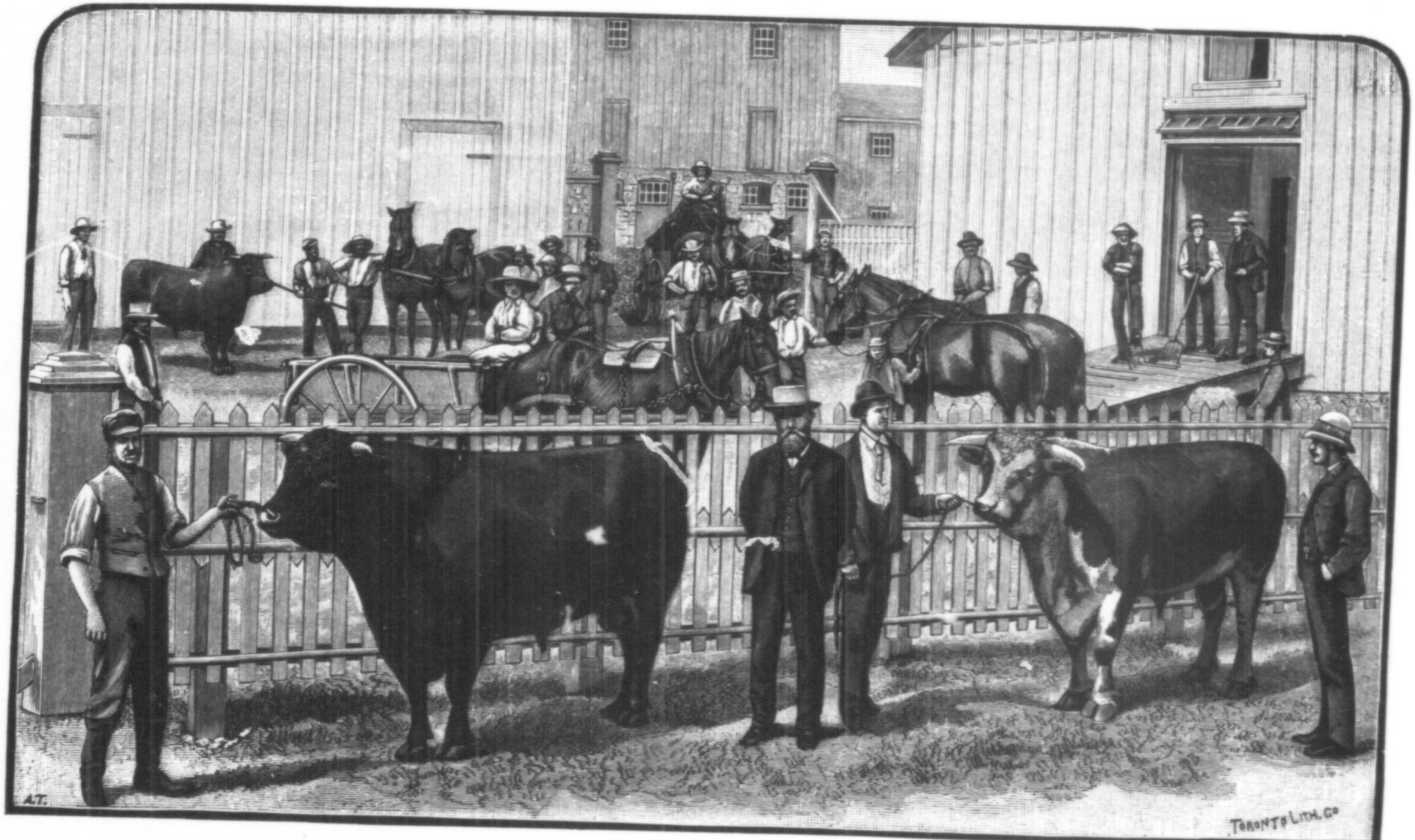
Grain and roots in bushels; hay and corn fodder in tons.

Not having any other reliable returns for comparison, and as it is necessary to compare with something, I have pleasure in using the five years of the Ontario Bureau of Industries from 1882 to 1886.

	Ontario.		O. E. Farm.
Winter Wheat	22	......	27
Spring Wheat	17	......	17
Barley	28	......	32
Oats	35	......	40
Peas	22	......	29
Hay	1.41	......	1.75
Mangolds	462	......	797
Turnips	420	......	635
Carrots	385	......	595
Potatoes	125	......	144

When twenty-two bushels is the average of winter wheat for the Province, our five bushels more shows we are not prominent in that respect, and possibly the 850 feet above Lake Ontario is the principal regulator. The fact also of our seventeen bushels of spring wheat representing exactly the mean of the Province is ample evidence that this district is not a leader in wheat per acre. In other grain our position is better; in barley we have made fourteen per cent. more, in oats also fourteen per cent. more, and in peas twenty-two per cent. over the mean of the Province. The cropping character of our district is, however, very clearly marked in root products. We as a farm have harvested seventy-five per cent. more mangolds than the Provincial average, and actually double in turnips and carrots. In potatoes our mean is about thirteen, and a fourteen per cent. better product in hay.

In order to more fully impress our twelve years' cropping, I beg to give a diagram of each for every year, with a brief note.



Morning Scene at Barnyard before going out to Work, Agricultural Farm, Guelph.

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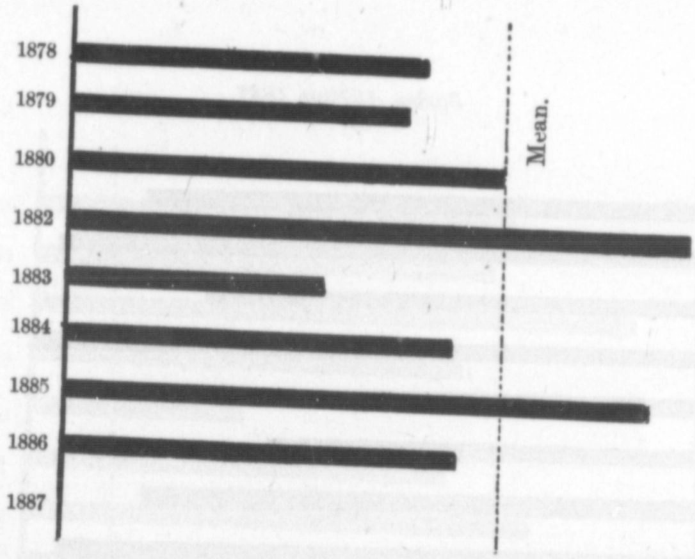
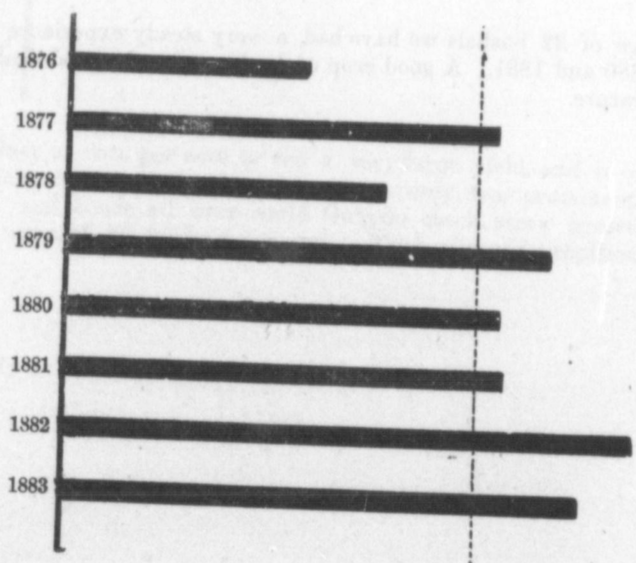
Winter Wheat at the Ontario Experimental Farm, 1878 to 1887.



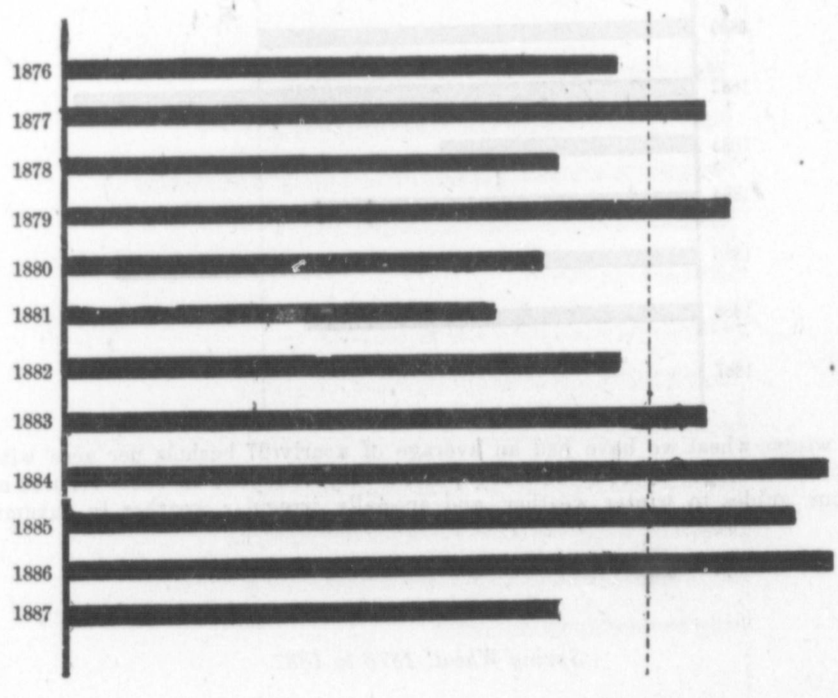
In winter wheat we have had an average of nearly 27 bushels per acre with two distinct over averages in 1882 and 1885, and a very low yield in 1883. These may be called our guides to winter weather, and specially irregular weather in autumn and spring.

Spring Wheat, 1876 to 1887.



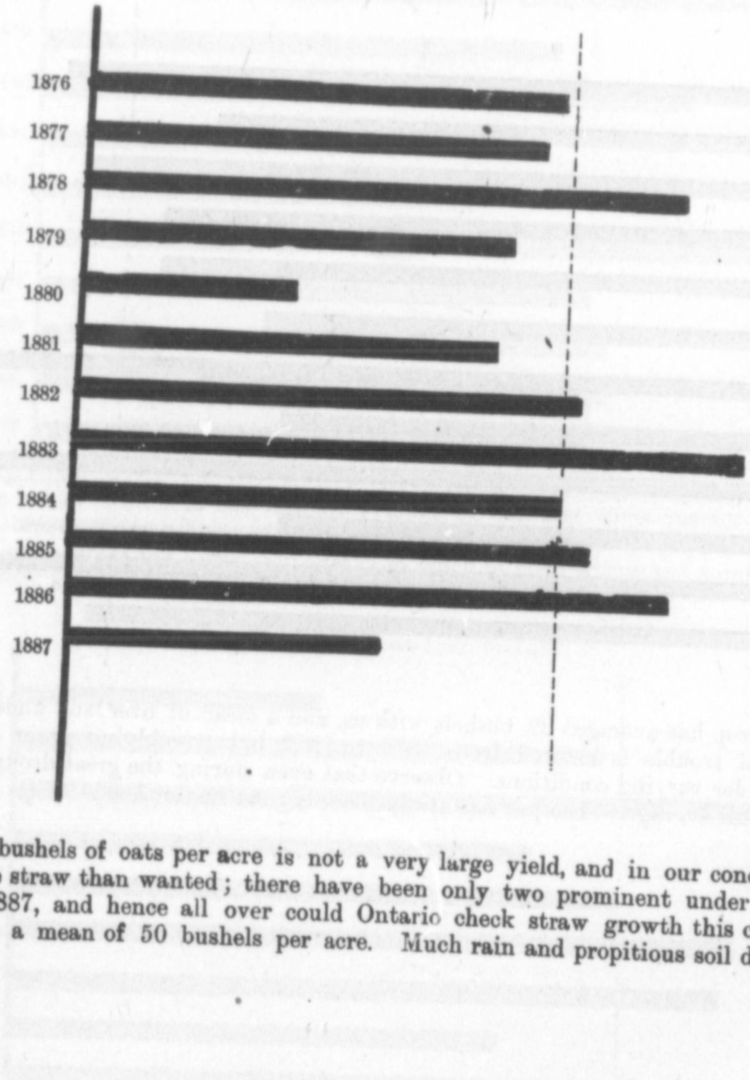
Our spring wheat has averaged 17 bushels with but two underaverages up to 1883, inclusive, which marks our departure from this crop meantime, in consequence of blight and rust. Spring wheat may be termed the test of moist warm weather during July.

Barley, 1876 to 1887.



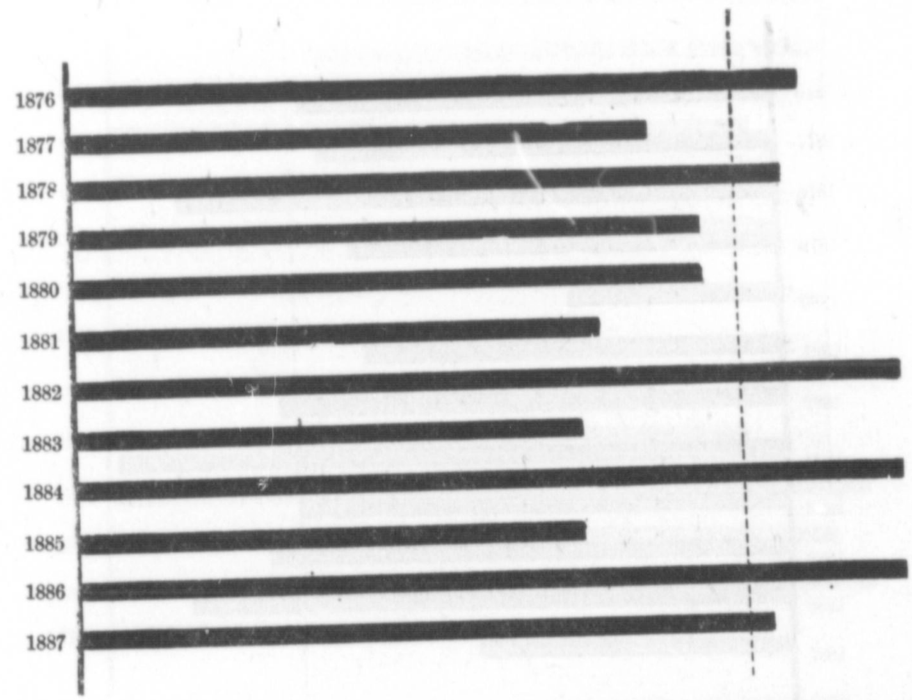
With an average of 32 bushels we have had a very steady experience in barley—low years only of 1880 and 1881. A good crop of barley tells of a good deal of moisture and medium temperature.

Oats, 1876 to 1887.



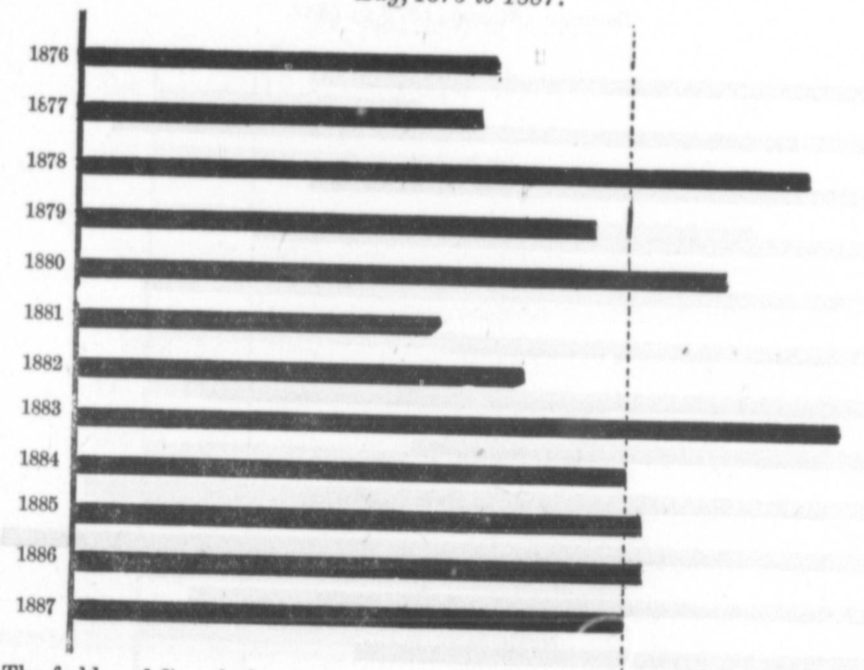
Forty bushels of oats per acre is not a very large yield, and in our conditions has meant more straw than wanted; there have been only two prominent under averages, 1880 and 1887, and hence all over could Ontario check straw growth this crop would easily reach a mean of 50 bushels per acre. Much rain and propitious soil do not give grain.

Peas, 1876 to 1877.



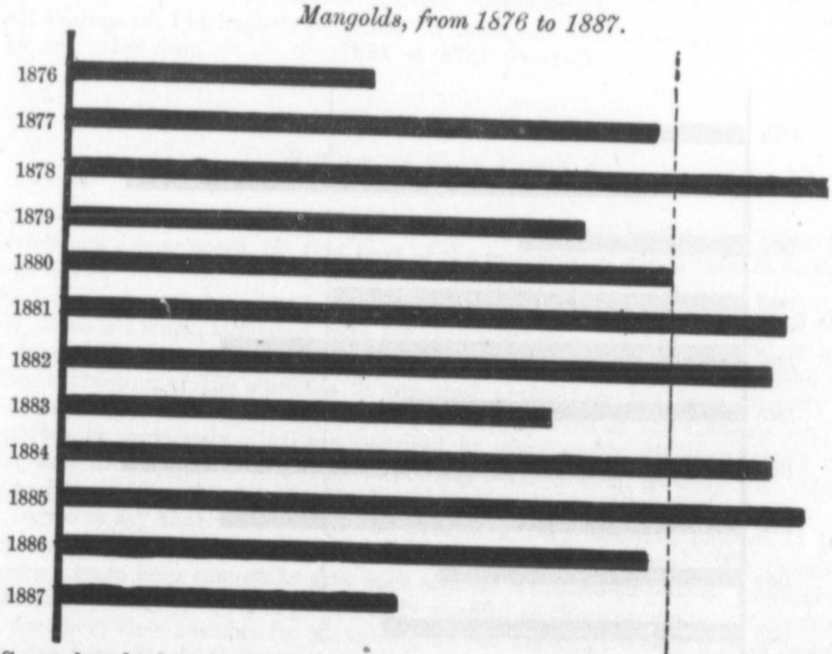
This crop has averaged 29 bushels with us, and a mean of over and under averages. The weevil trouble is marked from 1879 to 1883, but possibly no grain has been so reliable under varying conditions. Observe that even during the great drought of 1887 we had a full average. The pea has always been a good rustler here.

Hay, 1876 to 1887.



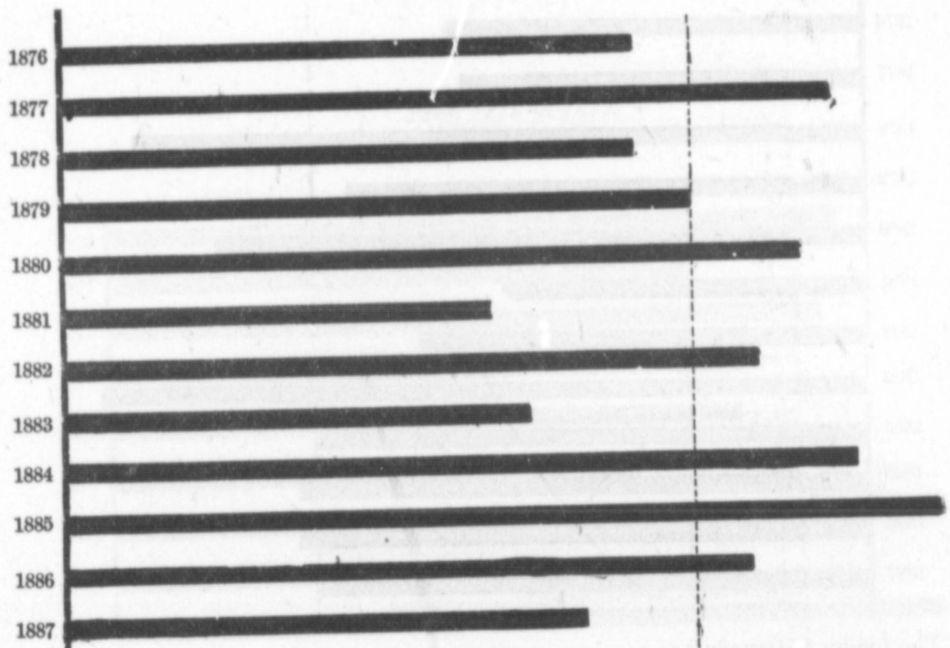
The fodder of Canada has been an average of one and three-quarter tons per acre here. Observe the steadiness of the crop all through, the year 1881 only being down to one and one-quarter ton. No crop speaks so much of good winter and summer conditions as this does, and hence a criterion for other countries.

Mangolds, from 1876 to 1887.



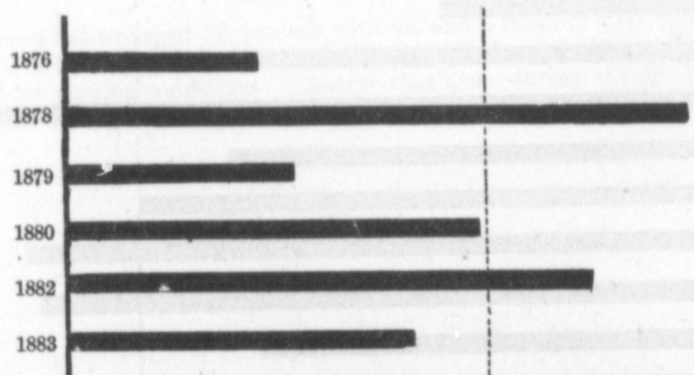
Seven hundred and ninety-five bushels, or twenty-four tons of mangolds per acre, implies good things both in climate, soil and management. Possibly of all root crops this is the most reliable and least patronized in Canada.

Turnips (Swede), 1876 to 1887.



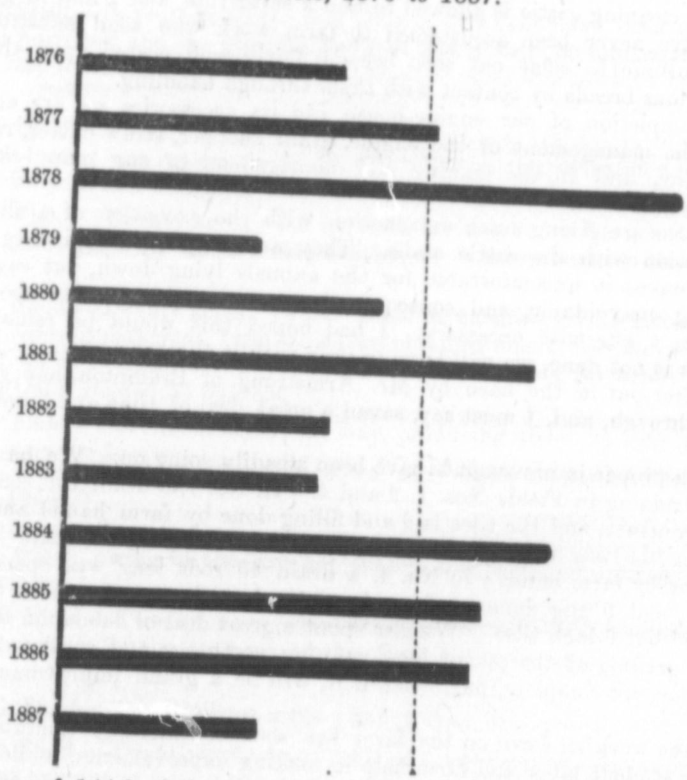
Nineteen tons (635 bushels) of Swede turnips per acre, over twelve years from a mean of twenty acres annually, is a handsome return, under the difficulties of fly and drought. A good crop here always speaks of plenty rain and an under average temperature.

Carrots, 1876 to 1887.



We have had more extremes in carrot crops than other roots; as the above average line represents 595 bushels per acre, the irregularity is easily noted.

Potatoes, 1876 to 1887.



An average of 144 bushels potatoes. I think our rainfall is better represented here than by any other crop.

REPORT OF FARM FOREMAN.

Prof. Brown,

SIR,—I have the honour to present herewith to you my first report upon the Farm and Live Stock Department, for that part of the past year in which they have been under my supervision.

As I did not come here until July 1st, I am unable to give an account of the spring or early summer's work, sufficient data for such not being available. And it is difficult for me to say whether or not these branches of this institution were up to the standard.

The instruction of the students in practical agriculture has been steadily kept up, and much material benefit has been derived from it by such of the students who had not the opportunity previously. All are required to come under the instructor's charge in rotation, and are taught ploughing, harrowing, hand sowing, mowing with the scythe, raking and curing hay, binding by hand, and in fact all general farm work.

I regret to say that we have not at present a very effective methed of imparting this knowledge, as we keep just enough horses to work the farm. We cannot at any time spare a team long enough to give each student a chance to become familiar with the management of horses. This is particularly needful to those students coming from cities, and in our short time suitable for ploughing we can barely give each a good lesson.

In the Live Stock Department matters are more favourable ; here the student is taught the best ways of rearing and the general management of farm stock.

I would here call your attention to a matter of importance regarding the instruction of students on live stock.

The student who does not feel inclined to come out at six in the morning to assist with feeding and cleaning cattle is allowed to find a substitute, and I find in general it is students who have never been accustomed to farm work who send substitutes. The students who continue to come out soon become fairly well posted upon the valuable points in the various breeds by contact with them through handling.

Since the completion of our engine-house and its accessories we are able to give instructions in the management of the engine, grain chopper, straw cutter, root pulper, threshing machine, and in the making and management of our pulp, consisting of straw, hay, roots and bran.

Our new barns are giving much satisfaction, with the exception of a slight irregularity in connection with the cattle stalls. They are about fifteen inches too short, which not only makes it uncomfortable for the animals lying down, but causes a great waste of bedding unavoidable, and consequemtly we are liable to run short towards spring, rendering a purchase necessary. I had hoped this would be remedied before winter, but, as it is not done, we will have to bear with it another season.

The rack-lifter put in the barn by Mr. Armstrong, of Brampton, has given entire satisfaction all through, and, I must say, saved a great deal of time and labour in filling the barn.

On the farm proper improvements have been steadily going on. We have done considerable underdraining in Fields Nos. 1, 2 and 4. In No. 1, a drain 109 rods in length was opened by contract, and the tiles laid and filling done by farm hands and students; in No. 2, a drain 104 rods long, with tiles 6 in. was opened, and tiles laid by contract, the filling-in done by farm hands; in No. 4, a drain 45 rods long was opened and tiles laid by contract, and filling done by farm hands and students. In these three drains nothing was used but 6-inch tiles. We also spent a great deal of labour in stoning fields 3 and 19. The grading of the centre lane, running north-east and south-west, was commenced. It is not yet complete, but, when it is, will be a grand improvement upon the old road.

Although the working force on the farm has been considerably diminished, yet we had to put some student labor and farm help in making improvements, while direct farm work suffered.

Several great changes have been made in the positions of the minor farm buildings. The experimental barn was moved eastward, and is now being used as a waggon shed. The implement shed was removed to the same frontage as the main barn, and is to serve its former purpose. The old engine-house was removed to the north-east side of the mechanical foreman's shop, and will be used as a lumber house. The farm foreman's stable was removed eastward across the lane, partly on the experimental plots of No. 14, where it will be used as a protection to the farm scales. The mechanical foreman's shop was then moved down abreast the others, making quite a formidable array of structures.

The past summer was one of exceptional hardships to vegetation.

From the 21st of June until the 5th of August no rain fell, and, in general, the heat was intense. Notwithstanding these disadvantages, an average crop of everything was secured, with hardly an exception. The hay, which was near maturity when the drought set in was a good crop, but the roots and grain were more or less affected.

During midsummer the root crop looked far from promising, but toward the latter part of the season they, in a large degree, made up for lost time, and a crop of fair size was gathered. I regret to say that, owing to excessive heat and drought, our catch of grasses and clovers was very slight, which will upset our arrangement for spring work considerably.

The cropping of the various fields of the farm was as follows:—

No. 1 Field.—Nineteen acres; in hay, which gave about $1\frac{3}{4}$ tons per acre.

No. 2 Field.—Seventeen acres; this field was broken from sod early in June, was worked as bare fallow, cultivated with gang ploughs in July, and the last ploughing was given during the latter part of August, between the 3rd and 7th of September, ten acres of it were sown with winter wheat of three varieties, namely, three acres Democrat, three acres Bonnell, and four of Clawson. The remaining seven acres we calculate to plant with potatoes in spring.

No. 3 Field.—Seventeen acres; five acres of this field have been given over for experimental purposes, and the gravelly knoll on north side of four acres was this year converted into a plantation. The balance of eight acres was sown to barley, yielding 27 bushels.

No. 4 Field.—Twenty acres; ten in natural pasture and ten in winter wheat; seven acres of the former was broken up by the Horticultural Department, and balance used as a paddock for pigs and cattle.

No. 5 Field.—Twenty acres; ten in bush and ten in winter wheat, which promised well until about 7th July when it was smitten by a heavy rust which lessened its yield very much.

No. 6 Field.—Twenty acres; twelve acres of turnips, giving about 510 bushels per acre; four acres of mangolds, from which we obtained about 450 bushels per acre; and one acre of white Belgian carrots yielding about 500 bushels per acre; three acres white Australian Oats, yielded 35 bushels.

No. 7 Field.—Seventeen acres; all hay, producing about $2\frac{1}{2}$ tons per acre.

No. 8 Field.—Twenty acres; all sown with white Australian oats, which yielded 32 bushels per acre.

No. 9 Field.—Twenty acres; all sown with Mensury barley, and seeded to timothy and clover, which, owing to the dry hot season, was completely killed out; yielded 30 bushels per acre.

No. 10 Field.—Twenty acres; ten acres sown with white Australian oats: the balance is taken up by the Orchard of the Fruit Growers Association, and the College Creamery.

No. 11 Field.—Twenty-three acres; hay, giving two tons per acre.

No. 12 Field.—Twenty-three acres; this field has been natural pasture until this fall when a great amount of labour was spent on it in cutting brush, stumping, filling drains which were cut last season, hauling off stones, and ploughing. Owing to the pressure of other improvements we have been unable to get it fenced; otherwise it is ready for seeding in spring.

No. 13 Field.—Twenty acres; all hay, which yielded about $1\frac{1}{4}$ tons per acre, but owing to a great part of it being killed out by ice or the spring freshet, it was given to weeds, so we were obliged to plough up after taking off hay.

No. 14 Field.—Twenty-four acres; this is the experimental field proper, 17 acres being divided into small plots for purposes of experimentation; four acres were in potatoes which yielded 80 bushels per acre; three acres were sown to corn for green fodder, part of which was fed to the bulls, and the balance put into the soil under experimentation.

No. 15 Field.—Twenty acres; this has been laid down to permanent pasture, and during the drought of the past season maintained its character excellently.

No. 16 Field.—Twenty-five acres; ordinary pasture.

No. 17 Field.—Twenty acres; four acres are taken off this field for a vineyard, under the management of the Horticultural Foreman. The remainder was in hay, which gave about one ton per acre.

No. 18 Field.—Thirteen acres; all hay, that gave about $1\frac{3}{4}$ tons per acre. This being the third crop of hay in succession, and noticing some foul weeds in the hay, we ploughed it about 20th of August $2\frac{1}{2}$ inches in depth, and immediately passed a heavy land roller over it; toward the middle of September we harrowed it thoroughly, and in the last week of October it was ploughed again 9 inches in depth, and is now in good shape for a crop in spring. The last ploughing was done by those of the students who have had practice before coming here, some of them making really fine work.

No. 19 Field.—Thirty acres; this field was broken from sod last Spring, and 24 acres sown with Golden Vine peas, which yielded 30 bushels per acre; the balance was sown with White Cluster oats, which yielded 20 bushels per acre. Immediately after harvest we put students to stoneing this field, which required a great deal of time. We then put on a dressing of well-rotted farm yard manure, about 15 tons per acre, on the south-east side of the field, which was ploughed under, and on the 4th and 5th of September we sowed it with winter wheat as follows:—five acres Democrat, five acres Bonnell, and six acres Clawson; the balance is prepared for spring crops.

No. 20 Field.—Twenty acres; all bush and uncultivated clearing.

No. 21 Field.—Twelve acres; sown with Mensury barley, which yielded 25 bushels per acre. This field was seeded to clover and timothy which was partly killed in the dry season, consequently we must crop it again next spring.

Implements.—The implements purchased for farm use since 1st July were two Gang ploughs from Bungay Manufacturing Company, Norwich; one wide plough, from Mr. Moore, of Waterloo; wide plough and scuffler, from Thos. Gowdy, of Guelph.

Valuation of Farm Implements, per inventory $2,836 00

I now beg to give the number and value of live stock at this date:—

Inventory and Valuation of Live Stock and Implements on hand December 31st, 1887.

	$ c.	$ c.
Horses:		
9 Working horses on farm	1,400 00	
2 for experiment and instruction	250 00	
		1,650 00
Cattle:		
1 Short Horn bull	1,500 00	
3 " cows	750 00	
1 " heifer	150 00	
		2,400 00
1 Hereford bull	2,000 00	
2 " cows	800 00	
2 " bull calves	350 00	
		3,150 00
1 Galloway bull	300 00	
2 " cows	500 00	
1 " heifer	150 00	
1 " bull calf	100 00	
		1,050 00
2 Polled Angus cows	600 00	
2 " heifer calves	250 00	
1 " steer	50 00	
		900 00
1 Ayrshire bull	200 00	
2 " cows	350 00	
2 " bull calves	160 00	
		710 00
1 Devon bull	200 00	
1 " cow	150 00	
1 " bull calf	100 00	
		450 00
1 Guernsey bull	150 00	
1 " cow	100 00	
		250 00

Cattle—(Continued):

	$ c.	$ c.
1 Jersey bull	150 00	
1 " cow	300 00	
2 " heifer calves	200 00	
		650 00
1 Holstein bull	250 00	
2 " cows	300 00	
1 " heifer calf	80 00	
1 " bull calf	150 00	
		780 00
1 West Highland bull	50 00	
		50 00
17 Grade cows	850 00	
1 short horn grade steer, 2 years	175 00	
1 Holstein " steer, 1 year	50 00	
1 Hereford " heifer 1 "	65 00	
1 Short Horn " " 1 "	45 00	
1 Holstein " " 1 "	50 00	
1 Galloway " steer 2 "	100 00	
1 Polled Angus grade calf	10 00	
1 Hereford " "	10 00	
		1,355 00
Swine:		
2 Berkshire sows, 1 year	75 00	
2 young Berkshire sows, 1 year	40 00	
2 Berkshire boars	45 00	
1 Mid. York sow	20 00	
		180 00
Sheep:		
6 Cotswold ewes	120 00	
2 " rams	100 00	
2 " " lambs	20 00	
		240 00
8 Oxford ewes	200 00	
1 " ram lamb	12 00	
3 " ewe lambs	30 00	
		242 00
5 Shrop. ewes	125 00	
1 " ram	250 00	
3 " ram lambs	45 00	
2 " ewe lambs	20 00	
		440 00
4 Southdown ewes	75 00	
1 " ram	30 00	
		105 00
1 Hamp. ewe	20 00	
1 " ewe lamb	15 00	
		35 00
2 Cheviot ewes	40 00	
2 " rams	75 00	
1 " ewe lamb	20 00	
		135 00

	$ c.	$ c.
Sheep—(Continued) :		
4 Leicester ewes	80 00	
1 " ram	30 00	
1 " ewe lamb	15 00	125 00
2 Lincoln ewes	50 00	
1 " ram	40 00	90 00
2 Merino ewes	20 00	20 00
1 Highland ram	20 00	20 00
21 grade ewes	126 00	126 00
		$15,153 00

I have the honour to be,

J. E. STORY,
Farm Foreman.

III.—THE LIVE STOCK.

We could add considerably to practical facts in connection with animal life, especially cattle and sheep,—facts in breeding where trouble has been experienced, much more in some breeds than with others under precisely similar conditions ; some very interesting things in failures and successes of service, by different methods or plans of it ; other facts in the conduct of young animals during milk and afterwards. If time allowed, as it really will not now so well, when we have to leave for Farmer's Institutes, in the beginning of January, we could develop points of utility in sheep life, and would like much to say several things favorably of four year's experience of the Cheviot breed here.

It was considered best to defer the sale of our surplus stock until next year, because most of the cattle were not weaned in September last, and many of the sheep were being improved after a severe culling out. Thus we may anticipate a large and important catalogue for 1888.

Our experience, by correspondence and by personal visits, as to the requirements of the country, as well as the outside market, can be briefly stated. Not one Ontario farmer asked for an Aberdeen Poll, Hereford, or Galloway, though three or four Ontario *breeders* have done so. Several are prepared to offer for all the Short Horn bulls we can put up along with Ayrshire and Holstein. The enquiry is more for bulls than heifers. There is a very decided keener demand for dairy breeds, with here and there—but far apart—a question upon the records of the family as milkers. None ask about a bull for the dairy, that is whether he is likely to be a good getter of *milch* cows. Jersey talk comes from wealthy city men, and a few enterprising experimental farmers, who have used ours this year with their herd of Durham grade cows more than any other of the bulls. Guernseys do not seem to be understood, and even the Devons remain unpatronized. We anticipate some interesting dairy experience with heifers of our own now in calf—first crosses of the Holstein and the Guernsey—with ordinary cows.

In sheep the best demand comes for Shrops, Oxford, Leicester, and South Downs, and in the order named ; others are enquired for, but not so prominently. There is a steady

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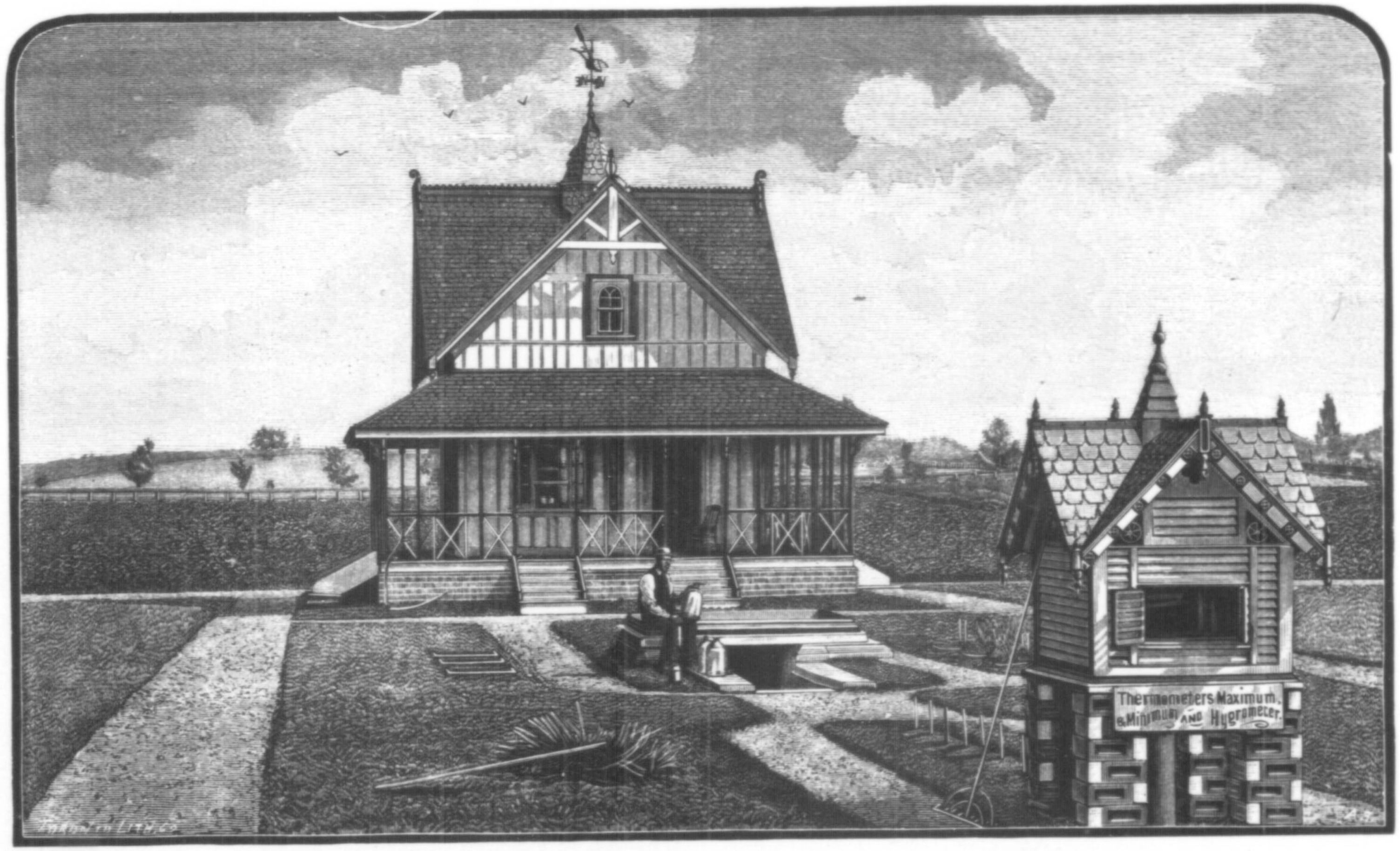


Experimental Station Building, Ontario Agricultural College, Guelph.

feeling for the Downs on the part of those who make a specialty of topping off a couple hundred wether lambs in the fall, upon grain and rape for exportation. Quite a number of our farmers are now doing this; they buy up all the dun, grey and black legs of their class, giving $3.50 a head about 1st September, and sell to shippers in November, often getting $5 to $5.50, and hence making large profits in actual cash as well as in getting up special fields by top dressing.

IV.—THE EXPERIMENTAL.

Our work in this Department has been continued very much in the testing of improved pasture and of food in winter, all in connection with dairying and the maintenance of animal life. I beg to draw attention particularly to the large average facts now held by us with reference to pasture, and therefore the establishment for the Province of what in other countries is looked upon as half their agriculture. It is my special duty to congratulate the station upon the satisfactory closing at present of this testing of grasses in a rotation, and to ask that every facility be allowed in coming years to ascertain how long they will remain in the form usually called permanent.

We have also brought to a close at present the enquiry, by cropping, into the value of several special fertilizers over a course of rotation, in which some features of practical importance are clearly told.

I have pleasure in again introducing the subject of preserving green fodder in winter, the silo and silage. We have ten tons of corn silage on hand for experiments this winter. I am under obligation to Mr. John Gould, of Ohio, for advice and some enthusiastic lessons in this connection, having had the pleasure of his acquaintance during a run at Wisconsin Farmer's Institutes last year. The facts of the chapter herewith on the silo are from him, Mr. Fry, of England, and others; hence should be up to time and of value to our farmers.

Mr. Zavitz, graduate of the O. A. College, and my Assistant in this department, has drawn up the report on new cereals from Europe. I desire to give my special acknowledgments for this gentleman's earnest and most thorough work during the last three years, whether in details of field plots, live stock tests, or in analysis of dairy products, he has proved himself a very capable superintendent.

To Prof. Wm. Brown.

Sir,—I have the honour of submitting the report of experiments with grains during the past season.

In extent and variety they exceed those of former years, the principal work, previously undertaken, being with fertilizers, modes of cultivation, etc. In addition to the field used for experimental purposes during the past five seasons, the new plots measured and staked off last autumn in No. 3 field of the farm, have given ample room for testing upon a large scale. The work during this season has not been confined to the growing of our own Ontario varieties only, but has included others from different parts of Germany, England and Scotland. We had hoped also to be able to report on Australian grains, but much delay in shipment caused them to arrive too late for this season, they having been six months on the road. Along with the experiments carried on at this Institution, we are pleased to have for report the results of the work of farmers who have been in co-operation with us this year. In the spring we sent quantities of grain to representative men in different counties, endeavoring to include every portion of the Province. We gave instructions as to sowing and handling of the samples and requested reports of the results. It has been exceedingly gratifying to us to receive so many complete reports, and our thanks are due to those who have given them. Only those who have been engaged in the details of the work know fully the immense amount of exact and careful labor required in experimentation. Having handled so varied and extensive a crop during the past season, we are in a position to say that the farmer who makes thorough tests is only the man who is fully interested in his profession.

The value of experiments carried on by individual farmers throughout the Province can scarcely be over estimated. No experimental station possesses such a variety of soil and conditions as is found in different portions of the country, hence the work of such a station is of limited value in some lines of experimentation, such as the testing of imported cereals. But when tests, having a uniform plan and system of management, are made upon all varieties of soil and under various conditions, and the results brought together, tabulated, and compared, much valuable information may be accumulated. Last fall, we sent out winter grains for testing to a number of reliable agriculturists, and expect returns of practical worth to report another year.

A valuable feature in this work should not be overlooked, and that is the fact that good grain is being spread over the Province. As an instance of this, we were informed by one of the experimenters that the produce of one of the samples of oats tested this summer received first prize at the Toronto Exhibition.

The past season has been an exceptionally hot and dry one over Ontario, and consequently, the yield of grain has been somewhat below what we would have expected had the weather been more favorable. The amount of rainfall during the summer, as measured in the large rain-gauge in the experimental field, was as follows:

During	May	1.58	inches.
"	June	2.36	"
"	July	.61	"
"	August	2.71	"
"	September	1.52	"

It would have added much to the value of the work had reports of rainfall been made from over the Province. In future we trust some plan may be adopted to accomplish this end.

There is much value and interest in the accompanying tables, and as they are condensed as much as possible, all that they contain cannot be seen at a glance. They should be carefully studied by all who are interested. While we present some notes with each table it is not intended as an elaboration, but merely to show what may be worked out of them. Conclusions must be carefully drawn, as there are many considerations which enter into any inference, which may seem to present itself. Soil, season, and previous cropping are all important factors in influencing results. Yet, viewing the work broadly, it will be safe to follow in the lines which they point out as giving the best results.

There is a broad field for experimental work among the grains. While we have not been lax in improvement by importation and careful breeding of our live stock, it cannot be said that we have done all that is possible in grain. Careful work by individual farmers and at this station would most assuredly be fraught with results of value to the agricultural community. While we regard with satisfaction the work of the past seasons, we realize the great necessity of its continuance in the future, there must be confirmatory experiments, year by year, before definite information can be stated.

Experimental Grains for 1887.

Number.	Names of Varieties.	Grain.	Obtained in Spring, 1887, from
1	Squarehead	Wheat	Scotland.
2	Hallett's Hunter's White	“	“
3	Wooly-eared	“	“
4	Red Chaff White	“	“
5	Chevalier	Barley	“
6	Common	“	“
7	Sandy	Oats.	“
8	Tam. Findlay (grown on Nairn's farm)	“	“
9	“ (grown on Cowan's farm)	“	“
10	Hopetown	“	“
11	Hamilton	“	“
12	Potato	“	“
13	Black	“	“
14	Blainslie	“	“
15	Tam. Findlay	“	“
16	Probsteier	Weizen (wheat)	Germany.
17	“	Hafer (oats)	“
18	“	Gerste (barley)	“
19	“	Roggen (rye)	“
20	Invincible	Wheat	Ontario.
21	Red Fife	“	“
22	Club	“	“
23	Rio Grande	“	“
24	White Fife	“	“
25	Red Fern	“	“
26	Lost Nation	“	“
27	Wild Goose	“	“
28	White Russian	“	“
29	Mars	“	“
30	Welcome	Oats	“
31	Black Tartarian	“	“
32	Canadian Triumph	“	“
33	Egyptian	“	“
34	White Australian	“	“
35	Six-rowed	Barley	“
36	Mensury	“	“
37	Two-rowed	“	“
38	Prussian Blue	Peas	“
39	Golden Vine	“	“
40	Prince Albert	“	“
41	White Marrowfat	“	“
42	Crown	“	“
43	Peerless White	Barley	England.
44	Empress	“	“
45	Golden Melon	“	“
46	Victoria Prize White	Oats	“
47	Red Nursery	Wheat	“
48	Early Racehorse White	Oats	“
49	Black Tartarian	“	“
50	Wooly-eared	Wheat	“
51	Potato	Oats	Scotland.
52	Blainslie	“	“
53	Chevalier	Barley	“
54	Squareheaded	Wheat	“
55	Stirlingshire	Barley	“
56	Sandy	Oats	“
57	Hunter's White	Wheat	“
58	Early Hamilton	Oats	“
59	Probsteier	Hafer (oats)	Germany.
60	“	Gerate (barley)	“
61	Summer Zeelander	Roggen (rye)	“
62	Summer Sachsischer	“ “	“
63	Winter Zeelander	“ “	“
64	“ “	Weizen (wheat)	“
65	“ Sechszeilige	Gerste (barley)	“
66	Champion White	Wheat	England.
67	Improved Rough Chaff	“	“
68	Defiance Red	“	“
69	Selected Squareheaded	“	“

BARLEY TESTED ON THE EXPERIMENTAL PLOTS.

No. of Grain.	Variety.	Sown.	Brairded.	Headed out.	Matured and harvested.	General Appearance.		Size of Ground cropped.	Weight.	
						Straw.	Grain.		Straw.	Grain.
								Acre.	lbs.	lbs.
5	Chevalier	April 25	May 5	July 4	July 27	Bright and stiff	Plump and bright	1-10	340	158
6	Common	" 25	" "	June 30	" 25	"	"	1-10	259	137
18	Probsteier	" 25	" "	" "	" 25	Long, clean and stiff	"	1-10	312.5	203.5
35	Six-rowed	" 26	" "	" 26	" 16	Somewhat rusted	"	1-10	....	152
36	Mensury	" 26	" "	" 30	" 25	Considerably rusted	Small and bright	1-10	214.5	155.5
37	Two-rowed	" 26	" "	July 6	" 27	A little rusted	Fair sample	1-10	219	119
43	Peerless White	May 7	" 13	" 14	Aug. 2	Small and shrunken	Small and shrunken	1-10	218.5	65.5
44	Empress	" "	" 12	" 14	" 3	Bright and stiff	Bright and shrunken	1-10	245	67
45	Golden Melon	" "	" 12	" 15	" 3	Bright and shrunken	"	1-10	228.5	83.5
53	Chevalier	" "	" 13	" 15	" 3	Bright and stiff	Small and shrunken	1-10	213	87
55	Stirlingshire	" "	" 15	" 4	July 26	A little rusted	Bright and shrunken	1-20	75	41.2
60	Probsteier	" "	" 12	" 9	Aug. 2	Bright and stiff	Small and shrunken	1-10	223	72

Remarks on the Barley Tests.

With the exception of one variety (No. 55), the barleys were all grown on range I. of the old experimental field. In 1882 this range was summer fallowed and supplied with a dressing of farmyard manure, and since that date it has been employed for testing cereals, with no additional fertilizing materials. The plots are somewhat lower than most of the surrounding land, and consist of a clay loam.

Ten varieties of barley have been tested this season; three obtained in Ontario, three from Scotland, three from England, and one from Germany. The quantity of seed sown on each plot was 9.5 pounds, except in the case of No 55, of which only one-half that quantity was used.

The varieties from the different countries gave the following produce of grain and straw per plots :—

Countries.	Grain, lbs.	Straw, lbs.
Scotland	121.	253.4
England	72.4	230.7
Germany	137.7	268.8
Ontario	142.2	216.8

We see from this that the Ontario varieties yield the greatest quantity of grain, and the least amount of straw. It could scarcely be expected that the foreign varieties would, during the first year, equal those obtained in Ontario, which have become adapted to the soil and climate.

It was unfortunate that a number of the imported grains were late in reaching us, in consequence of which the seeding took place at two different dates. Six varieties were sown on April 25th, and six varieties on May 7th. The table seems to show quite clearly that the different dates of sowing had a considerable influence upon the yield of grain, while the difference in the amount of straw was not so marked. A comparison between the average produce of grain and straw from the two dates of seeding is as follows :—

Date of Seeding.	Grain, lbs.	Straw, lbs.
April 25th	154.	269
May 7th	75.7	218.7

The yield of grain from the earlier seeding was more than double that from the latter. Variety of grain may have considerable to do in bringing about this difference, but when we refer back to the table and see the variation in the results of the same varieties, as in the case of Chevalier and Probsteier, we are forced to come to the conclusion that season was a very prominent factor in determining the yield. The date of seeding will have to be taken into consideration whenever conclusions from these tables are drawn.

Among the list of grains of the first sowing, the German variety stands preeminently above the rest in yield of grain. The barley was a good sample for the season, and the straw above the average in quality. The Ontario common six-rowed variety was nine days earlier than the rest in ripening. The grain was of good quality, although the straw was slightly affected with rust.

The samples of barley from the later seeding were somewhat inferior to the others. The straw was rather short, but clean and bright. In this case the Chevalier variety takes the lead in produce of grain, while the Peerless White occupies the lowest place, giving 25% less than the Chevalier.

Oats Tested on the Experimental Plots.

No. of Grain.	Variety.	Sown.	Brairded.	Headed out.	Matured and Harvested	General Appearance. Straw.	General Appearance. Grain.	Size of ground cropped.	Weight. Straw.	Weight. Grain.
								Acres.	lbs.	lbs.
7	Sandy	April 27	May 9	July 15	July 29	Short, stiff, a little rusted	Inferior quality, somewhat uneven.	1-20	187.5	29.5
8	Tam Findlay (Grown on Nairn's farm)	" 27	" 8	" 14	" 29	" " "	Grain small and light	"	179.	26.
9	Tam Findlay (Grown on Cowan's farm)	" 27	" 8	" 14	" 29	" " "	Grain small and light	"	169.2	28.8
10	Hopetown	" 27	" 8	" 11	" 29	" " "	Small but quite uniform	"	159.	35.
11	Hamilton	" 27	" 8	" 12	" 29	Short, stiff, and rusted some	Very poor quality, light and small.	"	149.5	27.5
12	Potato	" 27	" 8	" 11	" 27	" " "	Fair quality, quite plump	"	142.	26.
13	Black	" 27	" 8	" 7	" 26.	Badly rusted	Poor sample	"	......	......
14	Blainslie	" 27	" 9	" 15	Aug. 3	Short, stiff, a little rusted	Very poor quality, light and small.	"	128.5	13.5
15	Tam Findlay	" 27	" 9	" 14	July 29	Short, stiff, very little rusted	Grain small and light	"	180.0	22.
17	Probsteier	" 27	" 7	" 6	" 25	Short but good	Medium in weight and color	"	......	49.
30	Welcome	" 27	" 8	" 4	" 19	Badly rusted	Plump and very uniform	"	137.	47.
31	Black Tartarian	" 27	" 9	" 8	" 26	"	Poorly filled and somewhat faded.	"	207.	37.5
32	Canadian Triumph	" 27	" 8	" 2	" 18	Very badly rusted	Uniform sample, rather light	"	132.5	51.5
33	Egyptian	" 27	" 9	" 6	" 26	Tall, brittle, average rust	Small but well filled	"	189.8	75.2
34	White Australian	" 27	" 8	" 7	" 29	Long, stiff, and almost free from rust.	Fair sample, quite uniform.	"	139.	69.
46	Victoria White Prize	May 7	" 14	" 19	Aug. 3	Comparatively free from rust	Inferior quality, small and light.	"	164.	16.
48	Early Racehorse, white.	" 7	" 15	" 12	July 26	Badly rusted	Average sample in plumpness and weight.	"	154.5	18.5
69	Black Tartarian	" 7	" 15	" 15	29	Considerable rust.	Light in weight, badly faded	"	......	17.8

Remarks on tests with Oats.

The new experimental plots, referred to in the introduction, were taken advantage of for the tests of the several varieties of oats. The soil is a clay loam, and much similar to that on which the barleys were tested. In 1885 a crop of spring wheat was taken off the land, and last year the field was summer fallowed, and fertilized with farmyard manure. Eighteen plots were occupied by oats this season, the greater number of which were in range No. II. the rest being in No. III. range. The quantity of seed used was $3\frac{3}{4}$ pounds of each variety. Nine plots were sown with oats received from Scotland, three from England, one from Germany, and five from Ontario. The seeding was all done on the same day, with the exception of the English varieties which were later reaching us in the spring. A comparison can be made of the varieties obtained through different sources, as was done in the case of the barleys. By looking at the table, we find the average yield of grain and straw per plot from the four sources to be as follows:—

Countries.	Grain, lbs.	Straw, lbs.
Scotland	26.0	161.8
England	17.4	159.2
Germany	49.0	....
Ontario	56.0	161.1

It must be remembered that the date of sowing the English varieties was later than that of the others, which fact may account for the small yield of grain in that case.

The best variety of each source appears to be as follows:—

Scotland	Hopetown.
England	Early Racehorse
Germany	Probsteier.
Ontario	Egyptian.

Among the other varieties, the Egyptian and the White Australian deserve considerable praise. The straw was almost free from rust, the grain of very good quality, and the yield about 25 per. cent above the average of the Canadian varieties. The Canadian Triumph was the earliest to mature, and had the rust not affected it so badly it would, probably, have taken a high stand.

The English oats became great victims to the rust, and the samples of grain were somewhat inferior to the average of the season, the Early Racehorse producing the best quality. An intermediate position was taken by the varieties from Scotland, while the one German sample made the best record of all the foreigners, the quality of both grain and straw being good, and the yield 40 per cent. above the next highest imported variety.

Wheats, Ryes and Peas tested on the Experimental Plots.

No. of Grain.	Variety.	Grain.	Sown.	Brairded.	Headed out.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.	Size of Ground cropped.	Weight. Straw	Weight. Grain.
									Acre.	lbs.	lbs.
20	Invincible	Spring Wheat.	April 22	May 3	July 6	July 29	Dull from being badly mildewed	Badly shrunken	1-20	90	16
21	Red Fife	"	" 22	" 3	" 6	" 29	Considerable rust	Somewhat shrunken	1-20	133.5	21.5
22	Club	"	" 22	" 3	" 4	" 27	Very badly rusted	Very poor quality	1-20	155.5	15.5
23	Rio Grande	"	" 22	" 3	" 2	" 29	Good quality	Large and plump	1-20	156.2	28.8
24	White Fife	"	" 27	" 7	" 6	Aug. 3	Very little rusted	Dark and shrunken	1-20	168	21
25	Red Fern	"	" 22	" 3	" 4	July 29	Good quality	Plump and large	1-20	155.5	44.5
26	Lost Nation	"	" 22	" 3	" 2	" 27	Rusted some	Medium plumpness	1-20	171.2	30.8
27	Wild Goose	"	" 22	" 3	" 4	Aug. 3	Long and clean	Plump and large	1-20	166.5	55.5
28	White Russian	"	" 22	" 3	" 2	July 27	Medium amount of rust.	Dark and shrunken	1-20	161.2	30.8
29	Mars	"	" 22	" 3	" 4	" 26	Very badly rusted	Small and shrunken	1-20	170.5	21.5
61	Summer (Zealander)	(Rye) Roggen	May 7	" 12	June 28	Aug. 3	Clean and short	Medium quality	1-10	133	45
62	Summer (Sachsischer).	"	" 7	" 13	" 28	" 3	" "	" "	1-10	150.5	41.5
63	Summer Common	Rye	April 26	" 5	" 16	July 26	Long and wiry	Good quality	1-10	441	114
38	Prussian Blue	Peas	" 25	" 6	July 4	Aug. 2	Good	Good	1-10	298.5	161.5
39	Golden Vine	"	" 26	" 6	" 4	July 27	"	"	1-10	271.5	161.5
40	Prince Albert	"	" 26	" 6	" 2	Aug. 2	"	"	1-10	355.5	145.5
41	White Marrowfat	"	" 26	" 6	" 2	" 2	"	"	1-10	219	129
42	Crown	"	" 26	" 6	" 2	July 27	"	"	1-10	191.5	129.5

Remarks on tests of Spring Wheat, Ryes and Peas.

Spring Wheats.—Range No. 1, in the new experimental field, was the land used for the testing of spring wheats. The soil on this range is very similar to that on which the oats were grown, while the previous cropping was precisely the same. The plots were of equal size and shape (2x4 rods), each receiving exactly the same amount of seed. The work was confined to the testing of ten varieties, all of which were obtained in Ontario. Had there been also a number of foreign varieties experimented with, the results would no doubt have been looked upon with even more interest than these obtained. A few wheats were sent here as spring varieties, but either they were wrongly named, or else were unable to thrive through the change of climatic conditions. It will be seen by referring to the table that the wheats were all sown on the same date, and are in every respect under fairly uniform conditions. The plot containing the White Fife variety was, however, seeded five days later than the rest. The Mars was the earliest to mature, but the quality of the grain was below the average and the straw badly rusted. The Red Fern and Wild Goose wheats gave the largest yields, while the straw was bright and of good quality in each case. The Club, with the exception of the Mars, was affected with rust most of all the varieties, and the grain was of poor quality and light yield.

A number of imported grains were sent from here last spring to Prof. Saunders, of the Dominion Experimental Station, Ottawa. In return, eighteen varieties of spring wheats were forwarded to this station, but owing to the lateness of their arrival, along with the very dry season, we have at present to state that they were not a success.

Ryes.—Four samples of rye were sown in Range I. of the old experimental field at the rate of ten pounds to the plot. Full notes concerning this range are given under the barley tests. One variety (No. xx.), did not reach maturity, but the others did fairly well. The two German varieties gave almost equal yields of grain, and were very similar in every respect. The one from Ontario, sowed eleven days earlier, gave more than double the quantity of grain.

Peas.—The peas were sown in the same range as the barley and rye. Five varieties of Ontario peas were used in testing. The quantity of each sown to the plot was as follows: Prussian Blue, 12 lbs.; Golden Vine, 12 lbs.; Prince Albert, 12 lbs.; Crown, 18 lbs.; and White Marrowfat, 21 lbs. Although the season was so very hot and dry, still they did fairly well, and were free from the ravages of the pea weevil (*Bruchus pisi*). The Prince Albert variety takes an exactly intermediate position in point of yield of grain, the Prussian Blue and the Golden Vine being ahead, and the White Marrowfat and the Crown appearing at the end of the list.

Names and Addresses of Farmers to whom Experimental Grains were sent in the Spring.

Name.	Address.	County.
John Raymond	Moulinette	Stormont.
John Hall	Cornwall	"
Henry Mitchell	Pembroke	Renfrew.
Chas. Spooner	Glenburnie	Frontenac.
John A. Wilmot	Kingston	"
James Trace	Allenwood	Simcoe.
Richard Graham	Elmvale	"
John McIntosh	Springville	Peterborough.
Wm. Rutherford	South Monaghan	"
Hugh Davidson	Peterborough	"
John Campbell	Woodville	Victoria.
J. Lick	Oshawa	Ontario.
J. Holtby	Manchester	"
John Varcoe	Carlow	Huron.
Robert Auld	Warwick, West	Lambton.
Alex. M. Wigle	Ruthven	Essex.
Geo. A. Wintemute	Belle River	"
James Davidson	Union	Elgin.
John B. Carpenter	Simcoe	Norfolk.
Wm. Dawson	Vittoria	"
Hugh Rankan	Collins' Bay	Frontenac.
John McNealy	Sunbury	"
Donald McDonald	Sutton, West	York.
J. S. Smith	Ailsa Craig	Middlesex.
John S. Howes	Harriston	Wellington.
J. A. McCallum	Martintown	Glengarry.
John B. Stone	Norham	Northumberland.
Peter Christie	Meaford	Grey.
Wm. Budd	Delhi	Norfolk.
Thomas Abraham	Newark	Lincoln.
Geo. Hyde	Shakespeare	Perth.
Geo. Frame	Sebringville	"
Humphrey Snell	Clinton	Huron.
G. E. Cresswell	Egmondville	"
Edwin Gaunt	St. Helen's	"
J. I. Hobson	Mosboro'	Wellington.
John Rown	Pembroke	Renfrew.
Daniel Mick	Micksburg	"
John Sisson	Churchill	Simcoe.
Lewis T. Leavens	Bloomfield	Prince Edward.
John M. Sprague, M.P.P	Demorestville	"
Ralph Lett, Jr	Eganville	Renfrew.
R. J. Dunlop	Kingston	Frontenac.
John Dooner	Osceola	Renfrew.
J. M. Drummond	Keene	Peterborough.
H. M. Wilcox	Whitby	Ontario.
James R. Mathewson	Brooklyn	"
Prof. Wm. Saunders	Central Expt. Station	Carleton.
Peter Graham, M.P.P	Warwick, West	Lambton.
W. G. Baldwin	Colchester	Essex.
J. B. Couisineau	Windsor	"
Chas. E. Lundy	Newmarket	York.
Geo. Lobsinger	Deemerton	Bruce.
Kinsman Grey	Brampton	Peel.
A. H. Garbut	Brampton	"
Jonn McMillan	Newmarket	York.
Geo. Ambury	Lynch Lake	"
The Graham Bros	Dalrymple	Victoria.
D. H. McLean	Richmond	Elgin.
Robert Ballantyne (Langside)	Sebringville	Perth.
John Shehan	Newark	Lincoln.
Wm. Dunn, Sr	Ingersoll	Oxford.
Ed. Jeffs	Bond Head	Simcoe.
John McMillan	Constance	Huron.

Names and Addresses of Farmers, Etc.—*Continued.*

Name.	Address.	County.
Alex. McLaren	Cromarty	Perth.
Thomas Ballantyne, M.P.P	Stratford	"
Wm. Collier	Ingersoll	Oxford.
James Begg	Moose Creek	Stormont.
Stephen Crandall	Cherry Valley	Prince Edward.
Thomas Wellbanks	Rednerville	"
James Hamblin	Woodbridge	York.
Geo. J. Morgan	Aultsville	Stormont.
Samuel Brown	Forest	Lambton.
James Begg	Tuam	Simcoe.
D. James	Thornhill	York.
D. A. Dowling	Appleton	Lanark.
Jabel Robinson	Middlemarch	Elgin.
Solomon Winters	Simcoe	Norfolk.
James Cohoe	Courtland	"
John Rymal	Hamilton	Wentworth.
Wm. Porter	Humber	York.
F. A. Nelles	York	"
Geo. Awrey	Binbrook	Wentworth.
Napoleon Rivard	Tecumseh	Essex.
Edward Trinder	Simcoe	Norfolk.
J. B. Boyce	Norham	Northumberland.
David Spencer	Rosehall	Prince Edward.
Thomas Walker	Ancaster	Wentworth.

Imported Cereals Tested by Farmers in Ontario During Summer 1887.

Number.	Name.	Grain.	Sown.	Brairded.	Headed.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.
8	Tam Findlay	Oats	May 14			Aug. 9	Bright	Good, but not equal to seed.
"	" "	"	" 4	May 16	July 1	" 6	Fine, bright and stiff	Medium quality.
"	" "	"	" 2	" 15		" 1	Stiff, and good length	Light.
"	" "	"	" 5		June 23	" 8	Heavy	Very light.
"	" "	"	April 29	May 7	July 12	" 15	Strong, short and stiff	Light.
9	" "	"	" 28		" 5	July 26	Fine and soft	"
"	" "	"	May 14	May 21	" 29	Aug. 17	Good	Plump and good.
15	" "	"	" 6	" 13	" 12	" 11	Coarse and clean	Medium.
10	Hopetown	"	" 14			" 15		Good.
"	"	"	" 3		July 5	" 16	Bright and short	Small, but plump.
"	"	"	" 14	May 22		" 13	Rusty	Light.
"	"	"	" 5		June 26	" 8	Heavy	"
"	"	"	April 28		July 3	July 26	Stiff and strong	"
"	"	"	May 14	May 21	" 29	Aug. 17	Good	Plump and good.
7	Sandy	"	" 14	April 29	May 7	" 15	Strong, short and slight	Light.
"	"	"	" 14	May 21	July 29	" 17	Good	Plump and good.
"	"	"	" 6	" 14	" 14	" 12	Very rusty	Small.
"	"	"	" 14	" 6	" 12	" 9	Fine, bright and stiff	Medium quality.
"	"	"	" 3		" 5	" 16	Bright and short	Small, but plump.

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Size of ground cropped.	Weight of Straw.	Weight of Grain.	Nature of Soil.	Previous Cropping.	County in which Tested.	Remarks.
	sq. feet.	lbs.	lbs.				
8	672	....	24	Gravelly loam	Oats, 1886	Stormont	Barn yard manure in fall of 1885, and plowed under.
"	1170	122	42	Heavy clay soil	Hungarian grass, 1886	Huron	Well manured in 1886.
"	1452	98	12	Sandy loam	Corn crop, 1886	Simcoe	Well manured in fall of 1886.
"	....	101	18	....	Oats, 1886	Perth	Manured in spring of 1887.
"	1815	114	32	Clay, with stones	Fall wheat, 1886	York	Well manured in 1885.
9	1089	74	32	Rich sandy loam	Wheat, 1885; Mangels, 1886.	Norfolk	Manured for the mangels.
"	450	....	35	Clay loam	General rotation	Stormont	
15	448	21½	8½	Sandy loam	Potatoes, 1886	Wellington	Well manured.
10	924	....	22¾	Gravelly loam	Oats, 1886	Stormont	Manured in fall of 1886, at rate of 25 loads per acre.
"	1200	68	30	Sandy loam	Fall wheat, 1886	Essex	
"	1452	90	11	" "	Corn crop, 1886	Simcoe	Well manured in fall of 1886.
"	....	114	32	....	Oats, 1886	Perth	Manured in spring of 1887.
"	1089	92	38½	Rich sandy loam	Wheat, 1885; Mangels, 1886	Norfolk	Manured for mangels.
"	450	....	37	Clay loam	General rotation	Stormont	
7	1815	100	29	Clay, with stone	Fall wheat, 1886	York	Well manured in 1885.
"	450	....	27	Clay loam	General rotation	Stormont	
"	448	24	7	Sandy loam	Potatoes, 1886	Wellington	Well manured.
"	1170	135	30	Heavy clay loam	Hungarian grass, 1886	Huron	Well manured in 1886.
"	1200	60	15	Sandy loam	Fall wheat, 1886	Essex	

NOTE.—This table is a continuation of that on previous page.

Imported Cereals Tested, etc.—*Continued.*

Number.	Name.	Grain.	When Sown.	Brairded.	Headed.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.
12	Potato	Oats	May 14			Aug. 27	Rusted	
51	"	"	" 18	May 26	July 24	Sept. 15	Good	Good.
"	"	"	" 12	" 19	" 13	Aug. 8	Short	Light.
"	"	"	" 12	" 19		" 6		
"	"	"	" 16	" 23	July 10	" 2	Strong and heavy	Inferior to seed.
17	Probsteier	Hafer (Oats)	" 12		" 6	" 17	A little rusty	Good.
"	"	Hafer (Oats)	" 14			" 15	Bright	"
11	Hamilton	Oats	" 3		July 5	" 16	Bright and short	Small but plump.
"	"	"	" 5		June 26	" 8	Heavy	Light.
"	"	"	April 28		July 8	July 26	Strong and stiff	Plump.
"	"	"	May 14		" 10	Aug. 8	Bright	Very bright.
58	"	"	" 12		" 4	" 17	Good	Good.
13	Black	"	" 6	May 14	" 9	" 4	Coarse and clean	Large and well filled.
"	"	"	" 14			" 16	Rusted	
48	Early Racehorse	"	" 17	May 21		" 3	Bright and long, a little coarse	
"	"	"	" 17	June 4	July 11	" 8	Rusty.	
"	"	"	" 12	May 16	" 5	" 4	Rusted badly	Very good.
"	"	"	" 20	June 12	" 20	" 8	Rusted, did not stand well	Light.
"	"	"	" 14	" 1	" 13	" 14	Heavy and badly rusted	"

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Size of Ground Cropped.	Weight of Straw.	Weight of Grain.	Nature of Soil.	Previous Cropping.	County in which Tested.	Remarks.
	Sq. feet.	lbs.	lbs.				
12	....	....	4	Sandy loam	Fall wheat and rape, 1886	Norfolk	Manured in fall of 1885; 20 loads per acre.
51	1089	108	50	Loam	Natural sod	Parry Sound	New land, broken up last spring.
"	1089	56	14¾	Clay loam	Hay, 1885; peas 1886	Glengarry	Land friable and naturally dry.
"	....	150	65	....	....	Simcoe	
17	1098	....	16	Rich loam	Roots, 1886	York	
"	1350	43	14	Clay and black sand	Potatoes, 1886	Bruce	
11	672	....	22¾	Gravelly loam	Oats, 1886	Stormont	Barnyard manure in fall of 1885, plowed under.
"	1200	64	27	Sandy loam	Fall wheat, 1886	Essex	
"	....	92	24	....	Oats, 1886	Perth	Manured in spring of 1887.
"	1089	56	25	Rich sandy loam	Wheat, 1885; Mangels, 1886	Norfolk	Manured for mangels.
58	1080	40	8	Sandy loam	Sod, 1886	Wentworth	
13	1350	72	18	Clay and black sand	Potatoes, 1886	Bruce	
"	1448	20½	14½	Sandy loam	"	Wellington	Well manured.
48	....	....	4	"	Fall wheat and rape, 1886	Norfolk	Manured in fall of 1885; 20 loads per acre.
"	1170	40	30	Clay loam	Peas, 1885; Oats, 1886	Frontenac	Manured for potatoes this spring.
"	....	....	13	"	....	Elgin	Manured October 1886.
"	990	95	25	"	Sod, 1885; Oats, 1886	Huron	Well manured with horse dung.
"	675	....	30	"	Oats, 1885; Oats, 1886	Stormont	New land, manured well in spring of 1887.
"	612	48	16½	"	Summer fallow, 1886	Huron	Sown where fall wheat killed out.

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Name.	Grain.	When Sown.	Brairded.	Headed.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.
48	Early Racehorse	Oats	May 23	June 1	July 17	Aug. 24	Medium length and bright	Bright, but light.
"	"	"	" 13	May 22	" 13	" 9	Short, stiff and very bright.	Plump.
"	"	"	" 14		" 5	" 1	Very bright	Bright and pretty plump.
"	"	"	" 12	May 18	" 10	" 8	Long and fine, not very bright	Bright and fairly well filled.
"	"	"	" 12	" 16		" 20	Bright and medium length	Large and good.
"	"	"	" 16	" 20	July 10	" 4	Fair length, fine and bright	Plump and good.
"	"	"	" 14	June 15	" 25	" 10	Very strong and bright but coarse.	Plump and nice.
"	"	"	" 12		June 29	" 17	Good	Good.
"	"	"	" 12	May 19		July 26		
"	"	"	" 14		July 6	" 30	Medium	Fair.
"	"	"	" 16	May 18	June 28	Aug. 4	Heavy, but soft	Rather coarse.
"	"	"	" 14	" 20	July 10	July 28	Strong and heavy	Not equal to sample.
49	Black Tartarian	"	" 14			Aug. 16	Rusted	
"	"	"	" 17	May 22		" 3	Rusted and very coarse	
"	"	"	" 17	" 27	July 16	" 15	Rusty	
"	"	"	" 12	" 16	" 13	" 12	Rusted, but strong and heavy	Good.
"	"	"	" 18	" 25	" 29	Sept. 10	Good	Good.
"	"	"	" 14	June 1	" 20	Aug. 15	Medium, slightly rusted	Not equal to sample sown.
"	"	"	" 23	" 1	" 20	" 24	Medium length and bright	Very good.

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Size of ground Cropped.	Weight of Straw.	Weight of Grain.	Nature of Soil.	Previous Cropping.	County in which Tested.	Remarks.
	Sq. feet.	lbs.	lbs.				
48	432	....	51	Clay loam	Summer fallow, 1886	Stormont	Manured, 1886.
"	1360	80	52	Heavy clay	Sod, 1885; oats, 1886	Perth	
"	990	45	25	Sandy loam	Barley, 1886	Wentworth	
"	1089	59	27½	Clay loam	Hay, 1885; peas, 1886	Glengarry	Land friable and naturally dry.
"	2562	....	42	Heavy clay	Roots, 1886	Peterborough	Well manured, a good piece of land.
"	....	....	18	Clay loam	Mangels, 1886	Peterborough	Manured in fall of 1885.
"	720	....	18	Black loam and clay sub-soil	A rotation of hay, cereal and root crops for 60 years	Prince Edward	
"	1350	40	7	Clay and black sand	Potatoes, 1886	Bruce	
	....	190	74	....	....	Simcoe	
"	1089	41¼	11	Poor clay loam	Barley, 1884; oats, 1885; Alsike clover, 1886	Ontario	
"	1088	....	23	Clay loam	Peas, 1885; oats, 1886	Simcoe	
"	1098	....	17	Rich loam	Roots, 1886	York	
49	....	....	7	Sandy loam	Fall wheat and rape, 1886	Norfolk	Manured in fall of 1885, 20 loads per acre.
"	1170	55	25	Clay loam	Peas, 1885; oats, 1886	Frontenac	Manured for potatoes this spring.
"	....	....	24	Clay loam	....	Elgin	Manured, October, 1886.
"	990	125	36	Clay loam	Sod, 1885; oats, 1886	Huron	Well manured with horse dung.
"	1089	148	53	Loam	Natural sod	Parry Sound	New land broken up last spring.
"	675	55	24½	Clay loam	Summer fallow, 1886	Huron	Sown where fall wheat killed out.
"	432	....	50	Clay loam	Summer fallow, 1886	Stormont	Manured, 1886.

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Name.	Grain.	When Sown.	Brairded.	Headed.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.
49	Black Tartarian	Oats	May 13	May 22	July 17	Aug. 16	Soft and rusted some	Light, not ripened well.
"	"	"	" 14		" 10	" 12	Bright	Very bright.
"	"	"	" 12	May 18	" 20	" 12	Short, coarse and some rusted	Uneven and poorly filled.
"	"	"	" 12	" 16		" 20	Bright, medium length	Large and good.
"	"	"	" 16	" 20	July 11	" 8	Good length, coarse and rusted	Plump and good.
"	"	"	" 14	June 20	" 29	" 16	Coarse, heavy straw	Plump and good.
"	"	"	" 12	May 18		" 10		
"	"	"	" 14		" 9	July 30	Rusted badly	Poor.
"	"	"	" 16	May 19	" 1	Aug. 13	Heavy but soft	Rather coarse.
"	"	"	" 14	" 20	" 10	July 28	Strong and heavy	Inferior to seed.
5	Chevalier	Barley	" 4	" 11	June 20	Aug. 1	Clear and bright	Very poor sample.
"	"	"	" 3		July 1	" 10	Bright and short	Shrunken.
"	"	"	" 2	May 15		July 28	Stiff and bright	Plump.
"	"	"	Apr. 28	" 6	July 8	Aug. 6	Fair length	Fairly good.
"	"	"	May 14	" 21	" 17	" 7	Good	Plump and good.
53	"	"	" 14			" 16	Bright	
"	"	"	June 1	June 5	Aug. 5	Sept. 7	Good	Good.
"	"	"	May 12	May 16	July 8	Aug. 5	Large, colored some	Plump, colored some.
"	"	"	" 12	" 17		" 3		

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Size of ground Cropped.	Weight of Straw.	Weight of Grain.	Nature of Soil.	Previous Cropping.	County in which Tested.	Remarks.
	Sq. feet.	lbs.	lbs.				
49	1632	167	49	Heavy clay	Sod, 1885 ; oats, 1886	Perth	
"	1080	50	8	Sandy loam	Sod, 1886	Wentworth	
"	1089	71½	23¼	Clay loam	Hay, 1885 ; peas, 1886	Glengarry	Land friable and naturally dry.
"	2562	....	42	Heavy clay	Roots, 1886	Peterborough	Well manured ; a good piece of land.
"	....	....	14	Clay loam	Mangels, 1886	Peterborough	Manured in fall of 1885.
"	720	....	20	Black loam, clay subsoil	A rotation of hay, cereal and root crops for 60 years	Prince Edward	
"	....	200	70	....	....	Simcoe	
"	1089	34	11	Poor clay loam	Barley, 1884; oats, 1885; Alsike clover, 1886	Ontario	
"	1088	....	42	Clay loam	Peas, 1885 ; oats, 1886	Simcoe	
"	1098	....	17	Rich loam	Roots, 1886	York	
5	660	52	28	Rich, heavy clay	Hungarian grass, 1886	Huron	Well manured in 1886.
"	1200	86	24	Sandy loam	Fall wheat, 1886	Essex	
"	1452	86	40	Clay loam	Potatoes, 1886	Simcoe	Manured and plowed in fall.
"	1815	90	40	Clay with stones	Fall wheat, 1886	York	Well manured in 1885.
"	750	....	40	Clay loam	General rotation	Stormont	
53	....	....	3	Sandy loam	Fall wheat and rape, 1886	Norfolk	Manured in fall of 1885—20 loads per acre.
"	1089	112	65	Loam	Natural sod	Parry Sound	New land ; booken up last spring.
"	1089	37½	28½	Clay loam	Hay, 1885 ; peas, 1886	Glengarry	Land friable and naturally dry.
"	....	220	95	....	....	Simcoe	

IMPORTED CEREALS TESTED, ETC.—*Continued.*

Number.	Name.	Grain.	When Sown.	Brairded.	Headed.	Matured and Harvested.	General Appearance. Straw.	General Appearance. Grain.
6	Common	Barley	May 14			July 28	Bright straw	Good but inferior seed.
"	"	"	" 3		June 20	Aug. 10	Bright and short	Shrunken.
"	"	"	" 2	May 15		July 28	Weak	Fair.
"	"	"	" 5		June 18	" 25	Medium	Good.
"	"	"	Apl. 29	May 6	July 8	Aug. 6	Fair length	Fairly good.
18	Probsteier	Gerste (Barley)	May 16	" 20	" 26	July 30	Light, but bright	Not well filled.
60	"	"	" 17	" 23	" 4	" 28	Strong and heavy	Not good as seed.
43	Peerless White	Barley	" 12	" 17		Aug. 9	Light and short	Bright, but shrunken.
"	"	"	" 16	" 19	July 8	" 4	Very short and rusted	Long and fair.
"	"	"	" 20	" 25	" 21	" 8	Not properly matured	Rusted.
45	Golden Melon	"	" 23	June 1	" 15	" 21	Bright, but short	Bright, shrunken.
"	"	"	" 14	" 28	" 3	July 19	Very small	Very small.
"	"	"	" 12	May 14	" 4	Aug. 3	Short	Shrunken.
55	Stirlingshire	"	" 14	June 1	" 10	" 8	Heavy	Large and plump.
"	"	"	" 13	May 19	" 2	" 2	Short, stood up well	Very good, plump and large.
"	"	"	" 14		" 4	July 26	Bright	Bright, but light.

IMPORTED CEREALS TESTED, ETC.—*Concluded.*

Number.	Size of ground Cropped.	Weight of Straw.	Weight of Grain.	Nature of Soil.	Previous Cropping.	County in which Tested.	Remarks.
	Sqr. feet.	lbs.	lbs.				
6	512	....	29½	Gravelly loam	Oats, 1886	Stormont	Barnyard manure in fall of 1885, and ploughed under.
"	1200	51	30	Sandy loam	Fall wheat, 1886	Essex	
"	1452	52	27	"	Corn crop, 1886	Simcoe	Well manured in fall of 1886.
"	....	53	29	....	Oats, 1886	Perth	Manured in Spring of 1887.
"	1815	89	38	Clay, with stones	Fall wheat, 1886	York	Well manured in 1885.
18	1360	....	24	Clay loam	Peas, 1885 ; Oats, 1886	Simcoe	
60	891	....	18	Rich loam	Roots, 1886	York	
43	1452	....	17	Heavy clay	"	Peterborough	Well manured, a good piece of land.
"	....	....	7	Clay loam	Mangels, 1886	"	Manured in fall of 1885.
45	675	....	38	"	Oats, 1885 and 1886	Stormont	New land, manured well in spring of 1887.
"	432	....	58	"	Summer fallow, 1886	"	Manured, 1886.
"	720	....	21	Black loam, clay subsoil	A rotation of hay, cereal and root crops for 60 years.	Prince Edward	
55	990	75	15	Clay loam	Sod, 1885 ; oats, 1886	Huron	Well manured with horse dung.
"	632	34	17	"	Summer, fallow, 1886	"	Sown where fall wheat killed out.
"	1360	44	39	Heavy clay	Sod, 1885 ; oats, 1886	Perth	
"	880	40	10	Sandy loam	Barley, 1886	Wentworth	

Remarks on Imported Cereals Tested by Farmers.

It will be seen from the foregoing list that grains were sent last spring to no less than eighty-eight farmers over the Province of Ontario. The weight of each sample sent was exactly two pounds in every instance, and from four to seven samples were forwarded to each individual. Owing to the very severe season the lateness in which some of the grains were sown, as well as for various other reasons, a few of the counties to which grain were sent are unrepresented in the returns. Results of tests have been received from seventeen counties of Ontario.

The grains sent out from this station were all imported last spring from Germany, England and Scotland, and the last which arrived were back to the express office for distribution within twenty-four hours after reaching us.

In working up the returns of the grain experiments, as sent in from the Provincial Experimenters, I have endeavoured to present the results in as clear and as concise a form as possible, while, at the same time, I have been very careful to omit nothing which would at all affect the value of the experiment, or which would be of general interest to the public.

A table has been made, in which each horizontal line contains the principal details of the test of one variety. The various experiments on each grain have been placed side by side, so that the results may be more easily compared and studied.

The different varieties of imported grains are now given with their average results from the accumulated tests of each. They are arranged in order of their yield of grain during the last season :

OATS.

Variety.	Weight of Straw.	Weight of Grain.	Total Weight.
	lbs.	lbs.	lbs.
Potato	104.7	33.4	138.1
Black Tartarian	100.7	30.3	131.0
Hopetown	91.0	28.5	119.5
Racehorse	70.9	26.9	94.8
Tam Findlay	88.4	25.4	113.8
Sandy	79.7	21.6	101.3
Early Hamilton	63.0	21.4	84.4
Black	46.3	16.3	62.6
Probsteier	43.0	15.0	58.0
Total Average	76.4	24.3	100.4

Barley.

Variety.	Weight of Straw.	Weight of Grain.	Total Weight.
	lbs.	lbs.	lbs.
Chevalier	94.6	40.4	138.0
Golden Melon	....	39.0	....
Common 2-rowed of Scotland	61.3	30.7	92.
Probsteier	....	21.0	....
Stirlingshire	48.2	20.2	68.4
Peerless White	....	12.0	....
Total Average	68.0	27.2	99.3

Names and Addresses of Farmers to whom Imported Wheats were sent this Fall.

Names.	Post Office.	County.	Number of the Variety sent.
Thomas Inglis	Belmore	Huron	54, 69, 67
A. R. Kidd	Warsaw	Peterborough	54, 50, 64
Wm. Nancekville	Ingersoll	Oxford	54, 50, 64
E. M. Zavitz	Coldstream	Middlesex	65, 64, 66
H. A. Morgan	Kerwood	Middlesex	66, 50, 65
A. E. Wark	Wanstead	Lambton	68, 57, 64
J. B. Muir	North Bruce	Grey	54, 69, 67
Robert Story	Pakenham	Lanark	64, 65, 66
Thomas Graham	Bell's Corners	Lanark	54, 69, 67
F. J. Sleightholm	Humber	Peel	66, 50, 65
R. M. Holtby	Manchester	Ontario	66, 50, 65
D. A. Dowling	Appleton	Lanark	68, 69, 65
Donald McDonald	Stutton, West	York	54, 50, 64
W. J. Stover	Norwich	Oxford	68, 67, 65
T. Raynor	Rosehall	Prince Edward	68, 69, 65
Elmer Lick	Oshawa	Ontario	66, 57, 67
S. P. Zavitz	Coldstream	Middlesex	66, 69, 64
Kinsman Grey	Brampton	Peel	68, 69, 65
John Rymal	Hamilton	Wentworth	68, 50, 67
R. E. King	De Cewsville	Haldimand	68, 50, 67
John B. Carpenter	Simcoe	Norfolk	54, 57, 65
Wm. Budd	Delhi	Norfolk	64, 65, 66
Geo. Hyde	Sebringville	Perth	64, 65, 66
Samuel Brown	Forest	Lambton	64, 66, 69
J. I. Hobson	Mosboro'	Wellington	66, 50, 65
John McMillan	Constance	Huron	68, 57, 64
E. Denton	London	Middlesex	68, 57, 64
David Spencer	Rosehall	Prince Edward	66, 57, 67
Wm. Dawson	Vittoria	Norfolk	68, 50, 67
Jabel Robinson	Middlemarch	Elgin	68, 50, 67
J. B. Boyce	Norham	Northumberland	66, 57, 67
Robert Ballantyne (Langside)	Sebringville	Perth	54, 57, 65
Oscar Chase	Sparta	Elgin	66, 69, 64
Edgar Haight	Sparta	Elgin	54, 57, 65
Napoleon Rivard	Tecumseh	Essex	54, 57, 65
Ed. Jeffs	Bond Head	Simcoe	54, 69, 67
J. S. Smith	Ailsa Craig	Middlesex	54, 50, 64
J. D. Zavitz	Coldstream	Middlesex	68, 57, 64
James Hamblin	Berwick	York	66, 57, 67
J. B. Couisineau	Windsor	Essex	66, 69, 64
Prof. Wm. Saunders	Experimental Station	Carleton	65, 67, 63, 66, 68, 64, 54, 50, 57, 69.

In conclusion, I wish to say that it is earnestly hoped that the work of cereal testing, as carried on during the last season, may be continued and steadily increased. It is through co-operative work of interested and energetic farmers, along with the assistance from this institution, that valuable results may be expected.

We have received from Australia eighteen varieties of spring grain, which we intend testing another season. No Russian grains have, as yet, been imported; but considering the success of testing during the past year, it seems very proper that steps be taken to secure some of the best Russian varieties for the coming season. At present we have on hand small quantities of Australian cereals, as well as a number of those named in the first part of this report, of which a distribution over the Province would be advisable. It is important that the experimenters of last year sow, during the coming spring, the produce which they received from their plots. From many letters received from farmers expressing the interest they have felt and value they have received from carrying on the tests, we are led to believe that they feel well repaid for time and labour expended.

Respectfully submitted,

C. A. Zavitz.

Effects of Special Fertilizers over a Four Year Rotation.

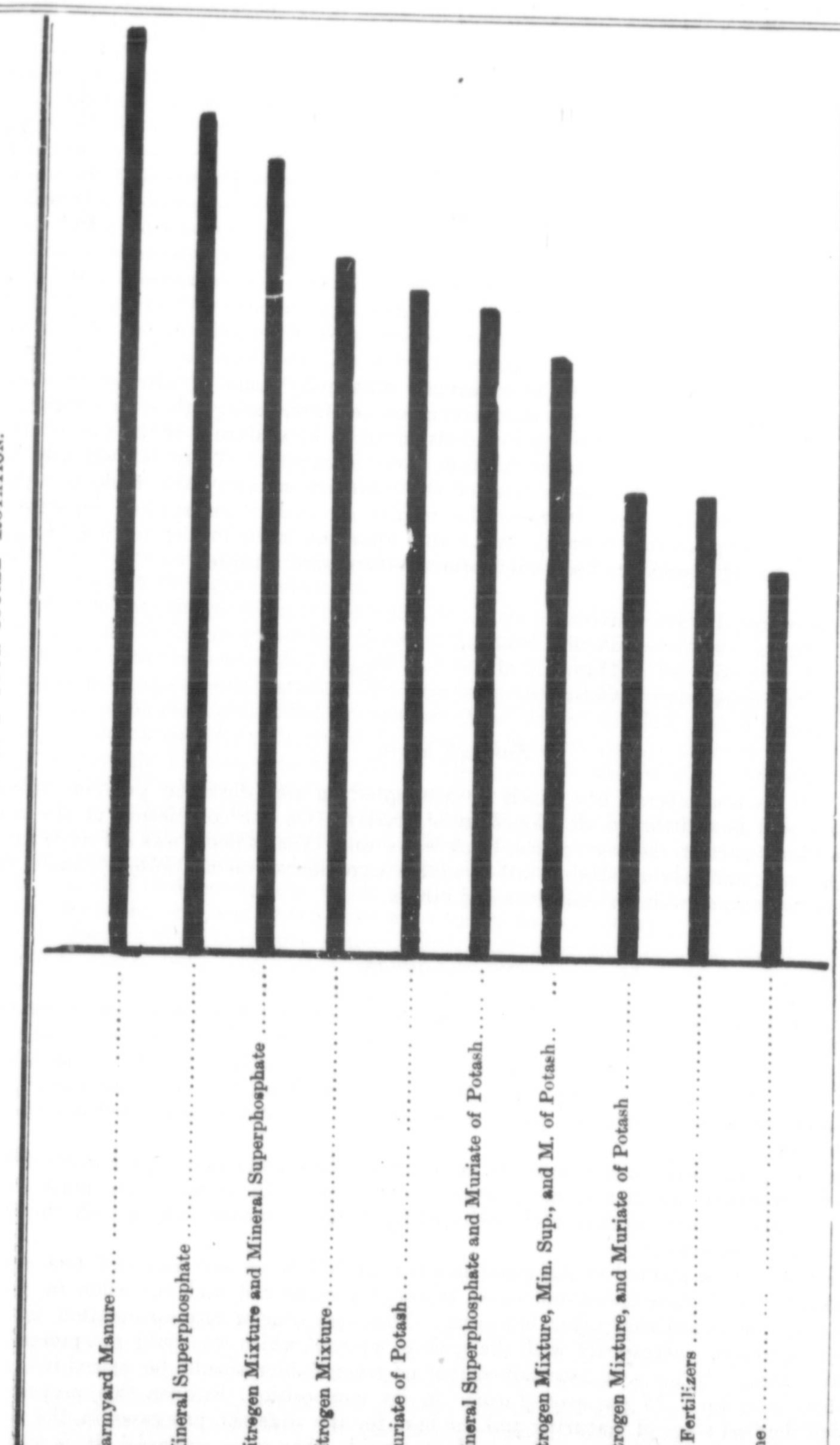
No fertilizers	100 (Reference.)
Lime	84
Nitrogen mixture and muritate of potash	101
Nitrogen mixture, mineral superphosphate and muriate of potash	132
Mineral superphospate and muriate of potash	140
Muriate of potash	143
Nitrogen mixture	150
Nitrogen mixture and mineral superphosphate	171
Mineral superphosphate	182
Farm yard manure	198

N.B.—Nitrogen mixture: equal parts of nitrate of soda, sulphate of ammonia and dried blood.

Analysis of Soil of Experimental Plots.

Moisture	2·941
Organic and volatile matter	10 494
Sand, silica and insoluble silica	78 590
Phosphoric acid	0·039
Sulphuric acid	0·150
Oxide of iron and alumina	0·297
Zinc	0·925
Magnesia	0·420
Potash	0·086
Soda	0·056
	100 000

RESULT OF FERTILIZERS OVER A FOUR COURSE ROTATION.



Per Acre per Annum Value.

Lime	$27
No fertilizers	31
Nitrogen mixture and muriate of potash	32
Nitrogen mixture, mineral superphosphate and muriate of potash	42
Mineral superphosphate and muriate of potash	44
Muriate of potash	46
Nitrogen mixture	48
Nitrogen mixture and mineral superphosphate	53
Mineral superphosphate	56
Farmyard manure	60

Note the low effects of lime, the apparently stationary result of nitrogen mixture with muriate of potash,—that from land having no fertilizer being taken as a standard of 100. Note also the comparatively low position taken by a mixture of the three (132), and the much higher when nitrogen mixture alone is applied. There is evidently an agreement for good in the association of the nitrogen mixture with mineral superphosphate (171), which comes between the results of each when applied separately. Mineral superphosphate has certainly made an important mark in the testing, but yet not equal to the sheet-anchor of all solid farming—farmyard manure.

Crops were: 1st year—Roots.
" 2nd " —Barley, seeded.
" 3rd " —Hay.
" 4th " —Oats.

Ensilage again.

It will be remembered how much we attempted in this direction previous to our large fire, and how little we developed satisfactorily. On the completion of the new farm buildings part of the root cellar, brick walls and cement floor, was set aside for a fifteen ton silo, and having studied all available experiences on the subject, made the following notes as a guide for ourselves and others.

Silo and Silage.

How to preserve fodder of any kind in a healthy, green condition all winter for the use of live stock, is yet, to some extent, a problem. Beginning in France, the silo or pitting system came to the States some six years ago, thence to England, where it has taken deeper hold than anywhere else. The States of New York and Wisconsin are probably now the most prominent practical believers in it, and Canada reflects but a mere shadow.

Any crop will make silage if taken in proper condition and at the proper time, but the most common are clover, meadow grasses and corn. In either there must be a maturity without decay, so that the most feeding value be secured along with the best condition for preservation.

Corn should be planted in the usual manner, in hill, three and one-half feet apart each way, but with three times more seed, thoroughly cultivated, and cut when in tassel and in glaze, or immediately after blooming. This very concise recommendation is not in exact agreement necessarily with the science, without which we could not proceed in this harvesting. It has been ascertained that no green fodder should be placed in a silo if it has more than *75 per cent of water* in its composition, because this proportion indicates the best stage of maturing and the best for the different processes in the silo; hence, before cutting the corn, and as a better guide than glaze or tassel, it is well to make a rough physical analysis of it, which any handy well-read man can do.

Cut with a strong mower so as to get everything neat "heads and tails;" avoid wet weather, and allow the corn to lie one day before hauling.

There are several forms of the silo—the stack, the portable form, the hole in the ground, and the expensively built one of brick and cement. Part of an ordinary root cellar answers if it is dry and walls plumb. Any ordinary mechanical hand will contrive the most efficient and cheapest according to special conditions when once the wants are understood. The size will depend upon number of cattle kept, allowing two tons for each during the winter; but the smallest will not be economical under ten tons, and because of unnecessary exposure when opening and using, the largest should not exceed fifty tons; consequently, if one hundred tons are required, it is advisable to have two separate silos of fifty tons each. As finally compressed silage weighs about 40 lbs per cubic foot, and as a height of fifteen feet is better than a width of fifteen, and as also the fodder will *sink one-third*, a ten ton silo will require to be fifteen feet deep, seven feet wide and seven feet long. "A perfect silo should be air-tight, water-tight, and as nearly as possibly heat tight;" no drain is necessary, and it is better to have no door in the side. Cement the floor and walls, and have the roof so that rain and snow are kept out. If a wooden partition is necessary—or, in the case of cutting off a part of a cellar, use 4x4 studs, with double-inch boards and tar paper between—the side next the fodder, of course.

Pass the corn fodder through a straw cutter in as short pieces as possible, and throw immediately into the silo; tramp carefully round the walls as filling proceeds, and stop when four feet in depth is obtained.

Now comes the most important point in all the "making": the temperature of the first, and of all subsequent batches, *must* reach 122° Farh., and until it is this no more can be added; if the heat exceeds 122°, do not be afraid as it can never rise so high as to produce spontaneous combustion. The time required for the proper temperature will be, depending upon condition of fodder, weather, condition of silo, and special management—from two to three days; ascertain temperature by burying thermometer in middle of material for ten minutes, proceed with the filling in two other batches, and allow proper temperature of last one before beginning to close up.

The covering may be of tarred paper, overlaid with inch boards, and weighted with stones up to 100 lbs. per square foot. The subsidence will be rapid, and everything having been properly attended to, the closing of the silo will be an almost complete air-tight case that two months afterwards should give corn fodder about as green and fresh as the day it was cut, and at the same time nearly free of acidity.

In opening the silo remove stones, boards, and paper from one end, broad enough to permit a man to use a long knife; cut clean down as the fodder is required, throwing it over the partition or by any mechanical contrivance found most suitable for the particular situation. Proceed with sections of the "pudding" as required for consumption.

Experiments to test the effect of extra Summer Fodder on the Quantity and Quality of Milk.

(Review from 1886 Report.)

1. Twelve common Ontario grade cows, averaging six years, 1,100 lbs. in weight, and two months after calving, were used in these experiments. None of the cows were in calf previous to 5th July, and five were considered to be so at the close of the work. The cows were divided into three lots of four each, and milked at 6 a.m. and 5.30 p.m. The milk record of the whole herd for the summer was an average of 27.9 lbs. per head daily.

2. The weather of the three periods that were selected as most severe on pasture and cattle, will be gathered from the following :—

——	July 21 to 31.	August 2 to 7.	August 9 to 14.
Highest temperature	89°.8	87°	92°.3
Lowest temperature	41°.5	41°.5	46°.
Mean temperature	66°	58°.7	69°.7
Rainfall	1.4 inch.	....	.78

3. The grazing consisted of part natural grasses on unreclaimed land, part bush, part fallow land, and part hay aftermath. The green fodders were supplied twice in the house when milking, at a rate of 20 lbs. per head daily.

4. Milk was set for 24 hours in the ordinary shot-gun cans, 20x8 inches, two inches of cream in which are taken as the standard of one pound of butter, in connection with patrons for our creamery. The average temperature of the milk at setting was 85°—extremes 82° and 91°—and gradually lowered by water and ice to a mean of 41°—extremes 40° and 43°.

5. An analysis of the accompanying table of results indicated the following facts, which, of course, must be supplemented with more tests in after years :—

Lot.	Periods.	Milk per cow daily.	Total milk used.	Inches of cream removed.	Butter obtained.	Butter per 100 lbs. milk.	Chemical Analysis.			Feed.
							Per cent of water.	Per cent. of fat.	Other solids.	
		lbs.	lbs.		lbs.					
1	July 21-31	21.79	871.5	61.25	34.	3.88	90.5622	.5758	8.8621	Pasture.
1	Aug. 2-7	24.35	487.	42.50	21.	4.31	90.6233	.4590	8.9066	Pasture and tare and oat fodder.
1	" 9-14	22.20	444.	34.25	17.5	3.91	90.6074	.4142	8.9783	Pasture.
2	" 2-7	28.65	573.	48.50	25.	4.36	90.5529	.5549	8.8922	Pasture.
2	" 9-14	28.95	579.	43.	21.5	3.71	90.4830	.7167	8.8003	Pasture and corn fodder.
3	" 2-7	26.35	527.	44.75	24.	4.55	90.5945	.4338	8.9717	Pasture and tare and oat fodder.
3	" 9-14	23.40	468.	36.	18.	3.84	90.5118	.6194	8.8687	Pasture and corn fodder.
2-3	July 21-31	22.92	1835.	131.	65.5	3.51	90.8695	.4485	8.6819	Pasture and tare and oat fodder.

6. Ordinary, well selected cows, that cost $42 each, gave a daily milking of nearly 24.21 pounds during the warmest and driest period of the year, upon good mixed pasture, and 25.20 pounds when green fodder was allowed, or only 1 pound of milk additional for every 20 pounds of such extra food.

7. Lot 1 increased their milk from 21.79 on pasture to 24.35 with tare and oat fodder, and afterwards reduced to 22.20 when on pasture only. Lot 2 increased only from 28.65 to 28.95, under similar conditions, the fodder in this latter case being corn. Lot 3 reduced from 26.35 to 23.40 when changed from tare and oat to corn; yet the highest milking record was with lot 2 on corn fodder.

8. As regards quantity of milk, there is evidence of a better stamp of cows in the case of lot 2, and of the poorest, of the herd in lot 1.

9. While the bulk of cream is not always a point of much practical importance, there may be something to evidence as affected by foods. The largest per cent. of cream was obtained from lot 1 on pasture, and the least from the same cows with tare and oat fodder,—a corresponding quantity of butter having resulted. Lot 2, when in receipt of corn fodder, also increased in bulk of cream, but very largely reduced the proportional quantity of butter. So also, lot 3 reduced its bulk of cream when changed from tare and oat to corn fodder. A combination of lots 2 and 3 gave the second best result in bulk of cream.

10. The very practical point of butter per one hundred pounds milk is very interesting and valuable. A mean of 4.01 pounds for the whole herd under varying conditions is considerably over the mean of British experience, and one half pound more than we allowed when testing at exhibitions. The least was from lots 2 and 3 upon tare and oat fodder, and the most from lot 3 on the like food. The effect of food in the production of more butter per a given quantity of milk is shown in lot 1, which increased from 3.88 on pasture to 4.31 when getting tare and oat fodder in addition, and immediately this fodder is removed the butter yield is reduced to 3.91. In the face of this fact, why is it that another lot of cows (2) reduced from 4.36 on pasture to 3.71 when corn fodder is added? Not only so, but our highest butter yield from lot 3 on pasture and tare and oat fodder, reduced nearly three-fourths of a pound when a change is made to corn fodder. The 220.65 double inches of cream gave 226.50 pounds of butter, or an over-run of about 2¾ pounds per hundred.

11. Milk, from pasture only, gave 4.05 pounds of butter, and 4.98 when green fodders were allowed. Corn fodder gave 3.77, and tare and oat fodder 4.12 pounds of butter per one hundred pounds of milk.

12. Twenty-five chemical analyses were made of the skimmed milk from this series of experiments, with the view to check the amount of cream left under the conditions named. Subject, therefore, to the special character of milk from individual cows and from a particular class of cows, and of the fact that chemical analysis is not nesessarily a test of butter production, we have the following notes:—

(1) One half pound (.5028) as an average of fat in milk from which the most cream has been obtained by the best and shortest method—centrifuge excepted—is evidently too much when the object is the most butter, without regard to the poverty of the skimmed milk for any particular article of commerce. The average from the various lots under every condition is as follows:—

	Water, per cent.	Fat, per cent.	Other Solids.
Lot 1	90.5976	.4830	8.9156
Lot 2	90.5179	.6358	8.8462
Lot 3	90.5531	.5266	8,9202

(2) Here is evidence of uniform character of product by total water and solids other than fat, and considerably dissimilar as regards milk fat remaining.

(3) Pasture was more free with its cream than when fodders were used with it, in the relation of .5149 held by pasture, to .5355 held by fodders. The milk from the same lot of cows (lot 2) held very much more cream—.7167 to .5549—when obtained from corn fodder. This is the most marked result of these tests—that one week succeeding another

four cows get 20 pounds of green corn fodder per head per day, in addition to pasture, at once the character of the milk changes and refuses to part with 6½ per cent. of its fat. The milk has not been reduced in quality so much, but seemingly, by some other property has not thrown off its cream so fully as it did when from pasture only. Nearly three-quarters of a pound (.7167) of fat left in the skimmed milk is unusual, and speaks of changed conditions. Further evidence of the effect of corn fodder is obtained in the case of lot 3, where, week succeeding week, the same cows, when changed from tare and oat to corn fodder, increase the fat of their skimmed milk from .4338 to .6194 per cent.

12. Finally, meantime, we gather from these introductory tests, that:

(1) By proper selection of the common grade cows of the country we obtain 5,000 lbs. in place of 3,300 lbs. of milk per summer season.

(2) Had such cows been upon the permanent pasture of this farm, the produce might have been about 10,000 lbs. in place of 7,500 lbs of milk per acre per summer season.

(3) The addition of specially grown green fodders to cows on good pasture, even in mid-summer, does not materially add to the quantity or quality of the milk.

(4) Certain green fodders affect the character of the milk as regards its ability to throw off cream, and

(5) That some green fodders add materially to the quality of the milk.

Milk in Winter without Grain.

Winter dairying is not yet a common thing in Ontario, even individually amongst farmers on any sort of system, and nowhere that I know of in the Province by any plan of co-operation. It requires no far sight to tell of a near developement of the interest throughout winter—subject, of course, to the day of milk having to take a second place to some other specialty in the cycle of events. Meantime we think it to be the duty of this Experimental Station to help the profession in those lines that should stand as guides or warnings for the coming years.

With this view we have carried out two experiments during the past winter that have, we think, proved several things, which, though not unknown in a general way, have possibly not received the same systematic attention that I shall now show.

In January last we selected four well balanced seven-year old Short Horn grade cows from a lot of ten that we had held all summer, and had cost us an average of $42. They calved in March, and were again in calf the following July—thus being from six to seven months gone during the course of the testing. The winter feeding previous to this special work consisted of 3 lbs. bran, 15 lbs. timothy hay, and 40 lbs. of turnips daily per head, being equal to a nutritive ratio of 1 : 5.9.

The cows were divided into two groups, by our best judgment of form and markings as well as by knowlege of their previous records. The groups were changed from one class of food to another, at equal terms from the 28th January to the 7th April, the experiment having thus extended over sixty-four days. Six days were allowed between terms, in order to counteract previous food influence. Every meal of food and milk was weighed, temperature of stables taken, exercise allowed, and the water drank noted. Feeding took place at 6 a.m., 11 a.m. and 5 p.m., milking at 7 a.m. and 5 p.m.

During January, previous to entry for experiment, Group I. weighed 2,322 lbs., and had given an average daily milking of 35 lbs.; and Group II., of 36lbs., with a weight of 2,325 lbs., when six chemical analyses of the milk gave :—

	Water.	Fat.	Solids other than fat.	Total solids.
Group I	86·143	4·634	9·223	13·857
Group II	86·106	4·736	9·157	13·893

Here is evidence of a very even condition of everything, with a small difference in favour of richness of milk from Group II.

The daily rations per cow for experimentation were :—

A ......40 lbs. turnips, 15 lbs. hay from p. pasture, and 8 lbs. bran.
B ......40 lbs. turnips, 15 lbs. hay of timothy and clover, and 8 lbs. bran.

The hay from permanent pasture was made up largely of meadow fescue, perennial rye, and some red and alsike clovers, and the other hay of about equal quantities of timothy and red clover.

Group I., on ration A, gave a daily milking of 36.6 lbs., and on ration B, of 33.5 lbs., with the following analysis :—

	Water.	Fat.	Solids other than fat.	Total solids.	Ash.
A................	86·271	4·644	9·085	13·729	·758
B................	85·900	4·776	9·323	14·099	·739

The cows of Group I., therefore, slightly increased in the quality of their milk from A to B ration, but yet nothing so marked as to override the usual coming and going of any cow under uniform conditions.

Group II, on ration B, gave a daily milking of 35.5 lbs., and on ration A of 36.7 lbs., with the following analysis :—

	Water.	Fat.	Solids other than fat.	Total solids.	Ash.
B................	86·661	4·192	9·146	13·339	·775
A................	86·424	4·474	9·102	13·576	·748

Group II., therefore, more distinctly increased in the quality of their milk when changed from B to A ration—as much as twelve per cent., or say one-fourth of a pound of butter to the hundred of milk.

I have not yet obtained the exact feeding value of either of those rations, because no authorities give hay as made up of certain grasses; but, taking both as equal to the mean of meadow and timothy and clover, their average nutritive ratio is about 1 : 5·3. We may, consequently, anticipate that A will be somewhat higher, but not much. We have, therefore, been handling foods in kind and proportions of more than ordinary importance as usually estimated in practice, as evidenced both by their chemical standing, and evidently also from what the cows have just reported to us. Over all the changes we now obtain the following composition of the milk as influenced apparently by these foods :—

	Water.	Fat.	Solids other than fat.	Total solids.	Ash.
Ration A..........	86·348	4·559	9·093	13·652	·753
Ration B..........	86·281	4·484	9·234	13·719	·757

And the milk produce for the whole course stands thus :—

Ration A ....23,080 lbs., or 36 1-16 lbs. per group.
Ration B ....22,450 lbs., or 35 5-6 lbs. per group.

Group I. entered with an average cow weight of 1,179 and closed at 1,222 lbs. Group II. began with 1,150 and closed with 1,186 lbs.

The cost of production may be placed thus, per cow :—

512 lbs. bran @ $12	$3.07
960 lbs. hay @ 10	4.80
2660 lbs. turnips	3.55

Making the 1,135 lbs. of milk per cow equal to 1 cent per lb., or nearly 2½ cents per quart.

We are now in a position to sum up, and ask what may be learned from these facts.

The prominent feature of this experiment is the uniformity in every respect of the milk from the four cows during mid-winter, upon food differing only to some extent in the quality of the hay allowed. Hence we may ask if *dry fodder* has much to do with any changes in the cow economy when giving milk, while she also gets a large proportion of such succulent and nutritions things as roots and bran.

Another indication of some importance is the high feeding value of our every day crops—turnips, hay and wheat bran. By a mixture of 40, 15 and 8 lbs. of these respectively per head per day, cows were not only enabled to keep up the full flow and quality of their milk, but to uphold condition until about one month of next calving.

While we did not necessarily work for an increase or even the maintenance of dairy products with cows so long after calving, it is clearly a point of very considerable importance to note how easy, comparatively, without grain proper, it has been to get milk all winter. We cannot overrate the significance of this fact as against the many examples of special cow records with so much and so many kinds of grain in these competitive times. If it shall be said that two gallons of milk per day will not pay when it costs about 9 cents and retails at 24, we have yet to learn where the profit goes. It is no creditable argument to say that this quantity of milk is equal to the *summer average* of all Ontario, but it does indicate how much could be done in winter even with the present class of cattle that are timed for summer use.

Our farmers, then, need not think of winter dairying as a system demanding of necessity much grain, and upon this really valuable question I shall have pleasure in submitting, at an early day, another experiment conducted at the same time as the fo going.

Winter Milk with and without Grain.

Cows, in the ordinary course of management, are not the best agents to test the *exact* effects of foods on dairy products, because of their incoming and being in calf—so irregularly and so long, often. We do not know what, and how much, to allow for these interruptions, and for the growth of the unborn calf. Last year Professor Grenside made several experiments in spaying cows and heifers, as explained in the Annual Report. We took advantage of this and used one of the cows for this experiment.

She is a common Canadian grade, eight years old, had her last calf in March, 1886, and was spayed on September 6th following. This cow was a natural milker, and required no education to make a show, hence we have much satisfaction in her conduct since altering. After this somewhat severe change, and up to the end of January, 1887, she gave a regular daily record of 22 lbs., and of 19.6 lbs. during February, just before being set aside for these tests. During February her milk gave the following analysis :

Water.	Fat.	Solids other than fat.	Total solids.
86.363	3.994	9.141	13.135

Hence, not a rich milk ; the food then, also, being our general ration of 3 lbs. bran, 15 lbs. hay and 40 lbs. turnips, *i.e.*, 1 : 5.90 nutritive ratio.

On March 1st, six days previous to actual commencement of testing, and just one year after calving, this cow was put upon a daily ration of 18 lbs. bran, 9 lbs. timothy and clover hay, with 30 lbs. sliced turnips, all mixed and dry. This was continued for twenty-eight days, when, after an interval of six days, the ration was changed to 10 lbs. of a mixture of equal weights of ground pease, oats, barley and corn, with 9 lbs. hay and 30 lbs. sliced turnips, as before, and continued for other twenty-eight days.

In this arrangement our object was to test the effects, through such a steady animal source, of a large quantity and similar value of bran on the one hand, and, on the other, of the mixture of grain that has hitherto with us given the cheapest and one of the most rapid results in fattening store steers.

With the bran regulating ration the daily milk was 18.8 lbs., and of the following character by eight analyses:

Water.	Fat.	Solids other than fat.	Total solids.
86.952	3.918	8.760	12.678

With the ration regulated by the mixture of grain we had a daily milking of 19.5 lbs., and this analysis:

87.255	4.718	8.037	12.755

The nutritive ratio of the bran diet is 1 : 5.04, and of the grain mixture 1 : 5.67. Details of management are similar to the four cows previously recorded. The mean temperature of our new stables was 44° for February, 44° for March, 51° for April, and 62° for beginning of May.

We learn meantime from these:

(1) That a very large daily consumption of wheat bran—about two and a-half patent pails full—with roots and hay, giving the comparatively high nutritive ratio of 1 : 5.04, did not produce either an equal quantity or quality of milk, as did the same value of a mixture of grain with similar roots and hay. Indeed the milk was reduced in quality 17 per cent., which would be equal to about one-half of a pound of butter per hundred of milk; or, perhaps it would be better to say that the mixture of grain raised the quality of the milk 20 per cent., as the normal condition of it previous to experiment was just about equal to that got from bran-feeding.

(2) That the highly concentrated and indigestible character of the bran of wheat, now so well cleaned of flour by the new milling process, can evidently be fed in over quantity to milch cows.

(3) That, nevertheless, the shell or skin of one grain, called wheat, was able to maintain animal life and waste, and at the same time give daily products only 2 cents less in value per day, a fact of immense importance in what may be termed a wheat-dairying country.

Bran in Fattening Store Cattle.

In previous years we have tested the value of different kinds of grain separately in the fattening of stores, but never bran thoroughly against any of them, or a mixture of them. The prominence now given to the bran of wheat in feeding milch cows decided the previous experiment, and in association with it we conducted another last winter with exactly the like kinds of food, in fattening store steers.

Eight animals were thus handled, all being Short Horn grade steers two years old—three only of which could be held as tops of their kind, and the others but very ordinary specimens. They were got in October, 1886, and put up to good stall feeding until the beginning of the test on 28th February following. The lot was made into two equal groups, balancing everything as usual to the best of our knowledge, and changing during periods of the 68 days ending 7th May.

The two rations per head per day were:—

A......18 lbs. bran, 9 lbs. timothy and clover hay, and 30 lbs. turnips.
B......10 lbs. of equal weights of ground pease, oats, barley and corn, with 9 lbs. hay and 30 lbs. turnips.

Upon the grain (B), all over the two periods, the average animal entered with 1,347 and came out with 1,371 lbs.

Upon bran (A), all over the same periods, the average entry was 1,330 and the closing weight 1,382 lbs. per head.

These brief statements of the whole experiment are so astonishing that recapitulation in another form is desirable.

Group I. on grain began at 1,334 and closed at 1,360, having increased only 26 lbs. per head in 33 days. When changed to bran the average animal increased from 1,360 to 1,403 lbs. in 35 days.

Group II. on bran started at 1,300 and closed with 1,361, thus increasing 61 lbs. in 33 days, and when changed to grain the average animal ran from 1,361 to 1,382 in 35 days.

Altogether, then, there has been a mean daily per head increase, from all sources over all the period, of over one (1.10) pound to the live weight. Grain gave a daily weight of two-thirds (.69) of a pound, and bran fully a pound and a-half (1.53) per head daily.

Animals were in good health and had no trouble, except one that bloated thrice when on bran, and hence would be an item asking for credit to that ration.

We have never had the same experience with a lot of stores. During the last eleven years with us the average daily increase to weight by many kinds of feed has been 2.03 lbs., the lowest 1.60, the highest 2.70. Besides, on almost an exactly similar ration to this grain (B), we have obtained in past years a mean of 2.25, so that we are in trouble in having to account for the unusual circumstance of the *general bad doing*, without reference to the specialties meantime. One thing is evident in this experiment, namely, that the conduct of each group has been very uniform, but all over there was a decidedly under-average lot of cattle. Quality was wanting in the majority, and few were hearty feeders. Nevertheless there was uniform health, and so far as regards agents for experimentation the conditions were precisely alike, with the reflection that treating such a class of animals to a variety of things would most likely be better for them, as against one kind of food in abundance.

The nutritive ratio of the bran diet is 1:5.04, and of the mixture of grain 1:5.64, which, though not always necessarily the best evidence of the feeding value, is a guide, and indicates in this case that the hay and roots with the bran was about 12 per cent. richer than the other ration. The two may be placed for all practical purposes at equal market value, and thus we have an increased interest in the competition.

That growing cattle life, specially set aside to produce beef during winter, should be more than doubled in added weight by the consumption of 18 lbs. of wheat bran as against 10 lbs. of a mixture of our best coarse cereals and the pea, seems hardly possible from a farmer's reasoning. The point is not only one of considerable importance; it is one of physiological interest, the more so as we have had the milking cow and the beefing steer giving such different results. Take the latter fact first of all :—

As shown in last chapter, a spayed cow—an agent of the very best kind by the way—not only gave somewhat less milk on 18 lbs. bran per day, but that milk was 17 per cent. less in butter fat than when she got the 10 lbs. of the mixture of grain in question.

Is bran, then, by its higher concentrated and less digestible character, better adapted to produce fat and flesh than milk and milk fat? It has most unquestionably said so in these tests, and while further prosecution of the enquiry may alter results to some extent, the facts so far are too prominent to be set aside as belonging to any unusual circumstances.

We do not enter upon the chemical bearings of the experiments at present, because Professor James has not yet completed analyses of fodders and the manure obtained.

It will be matter of much interest to all feeders to note that while the cow ate both rations freely and left nothing to re-weigh, the steers did not consume all the bran ration, but left an average of 2½ lbs. per head per day; at the same time the well-balanced grain ration was cleaned up by the steers, and possibly they would have taken more. It appears, then, that fattening stores cannot make use of more than 15 lbs. bran in association with 30 lbs. turnips and 9 lbs. hay daily per head.

But further, the cost of production should not be overlooked even in an introductory test. In a former experiment we ascertained that bran was not only able to maintain animal life and waste, but to give dairy products only two cents less in value per day in correspondence with the same market value of the grain ration. Now we have fattening steers that not only gave 100 per cent. more daily increase, but did so at one cent per head less cost when the food was regulated by bran as against grain.

We close now with the memorandum that apparently the exact place of wheat bran as food for cattle is not clear enough to justify any one in an irregular and indefinite use of it, for:—

1. Is its general chemical standing yet a steady thing?
2. How much of its properties is assimilated by the animal system in different cases?
3. Is it really of more value as a fertilizer after passing through the animal than it was previously?
4. Is it always better dry than wet when fed?
5. Should it be mixed with other food, and what kinds?
6. What is its place in association with pasture?
7. What are the maximum economical quantities in different cases?

The Marking Power among Cattle.

I think, had this station kept exact notes of the varieties in cattle-life obtained during the last twelve years, much interest would have gathered, and may-be considerable every-day value realized as well. I make no apology to the Government or country for the want hitherto of any systematic notice of this branch of our work, as, with many other duties and a diffidence in submitting anything on a subject so often uncertain and so seldom handled even by experts, excuse may reasonably be overlooked or allowed.

But to-day, the day of experimentation, and of much literary impudence everywhere, we do not fear to break new fallow. Of course I have my own private jottings to fall back upon, and, as all interested men know, the field of observation here has been varied and pretty full for one farm.

I call the subject *marking* power, in hair and skin—not prepotent, not heridity, nor atavic power, which, though likely more correct scientifically, are not the best for my purpose at present.

1. One rather remarkable and practically important thing in our experience has been the absence of any bad marking of breeds amongst themselves as pure breeds, where cows are herding together in all seasons, and under all other circumstances of the coming and going of cattle there would seem to be risks of this kind. For example, no Devon, or Galloway, or Aberdeen Angus Poll has taken the white face of the Hereford, the white splashing of the Holstein, or all throughout the one of the other. I name these breeds specially, because they are usually those that hold a colouring in their characteristics and points, and are judged accordingly. The explanation of this fact is evidently that of familiarity of company not having the effect usually following a sudden appearance of a differently coloured animal either during service or at a certain stage of the growth of the *fœtus*. I believe more bad marking arises from cows going to exhibition than anything else.

2. We have also had most clear evidence of the superior marking power of the male over the female when both are pure or thorough in their breeding. Breeds even that do not *profess* typical markings, such as Short Horn, Jersey, Guernsey and Ayrshire, have invariably followed the sire both in male and female issue. White is undoubtedly the purest, the strongest and the most reliable of all colours, if it is a colour at all. Very dark red, or even black and yellow Ayrshire cows, yield to a white sire of their kind, and if he be spotted red and white, the very clouding of his red and white is given through a white cow.

3. In cases of crosses by pure-bred males and grade cows, we have had extensive examples of marking. I know of few instances among hundreds where the sire did not impress himself strongly. This, of course, was more exact in cases of an uniform one-colour, such as Devons and Polls against Hereford and Holstein. Yet even in the latter, the splashing of white and black has been uniform as regards position and general area,

though not precisely the outline in every instance. Very striking copies of colouring are got from the Holstein—so precise in hair and skin by the first cross with ordinary grade cows that no expert could tell them from thoroughbreds.

4. Another feature of this study is the individual character of the male or female as bearing on the power of either to mark their progeny. If a sire be less prominent in his nervous organization in proportion to his frame—having a more effeminate head, wide forequarters and less prominent spine, there will be more cases of the cows affecting colour. Hence beefing breeds, so-called, are not so persistent in marking as dairy breeds proper, because their nervous development is much less in relation to the whole body.

5. We have had no clear examples of bad marking by breeding the same cow to different classes, where it might be expected that the effect on the cow of the first, say a Galloway sire, would be noticed in the marking of the second calf, say by a Short Horn.

6. What may be called impotence of recurrence has also come into our experience—that is, where the cow possesses the colour of the old or original cattle from which the improved breed of her own kind has sprung, and which, in her case, is simply a reversion ; she will invariably, nay in almost every case, give a calf following the sire, which is, of course, very different in colour and the type of the improvement in question. This is true both in Short Horn and Aberdeen Angus Polls. We have an entirely red thoroughbred Aberdeen Angus Poll cow—not a black hair anywhere, and her skin nowhere dark except a slight mottling of the nose. With the bull of her kind this cow has always given a most typical black calf in all the hair, and skin, and moss that belong to the doddies. I believe the impotence would be equal were the sire red and the cow red. The law in this aspect seems to "hark back," and not to tie with immediate relations, so that while this red cow undoubtedly took her colour from a far back source, she is not of herself able, nor would a red bull of to-day likely be able to mark his colour, even when both parents are red.

7. But we have also several examples of marking that "throw back" only when between parents of the like class, and yet that are true to the sire when the dam is a grade. This has been a point in our Jersey breeding here ; most of our pure-bred calves of this class are spotted white and otherwise irregular in colour, but those from crossing with common grade cows are whole coloured, as the bull is. It cannot be said that the Jersey cows have directly influenced the parti-colouring, for they are themselves whole in colour, and so the question is either one of an abnormal blending of blood, or of superior power on the part of the bull when the cow is from no particular source.

Finally we learn the following in regard to the marking power of different breeds of cattle :—

(1) The cows of many breeds herding continuously together do not endanger the special marking of the progeny of any of them.

(2) The strongest colour in respect of influence upon progeny is WHITE.

(3) Whole colours, or one colour, are more certain of exact perpetuation than a mixture of them.

(4) Colouring is more certain of being perpetuated when the sire has a marked nervous organisation.

(5) Improved breeds, or those that have been specially bred from various sources to attain certain results, are not so decided in marking their progeny.

(6) Dairy breeds are more powerful in marking than those disposed to make flesh and fat.

(7) There does not seem to be much tendency to bad marking by breeding the same cow to bulls of different breeds.

(8) A cow or bull having the colour of the original type of what is now an improved breed, with a very different colour, will produce more of the improved than of the old colour.

Some Suggestive Creamery Notes.

During the close of the recent severe drouth, in the two first weeks of August, we tested the butter value of milk and cream from nine distinct sources on this farm for comparison with the average received from the patrons of our creamery, which is managed on the ordinary gathering plan, and also in connection with the very dry condition, and shortage of pasture.

1. Our creamery patrons are instructed to set milk in cans, 20x8 inches, and keep in water not over 50°; skimming is done by them, and the cream valued by the "Comp Oil Tester," purposely at irregular intervals, and paid for accordingly. The standard for one pound of butter is one inch on the cream can, 12 inches in diameter, or 16 gauges or ounces on the oil tester.

2. We took some thirty milkings, and portions of milkings, from Short Horn, A. A. Poll, Hereford, Devon, Holstein, Ayrshire, Guernsey, a spayed common Canadian cow, and Short Horn grades, on our permanent pasture plots—in all 13 cows. The milk was set in $2\frac{1}{2}$ inch test tubes and iced water, at from 40° to 45° for twenty-four hours, so as to copy as nearly as possible the conditions of the creamery patrons.

3. It is not contended that conditions were exactly alike on an average, nor that our cows under all the variety of circumstances were alike to the 800 which supplied our creamery, but it is plain that large averages can be checked, and material of this sort gathered year by year for reference and ultimate practical guidance. It is to be regretted that our Jerseys and Galloways have not contributed to this experiment, as we expect they will do for another in the course of a month.

4. The per cent. of cream from all our sources was only 11 on an average, cows being on pasture and getting 3 lbs. bran per head daily, those on permanent pasture excepted. Classifying these sources, we have a mean of 12 per cent. from the three prominent beefing breeds, named Durham, A. A. Poll, and Hereford; from the two heavy milkers, Holstein and Ayrshire, $7\frac{1}{2}$ per cent.; from the two acknowledged butter breeds of the number, Devon and Guernsey, $12\frac{1}{2}$ per cent., and from grades, 12 per cent. cream. The separation of cream was very indistinct in the cases of Devon and Ayrshire. The highest per cent. was a mean of 18.8 from the Guernsey, and the lowest $6\frac{1}{2}$ from Holstein.

The oil tester showed the following quantity of butter fat, namely, ounces per inch of the cream can, 16 being the standard for one pound of butter:

Durham	
A. A. Poll	$16\frac{1}{3}$
Hereford	17
Devon	17
Holstein	11
Ayrshire	7
Guernsey	$10\frac{1}{3}$
Spayed grade	17
Grades on permanent pasture	$15\frac{1}{3}$
	$16\frac{1}{6}$
Mean	$14\frac{1}{8}$

6. The mean of 293 tests at the creamery during the same period was $13\frac{1}{2}$, and for the previous part of the season 14.

7. The first thought upon these facts is the *cream lowness* of all the make of 36,000 lbs. of butter at our creamery up to 17th August. The cattle of the district are principally Durham grades, with a touch of Devon, Hereford, Ayrshire and Galloway here and there. But is it particular breed, or management, or a tester too high for our conditions that has regulated the $13\frac{1}{2}$ in place of giving 16 gauges? My answer partly to this is the

check from the thoroughbred and grade cows of the College. They have not, as a whole, even reached the standard of the oil tester, but, excluding the Devon, Holstein and Ayrshire, they gave 16½, which may show that the area of the cream-can has been based upon a different source, or sources, or conditions, of milk from those of the creamery supply.

Another thought is the character of the skimming by patrons as a whole, which may have been *deeper* than what we did, for of course we took cream only. Yet, as I have shown, three of the pure breeds gave as low as 9½, or actually 40 per cent. less than the creamery. Where then lies the actual check 'tis difficult to say. It is proper to note that in Durham, A. A. Poll, Holstein, Guernsey and grades we have cows not used in any previous testing here.

9. Taking the standard of 16 on the oil tester as a base of comparison, it results that, irrespective of quantity of milk and of quantity of cream, the three beefing breeds, Durham, A. A. Poll and Hereford, have given one ounce over the pound; the two heavy milkers, Ayrshire and Holstein, seven ounces under, and the two butter breeds, Devon and Guernsey, two ounces also under the standard for a pound.

10. But, with quantity of cream added to butter value by the method adopted, there results this very suggestive list:

Guernsey	30	per cent. *over* standard.
Grades	14	" *under* "
Hereford	18	" " "
Durham	20	" " "
A. A. Poll	25	" " "
Ayrshire	65	" " "
Devon	70	" " "
Holstein	82	" " "

Hence, if the standard represents 3½ pounds of butter to the hundred pounds of milk, the Guernsey would produce 4½, and the Holstein two-thirds of a pound per hundred.

NOTE.—Some readers may have to be told that an "Oil Tester" is a recent invention by which cream is subjected to repeated churning and heating, so that in the course of three hours there is a very distinct separation of the curd, the whey and the fat or oil; hence the name "Oil Tester." It has also to be noted that this almost pure melted fat or oil is much less in bulk proportionately to its milk, or to the cream from the same milk under ordinary rising,—as much possibly as would raise the Guernsey from 4½ to 6, and the others correspondingly.

Improved Temporary Pasture and Milk Production.

Some may think we have said enough about pasture during the past five years, and that experiments are now conclusive as to what can be done for its improvement. It seems, however, to be desirable to close the season with some additional facts and under new aspects.

Hitherto our work in testing mixtures of grasses and clovers has been termed *permanent* pasture, because the object is the maintenance of such a crop for many years, perhaps even for all the time that several generations can remember, of which we have examples in older lands. But, as it is difficult to grasp the full significance of what goes so far away from our yearly practice, we shall look at this class of pasture as if it had been connected with an ordinary rotation of crops, where, after two years' hay there is usually two or three years' pasturing before breaking up for another succession. Thus we hope to bring home to everybody one of the duties of the day in connection with Canadian dairying.

We seeded in 1884 without a grain crop, and took hay the same year; it could as well have been with a crop of grain. In 1885 we grazed and obtained 7,800 lbs. of milk per acre; it could as well have been another crop of hay. We also grazed in 1836 and obtained 6,670 lbs. of milk. This, therefore, would be a system of one year's hay and two years' pasture, applicable to some soils and grain-growing districts. The result here would have been a mean annual milk crop of 7,235 lbs. per acre, with $61 for butter and skim milk. Had the same land been laid down to timothy and clover, and an average of the Province realized (that is 1,300 lbs. of milk per acre), the revenue would stand at $11 per acre. Against the mixture of grasses is the sum of $3.50 as the difference between $5 for seed and the ordinary $1.50 of timothy and red clover, for there should not be any for management and manures. Hence, during two years, the improved pasture gave $96 per acre over all the profits of the ordinary cultivated runs for Ontario cows.

But, possibly, neither of these pastures are at their best in three years, and a longer rotation may be desirable.

The same fields were kept in sod during 1887—the driest season in Ontario for many years. As part of good management in continuing temporary pasture, as well as permanent, under heavy stocking for three years, we applied $22 value of manures per acre in preparation for 1887; hence we must debit with 10 per acre as a proportion for that year, in addition to the extra cost of seeding. As this is our closing point at present, take the following statement:

		lbs.
Milk per acre in 1885		7,800
Milk per acre in 1886		6,670
Milk per acre in 1887		4,010
Yearly average		6,160
Value of milk per acre		$156 00
Extra cost of seeding	$ 3 50	
Manures	10 00	
Allowance for extra management	3 00	
		$ 16 50
Net revenue for three years		$139 50
Ordinary pasture for same period		33 00
Difference in favor of improved pasture		$106 50

Or $35.50 *better*, per acre per annum.

The account is now closed, and sod may be broken for a crop of pease or oats.

What more need be advanced meantime? If it is necessary that a sample of the soil, the pasture, the cow, the milk and the manure should be submitted to all our farmers in order to convince and convert, then our national future in dairying will be a slow and third-rate one indeed.

With the average farm of 150 acres in Ontario in possession of ten acres of such improved temporary pasture, the annual difference would amount to about $350, and consequently to about $15,000,000 for the Province.

It is a pertinent fact in nearly all civilized agriculture everywhere—in older times as well as now—that propitious conditions in nature make men indifferent and unprogressive; in other words, they are too well off. Unquestionably our Province is full of many fat things, and while it may be somewhat uncharitable to draw an inference in this connection, and knowing how easy it is to find fault, I desire most seriously to say to our farmers that individual and Provincial co-operation and emulation are as much desirable as the wider lines of international union. For the sake of self, then, let us have something approaching to 6,000 lbs. of milk per acre, in place of the $17\frac{1}{2}$ lbs. per cow per day and the 900 lbs. per acre per annum. (See Mr. Blue's paper to Dairymen's Associations, 1886-7.)

Some Facts and Experiences in Preparation for Wintering Live Stock.

General Food.—Our regulating food for all cattle is prepared thrice a week, and consists of 40 lb. pulped turnips or mangels, 15 lb. cut hay and 3 lb. of bran per head daily on an average of kind and age. These foods are mixed in a heap about four feet deep, and used before much heating or during the sweet stage of fermentation, which is usually when the temperature reaches 70°. The nutritive ratio of this mixture is 1:5.9, and the market cost 16 cents per head per day; the cost to the farmer is about 9 cents. Water is given about 40°, and the stable is never over 50°, with proper ventilation. The breathing space for each animal is about 900 cubic feet.

Cut Hay.—A saving, estimated at 12 per cent. in feeding horses and 30 per cent. for sheep, was realized last winter with cut hay. The animals cannot leave any amongst their feet, and they eat more of the rougher portions.

Steam Power.—A 17 horsepower portable engine, with a 20-inch French burrhstone mill, grinds 30 bushels of pease or barley in one hour at a cost of one cent per bushel, including every possible cost. The same power drives hay-cutter and root-pulper both at the same time, and in less than two hours prepares the food named in first paragraph, being 2,000 lb. hay and 6,000 lb. roots. The cost of this is 55 cents per ton, or one and one-half cent per head of cattle daily, including interest on cost of engine, fuel, tear and wear, oil, engineer, two hands at hay-cutter, two at pulper, and two at mixing the food.

Ice.—For creamery and college use we harvest about 400 tons every year; placing a full value upon everything, including teams, men and student labour, and, having had to haul nearly one and one-half mile, ice has cost us 60 cents a ton.

Manure.—With an uncovered court, where cattle, horse, and sheep manure is regularly mixed, where cattle are exercised every day over the manure, where gypsum is systematically used in cattle stalls, where all surface liquid is caught in a tank, where drains from stables take liquid to tank also, and where the liquid can be applied to the manure pile as required, there is during winter practically no waste by evaporation, washing away, or over-fermentation. But much snow lying long retards proper decomposition of materials and necessitates hauling to piles in fields in winter, or turning over in the yard in early spring so as to induce rotting. We made three tons of farmyard manure per day, and on putting stock out to grass on 10th May our court had given us the following quantity and value of fertilizing materials, in association, of course, with humus, from 550 tons sent out in the rough from the different animals:—

	Lb.		Value.
Potash	8,800	@ 5c.	$440
Chlorine	735	.....	....
Phosphoric acid	4,950	@ 6c.	297
Nitrogen	7,700	@15c.	1,155
Soda	3,300	.....	....
Lime	15,400	.....	40
Magnesia	1,650	.....	....
Sulphuric acid	5,500	.....	....
Silica (soluble)	12,100	.....	....
	60,135	.....	$1,932

Sulphuric acid and lime are more than an average, in consequence of using gypsum every day as explained. Valued chemically, these 60,135 lb. of fertilizers are worth at least $2,000, irrespective of the humus and of those materials usually not valued as *direct* fertilizers on the market. One-fourth by weight is actually lime, and this to be used upon soil abounding in the mineral itself, where there is at least one per cent. of it; one-fifth is soluble silica, and of that our average field contains a sufficient proportion; one-seventh is potash, and when the soil of this farm has only about ·086 per cent. (the twelfth part of one per cent.), its value can be appreciated; one-twelfth of the manure is phosphoric acid, so that its importance will be seen in a soil containing ·040 per cent. of that material. Of chlorine the manure has an abundance proportionately, as we offer so much salt to all our animals. As nitrogen with phosphoric acid and potash are the main elements of cultivated plant life, I think it will surprise some to note the large amount of nitrogen we are receiving per farmyard manure, one-eighth by weight of the whole. And who will contend that thus, in association with other fertilizers, it is not very much more valuable and safe than by the use of nitrate of soda, or other special agency? Nitrogen in farmyard manure is thus equivalent to 34 lb. per acre per season of our actually cropped area, or 24 lb. for every acre under cultivation. We have no exact experiments to show how much our average cropping removes annually, but from experience elsewhere it cannot be over 30 lb., so that we seem to be accumulating rather than losing, and I believe this to be the fact.

Altogether, then, on the question of our valuation of manure in previous years it appears that $3.50 per ton, as above, is $1 more than what was asked in connection with the fattening of store cattle.

Winter Crops.—Farmers are harvesting something every day, and as few of us are in the habit of estimating winter products in correspondence with those of summer, we give the following as a safe under-calculation of what we realized during 1886-7 in connection with a cultivated farm of 350 acres, or perhaps correctly of 250 acres, that gave hay, straw, grain, and roots. Take both areas:—

	350 acres.	250 acres.
Thoroughbred cattle, 15 head	$4 50	$6 00
Thoroughbred lambs, 50 head	1 10	1 50
Wool from seventy head	30	40
Pure bred swine, 12 head	45	55
Fattening cattle, 12 head	1 75	2 50
Milk from 12 cows	1 40	1 90
Manure from 75 cattle, 14 horses, 80 sheep, and 5 swine.	4 25	6 00
Gross revenue per acre for winter	$13 75	$18 85

The Grazing of Sheep on Improved Pasture.

We have been trying for twelve years to impress our farmers with the fact that one of the most prominent weaknesses of Canadian agriculture is unappropriated land and non-production of wool and mutton. The country is really doing nothing in this respect in correspondence with others, and what we could do by improvements, what by ordinary management, and what we are only doing now, may be thus illustrated:—

	Canada annually.
Present wool and mutton	$ 9,280,000
By ordinary attention	20,000,000
By improvements	30,000,000

These have no reference to production of pure breeds as a specialty, but the use of them with the common sheep of the country in order to realize annual crops from our so-called comparatively worthless possessions, in addition to pasture connected with arable.

If the 3,793,800 acres of ranches already rented in our North-West Territories are equal to the ordinary hill grazings of Britain, they will maintain 1,250,000 head of sheep in place of the present 75,000 cattle, 6,318 horses and 16,431 sheep (see Dr. McEachran's report just issued). These represent about 400,000 sheep; hence, were these natural runs improved, it is safe to estimate they would carry over 2,000,000 head, in addition to cattle, and would thus stand at an annual revenue of $8,500,000 in wool and mutton alone.

We are not believers in an equal revenue being realized in wool and mutton by any breed per acre from our best cropping soils, as compared with, for example, dairy products, and so the object of the experiment now to be submitted was to test the ability of improved pasture on such soil to maintain so many sheep per acre per annum, and compare with cows and store cattle.

For this purpose we chose a four year old acre of permanent pasture, the make-up, condition and management of which are now familiar to all interested. Divided field in two equal parts, and on 5th May put on five shearling ewes—Oxford, Shrops and Cheviot—that weighed an average 107 lbs. On 23rd May put two others to keep down roughness of pasture, that averaged 139 lbs. As these seven sheep were unable to do this, we added seven stock rams on 9th June, thus making fourteen in all. Of course these were kept separate, and rotated from field to field. Removed the rams on 2nd July, and on 3rd August also removed the two extra ewes, when the extraordinary dry season was telling. No grain or extra food of any sort was allowed.

At this critical time of grazing we made the following observations on appearance of the grasses and clover that composed the pasture in question:—

Meadow Fescue	Most plentiful of any.
Alsike clover	A large quantity.
Canadian blue	Considerable quantity.
White clover	Medium in quantity.
Orchard	Medium.
Timothy	A good average.
Red top	Good.
Red clover	A small quantity.
Italian rye	Very little.
Fall oat	Very little.
Perennial rye	None.

The experiment with these sheep was closed on 1st October, as they were required for distribution to service. At this time the pasture looked well, a good bite having been left; hence other sheep were put on and grazing continued until snow came, on 20th November. It is not necessary to take advantage meantime of this subsequent depasturing.

The average grazed during the term from 5th May to 1st October was fully seven head per acre; the increase to weight was 22 lbs. per head. This is the statement; what does the Canadian farmer think of it?

Some will say, "Only $7.00 value of wool and mutton per acre per annum after all." True in that respect, though the animals were pure bred, and up-keep of vigorous growth their case and not one of immediate consumption. The grazing of sheep is not usually looked upon as worth more than $1.00 a summer in Ontario, but unfortunately the average is not a very bright thing, and usually requires one acre per head.

The correct criticism is to compare the result with something more familiar and under equal conditions. We had this immediately alongside the acre in question as given in Bulletin xx. There during 1887, 4,010 lbs. of milk were obtained per acre, and consequently a value of about $40. Then, again, it is usual to say that from four to five sheep are equal to one cattle beast upon pasture; in this comparison, therefore, we have this pasture representing actually one and half-cow per acre.

But apart from these facts, we are gratified in placing on record for the use of our people the continued prominent good conduct of our mixture of grasses and clover under very severe circumstances, as a piece of temporary or permanent pasture in association with crop-growing. We have now demonstrated beyond doubt that such pasture produces milk, beef and mutton in quantity three times more than the present average of the Province of Ontario.

V.—THE MECHANICAL DEPARTMENT.

To William Brown, Esq.

Dear Sir,—In accordance with our usual practice of giving a general summary of the year's work done by the Mechanical Department in connection with this institution, I beg to submit the following statement :—

Naturally the scope of my report resolves itself into two parts—first, as to the instruction imparted to students ; and second, as to the work which we have accomplished during the year.

Our first object in dealing with new students is to make them thoroughly familiar with the names and uses of the various tools. The hour devoted to this purpose is, in my opinion, the most important of the day, for by this means they acquire a general knowledge of the trade which they could not get if they were simply set to work upon whatever there might be to do at the particular time for which they were assigned to my department. In fact, in this hour set apart specially for instruction, they are able to learn many things which they could not learn otherwise perhaps in the whole course of their stay at the institution, simply because they might not be called upon to do such work.

As many of the students come entirely ignorant of the purposes for which various tools are used, it is necessary in teaching them to begin with the very rudiments of carpentry. For instance, before they can plane a board they must be told that the jack-plane is the proper tool to use first, and it must be pointed out to them next, if it is necessary, to "try a board up." They are given the try-plane and shown how to use it, and finally they are instructed as to the use of the smoothing-plane. In the same way the students are taught with respect to the uses of the different saws; they are also shown how to set and sharpen such tools. Then they are instructed in the different terms of carpentry, such as gaining, mortising and tenoning, and shown how to beat out a mortise. The course likewise includes lessons upon the use of gauges and squares, and special attention is paid to the framing-square. When they get farther ahead they receive instruction as to the comparative strength of different kinds of wood, as, for instance, how much stronger a piece of ash is than a piece of pine, etc. In this way the whole school is gone over, each batch of boys as they are allotted to the department. By such instruction, together with the practical experience they obtain by actual work, they cannot fail to gain a knowledge of carpentry and of handling tools which must prove valuable when they launch out as farmers for themselves.

As to the work accomplished, it would serve no purpose to specify all the odds and ends which constitute a large part of the work done in this department in the course of a year. That for the year ending September 30th, 1887, does not differ from the work of previous years, in that it has to a great extent consisted of repairs and alterations. For example, considerable repairs were made in connection with the bull-sheds, the wind-pump, cattle stables, green-house, and College building. All the implements were overhauled and repainted; all the doors in the new barn having swollen, were taken off and planed down to fit; the grape-vine fencing was put in good order ; a block and tackle erected in the ice-house for raising blocks of ice, and boards supplied for enclosing the ice as it was stored; the posts about the old stable court taken up and removed; and, in the fields, the pumps and water troughs received attention. Such is an outline of some of the repairs which occupied our time.

In the way of new work undertaken and carried out, there was the erection of a cover over the rain and drain guages ; the building of a small house at the College for the purpose of holding the fire-hose, and the construction of reels on which to wind this hose; the building of a coal-house at Prof. Brown's residence ; the laying of about twenty rods of four-foot sidewalk from the stables to the carpenter shop ; the construction of a number of pig troughs ; the enlarging of granaries ; the erection of feed boxes for loose cattle, of harness presses behind the horse stalls, and of hay forks over the sheep stables. The students also assisted in the erection of a patent rack lifter.

Perhaps a piece of fancy fencing put up along the south lane in front of the stables is worth a line in passing. It extends about four rods, and is made with high and low pickets alternately. There are four gates, and a gate of similar construction leads from the cattle court. The whole is painted a drab colour, and looks very handsome.

Considerable work was done in connection with the sheep quarters. A portable fence was made for the purpose of dividing the sheep yards; part of the stable was partitioned off into pens for breeding purposes; a room was fitted up for storing wool; a passage formed along the whole length of the sheep stables, which passage, together with the wool room, was floored; a large number of feeding racks were made, as was also a rack for the drying of sheep after being washed prepatory to shearing.

As invention progresses, the work of the farmer becomes less and less laborious, and machinery is made to do work which was akin to slavery in former days. The machinery in use in connection with this institution is naturally extending every year, and the work of setting it up and keeping it in repair has grown to be quite an item among the duties of the mechanical department.

Early in the year we erected machinery for driving the chopping mill, but afterward this was altered to form a part of the general system subsequently introduced. There were also a counter shaft and pulleys put in for cutting hay for the horses.

Later on in the year we built an engine house, with cedar block foundation, 20 x 30 feet in size, with 16 feet posts, at a distance of 50 feet from the barn, as a precaution against fire. After a good deal of planning and consultation with yourself and Mr. Mills, we decided upon a system which was recommended by the Advisory Board, viz., connecting with the barn machinery by means of a wire rope, $\frac{5}{8}$ inch in diameter, over two large grooved wheels, one placed in the engine house over the engine, and driven from the engine wheel by a band wheel 40 inches in diameter. The wire rope now communicates the motion to counter shaft inside the barn, and this counter shaft has a pulley to connect with counter shaft with pulleys to drive the several machines, which are, turnip pulper, straw cutter and chopping mill. These three machines are driven from the third counter shaft. There is on the second counter shaft a gear core wheel communicating motion by pinion and counter shaft for the purpose of driving separator. This last shaft connects to a jack, which can be placed in several positions on the floor, so that the separator can reach the different mows. This system gives splendid satisfaction so far as motions are concerned, but the wire rope does not work advantageously for the reason that the wheels were bought second hand and are not true. To make this perfect we will require two grooved wheels between the driving wheel and the driven wheel, to steady the wire rope.

The foregoing is a synopsis of the work which has engaged our attention during the year.

Yours truly,

JAS. MCINTOSH,
Foreman.

VI.—CONCLUDING NOTES.

WHY FARMERS DO NOT PATRONIZE AGRICULTURAL COLLEGES.

One of the most pointed communications on this subject recently is from the pen of J. A. W. Oliver, in the "Mark Lane Express:" much truth in bare facts, and very pertinent. With this stimulant I beg to close my 1887 report, by offering a list of reasons, that to me seem to cover the ground in question. Singly or in combination, according to circumstances, they tell why farmers in any country do not send their sons to Agricultural Colleges.

1. Because most of the present farmers have improved their own properties, and consider that their sons should do as well as they have done: reasonable in their light, but rather conservative and unprogressive.

2. Many consider they are as able, and better able, to educate in farming, as any agricultural college can : true, but do they, and what of the science ?

3. That as they have gained their own experience and success by dint of hard labor, hence hard labor is the only true teacher for any farmer : this is the strong philosophy of the plough.

4. Because many have no strong appreciation of the high place of their profession, or respect for its advancement : it is not a profession to such, but a *morning* and *evening* existence.

5. Some are too poor in means, and in labor help to allow a son from home : one of the few legitimate reasons.

6. A few are so politically influenced as to ignore any school not governed by their party.

7. Others have been taught, or at anyrate have the impression, that "science and practice" mean book learning, and that book farming has always been a failure : much truth in one way.

8. Because several farmers' sons who have done well at such colleges have left farming as a profession.

9. They have heard that farmers' sons are classed by themselves and refused admittance to the other college circles : decidedly untrue.

10. They think their sons are influenced for evil by other students at college : true, in all conditions of life, but dependent on individual character.

11. Because college discipline is loose in some respects : also true but not a prominent thing.

12. Because students are not allowed to follow their bent by choosing one or two special agricultural subjects, and are obliged to devote considerable time to English literature, etc. : well worth consideration.

13. Many have been influenced by the non-success of young men known to them, and place more importance upon this than any successful cases they have known.

14. The notoriety that would be attached to sending a son,—a sort of admission to neighbours that they are incapable of showing their own families how to farm.

15. The smart boys having adopted other professions, the dull ones at home are good enough there.

16. Because the faculty is not an efficient one : a rare circumstance as the present generation will not tolerate incapacity.

I consider a large measure of charity is due in arguing any of these circumstances, for it cannot be expected that farmers, as a body, realize the importance of a better education so much as those who have been inststrumental in establishing agricultural colleges ; were they so, it is safe to say that such institutions would be much older in our history and farmers themselves leading in other national problems. Labour and wait should be our motto.

I have the honour to be, sir,

Your obedient servant,

WM. BROWN.

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To the Presi

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PART VI.

REPORT ON

PRACTICAL HORTICULTURE.

ONTARIO AGRICULTURAL COLLEGE,
December 31st, 1887.

To the President of the Ontario Agricultural College:

SIR,—In reviewing very briefly the operation in the practical horticultural department of the Institution for the closing year, I would say that with the exception of a small plantation of forest trees laid out last spring, but very little new work has been undertaken during the year.

This plantation, about three acres in extent, is situated in farm field No. 4, lying in full view from the front of the college building, covering an abrupt gravel knoll, and intended to screen from the eye a somewhat unsightly gravel pit which has been in use for the last few years. The young trees, from three to five feet high, were raised from seeds in the garden or in the experimental grounds, and are composed of a varied assortment, both evergreen and deciduous. The plantation is bounded principally by Norway and native spruces, larch and Austrian pines, enclosing walnut, butternut, English and American ash, birch, elm, linden, Norway and hard maple, etc. The whole is planted in lines eight feet apart, which will admit of the ground being cultivated for several years until the trees are well established. The planting has been a very fair success with the exception of the larches, which, from the naturally dry gravelly soil, and followed by the extreme heat and drought of June and July, many of them failed, and will have to be replaced or substituted the coming season. In 1880, and two following years, several clumps of forest trees were planted in various fields of the farm, the object being twofold—first, for landscape effect, breaking views, etc., and secondly, to test experimentally what growth and progress may be made by the different species and varieties of forest trees under cultivation. Since then, from changes made in special fields, some of those clumps had to be removed for a time, but the original idea has not been lost sight of. Encouraged by the success of those already established, preparation is now being made for extension in this line. About ten thousand seedling trees of varied sorts, viz., Scotch and Austrian pines, larch, elm, mountain ash, sycamores and western catalpas, were procured last spring and planted in our nursing grounds for future use. The following branches of this department, namely, orchard, including small fruits, arboretum and vineyard, has been fully reported on by Prof. Panton, who has taken an active interest in these matters for educational purposes each having been made the subject matter of respective bulletins issued from time to time throughout the season, the whole of which, with additional notes of later observations, I expect will be embodied in his report of this year. I need only say that, notwithstanding a somewhat precarious season on account of the exceptionally hot and dry weather throughout the growing months, causing a shortness in the majority of farm and garden crops, we had nothing in the shape of a failure in either—what proved hurtful to some was favourable to others. Grapes were unusually good—nearly three tons of fairly matured fruit was cut, up to the first week in October, whereas in ordinary years the earliest varieties only came in about that date. Our experience, of now seven years, tell us plainly that any variety that does not ripen before, or at least equal with Concord, is unprofitable to grow in this section of country. It is true that under certain conditions, such as more shelter, a lighter soil, with a warm, well drained or gravelly sub-soil, some may be successful even in this locality, but from our past record, with a fair trial of about ninety varieties, it seems to me doubtful whether it is wise to continue growing such a large assortment with the bare probability of getting a paying crop once in six or seven years. I feel convinced that a selection of one-fifth of the above variety would include the cream of our present collection, and all that is likely to pay for their cultivation here. The earlier small fruits were very promising and good for a time, but from the continued drouth and persistently dry atmosphere, the bearing season was short.

In vegetables, potatoes, cabbage, cauliflowers and celery were under the usual yield; in everything else a good average crop was secured, and such as can be stored we have in abundance for college uses.

The lawn, flower beds, and borders generally, were satisfactory throughout the summer months, although from the somewhat limited plant growth they had not at any time that fresh luxuriant appearance characteristic of a more favourable year.

I would only further remind you that the greenhouses are still in the unsatisfactory condition reported for several years past, quite unsuited to grow the better class of pot plants, as well as too limited in extent to contain from eight to ten thousand bedding plants now necessary to furnish the grounds.

These defects have been so frequently pointed out that I deem it unnecessary repeat them here. It is only by the aid of hotbeds, frequent handling and much care that we can produce the above number of plants as we have hitherto done.

The following vegetables and fruits were supplied to the College during the year:

January.

Carrots, 3½ bush. at 30cts	$1 05	
Turnips, 2½ bush. at 20cts	50	
Onions, 4 bush. at $1.50	6 00	
Parsnips, 3 bush. at 40cts	1 20	
Salsify, 1 bush. at $1.00	1 00	
Celery, 18 doz. at 60cts	10 80	
Cabbages, 2 doz. at 70cts	1 40	
Sundries	30	$22 25

February.

Turnips, 4 bush. at 20cts	80	
Parsnips, 4¼ bush. at 40cts	1 70	
Onions, 6¾ bush. at $1.50	10 12½	
Carrots, 5 bush. at 30cts	1 50	
Cabbages, 5 doz. at 70cts	3 50	
Herbs, 3 bun. at 5cts	15	
Sundries	20	17 97½

March.

Parsnips, 4 bush. at 45cts	1 80	
Turnips, 3 bush. at 20cts	60	
Carrots, 5 bush. at 30cts	1 50	
Beets, 1½ bush. at 35cts	52½	
Onions, 6 bnsh. at $1.50	9 00	
Cabbages, 9 doz. at 70cts	6 30	
Sundries	65	20 37½

April.		
Carrots, 6 bush. at 30cts.	$1 80	
Onions, $1\frac{1}{2}$ bush. at $1.50	2 25	
Turnips, 3 bush. at 20cts.	60	
Beets, 1 bush. at 35cts	35	
Parsnips, 4 bush. at 45cts	1 80	
Salsify, $\frac{1}{4}$ bush. at $1	25	
Cabbages, 11 doz. at 70cts	7 70	
Herbs, 6 bun. at 5cts	30	
Sundries	40	
		$15 45
May.		
Turnips, 4 bush. at 20cts.	80	
Lettuce, 8 bush. at 60cts	4 80	
Parsnips, $8\frac{1}{2}$ bush. at 45cts.	3 $82\frac{1}{2}$	
Rhubarb, $25\frac{3}{4}$ bush. at 70cts	18 $02\frac{1}{2}$	
Cabbages, $1\frac{1}{3}$ doz, at 75cts.	1 00	
Asparagus, 744 bun. at 4cts	29 76	
Onions, 21 bun. at 5cts	1 05	
Sundries	85	
		60 11
June.		
Rhubarb, 18 bush. at 60cts	10 80	
Spinach, 25 bush. at 50cts	12 50	
Lettuce, $5\frac{3}{4}$ bush. at 50cts	2 $87\frac{1}{2}$	
Peas, $6\frac{1}{2}$ bush. at $1.00	6 50	
Asparagus, 783 bun. at 4cts	31 32	
Onions, 38 bun. at 5cts	1 90	
Goosberries, 211 qrts. at 6cts	12 66	
Strawberries, 178 boxes, at 7cts.	12 46	
Sundries	20	
		91 $21\frac{1}{2}$
July.		
Peas, $10\frac{1}{4}$ bush. at $1.00	10 25	
Rhubarb, $1\frac{1}{4}$ bush. at 60cts	75	
Lettuce, 2 bush, at 40cts.	80	
Spinach, $2\frac{1}{2}$ bush. at 40cts	1 00	
Beets, $1\frac{1}{2}$ bush. at 80cts	1 20	
Potatoes, $8\frac{1}{2}$ bush. at $1.50	12 75	
Carrots, $2\frac{1}{4}$ bush. at 60cts	1 35	
Beans, 4 bush. at $1.00	4 00	
Apples, 2 bush. at 80cts.	1 60	
Cucumbers, $\frac{1}{2}$ bush. at $1.40	70	
Goosberries, 91 qrts. at 6cts.	5 46	
Strawberries, 34 boxes, at 6cts.	2 04	
Raspberries, 677 boxes, at 7cts	47 39	
Currants, 182 boxes, at 6cts	10 92	
" Black, 45 boxes, at 12cts	5 40	
Onions, 20 bun. at 5cts	1 00	
Herbs, 4 bun. at 5cts	20	
Corn, 1 doz. at 8cts	8	
		106 89

August.

Beans, 4 bush. at $1.00	$4 00	
Cucumbers, 4 bush. at $1.50	6 00	
Potatoes, 18½ bush. at 90cts	16 65	
Carrots, ¾ bush. at 25cts	18½	
Apples, 13½ bush. at 70cts	9 45	
Onions, 1¼ bush. at $1.50	1 87½	
Tomatoes, 11¾ bush. at $1.30	15 27½	
Beets, ½ bush. at 25cts	12½	
Corn, 62 doz. at 8cts	4 96	
Vegetable Marrow, 7½ doz. at 60cts	4 50	
Cabbages, 3 doz. at 60cts	1 80	
Peppers, 1½ doz. at 15cts	22½	
Cauliflower, ½ doz. at 75cts	37½	
Raspberries, 55 boxes, at 7cts	3 85	
Plums, 156 qrts. at 6cts	9 36	
Sundries	20	$78 83

September.

Potatoes, 70 bush. at 65cts	45 50	
Apples (Russets), 15 bush. at 70cts.	10 50	
Apples, R. J. Greening, 6 bush. at 70 cts	4 20	
" Snow, 23 bush. at 70cts	16 10	
" Baldwin, 5 bush. at 75 cts	3 75	
" Mixed, 8½ bush. at 50 cts	4 25	
" Crab, 1 bush at $1.00	1 00	
Onions, 1 bush. at $1.50	1 50	
Pears, 1½ bush. at $1.60	2 40	
Parsnips, ¼ bush. at 40 cts	10	
Carrots, 1 bush. at 30 cts	30	
Tomatoes, 9½ bush. at 80 cts	7 60	
" Green, 4 bush. at 50 cts	2 00	
Corn, 7 dozen at 8 cts	56	
Cabbage, 2 dozen at 60 cts	1 20	
Cauliflower, 1½ dozen at 70 cts	1 05	
Peppers, 1 dozen at 15 cts	15	
Citron, 5 dozen at 60 cts	3 00	
Celery, ½ dozen at 60 cts	30	
Vegetable Marrow, 23½ dozen at 60 cents	14 10	
Plums, 96 quarts at 6 cts	5 76	
Grapes, 338 lbs. at 4 cts	13 52	
" 272 lbs. at 2 cts	5 44	
Melons, 21 at 10 cts	2 10	
Sundries	25	146 63

October.

Carrots, 2¼ bush. at 25 cts	62½	
Parsnips, 3 bush. at 40 cts	1 20	
Tomatoes, ½ bush. at 75 cts	37½	
Onions, 2½ bush. at $1.50	3 75	
Salsify, 1 bush. at $1.00	1 00	
Beets, 1 bush. at 35 cts	35	
Turnips, ¾ bush. at 15 cts	11	
Cabbage, 8 doz. at 50 cts	4 00	

Celery, $17\frac{1}{2}$ doz. at 60 cts	\$10 50	
Cauliflower, $13\frac{1}{2}$ doz. at 60 cts	8 10	
Winter Radish, $5\frac{1}{2}$ doz. at 10 cts	55	
Cabbage (pickling), $9\frac{1}{2}$ doz. at 60 cts	5 70	
Melons, 16 at 10 cts	1 60	
Sundries	80	
		\$38 66

November.

Turnips, $3\frac{1}{4}$ bush. at 15 cts	49	
Parsnips, $3\frac{1}{4}$ bush. at 40 cts	1 30	
Carrots, $2\frac{1}{4}$ bush. at 25 cts	56	
Onions, $4\frac{1}{4}$ bush. at \$1.50	6 $37\frac{1}{2}$	
Artichokes, 2 bush. at 75 cts	1 50	
Beets, 1 bush. at 35 cts	35	
Celery, $34\frac{1}{2}$ doz. at 60 cts	20 70	
Cabbage, 6 doz. at 50 cts	3 00	
Radish, 8 doz. at 10 cts	80	
Cauliflowers, 5 doz. at 60 cts	3 00	
Vegetable Marrow, 3 doz. at 10 cts	30	
Herbs, 3 buns. at 5 cts	15	
		38 $52\frac{1}{2}$

To December the 15th.

Parsnips, 2 bush. at 40 cts	80	
Artichokes, 2 bush. at 75 cts	1 50	
Turnips, $1\frac{3}{4}$ bush. at 15 cts	26	
Carrots, $1\frac{1}{2}$ bush. at 25 cts	$37\frac{1}{2}$	
Onions, 1 bush. at \$1.50	1 50	
Salsify, 1 bush. at \$1.00	1 00	
Beets, 1 bush. at 35 cts	35	
Celery, 9 doz. at 60 cts	5 40	
Radish, 4 doz. at 10 cts	40	
		11 $58\frac{1}{2}$
Total supplied to College		\$648 $49\frac{1}{2}$
To Prof. Brown at above rates, to August the 1st		48 27
Sold, and cash paid to Bursar		296 69
Total		\$993 $45\frac{1}{2}$

Inventory—Stock and Implements on hand, as per list in offices.

JAMES FORSYTH.

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To the Honoura
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PART VII.

REPORT OF THE PHYSICIAN.

GUELPH, December 31st, 1887.

To the Honourable A. M. Ross,
Commissioner of Agriculture :

SIR,—At the close of another year I have the honour of presenting my Annual Report.

I am pleased to be able to state that the College is in a good sanitary condition. I have exercised constant watchfulness during the past year, as we have had more than the usual contagious diseases in the city and country.

We have had nothing of an unusual character until the present session. During the past three months we have had a good deal of throat trouble of an inflammatory nature.

We had one case of diphtheria, which received immediate treatment and isolation, and was thereby prevented from spreading. This patient made a good recovery, for which we were thankful, as there have been a good many deaths in the city and country from this disease this year.

I am still anxious to see in connection with this Institution properly isolated apartments for the sick, where, in case of epidemic, we could remove our patients at once.

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

E. W. McGUIRE.