TWELFTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

1886.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY WARWICK & SONS, 26 AND 28 FRONT STREET WEST
1887.

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FOR THE YEAR COMM

To the Honourable A.
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DEAR SIR,—I have
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In this Report we
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REPORT OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM, GUELPH.

FOR THE YEAR COMMENCING THE 1ST JANUARY AND ENDING THE 31ST DECEMBER,

1886.

To the Honourable A. M. Ross,
Commissioner of Agriculture:

GUELPH, January 3, 1887.

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

In this Report we have reviewed briefly the work of the year 1886, under eight 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.
RART IV.—THE REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.
PART V.—THE REPORT OF THE PHYSICIAN.
PART VI.—THE REPORT OF THE PROFESSOR OF AGRICULTURE.
PART VII.—THE REPORT OF THE FOREMAN OF THE HORTICULTURAL DEPARTMENT.
PART VIII.—THE REPORT OF THE PROFESSOR OF DAIRYING.

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

JAMES MILLS,
President.

REPOR

I am pleased to
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PART I.

REPORT OF THE PRESIDENT.

INTRODUCTION.

I am pleased to observe a rapidly increasing interest in the work of agricultural education throughout this Province, and, I might say, throughout the whole Dominion. This awakening is, no doubt, due to many causes; such, for instance, as the increased efficiency of our agricultural press, the work of the Ontario Agricultural College, the reading of our reports, and the holding of Farmers' Institutes; but, perhaps, the most potent agency of all has been the simple logic of circumstances, which are forcing thoughtful people to the conclusion that something must be done to make the work of our agriculturists more productive, and secure to the farmers of this country a larger return for the labour and capital annually expended on their farms.

With a view to the accomplishment of this object, I have, for the last four years, persistently urged (1) that all teachers in training at our Normal Schools should have a short course of lectures on agriculture, live stock, dairying, and forestry; (2) that the first principles of agriculture should be taught in all our rural Public Schools; and (3) that there should be established in each of our thirteen agricultural districts, an Agricultural High School, to give young farmers instruction in agriculture, live stock, dairying, veterinary science, chemistry, geology, botany, reading, writing, spelling, arithmetic, English grammar, English literature and composition. Nothing definite has yet been done towards the adoption of any of these suggestions; but I have reason to believe that, before long, some sort of provision will be made for giving a course of lectures on agriculture to the teachers at the Toronto and Ottawa Normal Schools. When this is done, the chief difficulty in the way of introducing the subject into the Public Schools will be removed, and we may then look for brighter days.

The depressing circumstances to which I have incidentally alluded are the diminishing yield and the low price of farm produce. These two results, coming together, have given rise to some anxiety in the minds of those who fully realize that agriculture has been, and must continue to be, the chief source of our wealth and prosperity. It cannot be denied that the agricultural outlook has been somewhat discouraging; but I believe we have passed the crisis and the prospect is becoming brighter every year. Prices are not likely to be much lower than they are now; and there are indications of a larger yield than we have had for some time.

It may be laid down as fundamental, that success in Canadian farming is no longer possible without proper drainage, thorough cultivation of the soil, and the rearing and feeding of live stock enough to furnish a constant and liberal supply of good farm-yard manure. Accepting this statement as unquestionable, we enquire what the farmers of Ontario are doing, and we are pleased to find evidences of progress in the right direction. The returns of the Ontario Bureau of Industries show that the Province is spending a considerable sum of money in under-draining, is importing a larger number of thoroughbred animals from year to year, is raising and feeding more cattle, growing a smaller acreage of wheat, barley, and rye, and a larger acreage of oats, pease, and turnips—all of which goes to prove that our farmers are waking up to the necessity of thorough underdraining and more liberal manuring. Add to this the fact that the dairy industry is making rapid progress among us, and we have reason for hopefulness, rather than dis-

couragement. One thing we need very much, that is, better cultivation of the soil, to keep our land thoroughly clean and get the full benefit of frost, manure, and atmospheric action. There must be a more liberal use of the plow, gang-plow, and cultivator, before we can reasonably hope for anything like the full returns which the farms of this Province are capable of producing. The prevalent custom of plowing stubble ground only once after harvest has produced bad results. Those who follow that system do not and cannot keep their land clean. A large portion of the farm should be plowed twice every fall—ganged immediately after the crop is taken off, and plowed again the ordinary depth sometime before the winter sets in. The farmers who follow this method, who seed much to clover, and use the cultivator in the spring, are making money in spite of the low prices. There are, of course, many other points which need attention under the head of tillage; but this is not the place to discuss them. We merely mention the matter, and express the hope that the growing desire for knowledge among farmers everywhere may soon lead to much needed improvements under this head.

CHANGES AND PROGRESS AT COLLEGE.

In reviewing the events of the year 1886, we find two or three items of information, which may be more interesting to general readers than the ordinary details of College work. The most important of these items are the admission of county students, the appointment of an Advisory College Board, the erection of farm buildings, and the organization of a class for post-graduate work.

At the last session of the Ontario Legislature, two somewhat radical amendments were made in the law which governs the Ontario Agricultural College and Experimental Farm. By one, the Commissioner of Agriculture sought to encourage the attendance of farmers' sons at the College; and, by the other, he made provision for the appointment of an Advisory Board of practical farmers, to assist him in the management of the Institution.

COUNTY STUDENTS.

The first amendment was to the effect that "every County and every Territorial District in the Province shall hereafter have the privilege of having during all College terms, one student in attendance and receiving instruction at the College, without the payment of any entrance or tuition fee. The County Council of each County shall nominate the student entitled to this privilege for the County, and the Advisory Board shall nominate the students for the Territorial Districts. Such student must be the son of a practical farmer resident in the County or District, and have lived on his parent's farm at least two years prior to his admission to the College.

This amendment was received with some disfavor, when it was first proposed in the House; and several supporters of the Government expressed their disapproval in Committee: but it was passed in deference to the opinion of the Commissioner of Agriculture; and I am now in a position to say that it is likely to be a decided benefit to the College. The result is that thirty-two Counties have nominated young men, and twenty-seven of these—all farmers' sons of a good type, are now in attendance. This gives us a larger proportion of farmers' sons and a better class of students than we have had.

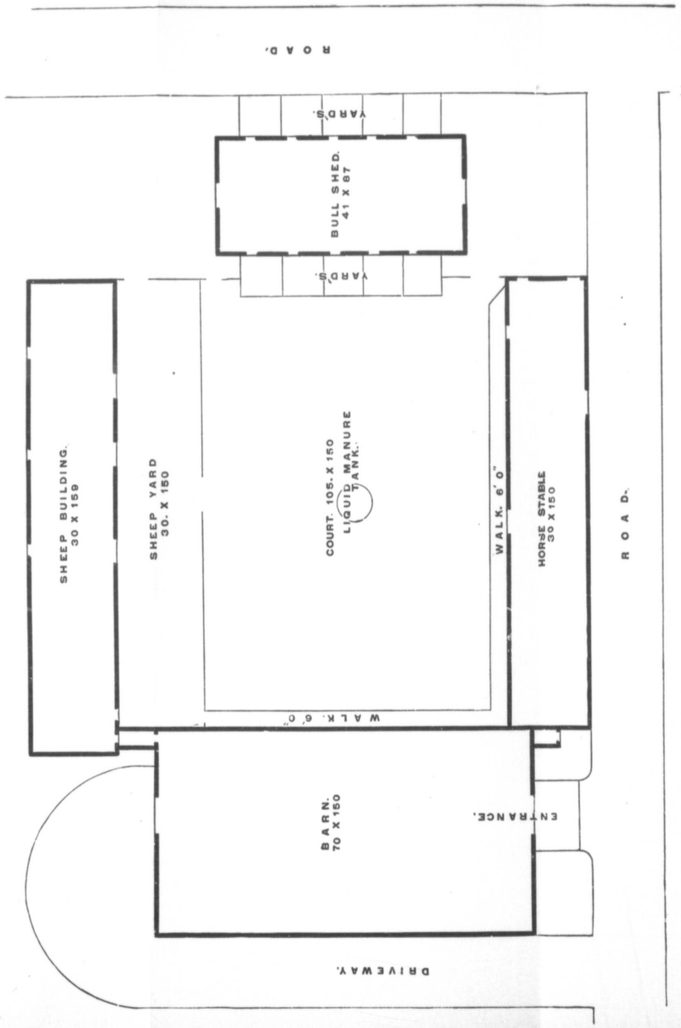
The twenty-seven Counties which are now represented by nominated students are as follows:—Brant, Bruce, Carleton, Dufferin, Frontenac, Glengarry, Haldimand, Halliburton, Kent, Leeds, Lennox and Addington, Lincoln, Middlesex, Norfolk, Northumberland and Durham, Ontario, Oxford, Peel, Peterborough, Russell, Stormont, Waterloo, Welland, Wellington, and York.

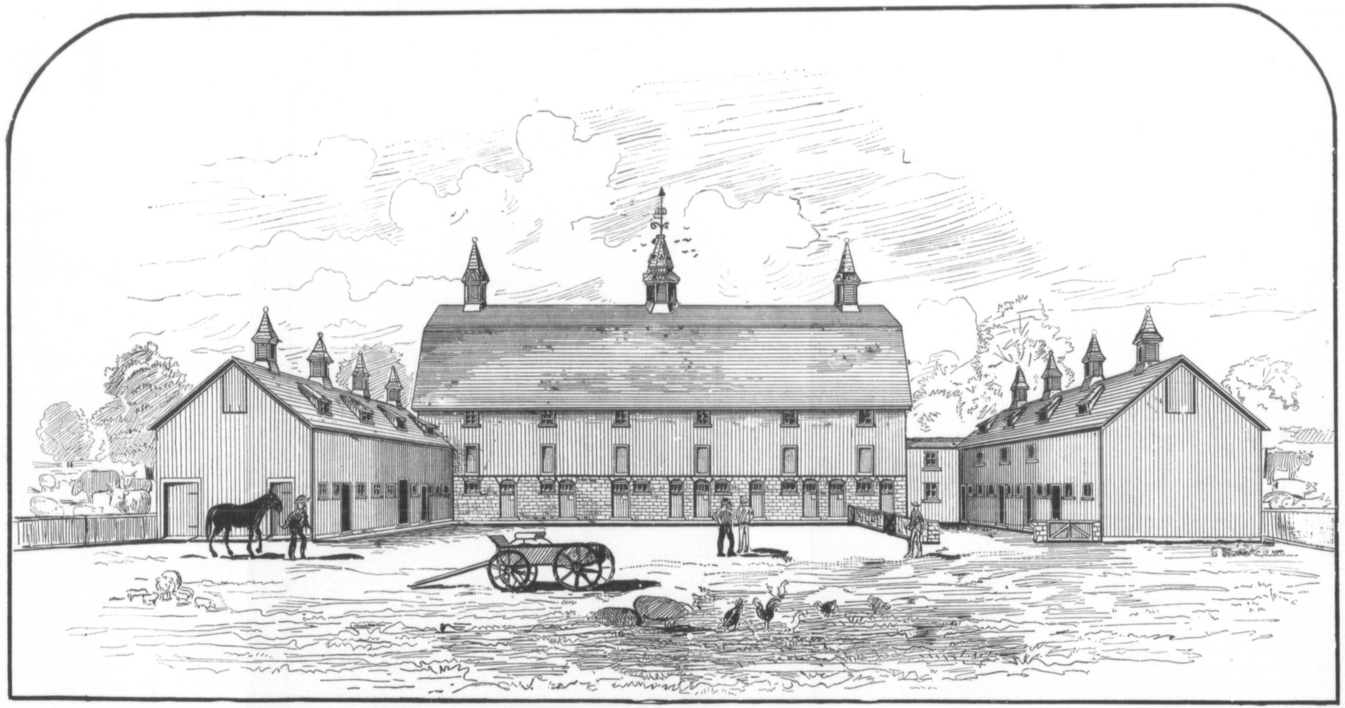
ADVISORY BOARD.

By virtue of the second amendment, an Advisory Board of practical farmers was appointed early last spring, from both political parties, to assist the Commissioner of Agricuture in the management of the different departments of the Institution, but especially the farm, regarding which the judgment of successful farmers from different parts of the Province should have considerable weight.

NEW FARM BUILDINGS.

GROUND PLAN.





NEW FARM BUILDINGS.

View from Bull Shed.

NEW FARM BUILDINGS.
GROUND PLAN.
SHEEP BUILDING.
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ONTARIO AGRICULTURAL COLLEGE, GUELPH.

DETAILS OF NEW FARM BUILDINGS.

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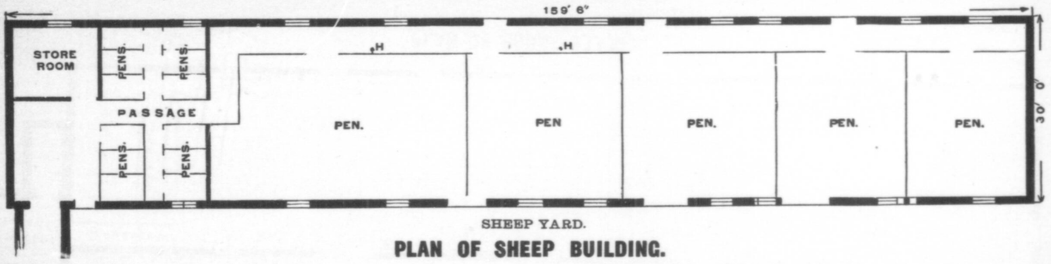
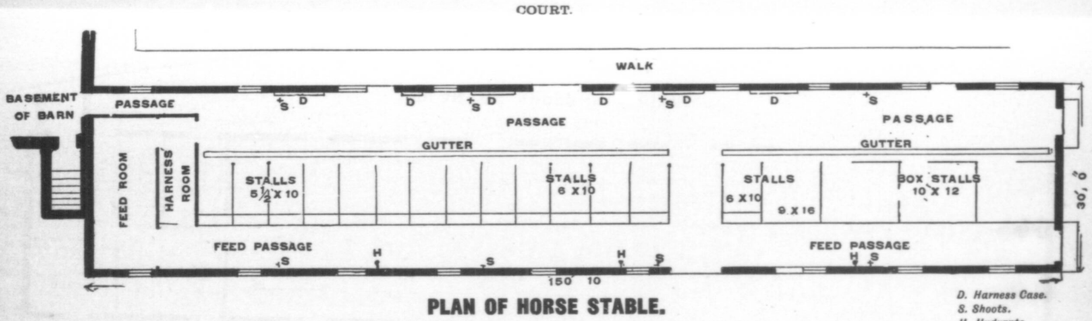
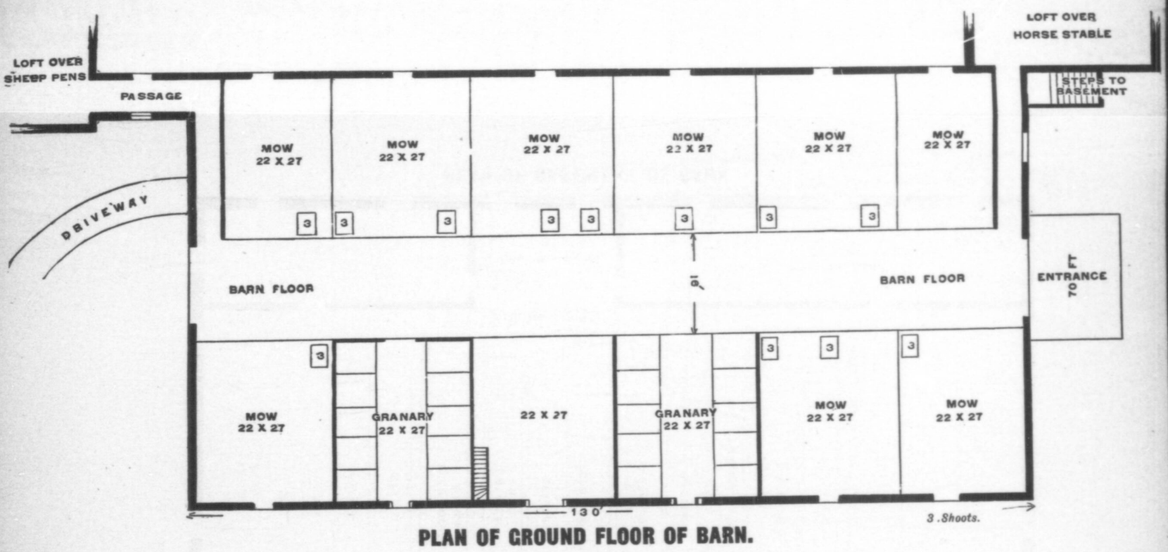


PLAN OF SHEEP BUILDING.



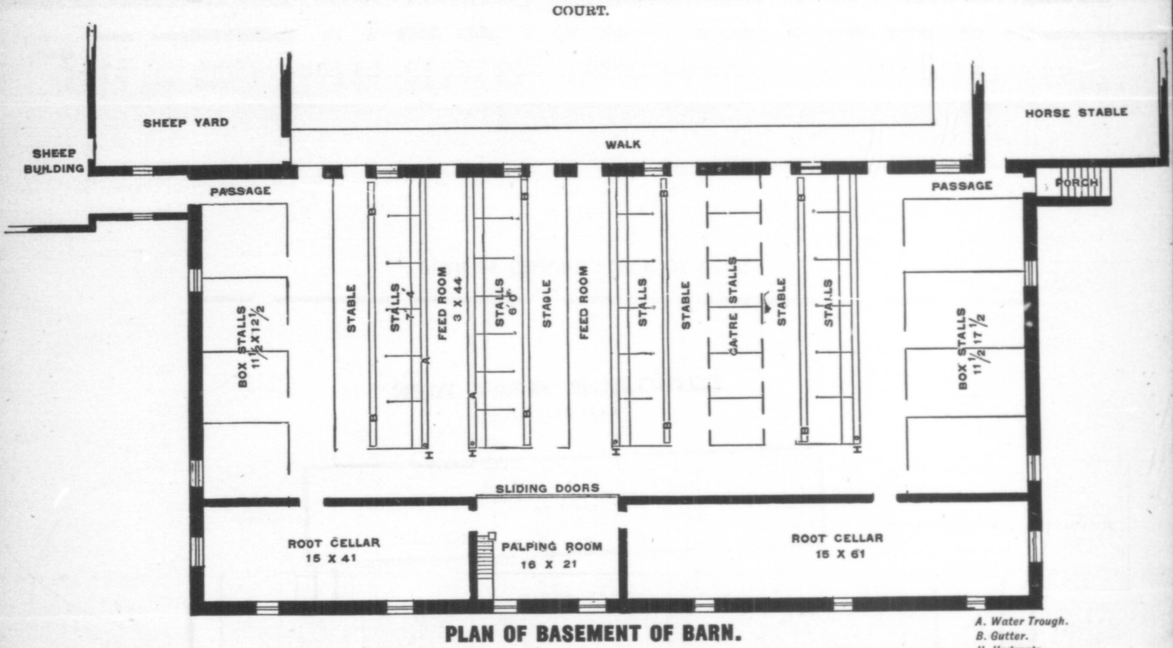
PLAN OF HORSE STABLE.

D. Harness Case.
S. Shoots.
H. Hydrants.



3. Shoots.

PLAN OF GROUND FLOOR OF BARN.



PLAN OF BASEMENT OF BARN.

A. Water Trough.
B. Gutter.
H. Hydrants.

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

DETAILS OF NEW FARM BUILDINGS.

The Board consists of eight members, one *ex-officio*, and seven appointed by the Lieutentant-Governor in Council, as follows :—

A. Blue, Deputy Commissioner of Agriculture, *ex-officio*, Toronto.
John I. Hobson, Mosboro', County of Wellington.
John McMillan, Constance, County of Huron.
Dr. William Saunders, London.
J. S. Smith, Ailsa Craig, County of Middlesex.
Edward Jeffs, Bond Head, County of Simcoe.
G. B. Boyce, Norham, County of Northumberland.
D. A. Dowling, Appleton, County of Lanark.

Chairman—John I. Hobson ; *Secretary*—A. Blue ; *Executive Committee*—John I. Hobson, John McMillan, and Edward Jeffs.

The Board held two regular meetings during the year ; the Executive Committee met once ; and the Chairman visited us from time to time, as occasion seemed to require. At these meetings the management of the College and farm was carefully looked into, some changes were recommended, and a number of suggestions made, chiefly in the direction of greater economy, better instruction in the outside departments, and more thorough efficiency everywhere. So that, already, we have reason to believe that the Commissioner's second amendment, no less than the first, will be of real service to both College and Farm.

NEW FARM BUILDINGS.

An important step in advance is the erection of new farm buildings. The old buildings, which were large and expensive, but too near the College, and not at all suited to our wants, were burned on the 29th September, 1885. New plans were prepared by Prof. Brown, and modified by Mr. Goff, the architect of the barns lately erected by Wm. Mulock, M.P., near Aurora. These plans were submitted to a special committee composed of the farmers in the Ontario Legislature and two or three others selected by the Commissioner of Agriculture. This Committee, failing to agree, the plans were abandoned; and Mr. John I. Hobson, of Mosboro', who knows more about the barns of Ontario than any other man in the Province, was requested to prepare a new set of plans. With the assistance of James Laidlaw, M.P.P., and some hints from Professor Brown, Mr. Hobson drew the plans, which were finally adopted. Mr. W. H. Worden, of Port Perry, was selected to prepare the specifications, and the contract was let to Mr. F. Schwendiman, of Drayton.

The work is now completed, and the buildings may be said to reflect credit on Mr. Hobson, Mr. Worden, and Mr. Schwendiman, alike. They consist of a large barn, with root houses and cattle stables beneath ; a good horse stable ; and a long shed with suitable yard and pens for sheep—all compactly arranged, spacious and convenient.

POST-GRADUATE WORK.

It has been felt for a length of time that the Ontario Agricultural College should furnish advanced practical instruction in Chemistry and some other branches, for Associates of the institution who may wish to continue their studies in certain departments for a few months longer than the regular course permits, with a view to preparing themselves more fully for the work of the farm, or for positions as teachers or professors of agriculture. A third year course has been suggested by some, and a special class by others.

Up to the present time, we have not seen our way clear to adopt any of these suggestions. We have considered carefully the various proposals made, and have waited until circumstances would seem to justify an extension in the direction indicated.

At length we have concluded to take the first step towards the adoption of a post-graduate course. We have decided to organize a class, which will commence on the 1st November and continue till the 15th April, or as much longer as may be desired.

The class will be open only to Associates of the College, on approval of the College Staff.

THE TERMS OF ADMISSION TO THIS CLASS ARE AS FOLLOWS :

Tuition—Free.
Board—$2.50 a week, paid from time to time, four weeks in advance.
Washing—At College rates, paid at the end of each term.
Towels, Sheets and Linen Bag—Provided by Student.
Gas and Chemicals used in Laboratory—$10 for the session, half on 1st November and half on 23rd January.
A Deposit of $5 to cover breakage, etc., to be refunded if not required.

Students in this class will be exempt from work in the outside departments, and may, with the approval of the President, confine their attention to any portion or portions of the work prescribed below, provided they put in full time on the work selected.
☞Students wishing to do so, may remain at work in the College during the Christmas vacation (22nd December to 22nd January.)

OUTLINE OF WORK.

1.—*Chemistry.*

Agricultural Chemistry—

(1) The reading of works, or portions of works, in the College Library, prescribed from term to term by the Professor of Chemistry.
(2) Reading and discussion with the Professor of Chemistry of articles in the periodicals furnished by the College.
(3) Writing of theses on subjects prescribed from time to time, and criticism of same.
(4) Lectures by Professor of Chemistry, developing more fully such subjects as—
  (i) Fertilizers.
  (ii) Soil preservation and renovation.
  (iii) Foods.
  (iv) Chemistry of the Dairy.

Laboratory Work—

(1) Handling of apparatus, chemical manipulation, manufacture of gases, etc.
(2) Qualitative analysis of water, soils, foods, fertilizers, etc.
(3) Quantitative analysis, volumetric and gravimetric, of soils, fertilizers, water, foods, and dairy products.
(4) Use of microscope in determining the composition of milk, butter, etc.
(5) Blowpipe analysis (if desired.)

2.—*Geology.*

Study of geological formations represented in Canada, and the characteristic fossils found therein ; economic products in Canadian rocks ; agencies at work in the disintegration of rocks and their influence in the formation of soil ; methods of distinguishing minerals.

3.—*Natural History and Horticulture.*

Botany.—Study of fungi, with special reference to those which are most injurious to to fruit and grain ; manipulation of the microscope, and methods of mounting specimens for microscopic examinations ; microscopic study of the structure of plants ; economic plants in addition to those treated of in the work of the second year.

Zoology.—Study of parasitic organisms injurious to farm animals ; further consideration of the vertebrata with special reference to economic birds.

Entomology.—Experiments and insecticides ; insects injurious to vegetation ; study of the life history of certain insects by personal observation and investigation on the part of the student.

The reading of portions of works and reports on this subject, as prescribed by the Professor of Natural History.

Horticulture.—Practical work in the greenhouse, garden and orchard ; discussion of general principles observed in landscape gardening ; investigation of the habits of plants by practical observation.

Special work in dairying, live stock, or veterinary science will be provided, if desired.

The organization of this class was not announced till late in October. Hence we could not expect many to enter it the first session ; but the terms of admission and the work prescribed have received the hearty approval of a number of the most prominent Associates of the College, and three have been regularly at work in the laboratory since the 1st of November.

WORK OF THE COLLEGE.

The work of the College is generally discussed under three heads :—The course of instruction, the boarding house, and the general business.

The routine in each of these varies very little from year to year. The course of instruction remains nearly the same, there is but little change in the buildings, and the general business is subject to slight variation.

I.—THE COURSE OF INSTRUCTION IN THE COLLEGE.

The scholastic year begins on the 1st of October, and ends on the 31st of August. It is divided into two sessions, and each session into two terms.

Sessions.

Winter Session, embracing the Fall and Winter Terms—1st October to 16th April, omitting the Christmas vacation.

Summer Session, embracing the Spring and Summer Terms—16th April to 31st August.

Terms.

Fall Term—1st October to 22nd December.
Winter Term—22nd January to 16th April.
Spring Term—17th April to 30th June.
Summer Term—1st July to 31st August.

Subjects Taught.

The regular course of study extends over a period of two years, and includes the following subjects :—

First Year.—Agriculture, Live Stock, Dairying, Inorganic Chemistry, Organic Chemistry, Geology, Structural Botany, Physiology, Zoology, Veterinary Anatomy and Materia Medica, English Literature and Composition, Book-keeping, Arithmetic and Mensuration.

Second Year.—Agriculture, Live Stock, Dairying, Arboriculture, Agricultural Chemistry, Meteorology, Systematic and Economic Botany, Entomology, Horticulture, Veterinary Pathology and Obstetrics, English Literature, Political Economy, Book-keeping, Mechanics, Levelling and Draining.

Method of Instruction.

The method of instruction is chiefly by lectures. Authors are read and studied in connection with the lectures on English Literature, Political Economy, and Systematic Botany ; but in the other subjects, text-books are not used in the class-room, except for occasional reference.

THE STAFF.

1. James Mills, M.A., *President.*

English Literature and Political Economy.

1. 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.

J. W. Robertson.

Dairying.

7. E. L. Hunt, Third Year Undergraduate, University of Toronto.

Arithmetic, Mensuration, Mechanics, Levelling, Elementary Surveying, and Book-keeping.

THE YEAR 1886.

In addition to what I have already mentioned, there has been nothing specially noteworthy in the year 1886, unless, perhaps, the change in regard to instruction in the outside departments.

Formerly the foremen of the several departments had no definite time set apart for the instruction of students. They were expected to do what they could at all times, but had no definite instructions regarding that part of their work, and the result was a good deal of complaining about lack of instruction.

At the first meeting of the Advisory Board, held last spring, the question of outside instruction was fully discussed; and the decision arrived at was that the Farm Foreman, the Gardener, and the Carpenter, must each devote every afternoon faithfully to the definite and specific instruction of the students sent to his department, throughout the lecture season, that is, from the 1st October to the 1st July in each scholastic year. Since that time the work has been better attended to; and it is hoped that there may not hereafter be any ground for complaint under this head.

This latter arrangement does not, of course, interfere with the work of the regular instructor, who spends the afternoons in teaching students how to plow, harrow, and perform other operations on the farm.

Changes in the Staff.

In my last report I spoke of the vacancy in the Department of Chemistry, occasioned by the death of Dr. Hare. The department was without a Professor from October to January; and at the latter date the vacancy was filled by the appointment of C. C. James, M.A., of Napanee.

During the winter, S. M. Barré resigned his position as Professor of Dairying, to undertake similar work in the Province of Manitoba; and J. W. Robertson, of Harriston, was appointed to take his place.

Both these appointments have proved very satisfactory.

Attendance.

The roll given below contains the names of those who have been in attendance any time during the year, making a total of 149, and representing the following places:—Ontario, 94; England, 26; Quebec, 8; Ireland, 4; Nova Scotia, 4; Scotland, 3; New Brunswick, 3; North-West Territory, 2; Prince Edward Island, 2; Cape Breton, Turkey and the Island of Jersey, 1 each.

Of this number, 91 were in attendance in the Fall Term of 1885; 10 entered in April and 45 in October, 1886.

There are 83 in attendance at the present time—3 associates engaged in post-graduate work, 24 second and 56 first year students.

COLLEGE ROLL FOR 1886.

NAMES.	P. O. ADDRESS.	COUNTY, Etc.
Acres, A.	Ottawa	City, Ont.
Austin, A. M.	Thornholme, Sunderland	England.
Bayne, S. R.	Lee, Kent	England.
Birdsall, W. G.	Birdsall	Peterborough, Ont.
Bishop, W. R.	Brussells	Huron, Ont.
Boyd, W. C.	London	Middlesex, Ont.
Bowie, T. M.	Mount Forest	Wellington, Ont.
Bradley, G. R.	Manotick	Carleton, Ont.
Broome, A. H.	Henley-on-Thames	England.
Brown, C. R.	Norwood	Peterborough, Ont.
Brown, S. P.	Whitby	Ontario, Ont.
Brush, G. H.	Clifton, Bristol	England.
Budd, W.	Delhi	Norfolk, Ont.
Calvert, S.	Rochdale	England.
Carlaw, G.	Warkworth	Northumberland, Ont.
Carman, H. D.	Sarnia	Lambton, Ont.
Carpenter, W. S.	Simcoe	Norfolk, Ont.
Chadsey, W.	Wellington	Prince Edward, Ont.
Cleugh, H. H.	Sarginson	Northumberland, Ont.
Cobb, C.	London	City, Ont.
Cockburn, J. S.	Hamilton	City, Ont.
Coutts, W. F.	Glammis	Bruce, Ont.
Craig, D. J.	Edinburgh	Scotland.
Craig, H.	Carsonby	Carleton, Ont.
Craig, J. A.	Russell	Russell, Ont.
Creelman, G. C.	Collingwood	Grey, Ont.
Culshaw, C.	Ashton on Ribble	England.
Davidson, J. F.	Peterborough	Peterborough, Ont.
Dean, H. H.	Harley	Brant, Ont.
De Mauritz, R.	London, E. C.	England.
Denison, D.	Selby	Lennox, Ont.
Denton, E.	London	City, Ont.
Donald, J. C.	St. George	Brant, Ont.
Donaldson, F. N.	Mobarnane, Tipperary	Ireland.
Donnelly, P. E.	Montreal	City, Q.
Drysdale, W. P.	Liverpool	England.
Elton, C. W.	Pincher Creek, near Fort MacLeod	North-West Territory.
Elton, R. F.	do do	do do
Esplen, J. H.	Burgoyne	Bruce, Ont.
Etherington, C. B.	Torquay, Devon	England.
Ewing, W.	Mulmur	Dufferin, Ont.
Farlinger, T.	Dundee	Quebec.
Fee, J. J.	Toronto	City, Ont.
Furness, D.	Toronto	City, Ont.

COLLEGE ROLL—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, Etc.
Gardiner, R. J.	Guelph	City, Ont.
Gibant, E. D.	St. Heliers	Jersey.
Gilbert, W. J.	Shediac	New Brunswick.
Globensky, E. A.	Saint Eustache	Quebec.
Graham, G. M.	Penzance, Cornwall	England.
Harcourt, G.	St. Ann's	Lincoln, Ont.
Harkness, A. D.	Irene	Dundas, Ont.
Harrison, R. S.	Stirton, Lincoln, Nottinghamshire	England.
Hart, J. A.	Berwick	Nova Scotia.
Hart, J. W.	Bridgetown	Nova Scotia.
Haslam, G. T.	Dublin	Ireland.
Heacock, F. W.	Kettleby	York, Ont.
Higinbotham, H. B.	Guelph	City, Ont.
Hirsch, J.	Manchester	England.
Holtby, R. M.	Manchester	Ontario, Ont.
Horrocks, T. J.	Toronto	City, Ont.
Howes, J. S.	Harriston	Wellington, Ont.
Idington, P. S.	Stratford	Perth, Ont.
Jeffrey, J. S.	Toronto	City, Ont.
Johnston, J. F.	Ottawa	City, Ont.
Kellogg, C. A.	Thamesville	Kent, Ont.
Kellogg, W. J.	Thamesville	Kent, Ont.
King, R. E.	Decewsville	Haldimand, Ont.
Knowlton, S. M.	Newboro'	Leeds, Ont.
Lea, H. F.	Toronto	City, Ont.
Leavens, D. H.	Belleville	Hastings, Ont.
Leadingham, A. M.	Turriff, Aberdeen	Scotland.
Leslie, J. P.	Georgetown	Halton, Ont.
Lick, E.	Oshawa	Ontario, Ont.
Livesey, E. M.	London	England.
Lyster, G. R.	Guelph	City, Ont.
Macfarlane, A. D.	Wallace	Nova Scotia.
Macdonald, P.	Caughnawaga	Quebec.
Madge, R. W.	Brucefield	Huron, Ont.
March, H.	Rochdale	England.
Marsh, G. F.	Thornbury	Grey, Ont.
McCallum, E. G.	Mantintown	Glengarry, Ont.
McIntosh, W. W.	Toronto	City, Ontario.
McKay, J. G.	Underwood	Bruce, Ont.
McKenzie, A. G.	Fairview	Oxford, Ont.
McLean, R. M.	Ottawa	City, Ont.
McNiven, W.	Mountsburg	Wentworth, Ont.
Meikle, W. F.	Morrisburg	Dundas, Ont.
Menzies, R. M.	Almonte	Lanark, Ont.
Mill, J. S.	Maria, Bonaventure	Quebec.
Miller, J. R.	Cow Bay	Cape Breton.
Moodie, J. W.	Toronto	City, Ont.
Morgan, J. H. A.	Kerwood	Middlesex, Ont.
Morrison, W. S.	Minden	Haliburton, Ont.
Muir, J. B.	North Bruce	Bruce, Ont.
Mutton, F. A.	Toronto	City, Ont.
Nelles, S. W.	York	Haldimand, Ont.
Notman, C. R.	Toronto	City, Ont.
Orsman, C. P.	Bathurst	Lanark, Ont.
Owen, W. H.	Hull	England.
Pady, W. J.	Barstaple, Devon	England.
Palmer, W. J.	Charlottetown	Prince Edward Island.
Paterson, B. E.	Ottawa	City, Ontario.
Patterson, J. W.	Constantinople	Turkey.
Poe, J. P.	Callan	Ireland.
Power, R. H.	Barrie	Simcoe, Ont.
Price, V.	Selby Oak, near Birmingham	England.
Rayden, J. S.	Charlottetown	Prince Edward Island.
Renfrew, W. C.	Quebec	City, Q.
Ritchie, H.	Toronto	City, Ont.
Robertson, D.	Kircudbright	Scotland.
Robson, J. W.	Liverpool	England.
Roome, H.	London	England.

NAMES.

Ross, J.
Routhier, J. A.
Rowen, M. B.
Serson, W. E.
Schofield, E. A.
Scott, J. A.
Scrugham, J. G.
Shantz, A.
Sharman, H. B.
Shirreffs, G. G.
Sinclair, J. J.
Sleightholm, F.
Smithers, A. S.
Somerville, A. R.
Soules, R. M.
Steacy, M. W.
Stewart, J. B.
Stewart, R.
Stubbs, H. C.
Sturge, E.
Sullivan, R.
Sweet, H. R.
Taylor, F. O.
Thompson, F. F.
Valance, R.
Van Luven, R. M.
Walter, J. R.
Warner, F. C.
Watts, W. G.
White, S. A.
Wiggins, G. C.
Willans, T. B.
Willans, N.
Williams, J. B.
Wilmot, A. B.
Zavitz, C. A.

Counties, etc.

Brant
Bruce
Carleton
Cape Breton
Dufferin
Dundas
England
Frontenac
Glengarry
Grey
Guelph
Haldimand
Halliburton
Hamilton
Halton
Hastings
Huron

College Roll—*Concluded.*

NAMES.	NAMES.	COUNTY, Etc.
Ross, J.	Whitechurch	Bruce, Ont.
Routhier, J. A.	Ottawa	City, Ont.
Rowen, M. B.	Holt	York, Ont.
Serson, W. E	Antrim	Carleton, Ont.
Schofield, E. A.	St. John	New Brunswick.
Scott, J. A.	Stoke, Devenport	England.
Scrugham, J. G.	Toronto	City, Ont.
Shantz, A.	Waterloo	Waterloo, Ont.
Sharman, H. B.	Stratford	Perth, Ont.
Shirreffs, G. G.	Clarence	Russell, Ont.
Sinclair, J. J.	Ridgetown	Kent, Ont.
Sleightholm, F.	Humber	Peel, Ont.
Smithers, A. S.	Montreal	City, Q.
Somerville, A. R.	Huntingdon	Quebec.
Soules, R. M.	South End	Welland, Ont.
Steacy, M. W.	Warburton	Leeds, Ont.
Stewart, J. B.	Peterborough	Peterborough, Ont.
Stewart, R.	Ottawa	City, Ont.
Stubbs, H. C.	Liverpool	England.
Sturge, E	Penzance, Cornwall	England.
Sullivan, R.	Dublin	Ireland.
Sweet, H. R.	Selby	Lennox, Ont.
Taylor, F. O.	Clifton, Bristol	England.
Thompson, F. F.	Uxbridge	Ontario, Ont.
Valance, R.	Osnabruck Centre	Stormont, Ont.
Van Luven, R. M.	Murvale	Frontenac, Ont.
Walter, J. R.	Wellington, Somerset	England.
Warner, F. C.	Decewsville	Haldimand, Ont.
Watts, W. G.	Dockenfield, Surrey	England.
White, S. A.	Ottawa	City, Ont.
Wiggins, G. C.	Windsor	Nova Scotia.
Willans, T. B.	Leeds	England.
Willans, N.	Leeds	England.
Williams, J. B.	Guelph	City, Ont.
Wilmot, A. B.	Oromocto	New Brunswick.
Zavitz, C. A.	Coldstream	Middlesex, Ont.

Analysis of Roll.

Counties, etc.	Students.	Counties, etc.	Students.
Brant	2	Ireland	4
Bruce	5	Island of Jersey	1
Carleton	3	Kent	3
Cape Breton	1	Lambton	1
Dufferin	1	Lanark	2
Dundas	2	Leeds	1
England	25	Lennox	2
Frontenac	1	London	2
Glengarry	1	Lincoln	1
Grey	2	Middlesex	3
Guelph	4	New Brunswick	3
Haldimand	3	Norfolk	2
Halliburton	1	Northumberland	2
Hamilton	1	North-West Territory	2
Halton	1	Nova Scotia	4
Hastings	1	Ontario (County)	4
Huron	2	Ottawa	7

ANALYSIS OF ROLL—*Concluded.*

Counties, etc.	Students.	Counties, etc.	Students.
Oxford	1	Stormont	1
Peel	1	Toronto	11
Perth	2	Turkey	1
Peterborough	4	Waterloo	1
Prince Edward (County)	1	Welland	1
Prince Edward Island	2	Wellington	2
Quebec	8	Wentworth	1
Russell	3	York	2
Scotland	4		
Simcoe	1		149

Ontario Students	94
Non-residents	55
Ontario Counties represented	36

RELIGIOUS DENOMINATIONS.

The College is patronized by members or adherents of nearly all the religious organizations in the Province. Last year there were eleven denominations represented in our class-lists, as follows :—

Presbyterians	47	Roman Catholics	3
Episcopalians	43	Bretheren	2
Methodists	29	Friends	2
Congregationalists	8	Menonite	1
Baptists	7		
Christians	4	Total	149
Protestants	3		

CLASS-ROOM WORK.

Lectures began, as usual, on the 1st October, 1885, and continued till the 30th June, 1886, which latter date was the end of the scholastic year, 1885-86.

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 system of rotation.

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

Miscellaneous.—Roads, lanes, fences.

Department 2.—Natural Science.

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

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

Human Physiology and Hygiene.—Description of the different tissues in 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 characters of each sub-kingdom, with special reference to classes of 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 Coleridge's "Ancient Mariner."

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 animals to keep.

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

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

Department 2.—Natural Science.

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

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

Zoology (Continued).—Sub-kingdoms further described ; detailed account of some injurious parasites, such as "liver fluke," "taperworm," "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.—Committing to memory and critical study of Goldsmith's "Traveller."

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.

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 Classics.—Committing to memory and critical study of Wordsworth's "Excursion," Book I.

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 animls 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 "King Richard the Second."

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 ontside 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 the plants grown in our green-houses, and the shrubs, etc., on lawn.

DEPARTMENT 3.—VETERINARY SCIENCE.

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

Veterinary Obstetrics.—Description of fœtal coverings. Phenomena 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.

FARMERS' INSTITUTES.

This is an age of associations and conventions. People seem to realize more than ever that union is strength and that combination is the most effective means of securing desired results in times of keen competition and aggressive enterprise.

Every trade and profession has some sort of representative organization which meets periodically for an interchange of opinion and for the discussion of matters which affect its rights, privileges, and standing in the community. The lawyers have their society, the doctors their association, and the Knights of Labor their union. These all have definite and specific objects in view, and among the secondary aims and incidental results are social enjoyment, mental improvement, and some advancement in technical knowledge.

Farmers, in this country at least, have never succeeded in forming an association to represent them as a class. The Grange organization was intended to do so; but there

are certain things about it which have made it distasteful to many, and obnoxious to some. Hence it has not received the support of farmers generally, and cannot be said to represent more than a small section of the farming community.

Farmers' Institutes are not intended to be in any way representative of agriculturists as a class. They are merely local groupings of farmers for the purpose of comparing notes, giving the results of experience, and reading and discussing papers on agriculture, live stock, dairying, fruit-growing, forestry, and other topics in which the farmers of each locality are specially interested.

Quite a number of such Institutes were held by the farmers of Ontario last year. The Professors of the College assisted in holding twenty-six; and in every case their efforts seemed to be appreciated and I have no doubt will be productive of much good. The farmers engaged very heartily in the work of preparing and reading papers,—took a leading part in the discussions, and appeared anxious to gain information about the minutest details of successful farming.

The plan on which we proceed is as follows: The farmers themselves organize Institutes according to instructions issued by the Commissioner of Agriculture, and hold at least two meetings in the year; and the Professors of the College assist at these meetings as often as they can do so, during the Christmas vacation, *i. e.*, from the 22nd December to the 22nd January.

Each Institute occupies about a day and a half, commencing at half-past one o'clock the first day and continuing till some time in the afternoon of the second day. In the evening of the first day, there is a public meeting at which the entertainment consists of music and short addresses.

The Government pays the travelling expenses of the Professors; and the locality in which the Institute is held provides a place of meeting and pays for heat, light, and local advertising.

The following list contains the names of the twenty-six places at which we assisted in holding Institutes last year: Newmarket (York), Collingweod (Simcoe), Lindsay (Victoria), Bobcaygeon (Victoria), Almonte (Lanark), Renfrew (Renfrew), Iroquois (Dundas), Gananoque (Leeds), Belleville (Hastings), Picton (Prince Edward), Brighton (Northumberland), Oshawa (Ontario), Georgetown (Halton), Drayton (Wellington), Durham (Grey), Markdale (Grey), Owen Sound (Grey), Brussels (Huron), Seaforth (Huron), Simcoe (Norfolk), St. Thomas (Elgin), Thamesville (Kent), Wanstead (Lambton), London (Middlesex), Brantford (Brant), St. George (Brant.)

WINTER TERM, 1886.

23rd January to the 16th April.

The students in attendance were those who had entered at the beginning of the Fall Term in October, 1885, or previous to that date—91 in number; and the work was to a large extent a continuation of the subjects begun at that time.

CLASS-ROOM WORK.

The term was ten weeks and three days long, exclusive of the time spent in the Easter examinations; and the lectures delivered were as follows:—

First Year.—31	lectures,	one hour each,	on Agriculture and Live Stock.
31	"	"	Chemistry.
20	"	"	Natural History.
21	"	"	Veterinary Anatomy.
20	"	"	English Literature.
10	"	"	English Composition.
29	"	"	Arithmetic and Book-keeping.
162			

Second Year.—15 lectures, one hour each, on Agriculture and Live Stock.

6	"	"	Arboriculture.
31	"	"	Agricultural Chemistry.
11	"	"	Entomology.
21	"	"	Political Economy.
20	"	"	English Literature.
21	"	"	Veterinary Pathology.
21	"	"	Statics, Hydrostatics, and Book-keeping.
146			

Also one hour a week was spent by the second year students in the practical handling and judging of horses, under the supervision of Dr. Grenside, our Veterinary Surgeon.

Department 1.—Agriculture and Live Stock.

In this department, the first year students devoted three hours a week to the study of the characteristic points and peculiarities of the leading breeds of sheep and horses ; and the second year men spent six hours on general agriculture, six hours on arboriculture, and eleven hours in handling, judging, and comparing the different breeds and varieties of sheep and cattle. Under the last head, the method of instruction was the same as usual, nd may be described as follows :—

A specimen of some kind, say a Shorthorn steer, is brought into the lecture-room, which is so arranged with galleried seats that every student while in his place taking notes has a full view of the lecturer and all his movements. The different parts of the animal are first pointed out and named, such for example, as the brisket, crops, loins, twist, etc. After this has been several times repeated, the students are called on to point out and name the several parts in presence of their class-mates. The lecturer then criticises the animal more closely, indicating the strong and the week points, and giving his estimate of it as a whole. Afterwards several animals of different breeds are brought in together, and he proceeds to describe and illustrate what are considered the good points of the animals for beef and milk, comparing and contrasting Shorthorns, Herefords, Polled Angus, Devons, Galloways, Ayrshires, Holsteins, Guernseys, and Jerseys, breed with breed, in regard to shape of frame, quality of flesh, feeding, fattening, milking, hardiness, and other properties. Much the same course is pursued with the different breeds of sheep. Cotswolds, Leicesters, Lincolns, Southdowns, Oxford Downs, Shropshire Downs, Hampshire Downs, and Merinos, are frequently examined in the class-room and compared with one another as regards carcass, constitution, wool, mutton, feeding, hardiness, etc. Thus the instruction in this department is made in the strictest sense definite and practical.

Department 2.—Natural Science.

The work of the Winter Term in the department of Natural Science embraces Inorganic Chemistry, Organic Chemistry, Zoology, Agricultural Chemistry, and Entomology.

In the winter of 1886, our first year students spent a few weeks in completing the Inorganic Chemistry which they had studied throughout the Fall Term, and then took up the more difficult, but no less interesting subject of Organic Chemistry. They had a course of lectures from Professor James on the most important organic compounds, and gave special attention to the nature and sources of starch, sugar, oils, fats, the albuminoids, or flesh-formers, and other substances which have a more or less direct bearing on general agriculture and the feeding of animals. At the same time they attended Professor Panton's lectures on Zoology, to get a general knowledge of the animal kingdom as a whole, and thereby fit themselves for becoming more intelligent and appreciative students of particular parts of that kingdom under the heads of Entomology and Veterinary Science.

The second year men were at the same time engaged in the study of Agricultural Chemistry and Entomology. During the previous term they had learned the relation of

Chemistry to Agriculture and Stock-raising; and with this knowledge they now proceeded to study the nature and sources of plant food, the origin and properties of the different kinds of soil, their preservation and renovation, the causes of unproductiveness, the properties and uses of various manures, the chemical composition of a number of fodders, and the nutritive value of each. On subjects such as these they spent three hours a week; and at the same time took a course of lectures delivered by the Professor of Natural History, on the marks, habits, and depredations of the principal insects that infest our crops and fruits, seeking especially to learn the best means of checking and preventing their ravages.

Department 3.—Veterinary Science.

As will be seen from the syllabus of lectures given on a previous page, the Winter Term in the Veterinary Department is devoted to the anatomy, physiology, and pathology of the horse, ox, sheep, and pig. The lectures to the first year students were on the anatomy and physiology of these animals, and were illustrated by the complete skeleton of a horse and portions of other skeletons. The second year lectures discussed various diseases and their treatment, especially the common ailments of the horse, as spavin, ringbone, curb, founder, inflammation, and such like; and, for the purpose of making the instruction as practical as possible, horses were regularly brought into the class-room and examined, first by the professor in the presence of the class, and afterwards by the students themselves. In this way the veterinary surgeon was each day enabled to see whether his lectures were really understood or not by those to whom they were delivered.

See Professor Grenside's report in part IV of this volume.

Department 4.—English Literature and Political Economy.

We spend no time on any foreign language, and not much on anything which has not a direct bearing on the duties of a Canadian farmer. We give all the subjects of the programme a fair share of attention, but lay most stress on Agriculture, Live Stock, Chemistry, and Veterinary Science. Our primary aim is to make good practical farmers; but we are not forgetful of the fact that it is no less important to make good citizens—to add some of the graces of a broader culture, and thereby fit our students for filling positions of trust, influence, and responsibility in Church and State.

The kind of an education which enables a man to make the most of his abilities in the social circle, the municipality, or the political arena, is got, not by confining the attention to any single subject, but by reading, writing and conversation, and from the sharpening and refining influence of many studies. At the same time, I think there is nothing else which contributes so much towards that end, and tends so directly to create and foster a taste for reading, as frequent practice in composition and the critical reading of selections from classic authors; and for this reason we devote all the time we can spare to exercises of this kind.

During the Winter Term of 1886 the first year students spent one hour a week on exercises in composition, and two hours in the critical study of Goldsmith's "Traveller." The second year men read Shakespeare's "Julius Cæsar" and "King Richard the Second," and committed to memory the best passages in each. They also devoted two hours a week to the discussion of such questions as are usually considered under the head of Political Economy—land, labour, capital, the production and distribution of wealth, strikes, lockouts, etc.

Department 5.—Mathematics and Book-Keeping.

Under this head, we have not undertaken anything beyond Arithmetic, Mensuration, Elementary Mechanics, and the less difficult operations in Levelling and Surveying. Even in these few branches, we lay most stress on what is likely to have frequent application in the ordinary business of a farming community. The Book-keeping also is of a special kind. It might be called Farm Book-keeping—farm, garden, field and dairy accounts.

Special Live Stock and Veterinary Class.

A special class was organized in October, 1885, as in the three previous years, for those who wished to devote their whole time during the winter months to the study of live stock and veterinary science.

There were five applicants for this class—one new student and four from the regular course; but only three remained for the examinations at Easter.

Easter Examinations.

The Easter Examinations were, as usual, on the class-room work of the Winter Session (1st October to 16th April). They commenced on the 6th and ended on the 16th April. The questions set in the different subjects will be found in the first part of Appendix 2. Most of the papers were difficult enough to differentiate the best students, while they gave all honest students a chance to pass.

Oral examinations on live stock were conducted as usual. Cattle, sheep, and horses were taken into the Veterinary Class-room on successive days; and the students, being admitted one at a time, were required to handle and judge the animals submitted, as if they were in a show-ring.

Examiners.

The examinations were conducted by the Professors of the College and the following outside gentlemen, to whom we are specially indebted and beg to return our sincere thanks:

John Hobson, Esq., Mosboro', Wellington .....Stock-Breeding and Feeding.
S. C. Smoke, B.A., Toronto.....English Literature.
Wm. Douglas, B.A., Toronto .....Political Economy.

Honours.

A complete record of all the candidates, regular and special, will be found in the Class Lists (Appendix 3)—not only those who passed or won honours, but also those who failed. A fair proportion got first-class honours in individual subjects, and a few gained the rank of first-class men in one or more of the five departments, and received honour certificates, as follows:

Honour Certificates.

Easter Examinations, 1886.

First Year.

Agriculture and Live Stock—

Natural Science—1. Scrugham, J. G., Toronto; 2. Sleightholm, J., Humber, Peel, Ont.; 3. Lick, E., Oshawa, Ont.; 4. Craig, J. A., Russell, Ont.; 5. Donaldson, F. N. Tipperary, Ireland; 6. Pady, W. J., Barnstaple, England; 7. Orsman, C. P., Bathurst, Lanark, Ont.; 8. Hart, J. W., Bridgetown, N. S.; 9. Johnston, J. F., Ottawa.

Veterinary Science—1. Scrugham; 2. Lick; 3. Bishop, W. R., Brussels, Ont.; 4. Sleightholm; 5. King, R. E., Decewsville, Haldimand, Ont.

English Literature and Composition—1. Scrugham; 2. Donald, J. C., St. George, Ont., and Donaldson; 4. Sleightholm; 5. Hart; 6. Lick; 7. Ledingham, A. M., Turriff, Scotland; 8. Johnston; 9. Pady; 10. Morgan, J. H., Kerwood, Ont.

Mathematics and Book-Keeping—1. Scrugham; 2. Lick; 3. Marsh, G. F., Thornbury, Ont.; 4. Hart; 5. Orsman; 6. Harkness, A. D., Irene, Dundas, Ont.; 7. Sleightholm; 8. Donald; 9. Howes, J. S., Harriston, Ont.; 10. Pady.

Second Year.

Agriculture and Live Stock—1. Zavitz, C. A., Coldstream, Middlesex, Ont.; 2. Brown, C. R., Norwood, Peterborough; 3. Sturge, E., Penzance, England; 4. Madge, R. W., Brucefield, Ont.; 5. Owen, W. H., Hull, England.

Natural Science—1. Madge; 2. Sturge; 3. Brown; 4. Zavitz; 5. Owen; 6. Fee, J. J., Toronto.

Veterinary Science—1. Owen; 2. Sturge; 3. Madge; 4. Holtby, R. M., Manchester, Ont.; 5. Zavitz; 6. Walter, J. R., Somerset, England.

English Literature and Political Economy—1. Madge; 2. Sturge; 3. Owen; 4. Jeffery, J. S., Toronto; 5. Calvert, S., Rochdale, England; 6. Fee.

Mathematics and Book-Keeping—1. Brown; 2. Zavitz.

Prizemen.

CHRISTMAS AND EASTER EXAMINATIONS.

First Year.

Agriculture and Live Stock.

1st. { J. Sleightholm. / J. G. Scrugham,
2nd. J. W. Hart.

Natural Science.

1st. J. G. Schrugham.
2nd. J. Sleightholm.

Veterinary Science.

1st. E. Lick.
2nd. J. G. Scrugham.

English Literature and Composition.

1st. J. G. Scrugham.
2nd. J. F. Johnston.

Mathematics and Book-Keeping.

1st. J. G. Scrugham.
2nd. E. Lick.

General Proficiency.

1st. J. G. Scrugham.
2nd. J. Sleightholm.
3rd. E. Lick.

Second Year.

Agriculture and Arboriculture.

1st. C. A. Zavitz.
2nd. C. R. Brown.

Natural Science.

1st. R. W. Madge.
2nd. C. R. Brown.

Veterinary Science.

1st. W. H. Owen.
2nd. E. Sturge.

Eng. Lit. and Political Economy.

1st. R. W. Madge.
2nd. E. Calvert.

Mathematics and Book-Keeping.

1st. C. R. Brown.
2nd. C. A. Zavitz.

General Proficiency.

1st. R. W. Madge.
2nd. E. Sturge.
3rd. C. R. Brown.

Special Live Stock and Veterinary Class.

Silver Medal—J. R. WALTER, Wellington, Somerset, England.

SPRING TERM.

(17th April to 30th June.)

The members of the special class and some others left at Easter. Ten new students were admitted, and the routine continued inside and outside pretty much as during Winter Term.

The class-room work of the first year students embraced agriculture, geology, botany, vererinary materia medica, Wordsworth's "Excursion," and mensuration. That of the second year students included agriculture, analytical chemistry, systematic and economic botany, veterinary materia medica and obstetrics, Millon's "L'Allegro" and "Il Pensenoso," and the outlines of levelling, surveying and road-making.

Examinations.

The Midsummer Examinations on the work of the Spring Term began on the 16th and ended the 19th June, and immediately thereafter a number of the students, who were members of the Ontario Field Battery, went into camp on the Guelph Exhibition Grounds, after which they returned to the

Closing Exercises of the College.

These exercises took place on the 30th June, and were unusually successful. The attendance was much larger than on any former occasion, and the interest throughout was all that could be desired.

Fifteen young men were presented for diplomas, which were granted by the Hon. A. M. Ross, Commissioner of Agriculture.

Messrs R. W. Madge and C. A. Zavitz, delivered valedictory addresses on behalf of the graduating class, and the medals were awarded as follows:

R. W. Madge....Brucefield, Ont.....Gold Medal.
Edgar Sturge....Penzance, Cornwall, England ..First Silver Medal.
C. R. Brown....Norwood, Peterborough, Ont ..Second Silver Medal.

The gold medal was presented by the Commissioner of Agriculture; the first silver medal, by James Innes, M. P.; and the second silver medal, by James Laidlaw, M. P. P.

The competition for the medals was keen as usual, and Messrs C. A. Zavitz and W. H. Owen may be mentioned as having come very close to the winner of the second silver medal.

Those who obtained an aggregate of 75 per cent. of the marks in any department were ranked first class and awarded honour certificates, as follows;—

Honour Certificates.

Midsummer Examinations, 1886.

First Year.

Agriculture and Dairying—1. J. G. Scrugham, Toronto; 2. E. Lick, Oshawa; 3. J. W. Hart, Bridgetown, N. S.; 4. W. Ewing, Mulmer, Ont., and W. H. A. Hart, Kerwood, Ont.; 6. T. N. Donaldson, Tipperary, Ireland.

Natural Science—1. R. E. King, Decewsville, Ont.; 2. Scrugham; C. W. Elton, London, England; 3. J. A. Craig, Russell, Ont.

Veterinary Science—1. Scrugham; 2. Hart; 3. King; 4. Lick; 5. J. Sleightholm, Humber, Ont.; 6. J. C. Donald, St. George, Ont.; 7. Craig.

English Literature—1. Scrugham; 2. Elton; 3. Donaldson and Hart; 5. Donald.

Mathematics—1. Lick and Scrugham; 3. Hart; 4. J. S. Howes, Harriston, Ont.; 5. R. DeMauritz, London, England; 6. W. J. Pady, Barnstaple, England; 7. King; 8. Sleightholm.

Second Year.

Agriculture and Dairying—1. C. R. Brown, Norwood, Ont.; 2. E. Sturge, Penzance, England; 3. R. W. Madge, Brucefield, Ont.; 4. C. A. Zavitz, Coldstream, Ont

Natural Science—1. Madge; 2. Sturge; 3. Zavitz; 4. W. H. Owen, Hull, England.

Veterinary Science—1. Brown; 2. Sturge; 3. Madge; 4. Owen.

English Literature—1. Madge; 2. Owen; 3. Sturge; 4. S. Calvert, Rochdale, England; 5. Brown.

Mathematics—1. Madge and Zavitz.

Special Certificates in Live Stock and Veterinary Science were awarded to J. R. Walter, Wellington, Somerset, England; J. P. Poe, Callan, Ireland; and Hugh Craig, Carsonby, Ont.

Associates.

The total number of associates up to the present time is 117. 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.
1879—Clinton, N. J.
1880—Clutton, A. H.
1886—Cobb, C.
1878—Crompton, E.

D.

1878—Davis, C. J.
1880—Dawes, M. A.
1882—Dawson, J. J.
1882—Dennis, J.
1881—Dickinson, C. S.
1877—Douglas, J. D.
1877—Dunlop, S.

E.

1882—Elworthy, R. H.

F.

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

Date. **G.**

1883—Garland, C. S.
1879—Gillespie, G. H.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindley, A. W.

H.

1882—Halleay, F.
1886—Holtby, R. M.
1880—Holterman, R. F.
1882—Horne, W. H.
1882—Howitt, W.

I.

1886—Idington, P. S.

J.

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

L.

1882—Landsborough, J.
1884—‡Lehmann, A.
1877—Lindsay, A. J.
1880—Lomas, J. W.
1878—Logan, T.

M.

1880—Macaulay, H.
1885—Macpherson, A.
1886—*Madge, R. W.
1882—Mahoney, E. C
1884—Major, C. H.
1877—Mason, T. H.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.
1883—McPherson, D.
1877—Meyer, G. W.
1881—Motherwell, W. R.
1885—†Muir, J. B.

N.

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

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

Associates—*Continued.*

Date.

O.

1877—O'Beirne, A. C.
1886—Owen, W. H.

P.

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.
1877—Shaw, G. H.
1882—‡Shuttleworth, A.
1882—Silverthorne, N.
1884—‡Slater, H.

Date.

S.

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.

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.

* Winner of Governor-General's Medal. † Gold Medallist. ‡ First Silver Medallist.
§ Second Silver Medallist.

SUMMER TERM.

(1st July to 31st August).

At the close of the Spring Term (30th June), when the year's lectures were ended, most of the farmers' sons went home for haying and harvest, and some of the other students hired out with farmers for the summer months; so that only twenty-five remained with us during the Summer Term (July and August). These worked nine and a half hours a day, giving more or less attention to all the departments, but spending the greater part of their time where it was most needed, *i. e.*, on the farm. I shall not attempt to give a detailed account of the routine in each department, but simply say that the young men received more or less instruction in the fields, the yards, the garden, and the shop; and assisted in doing all there was to do in the summer months, on a four hundred-acre grain and stock farm, and in the management of a large vegetable garden, flower garden, orchard, and lawn.

FALL TERM.

Commencement of a New Scholastic Year—1st October, 1886.

Thirty-eight old students returned at the beginning of the Fall term, and forty-five new ones were admitted, making a total of 83. Their names, post-office address, and other information regarding them having been given in the college roll and the analysis on a previous page, there is only one or two particulars which need be mentioned under this head.

Age of Students.

The ages of our students in the Fall Term of 1886, ranged from 16 to 28 years, as follows:—

6	at the age of	16 years.	9	at the age of	22 years.
7	"	17 "	4	"	23 "
11	"	18 "	1	"	24 "
21	"	19 "	2	"	25 "
12	"	20 "	1	"	28 "
8	"	21 "			

The average age was $19\frac{3}{4}$ years.

Class-Room Work.

The time table in Appendix I. indicates the subjects which were taken up in the Fall Term, and the number of hours allotted to each. Lectures began on the 4th October, and continued without interruption till the 17th December.

The first-year students received four lectures a week on the characteristic points and peculiarities of the different breeds of cattle; had a course of lectures with experiments on Chemical Physics and Inorganic Chemistry; and spent two hours a week in studying the Anatomy and Physiology of the horse. Under the head of English and Mathematics, they read Thomson's "Seasons"—"Autumn," and reviewed certain portions of Arithmetic, with special reference to the requirements of farming in Canada.

The attention of the second-year men was directed to such subjects as stock-breeding, farm management, and the experimental plots; the selection of animals for beef; the housing, feeding, and fattening of the same; the comparative values of pastures and green fodder; results from the different kinds of seed, soil, and manures; and the previous season's experiments with wheat, oats, and grasses. They had two lectures a week on Horticulture, and a full course on Agricultural Chemistry—the composition of different plants in relation to the soils on which they grow, the preservation and renovation of soils, the chemical composition and value of different manures, the superphosphates, double silicates, and other substances which furnish plant food. They spent two hours a week at lectures on Veterinary Pathology, and one in handling and examining horses for spavin, ring-bone, splint, founder, and other diseases, all under the eye and direction of our veterinary surgeon, Dr. Grenside; they also read Shakespeare's "Julius Cæsar," and devoted some time to the study of drainage and book-keeping.

BOARDING HOUSE AND COLLEGE BUILDINGS.

The work in this department embraces the heating, lighting, cleaning, and repairing of the College buildings, and the boarding and oversight of the students in the College.

The College is heated by steam, lighted by gas from Guelph, and supplied with water from the city water-works. The supply of the two latter is quite satisfactory, and the steam heating serves the purpose well, except in very cold weather, when the radiators in the halls do not keep the rooms on each side quite so warm as they should be for the comfort of persons engaged in study.

The bursar provides the supplies, the culinary departments under the supervision of the Matron, and the students are looked after by the assistant Resident Master, with some help from two of the Professors.

Additions to Buildings.

Last year I called attention to the fact that the coal shed connected with the College was not large enough to hold more than half of our year's supply of coal. Consequently a large part of it was exposed to rain and snow throughout the fall and winter. During the past summer an addition was made to the shed, and we now have ample room for all the coal that we require.

In regard to the surroundings of students in the College, and the duties required of them, I may say that their rooms are furnished with beds, bedding (except sheets), bureaus, mirrors, washstands, study tables, and chairs. They sleep separately, two in a room, and, in a few instances, three.

Daily Routine.

The daily routine during the Fall, Winter, and Spring Terms, is as follows :—

Twelve students, selected in rotation, go out at six in the morning to feed the cattle and sheep, clean stables, etc. The rest are called at six, and go to breakfast at half-past six. At 7.30, those who are not working outside, go to drill for an hour. All assemble in the class-room for roll-call and prayers at 8.30 ; and from 8.45 to 11.45, they are at lectures in the College.

For the afternoon, the entire number is divided into two equal divisions, which work and study alternately. One division goes out to work from 1.30 till tea time ; and the other reads or studies under a Professor in the class-room from 1.30 to 4, after which they are free till the call for tea at 5.30 or 6, according to the season of the year.

From seven to half-past nine in fall and winter, and from eight to half-past nine in spring, they all study in their rooms under the supervision of the night watchman and one of the Professors. Lights are put out at ten and the doors closed at half-past ten.

The half of every Saturday is a holiday ; and every student, who is not under ban for some misdemeanor, is allowed to be out one evening in the week till half-past ten. When going out, each student leaves his name with the master or professor in charge, and is required to report himself when he returns.

On Sunday morning all students are required to attend their respective places of worship in Guelph, unless they are excused by the President. In the evening it is optional whether they go or stay in the College.

Such is the routine in the boarding house, and such are the duties which are required of students therein during nine months of the year. The Summer Term (July and August) is devoted entirely to work in the outside departments. Those who remain with us for that term, work nine and a half hours a day outside ; and the duties inside differ but little from those in an ordinary boarding house on a large scale.

Discipline.

I am pleased to be able to say that we have not had any serious case of discipline during the past year. Everything has gone on quietly and without the slightest friction. All the students have been respectful and obedient, and the great majority have shown a desire to make a right use of their time.

III.—THE BUSINESS DEPARTMENT.

Under this head there is a variety of work, for which the President and the Bursar are chiefly responsible—correspondence, books and accounts, general business, and the finances.

Correspondence.

The correspondence of the College falls chiefly to the lot of the President, and occupies a considerable portion of his time. There are constant applications for circulars and reports; enquiries about the terms of admission, cost of board, etc.; and requests for information and advice regarding a great variety of matters connected with farm practice throughout the Province; and to this is added the work of arranging annually for a number of Farmers' Institutes in the month of January. Last year the correspondence under the last head occupied most of my spare hours during the months of November and December; and the work is steadily growing in magnitude and importance.

Books and Accounts.

Our Bursar, Mr. A. McCallum, as Financial Agent of the Institution, is chiefly responsible for the work under this head. It is his duty to examine all accounts against the College, the Farm, and the Creamery; to check them by invoices and requisitions; to charge each item under the proper head; to make out separate statements for these three departments every month, and submit them to the President, the Farm Superintendent, and the Manager of the Creamery, respectively, for their approval; after which he has to send them to the Treasury for payment.

The Bursar also receives and accounts for all moneys from the College, the Farm, and the Creamery, and pays all accounts that have been approved by the President, the Farm Superintendent, or the Manager of the Creamery, and passed by the Auditor. He also keeps five sets of books, as follows:—

No. 1. Shewing the monthly expenditure under each head of the appropriation for the collage and boarding-house.

No. 2. Giving in detail the revenue and expenditure for the outside departments under the Farm Superintendent.

No. 3. Shewing the live stock and farm produce on hand, and the sales and purchases made under this head from time to time.

No. 4. Giving a statement of the purchases, sales, and other items of revenue and expenditure in connection with the Creamery.

No. 5. Shewing the account of each student from the day he enters the College till he leaves it—tuition fees, board and washing, amounts allowed for labour, and cash balances paid the College for board and washing.

Printed sheets containing the names of all the students are furnished each foreman daily, who fills in the blanks with the description of the work done that day by the students in his department, the number of hours each has worked, and the estimated value of such work. These are filed daily in the office, and journalized weekly. At the end of the financial month these sums are posted to the credit side of each student's account in the ledger, whilst on the debit side is placed the cost of the board and washing for that month, as obtained from the books of the storeroom and the laundry.

General Business.

In addition to his duties as book-keeper, the Bursar has to provide supplies for the boarding-house, and see that the quality of all articles furnished by tender is up to the standard required by the terms of contract.

The President signs requisitions for all purchases in the college, takes charge of the college buildings generally, and is responsible, not only for the management, but for the discipline of the inside departments, as regards both officers and students.

Finances.

Revenue.

The College revenue in 1886 amounted to $7,347.18, and was made up of the following items:

(1) Tuition fees	$2,591 17	
(2) Balances paid for board after deducting allowances for work in the outside departments, including also a few fines imposed for violation of rules	4,720 19	
(3) Chemicals used by students engaged in post-graduate work	15 00	
(4) Bed sheets sold to students (since change in regulations).	15 82	
(5) Supplemental examinations	5 00	
Total revenue in 1886		$7,347 18

Expenditure.

No. 1—College Maintenance.

(1) Salaries and wages	$12,652 42	
(2) Food—		
Meat, fish and fowl	3,225 44	
Bread and biscuits	654 81	
Groceries, butter and fruit	3,284 17	
(3) Household Expenses—		
Laundry, soap and cleaning	177 12	
Women servants' wages	1,639 25	
(4) Business Department—		
Advertising, printing, postage and stationery	609 37	
(5) Miscellaneous—		
Chemicals	21 94	
Library and reading-room (books, papers and periodicals)	382 95	
Unenumerated	658 91	
		$23,306 38
Less college revenue		7,347 18
Net Expenditure for Maintenance		$15,959 20

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

Furniture and furnishings	$785 72	
Repairs and alterations	773 46	
Fuel	3,067 49	
Light	823 33	
Water	550 00	
		$6,000 00
Total net cash expenditure in 1886		$21,959 20

The net sum voted by the Legislature was	$23,420 00
Consequently the unexpended balance for the year is	$1,460 80

Summary of Entire Expenditure.

Net cash expenditure as above	$21,959 20	
Produce, etc., from farm and garden (see Appendix 4)	1,490 16	
	$23,449 36	
Less—		
Amount paid by College for labor of students on farm and garden	2,939 70	
Other payments on account farm officers, etc	2,200 00	
Three-fifths of salary of Professor of Dairying (for time devoted to general dairy interests throughout the province)	900 00	
		$6,039 70
Entire net expenditure of College in 1886		$17,409 66

CONCLUSION.

Information regarking the reading-room, library, and museum, will be found in Professor Paton's report in Part II., of this volume.

Literary Society.

The literary society in connection with the College never was more active and useful than it has been during the past year. The members of the society met every Friday evening during the Winter Session, in one of the class-rooms, to practise reading, debating and declamation. The majority of the students became members of the society; and the work done was a valuable addition to the educational appliances of the Institution.

In the performance of such work, young men have an opportunity of testing their powers before they engage in the duties and assume the responsibilities of real life in church or state. They learn to speak in public, and gradually become acquainted with the rules of order according to which public meetings are conducted. Their wits are sharpened, their reasoning powers developed, and their manners improved.

Recommendations.

Under this head we generally enumerate our wants and plead for the expenditure of more money. Some of our wants have been supplied during the past year, but we are still in need.

We must admit that hitherto the Government has dealt liberally with us. There is no other agricultural institution on this continent, that has in any twelve years of its history spent so large a sum of money on the farm connected with it, as our farm has received within the last twelve years, for drainage, fencing, tillage, buildings, implements, live stock, and experiments.

This praiseworthy liberality has arisen from a desire on the part of all concerned, that the farm should be a prominent factor in the work of this Institution; and the result is that in farm equipment we do not fear comparison with the best institutions in the country. I regret that I cannot say so much for the College. In fact, I am forced to

acknowledge that there is some ground for the criticisms of those who, at home and abroad, have lately been calling attention to our lack of some buildings and appliances which are clearly necessary, in order to do the work of the College proper, in such a way as to keep pace with the progress of the times.

Chemistry is the foundation of scientific agriculture; and without it no real progress can be made. Hence any agricultural institution which does not provide adequate appliances for the most thorough and advanced work in this department, must, in some measure, fail to accomplish the object for which such institutions are maintained.

We have a room set apart for Chemistry, and some old-fashioned greenhouses for instruction in Botany and Horticulture; but we make no claim to anything like adequate equipment in either of these departments.

Two things we must have at once, or we shall certainly fall behind in the race, *i.e.*, a separate building with first-class appliances for instruction and practical work in Chemistry, and a good botanical laboratory with suitable green and propagating houses.

In addition to these, we need a gymnasium, a carriage house and horse stable, some alterations and new cases in the museum, and an appropriation for painting the outside wood-work of the College.

Hoping that this statement of our wants may receive your favourable consideration,

I am,
Your obedient servant,

JAMES MILLS,
President.

APPENDIX 1.

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.	Physiology and Hygiene.	1. Bookkeeping.	Agriculture.
9.45	English Literature.	Physiology and Hygiene.	English Literature.	2. Arithmetic. 3. Agriculture.	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.	Agriculture.	Practical Horse.	Agriculture.
10.45	Veterinary Pathology.	Agricultural Chemistry.	Veterinary Pathology.	Agricultural Chemistry.	Agricultural Chemistry.

APPENDIX 2.

ONTARIO AGRICULTURAL COLLEGE.

EXAMINATION PAPERS.

I. PAPERS SET AT THE MATRICULATION EXAMINATIONS, EASTER, 1886.

MATRICULATION.

ARITHMETIC.

Examiner : E. L. HUNT.

1. Add $\frac{3}{9}$ and $\frac{17}{24}$ and reduce the sum to a decimal fraction.

2. Divide .0121 by 110 and multiply the quotient by 350.25.

3. Find the cost of 3 tons, 14 cwt. 18 lbs. of hay, at $12 a ton.

4. A and B can do a certain work in 8 days; A and C in 10 days; B and C in 12 days. How long will it take A, B and C to do the work?

5. A tank is supplied by two pipes. By one it can be filled in 7 hrs., and by the other in 11 hrs. After the first has been supplying for 2 hours, the second is also opened, when both together continue to supply for $2\frac{1}{2}$ hrs., and then the first is closed. How long before the tank is filled?

6. If $1\frac{3}{4}$ bush. of wheat are sown to the acre, how much will be required to sow a field 264 yds. long and 154 yds. wide?

ENGLISH GRAMMAR.

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

1. "For a creamery, ice is *necessary ;* but *even* in *ordinary* dairying no one *who wants* good *butter* can *dispense* with it in warm weather."

Separate the above into simple sentences, state the kind of each, and parse the words in italics.

2. State three different methods of forming the plural of nouns. Give singular of *potatoes, pence, kine, shears, brethren.*

3. Name the parts of speech and give examples of each.

4. Correct, where necessary, the following sentences :—

(*a*) The college staff is all back from its holidays.
(*b*) I do not like these kind of sheep.
(*c*) The first and second cow has not been milked.
(*d*) No one can leave the room until the proper time of dismissal.

EASTER EXAMINATIONS, 1886—Continued.

COMPOSITION.

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

1. Quote at least eight lines of poetry.
2. Write a composition on one of the following subjects:—
   (*a*) The pleasures of farm life.
   (*b*) Fall in Ontario.
   (*c*) Ambition.

MATRICULATION.

GEOGRAPHY.

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

1. Name the most important rivers of North America, and where they empty.
2. *Where* and *what* are Trinidad, Vancouver, Mobile, Ceylon, Niagara, Bristol, Danube, Biscay.
3. What effect has a high range of mountains upon the climate of a country?
4. Draw a map of South America, indicating the principal rivers.
5. Name the fresh water lakes of North America.
6. Define Delta, Isthmus, Estuary, Watershed and Bay, giving examples.

READING AND DICTATION.

Selections from the Fourth Reader.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1886.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Specify the considerations that should guide anyone in the construction of roads and fences.
2. The under-drainage of farm land secures several things: Name ten of the most important.
3. It is proposed to drain No. 17 field of this farm: Show how you would do this, naming drains and giving a sketch of the ground. Give reasons for the manner in which you lay off said drains.
4. Explain the value of rotation in cropping. Give an example.
5. What circumstances regulate the application of fertilizers to farm crops?

EASTER EXAMINATIONS, 1886—Continued.

FIRST YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. Compare the Aberdeen Poll and Shorthorn breeds of cattle.

2. Criticise the Ayrshire, Holstein and Devon breeds of cattle for direct dairy purposes.

3. Why is the Leicester called Shorthorn among sheep?

4. What are the five principal things to be considered in judging a fleece?

5. Give brief description of a model fattening steer, without reference to any particular breed.

6. Sketch the principal features of a good milch cow.

FIRST YEAR.

INORGANIC CHEMISTRY.

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

1. *Fire*—Define combustion, and give the chemical changes taking place in the burning of fuel.

2. *Air*—What is the composition of the air?

3. *Earth*—Name in order the most important constituents of the solid earth.

4. *Water*—Give composition and symbol. Distinguish rain, river and sea waters. Give two of the most important uses of water in nature.

5. *Breathing*—What chemical changes result from breathing the atmosphere? Prove that the exhaled breath differs from the inhaled breath.

6. *Life*—State the relationship existing between animal and vegetable life.

7. *Chlorine*—Shew how chlorine can be used as a disinfectant. Upon what property or properties does this use of chlorine depend? Give formulas if possible.

8. *Symbols*—Give chemical symbols for four acids and from them derive the salts of Sodium and Magnesium.

9. *Animal Heat*—Explain chemically how animal heat is maintained.

10. *Compounds*—Give chemical composition of the following substances:—Sand, Clay, Limestone, Salt, Nitre, Quartz, Superphosphates, Cast-Iron, Burnt-Lime, Slaked-Lime, Pearl-Ash, Epsom Salts, Marble, Caustic Potash, Baking Soda. (Symbols and names are required as far as possible.)

FIRST YEAR.

ORGANIC CHEMISTRY.

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

1. Define the chemical term Radical. Give names and symbols for five (5) monad and five diad radicals.

2. *Common Alcohol*—(*a*) Give its chemical name and symbol; (*b*) give the change occuring in alcholic fermentation.

EASTER EXAMINATIONS, 1886—Continued.

3. State chemically the origin of sugar and wood-fibre in vegetation.

4. Explain the souring of milk, and the curdling of milk, giving reaction in former case in formula.

5. Distinguish Alcohols, Acids and Ethers, according to their chemical composition.

6. What are Albuminoids? Give names and examples of the different forms.

7. Distinguish Decay and Putrefaction.

8. State as far as you are able the chemical composition of Starch, Vinegar, Milk, Cheese, Butter, Eggs, Tea, Tobacco, Beer and Ale.

FIRST YEAR.

PHYSIOLOGY AND ZOOLOGY.

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

1. Name the different classes into which the sub-kingdom Vertebrata is divided and give the characters of any one.

2. What is meant by insectivorous birds? Give a popular classification of such, and name those belonging to the second division.

3. Distinguish between a whale and a shark, and explain the expression "distribution in time and space," as applied to animals.

4. Draw a diagram illustrating the circulation of the blood. Explain the term Hygiene.

5. State the changes, and where they take place, which the food undergoes until it reaches the *Thoracic Duct.*

6. Classify foods with reference to their use in the animal economy. Write brief notes on Milk, Oatmeal, and Potatoes, as feeding stuffs.

7. State the effects of alcholic stimulants upon the system.

8. Identify the specimens before you.

FIRST YEAR.

VETERINARY ANATOMY.

Examiner—F. C. GRENSIDE, V. S.

1. Mention the bones that enter into the formation of the Pelvic cavity, and name the organs contained in that cavity in the mare.

2. Give the names ordinarily applied to the joints of the fore and hind extremities, in order, from above downwards.

3. What are the functions of glands? Give some examples of those possessing ducts, and those that are ductless.

4. Describe the difference in the appearance of temporary and permanent incisors, and state indications of a five year old mouth.

5. Describe the small intestine.

6. Name the urinary organs, and describe the bladder, stating how urination is effected.

7. Give a general description of the lymphatic or absorbent system.

EASTER EXAMINATIONS, 1886—Continued.

8. Describe the heart.

9. Describe the ovaries and the Fallopian tubes; also the manner in which the womb is retained in its position.

10. Name the cranial nerves and state their respective functions.

FIRST YEAR.

ENGLISH LITERATURE.

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

1. Give the chief characteristics of Macaulay as a writer, and name some of his most important works.

2. Name the principal charges made against Warren Hasting's administration in India, and state who were the chief speakers in the prosecution and defence.

3. Who was Soverign of England at this time, and what was the result of the trial?

4. Sketch briefly the character of Nuncomar, Hastings and Impey.

5. Give the reasons put forward by Macaulay, for believing that Francis was the author of the Letters of Junius.

6. "He would recover the estates which had belonged to his father. This purpose grew stronger as his intellect expanded. He pursued his plan with calm indomitable force of will, and when under a tropical sun, his hopes amidst all the cares of war, finance and legislation, still pointed to Daylesford. When his life, chequered with good and evil, with glory and obloquy, closed, it was at Daylesford."

(Explain the references in this passage and paraphrase this quotation).

7. Describe the mode of government in India at the time of Hastings.

8. What reasons can be urged in favour of Hastings' conduct? State how he erred in the management of his case.

FIRST YEAR.

COMPOSITION.

Examiner—JAMES MILLS, M.A.

1. Quote rules for punctuating simple sentences.

2. Punctuate the following passages and give the rule for every mark inserted:

   (*a*) Deut x 21 2 Sam ix 18 AD 1886

   (*b*) Be our plain answer this The: throne we honour is the people's choice. There are three genders the mascline the feminine and the neuter.

   (*c*) Greece fell but how did she fall did she fall like Babylom did she fall like Lucifer never to rise again

3. Give an example each of a *simple*, a *complex*, and a *compound* sentence.

4. State the principles which guide in the arrangement of phrases in a simple sentence and clauses in a complex sentence.

5. Complete the following sentences by supplying substantive clauses:

   (1) We cannot tell———

   (2) Look at the elephant: did you ever wonder———?

EASTER EXAMINATIONS, 1886—Continued.

6. Expand into complex sentences :

(*a*) The rainbow seen yesterday was very beautiful.

(*b*) The wind being fair, we put to sea.

7. Contract into simple sentences :

(1) The trees are growing along the river, and are very large.

(2) Dr. Johnson was in great distress, when he was writing many of his works.

8. Combine the following statements into a simple sentence :

The island at first seemed uninhabited.
The natives gradually assembled in groups on the shore.
The natives overcame their natural shyness.
The natives received us hospitably.
They brought down for our use the various products of their island.

9. Write a short composition on *the kind of education which a farmer should have.*

FIRST YEAR.

ARITHMETIC.

Examiner—E. L. HUNT.

1. N. B.—Only for those who fail to do three of the following questions : Find the simple interest, the compound interest, the true discount, and bank discount on $3,798 for $2\frac{1}{2}$ years, at 7 per cent.

2. From the following, taken from the tables of the dairy test of 1884-85 : Compare the Holstein and Jersey as to the quantity of butter made in the season.

SERVICES.	Milk. Per Season.	Cream. Per Cent.	Butter. Per 100 lbs. Cream.
Holstein	7,000	11.9	34.5
Jersey	3,500	19.9	55.0

3. (*a*) If an ounce of gold and an ounce of wheat are placed in opposite scale pans, what weight of wheat must be added to make the scales balance ?

(*b*) If a pound of silver and a pound of oats are placed in opposite scale pans, what weight of silver must be added to make the scales balance ?
(A pound Avoirdupois, contains 7,000 grains Troy).

4. A insures his property for $\frac{5}{8}$ of its value at $\frac{3}{4}$ per cent. for 3 years. It is destroyed by fire, and after the Insurance Company pay the claim in full, A's loss is $3,600, besides the amount paid as premium. Find the value of the property and amount of one premium.

5. (*a*) $8,650 is invested in the 6 per cent. Stocks, at 110. Find the amount of Stock purchased and annual income.

(*b*) A owns $3,800 of the 5 per cent. Stocks, at $95\frac{1}{4}$; he sells out and invests the proceeds in the 7 per cents., at $119\frac{3}{4}$. Find the alteration in his income, brokerage in each case being $\frac{1}{4}$ per cent.

6. A farm is let for a fixed sum of money, and a certain number of bushels of wheat ; when wheat is 70 cents a bushel the rent is $750 ; when wheat is 78 cents a bushel the rent is $780. What will the rent be when wheat is 91 cents a bushel ?

EASTER EXAMINATIONS, 1886—Continued.

7. A and B engage to reap a field for £4 10s., and as A could reap it alone in nine days, they promise to complete it in five days. They found, however, that they were obliged to call in C, an inferior workman, to assist them for the last two days, in consequence of which B received 3s. 9d. less than he otherwise would have done. In what time could B and C reap the field?

FIRST YEAR.

BOOK-KEEPING.

Examiner: E. L. HUNT.

1. Write the form of a note negotiable without indorsement, of an accepted draft, and of the receipt which would be given in question 4, Dec. 31st

2. If you find the Cr. side of the Trial Balance is larger than the Dr. side, explain how you would proceed to detect the errors in your entries.

3. In opening your ledger at the beginning of the year, give the entries you would make if engaged in mixed farming on an ordinary farm of 200 acres.

4. Enter the following in the accounts affected: Jan. 20, sold for cash, 120 bushels barley @ 65c. a bushel; Feby. 5, sold for cash, 70 lbs. butter @ 20c. a lb.; April 10, fed cows 2 tons hay @ $9.00 a ton, and 50 bushels of oats @ 35c. a bushel, and 300 bushels turnips @ 8c. a bushel; Aug. 25, bought a cow, $70.00; Dec. 31, paid S. Harvey (hired man) $30.50, being the balance due him for the year.

5. Make out and close an account with the store steers from January 1st, 1885.

6. State in what accounts, and on which side of them, you would enter the following:

(*a*) Lost my pocket-book containing $50.00; paid 75c. for advertising it; and after a few days it was returned, when I gave the finder $6.00.
(*b*) Sold 25 acres of land for $60.00 an acre, taking in payment one thoroughbred bull $900.00, and the balance in cash.
(*c*) Lent $5.00 to a neighbour for a few days, taking his I.O.U
(*d*) Paid $10.00 for insurance of household furniture.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. To what extent and in what manner would it be advisable for the average farmer of Ontario to change his system of farming to meet the requirements of Dairying as now practised?

2. Where Dairying is advisable as a specialty on the part of an individual farmer, under what circumstances would you advise Butter and Cheese respectively? Recommend, if you can, the extension of the business into winter.

3. The improvement of our pastures is an acknowledged want: specify the manner in which this crop will affect Ontario Agriculture, both at home and abroad.

4. Give a brief account of the manner of establishing permanent pastures.

5. Make a list of the points to be taken into consideration in arranging farm buildings, with a brief note explanatory of each.

EASTER EXAMINATIONS, 1886—Continued.

SECOND YEAR,

LIVE STOCK.

Examiner: WM. BROWN.

1. The Shorthorn, Ayrshire, Holstein, Guernsey, Devon, and Jersey breeds of cattle contest the dairy field at present: name any two of them that meet the average conditions of Ontario in this specialty equal to any other three of the same list. Give full explanations.

2. To what extent should the average farmer consider the selection of a bull for dairy purposes and indicate which the animal should be, irrespective of any particular breed.

3. In what direction should an average farmer aim at wool and mutton to day?

4. Specify the good and poor points of the South Down, Oxford Down, and Cheviot breeds, as applicable to the last question.

SECOND YEAR.

ARBORICULTURE.

Examiner: WM. BROWN.

1. The scientific and practical application of Forestry to Canada involves many considerations: specify those we have studied from a more immediate agricultural interest.

2. Give brief notes on the planting of shade trees, specifying in order the items of management from the purchasing of trees on to the second year's stage.

3. In the formation and management of extensive plantations give the principal operations up to the third year.

4. To what extent would the average Ontario farmer be justified in devoting so much of his land to a crop of trees with a view to direct cash profits?

5. Name the trees most suitable for shade, for shelter belts, or clumps, and for large plantations in Ontario.

SECOND YEAR.

AGRICULTURAL CHEMISTRY. I.

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

1. Name the chemical elements found in plants, stating the special forms of combination of each.

2. State the functions of (*a*) leaves and (*b*) roots in the development of plant life.

3. (*a*) How do soils originate? (*b*) Discuss the origin and effect of colour of soils.

4. What are the effects of (*a*) tillage and of (*b*) drainage upon soils?

5. What are the most valuable ingredients of fertilizers? Name the principal sources of each (natural and commercial).

6. Discuss farm yard manure, (*a*) its preservation, (*b*) its effect, (*c*) its application.

7. What are the distinguishing characteristics in composition of the following classes of products:—cereals, hay, leguminous crops, roots.

EASTER EXAMINATIONS, 1886—Continued.

8. What are the manures specially adapted for each of the above? Give brief reasons.

9. State the scientific reasons for the advantages derived from rotation of crops.

10. Give a rotation (four or five years) with your reasons for adopting the same.

SECOND YEAR.

AGRICULTURAL CHEMISTRY. II.

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

1. Describe briefly the process of digestion, stating the peculiar functions of the several digestion ferments.

2. Define (and give examples of) Digestion, Co-efficient, Nutrient, Fodder, Ration, Nutritive Ratio.

3. Give the Nutritive Ratios of ten common Canadian fodders.

4. Distinguish fats, carbohydrates, and albuminoids, according to their chemical composition: state their peculiar value and functions in a ration; and give examples of fodders in which each predominates.

5. Discuss briefly the feeding of cows for milk, sheep for wool, and of horses for work.

6. Give average composition of milk. Wherein consists the special feeding value of whey, buttermilk, and skimmed milk?

7. Explain the whole process of obtaining butter from milk. What is the chemical composition of butter? Explain, chemically, rancidness in butter.

8. Calculate the value of the Phosphoric Acid contained in the fine ground bone phosphate made from the bones of a 1,500 lb. ox.

SECOND YEAR.

ETOMOLOGY.

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

1. What is an insecticide? Name some of the most common, and state how they are used.

2. Explain the terms:—maggot, weevil, nymph, chrysalis, pupa, grub, bug, as applied to insects.

3. Name some insects that are injurious to plants in both the larval and imago condition.

4. Name the orders to which our most beneficial insects belong, and specify four genera.

5. Give remedies for the destruction of the following noxious insects:—Climbing cut-worms, turnip beetle, and the apple tree bark louse.

6. Contrast Telea with Platysamia. What fruit trees do they affect?

7. Give the salient characters of the plum curculio, the clover midge and the saw fly, and give remedies to prevent their ravages.

8. Identify the specimens before you, indicating the plants which they affect, and give one remedy for each of the first six.

EASTER EXAMINATIONS, 1886—Continued.

SECOND YEAR.

VETERINARY PATHOLOGY.

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

1. Define what is meant by Specific and Sporadic diseases, and give an example of each class.

2. What are the different symptoms of Dislocation of the Cervical Vertebræ and Wry-neck; and what are the results of each accident?

3. Name the diseases of the feet to which horses are liable, and describe how to diagnose and treat a case of punctured foot.

4. Describe the symptoms, causes and treatment of Poll-evil and Fistulous Withers.

5. Mention the structures that are involved in Simple Ophthalmia, and describe the treatment of this affection.

6. Define the term hernia; and explain all you know about the umbilical form.

7. Describe the symptoms, possible terminations, and treatment of Garget, in the cow and ewe.

8. State whether the cow or horse is most subject to gastric or intestinal derangements respectively; and give reasons for answers.

9. Describe the usual exciting and predisposing causes of digestive and respiratory disorders; also a rational plan of securing efficient ventilation.

10. Mention the indications for Tracheotomy, and describe how to perform the operation, stating the structures which are incised.

SECOND YEAR.

SHAKESPEARE—RICHARD II.

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

1. Wrath-kindled gentlemen, be rul'd by me:
   Let's purge this choler without letting blood.
   This we prescribe, though no physician;
   Deep malice makes too deep incision.
   (*a*) By whom spoken?
   (*b*) To whom do the pronouns *me*, *'s* and *we* refer respectively?
   (*c*) Give the different meanings of *let*.
   (*d*) Name and explain the figure employed in the second line.
   (*e*) Scan the 3rd and 4th lines.

2. Quote the passages in which occur the following expressions: *dark dishonour's use, slander's venomed spear, gilded loam or painted clay, a dearer merit not so deep a maim, four lagging winters, the hungry edge of appetite, this precious stone set in the silver sea.*

3. Give the meaning and derivation of the following words: *inveterate, appeal, miscreant, inhabitable, atone, degenerate, regenerate.*

4. A partial slander sought I to avoid,
   And in the sentence my own life destroyed.
   (*a*) By whom spoken?
   (*b*) Explain the meaning of *partial slander*.
   (*c*) Analyze this extract syntactically.

EASTER EXAMINATIONS, 1886—Continued.

5. Locate the following passages, and explain concisely the allusions and meaning in each :—

(1) "Whose manners still our tardy apish nation,
Limps after in base imitation."
(2) "Thy state of law is hand-slave to the law."
(3) "Take Hereford's rights away, and take from Time
His charters and his customary rights."
(4) "We hear this fearful tempest sing,
Yet seek no shelter to avoid the storm."
(5) "The task he undertakes
Is numbering sands and drinking oceans dry."
(6) " "Tut, tut !
Grace me no grace, nor uncle me no uncle."

6. Name four of the greatest poets and four of the greatest prose writers of the Elizabethan era of English literature.

7. Give in order the sovereigns of the Plantagent line proper, with a note on the reign of each.

(*a*) Who was the greatest poet in England in the reign of Richard II ?

8. Name the different classes of Shakespeare's plays, giving an example of each, and say to which class Richard II. belongs.

9. Sketch briefly the characters of Richard II. and Bolingbroke.

SECOND YEAR.

POLITICAL ECONOMY.

Examiner : W. Douglas, B.A.

N.B.—Give brief answers to all questions.

1. *Commodities*—The denominator being constant, how will the wealth of the community be affected by increasing or diminishing the numerator ?

2. The numerator being constant, how will wealth be affected by increasing or diminishing the denominator ?

3. *Product*—Numerator being constant, how will wealth be affected by increasing or diminishing the denominator ?

4. The denominator being constant, how will wealth be affected by increasing or diminishing the numerator ?

5. The numerator being constant how will value be affected by increasing or diminishing the denominator ?

6. Give an example where an increase of wealth coincides with an increase of value.

7. Give an example where a diminution of wealth coincides with an increase of value.

8. Give an illustration showing that a substance is wealth only when it is (1) in the right place, (2) at the right time, (3) in the right quantity.

9. Why is one man a watchmaker and another man a hatter ? Give *five* reasons.

10. Are people becoming more dependent or independent of one another ? Illustrate.

11. Whose income continues only so long as he make effort ? Whose income continues for ever, though he toil not ?

EASTER EXAMINATIONS, 1886—Continued.

12. Does interest increase or diminish in the course of years? Does rent (including town property) increase or diminish? Give proofs.

13. When men strike, is it for increase of *real* wages or *nominal* wages? How do workmen sometimes diminish real wages?

14. What effect has aided immigration on wages?

15. What new competitor is the Canadian farmer meeting in the British wheat market?

16. What is the rent per acre of land in the following locations?
(*a*) In the neighbourhood of the College;
(*b*) In the centre of Guelph;
(*c*) In the centre of Toronto.

17. Why are wages and interest at nearly the same rate in these different places, and why do rents differ so enormously?

SECOND YEAR.

MECHANICS.

Examiner: E. L. HUNT.

1. Explain the terms—uniform acceleration, mass, momentum, density.
Why does a heavy body, when allowed to fall freely, move with a uniform acceleration?

(*a*) A stone dropped from the hand into a well strikes the bottom in $2\frac{1}{2}$ secs; find the depth of the well.

(*b*) A body weighing 9 lbs. is projected vertically downwards from the edge of a precipice with a velocity of 40 ft. a sec., and at the same moment another weighing 29 lbs. is dropped: find the distance between them at the end of $1\frac{3}{4}$ secs.

(*c*) Find the time when the momentum of one is equal to that of the other.

2. (1) When would the wheel and axle work at a mechanical disadvantage? (2) How may the mechanical advantage of the screw be increased? (3) Where is the greatest strain in the handle of a pitch-fork? Explain.

3. What are the conditions that two forces acting at a point may be in equilibrium? (*a*) 2 forces of 42 lbs. and 56 lbs. act on a body at right angles to each other: find the magnitude of the single force equivalent to these two forces; (*b*) A horizontal force of 75 lbs. is required to move a body along a level road: find the magnitude of the force if it act at an angle of 30° to the horizontal. (In ordinary cases would the actual be greater or less than the mathematical result? Why?)

4. In the hydrostatic press shew clearly that the work done by the power is equal to the work done by the weight.

5. (*a*) If the specific gravity of maple is 0.65 find to what depth a cubic block of it, the length of whose edge is 28 ft., will sink in water; (*b*) What weight placed on it will just immerse the whole block?

6. Explain, using a diagram, the working of the common pump, and by reference to diagram state when it will fail to work.

7. Draw a rough sketch of the Hydraulic Ram and clearly explain the principle by which it works; mention cases where it may be advantageously used.

8. Given that a cubic foot of water weighs 1000 ozs. and the atmospheric pressure 15 lbs. to square inch; find the height of the column of water sustained by atmospheric pressure.

9. In a lifting pump, if the diameter of the bore is $1\frac{3}{4}$ inches, and the distance from the end of the handle to the piston rod is 3 feet, and from the piston rod to the bolt about which the handle turns is 6 inches, find approximately what power exerted at the end of handle is required to raise the piston when the column above the valve is 100 ft. high.

(*b*) Find the power, if exerted one foot from end of handle.

III. PAPERS SET AT THE MIDSUMMER EXAMINATIONS, JUNE, 1886.

FIRST YEAR.

AGRICULTURE.

Examiner: Wm. Brown.

1. Classify Manures and indicate the practical value of those common to Canada.

2. Report on the accompanying sample of Barley.

3. What affected the time of seeding and quantity of seed per acre in our farm work his season?

4. Give details of the management of Field 5.

5. How do we usually prepare land for a root crop?

6. Give a short criticism on the systems of Bare Fallowing and Root Cultivation.

7. What is the place of Green Fodders in mixed farming? Which particular plants do you recommend? Give reasons.

8. What is implied in the term—"a first-class pasture"?

FIRST YEAR.

DAIRYING.

Examiner: J. W. Robertson.

1. Describe the best method of rearing calves for the Dairy—as to feeding, etc., till time of dropping first calf.

2. How and under what conditions should milking be done? Give reasons with answers.

3. What is the best feed for milking cows in spring time?

4. What treatment will best prepare milk for delivery to a cheese factory?

5. Explain how the lactometer should be used and what may be learned of the quality of milk from its use.

6. Give a definition of cream, and state its average composition.

7. How should cream be prepared for churning?

8. Name the qualities, with comparative points of value, possessed by perfect butter.

9. What effect would the development of excessive acid have on the body, flavour, texture, and colour of cheese?

MIDSUMMER EXAMINATIONS, 1886—Continued.

FIRST YEAR.

GEOLOGY.

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

1. Name the different geological systems represented in Manitoba and the North-West, and give the economic products found in each.

2. Describe the rock exposures found either at Guelph or Limehouse.

3. In what respect is a knowledge of Geology of importance in the study of agriculture?

4. Explain the terms "weathering" and "denudation," giving examples of each.

5. In what rocks are the following found:—coal, petroleum, salt, chalk, gypsum, copper, and lead?

5. Describe the condition of North America at the close of the Archean age.

7. Write brief notes on the formation of glaciers, their influence on a country; and state reasons for believing they once were in Ontario.

8. What inferences can be made from fossils in rocks? Give examples illustrating your answer.

9. Identify the specimens before you.

FIRST YEAR.

BOTANY.

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

1. State the different ways in which plants climb; give examples of each.

2. Name the essential organs in a flower, and state what modifications these undergo through selection and cultivation.

3. Contrast an exogenous with an endogenous plant.

4. Name the most important underground stems, and give examples.

5. Give notes on the fertilization of plants, and name the agencies by which it is effected.

6. Show in what respect plants and animals are dependent on each other.

7. State conditions which influence the distribution of plants.

8. Give short notes on Stomata, Silique, Legume, Stipule, Spike, Epigynous, as applied to plants.

9. Analyze the specimen before you.

FIRST YEAR.

VETERINARY MATERIA MEDICA.

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

1. Describe the relationship of the physiological actions of medicines to their therapeutic effects.

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

MIDSUMMER EXAMINATIONS, 1886—Continued.

3. Give the symbols used to express the different weights, also the various measures of capacity of medicines.

4. Describe the different forms in which medicines are used and given to the domesticated animals.

5. Define the following terms, viz. :—Cathartic, Diaphoretic, Anaesthetic, Sedative, Alterative and Ecbolic.

6. Which is the best kind of aloes for the horse? State the quantity necessary to purge a horse, and when its use is contra-indicated.

7. State the respective effects of alum and aniseed on the lacteal secretion, and mention some substances the actions of which are similar to anise.

8. Give the dose of aconite and its actions.

9. Describe the course to pursue in ridding a dog of tapeworms.

10. What are the actions of Chloral Hydrate, and its properties.

FIRST YEAR.

ENGLISH LITERATURE.

Gray's "Elegy" and Selections from Wordsworth.

Examiner: E. L. HUNT.

1. Quote Wordsworth's description of a sunset; also any passages from Wordsworth and the Elegy which refer to the early morning, noon, and nightfall.

2. Locate the following passages and explain the meaning of each :—

(*a*) "And yet the miser mind
Mourns less for what age takes away
Than what it leaves behind."

(*b*) "He fixes good on good alone."

(*c*) "There is often found
In mournful thoughts, and always might be found,
A power to virtue friendly."

(*d*) "And many a holy text around she strew
That teach the rustic moralist to die."

(*e*) "The threats of pain and ruin to despise."

3. What, according to Wordsworth, are the traits of character desirable in the ideal happy warrior?

4. Define Simile, Alliteration, Antithesis, Personification, and Pathetic Fallacy, and give an example of each from any of the poems read.

5. Scan the following lines and name the metre in each :—

(*i*) And leaves the world to darkness and to me.
(*ii*) Let loose their carols when they please.
(*iii*) Are quiet when they will.
(*iv*) In bodily form. But without further bidding.
(*v*) Frugal, affectionate, sober and withal.

6. Quote the stanzas in which the following occur :—

(*i*) "Shapless sculpture."
(*ii*) "Pious drops."
(*iii*) "Neglected spot;" also quote those which convey the thought that (*a*) all human glory ends at last at death; (*b*) The world knows little of many of its greatest men; (*c*) Man wishes to be remembered after death; (*d*) Poverty represses genius.

7. Write a brief criticism of the Elegy.

MIDSUMMER EXAMINATIONS, 1886—Continued.

FIRST YEAR.

MENSURATION.

Examiner: E. LAWRENCE HUNT.

1. How many bricks are required to build a wall 80 ft. long, 18 ins. thick, and 15 ft. high, a brick being 9 ins. long, $4\frac{1}{2}$ ins. wide, and 3 ins. deep?

2. A barn is built 120 by 65 ft., with the same amount of wall: (*a*) How much more floor surface would there be if the barn were square? (*b*) If it were round?

3. A stick of timber 45 ft. long is in the form of a cylinder: (*a*) Find the solidity if the diameter is 5 ft. (*b*) Find the solidity of the largest square stick that can be hewn out of it.

4. A bin is 12 ft. long, 5 ft. wide, and 4 ft. deep: (*a*) How many bushels will it contain? (*b*) How often can the pail (which is in Examination Hall) be filled from it?

5. A ditch is half a mile long, 2 ft. wide at bottom, and 4 ft. deep; the sides slope so that each makes an angle of 120° with the bottom, (*i.e.* an angle of 30° with the *perpendicular* from the bottom); find the number of cubic yards of excavation.

6. A ditch is 8 ft. wide at the top and the sides meet at the bottom at an angle of 60°; find the depth of the water when the ditch is half full of water.

SECOND YEAR.

AGRICULTURE.

Examiner—WM. BROWN.

1. Indicate the practical bearings to the country, of the two pasture experiments now being conducted in field plots.

2. The cropping of this farm is made up of so much grain, roots, fodders, and pasture: Show roughly the relation of these to (1) maintenance of Working and Stock animals; (2) surplus pure-bred stock sold; (3) milk; (4) wool; (5) steers fattened annually. Illustrate by diagram if necessary.

3. The following is Rotation A in our experimental plots: (1) roots; (2) spring wheat, seeded; (3) hay; (4) hay; (5) pasture; (6) peas; (7) oats. Rotation B is the same length, but differently followed—give its details; give also the four shifts of Rotation C, and shew any relationships to A and B.

4. Make comparative notes on the arrangements of new farm buildings, as planned by the class, and those now in course of construction.

SECOND YEAR.

DAIRYING.

Examiner—J. W. ROBERTSON.

1. Give reasons why dairy farming is preferable to exclusive grain growing.

2. State the main characteristics of a good dairy cow.

3. How might the *quality* of the milk from an ordinary herd be improved?

4. Compare the relative profits from heifers dropping their first calves at two years old, and three years respectively.

M'DSUMMER EXAMINATIONS, 1886—Continued.

5. Describe the most economical method of feeding dairy cows while not milking during the winter.

6. What treatment would be effective in removing a leeky taint from milk, and to what class of taint does it belong?

7. State the methods of separating cream from milk, and say what considerations would guide you in determining as to which is preferable.

8. What is the average composition of milk, butter, cheese?

9. State the proper range of churning temperatures, and briefly describe the process of butter-making from the time churning commences.

10. Name the qualities, with comparative points of value, possessed by perfect cheese.

11. How would you be guided in selecting places whereon to erect a creamery and a cheese factory?

12. What is rennet, and what is its action in cheese-making?

SECOND YEAR.

ANALYTICAL CHEMISTRY.

Examiner—C. C. JAMES, M.A.

1. Draw the apparatus (in use) for making carbon dioxide.

2. How would you distinguish the principal acids?

3. How would you easily distinguish at sight gypsum and mica, quartz and marble, hard and soft coal, ground apatite and superphosphate, calcite and crystalline quartz?

4. State the ingredients of *common salt*. How would you determine the presence of each?

5. Analyze the sample of *soil*. From your results what can you say as to its value, its origin, its greatest need in the way of fertilizers, etc?

6. Examine the sample of water, and report on it, drawing any conclusions warranted by your analysis.

N. B.—In all results, the re-agents used, and the accompanying re-actions must be stated.

SECOND YEAR.

METEOROLOGY.

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

1. Explain the term "area of low pressure." How is it ascertained? What practical use is made of it?

2. Climate is said to be affected by the physical features of a place: Illustrate this by referring to a district situated as follows: (1) In the vicinity of a large body of shallow water; (2) near a body of deep water; (3) separated from the ocean by a lofty chain of mountains.

3. Describe the *pluviameter*, and shew the practical use of data obtained by it. Tabulate the results from a series of six observations on snow and rain.

4. Where, when, and why do the Chinook winds occur?

MIDSUMMER EXAMINATIONS, 1886—Continued.

5. What data are required concerning the temperature of a place to form an idea of its climate.

6. Under what circumstances does the thermometer fail to give you the true idea of the coldness of a locality.

7. Name the different kinds of thermometers used, and reduce 60° Fahr. to 6° centigrade.

8. Explain the Vernier as used on a barometer.

9. Read the instrument before you.

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

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

1. Give the life history of the fungus which causes smut, and some remedies to prevent it.

2. Give a popular classification of the most common plants found in the orders, Cruciferæ, Boraginaceæ and Amarantaceæ.

3. Give the principal characters of the orders, Oleaceæ, Lobeliaceæ and Coniferæ.

4. Name orders in which plants are found, from which the following economic products are obtained :—sugar, lumber, oil, and hemp.

5. Name some of the most common wild flowers of April and May, and the orders to which they belong.

6. Distinguish the so-called Calla lily from a true lily.

7. Account for the distribution of weeds ; classify the most common according to the time required for their development, and give some general principals required to be adopted to destroy them.

8. In the samples of wheat, oats, and peas given, name the different kinds of weed seeds found in each of them.

9. Analyize the plant before you according to the accompanying schedule.

SECOND YEAR.

PRACTICAL HORTICULTURE.

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

1. Given the following plants : Ageratum, Cineraria, Orthonna, Lobelia, Amaranth, Coleus, Geranium, and Ricinus ; how would you arrange them :—

(1) In a bed with a wall at the back.
(2) In a rectangular bed at a distance from a fence or wall.
(3) In a circular bed.

2. Name a collection of plants best adapted for hanging baskets, carpet bedding, and window culture.

MIDSUMMER EXAMINATIONS, 1886—Continued.

3. What specimens of grafting are placed before you? State the precautions necessary to observe in this operation.

4. How would you proceed to grow plants from cuttings? Name some in which this process is often followed.

5. How would you make a soil suitable for potting plants?

6. Name some shrubs which have failed, owing to the climate, at the Agricultural College, and give seven of the most thrifty.

7. Identify the plants in the collection before you.

SECOND YEAR.

VETERINARY MATERIA MEDICA.

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

1. Give a prescription containing a vegetable and mineral tonic, stating the indications for the administration of such, and the best method of giving the same to a horse.

2. Which is the most powerful diaphoretic agent we know of, and in what conditions will it be found useful?

3. Describe how to prepare what is called "White Lotion," and state its uses.

4. Mention the medicinal and dietetic products of flax-seed.

5. Describe how to prepare a purgative drench for the ox.

6. Give the properties of Biniodide of Mercury and state how to prepare it for use, also the indications for its use.

7. What is Opium? Give its properties, actions and uses; and state how it differs from Laudanum and Morphia.

8. What are the common names for Nitrate of Potash? Give its actions and medicinal uses.

9. Give the technical names for Epsom and Glauber's Salts respectively, and state their comparative value as purgatives for the ox.

10. Give a prescription for Tympanitis in the ox.

SECOND YEAR.

BREEDS OF HORSES.

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

1. What is the supposed origin of the Shire and Clyde respectively? State any differences in feature that would enable one to distinguish a representative of one breed from that of the other.

2. Make a comparison of the limbs of a Shire and Clyde, and describe the significance or feather *versus* no feather.

3. Name the four breeds of draught horses, and name the characteristic middle piece of each.

4. Compare the fore and hind-quarters, head and neck of the Suffolk and Clyde.

5. Name the varieties in colour found amongst the Suffolks and Percherons.

6. Mention two prominent defects frequently noticeable in the Percheron.

MIDSUMMER EXAMINATIONS, 1886—Continued.

7. Describe the characteristics of the Cleveland Bay.

8. Define the term, "quality," as applied to a horse, and describe the origin of "Thorough-bred" breed.

9. Describe the factors that have determined the existence of the American trotter.

10. What are the predominating colours and average height of the Thoroughbred.

SECOND YEAR.

ENGLISH LITERATURE.

MILTON'S "L'ALLEGRO" AND "IL PENSEROSO."

Examiner—S. C. SMOKE, B.A.

1. About what period of Milton's life were these poems written? Name some of his other writings.

2. Which of these two poems do you prefer? Give grounds of preference.

3. Quote the passages in which the following expressions occur: *Slumbering morn, tufted trees, shadowy flail, busy hum, deluding joys, fleecy cloud, dewy-feathered sleep.*

4. ". . . . . Daemons that are found
In fire, air, flood, or under ground,
Whose power hath a true consent,
With planet, or with element."

Explain what is meant.

5. "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*) Write notes on *Cerberus, Stygian, Cimmerian.*
(*b*) Explain the force of the words *brooding* and *jealous* as used here.
(*c*) Shew the syntactical relation of the words *hence, born, forlorn, ragged, dwell.*
(*d*) Scan the last two lines.

6. "But, O sad virgin, that thy power
Might raise, Musaeus from his bower,
Or bid the Soul of Orphans sing
Such notes, as warbled to the string,
Drew iron tears down Pluto's cheek,
And made Hell grant what love did seek."

(*a*) Relate the story of *Orphans.* (*b*) Parse *sing, as, warbled, drew.*
(2) *Might raise*; What would be the difference in meaning if *may* were used instead of *might.*

7. "The full voiced *quire.*" What other way of spelling the word italicised? What is the derivation of the word? Give your opinion as to the desirability of adopting a system of *phonetic spelling*, with your reasons.

MIDSUMMER EXAMINATIONS, 1886—Continued.

8. Write as good a prose paraphrase as you can of the following passage :

"But let my due feet never fail
To walk the studious cloister's pale,
And love the high embowed roof,
With antique pillars massy proof,
And storied windows richly dight,
Casting a dim religious light.
There let the pealing organ blow
To the full-voiced quire below
In service high, and anthems clear,
As may with sweetness, through mine ear,
Dissolve me into ecstasies,
And bring all Heaven before mine eyes."

9. What do you consider the essential characteristics of poetry, and wherein does it differ from prose? What meaning would you attach to the expression "a prose poem," which is sometimes used?

SECOND YEAR.

ROAD-MAKING, LEVELLING AND SURVEYING.

Examiner—E. LAWRENCE HUNT.

1. Write notes on the *slopes* of a road.

2. Give full directions for the construction of gravel roads, and state the objections to large stones on a road.

3. If a force of 80 lbs. is required to draw a load of 1 ton along the level,
   (*a*) What force is required to draw the load up a slope of 1 in 15?
   (*b*) What fraction of the load could be drawn up a slope of 1 in 20, with a force of 80 lbs.

4. Distinguish *true* and *apparent* level.
   (*a*) If A and B are five miles apart, and on the same *apparent* level; find the height of A above the point of true level with B.
   (*b*) If they are 100 yds. apart.
   (*c*) If a trench be dug from A to B (See A), how would the water appear in the trench?

5. Complete the following field-book and determine the relative heights of A and F, and draw a sketch of the line :—

Stations.	Distances.	Back-Sights.	Fore-Sights.	Ascents.	Descents.	Total Heights.
A						
B	140	5.50	2.75			
C	60	7.60	1.80			
D	160	3.00	6.45			
E	35	1.30	7.00			
F	80	3.50	3.85			

6. Indicate the measurements you would take to determine the area of the field represented by the accompanying outline.

Record your measurements in the field-book, and complete the area, using your own figures. (The distance from A to B, through C, is 12 chains).

APPENDIX 3.

CLASS LISTS:

I.—EASTER EXAMINATIONS, 1886.

II.—MIDSUMMER EXAMINATIONS, 1886.

I.—EASTER EXAMINATIONS, 1886.

FIRST YEAR

Classes.		Agriculture.	Live Stock.	Judging Cattle. (Oral Exam.)	Judging Sheep. (Oral Exam.)	Inorganic Chemistry.
Honours.	I.	1 Sleightholm, J. 2 Scrugham, J. G. 3 Lick, E.	1 { Scrugham. Sleightholm. 3 Donald. 4 { Hart, J. W. Lick.	....	....	1 Scrugham. 2 Lick. 3 Sleightholm. 4 Orsman. 5 Donaldson. 6 Pady. 7 Craig, J. A. 8 Hart, J. W.
	II.	1 Donald, J. C. 2 Hart, J. W. 3 Ledingham, A. 4 Creelman, G. C. 5 Gilbert, W. J. 6 Morgan, J. H. 7 Craig, J. A. 8 Bishop, W. R. 9 Birdsall, W. G. 10 Miller, J. R. 11 King, R. E. 12 Donaldson, F. N. 13 Hart, J. A. 14 Bowie, T. M. 15 McNiven, W.	1 { Ledingham. Johnston. 3 { Creelman. Morgan. 5 Marsh. 6 { Acres. Hart, J. A. 8 King. 9 Gilbert. 10 { White. Pady.	1 Sleightholm. 2 { Scrugham. Lick. Hart, J. W. Donald. Bishop. 7 { Hart, J. A. Morgan. 9 { Ewing. Knowlton. Ledingham. Leavens. Marsh. Miller. Bowie. Paterson.	....	1 Johnston. 2 Paterson. 3 Ewing. 4 Gilbert. 5 Livesey. 6 Ledingham. 7 Donald. 8 Marsh. 9 King. 10 Hart, J. A. 11 Bishop. ....

CLASS LISTS (EASTERN EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	LIVE STOCK.	JUDGING CATTLE. (Oral Exam.)	JUDGING SHEEP. (Oral Exam.)	INORGANIC CHEMISTRY.
PASS. III.	1 White, S. A. 1 Williams, J. B. 1 Farlinger, T.	1 Craig, J. A. 2 Meikle.	1 Schofield. 1 Orsman. 1 Meikle. 1 Gilbert.	1 Lick. 1 Morgan.	1 Creelman.
	4 Orsman, C. P. 4 Ritchie, H. 4 McCallum, E.G. 4 Acres, A. J. 4 Pady, W. J. 4 Davidson, J. F.	3 Ewing. 3 Coutts.	5 Smithers.	3 Creelman.	2 Leavens.
	10 Marsh, G. F.	5 Schofield.		4 Donald.	3 Morgan.
	11 Harkness, A. D. 11 Howes, J. O. 11 Ewing, W. 11 Leavens, D. H. 11 Paterson, B. E. 11 Johnston, J. F.	6 Bowie. 6 Birdsall.	6 Creelman. 6 Davidson. 6 Graham. 6 King. 6 White.	5 Leavens.	4 Howes.
	17 Knowlton, S. M.	8 Davidson. 8 Williams.		6 Hart, J. W.	5 Meikle.
	18 Brush, G. R. 18 Schofield, E. A.	10 Smithers. 10 Donaldson.	11 Farlinger.	7 Donaldson.	6 Bowie.
	20 Livesey, E. M.	12 Miller. 12 Paterson. 12 Bishop. 12 Leslie.	12 Robertson. 12 McCallum. 12 Leslie. 12 Birdsall. 12 Brush. 12 Coutts. 12 Furness.	8 Howes.	7 Davidson.
	21 Scott, J. A. 21 Coutts, W. F. 21 Smithers, H. S.	16 Orsman. 16 Howes.		9 McCallum.	8 Williams.
	24 McDonald, P. F. 24 Leslie, J. R.	18 Lyster.		10 McIntosh.	9 Harkness.
	26 Lyster, G. R. 26 Graham, G. M.	19 Leavens.	19 Donaldson. 19 Scott.	11 Paterson.	10 Knowlton.
	28 Furness, D.	20 McNiven.		12 Knowlton.	11 Lea.
	29 Meikle, W. F. 29 Donelly, P. E.	21 Livesey. 21 McCallum.	21 Craig, J. A. 21 Johnston. 21 McNiven. 21 Pady. 21 Craig, D. J.	13 Craig, J. A.	12 Leslie.
	McIntosh, W.	23 Brush. 23 Graham.		14 Johnston.	13 Ritchie.
	Lea, H. F.	25 McDonald.	26 Howes.	15 Miller.	14 McNiven.
	.....	26 Furness. 26 Ritchie.	27 Harkness.	16 Meikle.	15 Birdsall.
	.....	28 Farlinger.	28 Williams. 28 Acres. 28 Donelly.	17 Ritchie.	16 Acres.
	.....	29 Harkness.		18 Furness.	17 Schofield.
	.....	30 Lea.	31 Livesey. 31 Lyster.	19 Acres.	
	.....	31 Knowlton.		20 Donelly.	Graham.
	.....	32 Scott.	33 Lea. 33 McDonald.	21 Lyster.	Smithers.
	.....			22 Bishop.	Brush.
	.....	Donelly.	35 McIntosh. 35 Ritchie.	23 Ledingham.	McIntosh.
	.....	McIntosh.		24 Davidson.	Miller.
	.....	.....	.....	25 Robertson.	Farlinger.
	.....	.....	.....	26 McNiven.	Coutts.
	.....	.....	.....	27 Leslie.	White.
	.....	.....	.....	28 Pady.	Furness.
	.....	.....	.....	29 Bowie.	Donelly.
	.....	.....	.....	30 Scott.	McDonald
	.....	.....	.....	31 Hart. J, A. 31 Sleightholm.	Lyster.
	.....	.....	.....		Scott.
	.....	.....	.....	33 King.	.....
	.....	.....	.....	34 Farlinger.	.....
	.....	.....	.....	35 Schofield.	.....
	.....	.....	.....	36 Orsman.	.....
	.....	.....	.....	37 Scrugham.	.....
	.....	.....	.....	38 Ewing.	.....
	.....	.....	.....	39 White.	.....
	.....	.....	.....	40 Coutts.	.....
	.....	.....	.....	41 Gilbert.	.....
	.....	.....	.....	42 Williams.	.....
	.....	.....	.....	43 Brush.	.....
	.....	.....	.....	44 Harkness.	.....
	.....	.....	.....	45 Birdsall.	.....
	.....	.....	.....	46 Marsh.	.....
	.....	.....	.....	Smithers.	.....
	.....	.....	.....	Graham.	.....
	.....	.....	.....	Lea.	.....
	.....	.....	.....	Livesey.	.....
	.....	.....	.....	McDonald.	.....

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.

HONOURS.

Classes.	Organic Chemistry.	Zoology.	Veterinary Anatomy.	English Literature.	English Composition.
I.	1 Scrugham. 2 Craig, J. A. 3 Sleightholm. 4 Lick. 5 Hart, J. W. 6 Ledingham. 7 Orsman. 8 Donaldson. 9 Bishop. 10 Livesey. 11 Pady.	1 Scrugham. 2 Sleightholm. 3 King. 4 Craig, J. A. 5 Pady. 6 Johnston. 7 Donaldson. 8 Ledingham. 9 Marsh. 10 Lick. 11 Donald. 12 Paterson. 13 { Hart, J. W. { Gilbert.	1 Scrugham. 2 Lick. 3 Bishop. 4 Sleightholm. 5 King.	1 Scrugham. 2 Donaldson. 3 { Donald. { Sleightholm. 5 Ledingham. 6 Lick. 7 Hart, J. W. 8 Johnston. 9 Morgan. 10 Craig, J. A. 11 Pady. 12 Paterson. 13 King.	1 Donald. 2 { Scrugham. { Hart, J. W. 4 Johnston. 5 Sleightholm. 6 Donaldson. 7 Pady. ....
II.	1 Gilbert. 2 Paterson. 3 Ewing. 4 Meikle. 5 King. 6 Marsh. 7 Johnston. 8 Hart, J. A. 9 Leslie. 10 Morgan. 11 Creelman. 12 Harkness.	1 Bishop. 2 Ewing. 3 Ritchie. 4 Livesey. 5 Hart, J. A. 6 Morgan. 7 Orsman. 8 Howes. 9 Graham. 10 Creelman.	1 Hart, J. W. 2 Ledingham. 3 Paterson. 4 Pady. 5 Craig, J. A. 6 Donald.	1 Graham. 2 Bishop. 3 { Coutts. { Williams. 5 Gilbert. 6 { Ewing. { Acres. 8 Creelman. 9 Marsh. 10 Livesey. 11 Meikle. 12 Ritchie. 13 Leslie. 14 Bowie.	1 Lick. 2 Ledingham. 3 Craig, J. A. 4 Morgan. 5 King. 6 Ewing. 7 Creelman. 8 Bishop. 9 Paterson. ....

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	ORGANIC CHEMISTRY.	ZOOLOGY.	VETERINARY ANATOMY.	ENGLISH LITERATURE.	ENGLISH COMPOSITION.
PASS. III.	1 Donald. 2 Howes. 3 Leavens. 4 Acres. 5 McNiven. 6 Knowlton. 7 Williams. 8 Birdsall. 9 McCallum. 10 Davidson. 11 Ritchie. 12 Schofield. 13 Furness. 14 Brush. 15 Graham. White. Coutts. Bowie. Lea. Donelly. Smithers. Miller. McDonald. Scott. McIntosh. Farlinger. Lyster.	1 Harkness. 2 Brush. 3 Leslie. 4 Meikle. 5 Birdsall. Acres. 7 McCallum. 8 Davidson. 9 Williams. 10 Smithers. 11 White. 12 Schofield. 13 Furness. 14 Coutts. 15 Bowie. 16 Knowlton. 17 Leavens. 18 Scott. 19 Miller. McNiven. McIntosh. Lyster. McDonald. Donelly. Farlinger. Lea.	1 Ewing. 2 Gilbert. 3 Donaldson. Howes. 5 Meikle. 6 Knowlton. 7 Morgan. 8 Marsh. 9 Hart, J. A. 10 Johnston. 11 Davidson. Livesey. 13 Harkness. Leavens. 15 Leslie. 16 Ritchie. Williams. Creelman. McCallum. Lyster. Farlinger. Coutts. Acres. White. Graham. Lea. McIntosh. Scott. Brush. Orsman. Bowie. Miller. Donelly. Schofield. McDonald. Smithers. Furness. McNiven.	1 Hart, J. A. 2 Schofield. Orsman. 4 Scott. 5 Howes. 6 Smithers. 7 Davidson. 8 Brush. 9 Leavens. 10 Harkness. Donelly. 12 McCallum. 13 Birdsall. 14 McNiven. 15 Lyster. 16 White. 17 Furness. Farlinger. 19 Knowlton. 20 Miller. McIntosh. McDonald. Lea.	1 Orsman. 2 Hart, J. A. 3 Gilbert. 4 Davidson. 5 McCallum. 6 Meikle. 7 Howes. 8 Coutts. 9 Williams. 10 Livesey. 11 Schofield. 12 Birdsall. 13 Leslie. 14 Scott. 15 Bowie. 16 Harkness. 17 Lea. 18 Ritchie. 19 Brush. 20 Marsh. 21 Leavens. 22 Graham. 23 Farlinger. 24 Knowlton. McDonald. Acres. White. Smithers. Donelly. Furness. McIntosh. Miller. McNiven. Lyster.

☞ 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.

Class.	Arithmetic.	Book-Keeping.	General Proficency.
Honours. I.	1 Hart, J. W. 1 Scrugam. 1 Lick. 1 Marsh. 5 Harkness. 6 Howes. 7 Orsman. 8 Donaldson. 9 Sleightholm. 10 Donald. 11 King.	1 Scrugham. 2 Sleightholm. 2 Orsman. 4 Donald. 4 Lick. 6 Marsh. 7 Johnston. 8 Hart, J. W. 9 Pady. 10 Paterson. 11 Hart, J. A. 12 Bishop.	1 Scrugham. 2 Lick. 3 Sleightholm. 4 Hart, J. W.
Honours. II.	1 Ewing. 1 Pady. 3 Johnston. 4 Ledingham.	1 Harkness. 2 King. 3 Morgan. 3 McDonald. 3 Schofield. 3 Birdsall. 7 Ewing. 8 Ledingham. 9 Howes. 10 Gilbert.	1 Donald. 2 Pady. 3 Ledingham. 4 King. 5 Donaldson. 6 Bishop. 7 Craig, J. A. 8 Marsh. 9 Johnston. 10 Paterson. 11 Ewing. 12 Gilbert.
Pass. III.	1 Hart, J. A. 2 Bishop. 3 Gilbert. 4 Leslie. 5 Knowlton. 6 Meikle. 7 Creelman. 7 Davidson. 9 Morgan. 10 McCallum. 11 Paterson. 12 Craig, J. A. 13 Ritchie. 14 Birdsall. 14 McDonald. 16 Williams. 16 Smithers. 18 Coutts. 19 Miller. 19 Farlinger. 19 Lea. Livesey. Donelly. Acres. McNiven. McIntosh. Furness. Bowie. Schofield. White. Graham. Brush. Scott. Lyster. Leavens.	1 Craig, J. A. 2 Bowie. 3 Creelman. 4 Leslie. 5 Davidson. 6 Leavens. 6 Coutts. 8 Meikle. 9 Knowlton. 10 McCallum. 11 Acres. 12 Ritchie. 13 Donaldson. 14 Livesey. 15 McNiven. 16 White. Donelly. Farlinger. Smithers. Williams. Lea. Graham. McIntosh. Brush. Miller. Furness. Scott. Lyster.	1 Hart, J. A. 2 Morgan. 3 Howes. 4 Creelman. 5 Harkness. 6 Meikle. 7 Leslie. 8 Davidson. 9 Ritchie. 10 Knowlton.

Department.		First-class men in the departments.
I.	Agriculture and Live Stock.	
II.	Natural Science.	1 Scrugham. 2 Sleightholm. 3 Lick. 4 Craig, J. A. 5 Donaldson. 6 Pady. 7 Orsman. 8 Hart, J. W. 9 Johnston.
III.	Veterinary Science.	1 Scrugham. 2 Lick. 3 Bishop. 4 Sleightholm. 5 King.
IV.	English Literature and Composition.	1 Scrugham. 2 Donald. 2 Donaldson. 4 Sleightholm. 5 Hart, J. W. 6 Lick. 7 Ledingham. 8 Johnston. 9 Pady. 10 Morgan.
V.	Mathematics and Book-Keeping.	1 Scrugham. 2 Lick. 3 Marsh. 4 Hart, J. W. 5 Orsman. 6 Harkness. 7 Sleightholm. 8 Donald. 9 Howes. 10 Pady.

☞ 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 (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURE.	LIVE STOCK.	ARBORICULTURE.	JUDGING CATTLE. (Oral Exam.)	JUDGING SHEEP. (Oral Exam.)
HONOURS. I.	1 Brown, C. R. 2 Sturge, E. 3 Zavitz, C. A. Madge, R. W. 5 Owen, W. H.	1 Zavitz. 2 Madge. 3 Brown. 4 Sturge.	1 Brown. 2 Zavitz. 3 Sturge.	1 Idington. Brown. Owen. 4 Zavitz. 5 Madge. Watts. Craig, H. Sturge. 9 Poe. Calvert. Menzies. Walter.	1 Idington. Sturge. 3 Madge. 4 Owen. Zavitz.
HONOURS. II.	1 Calvert, S. 2 McKay, J. G. 3 Fee, J. J. Holtby, R. M. 5 Idington, P. S. 6 Power, R. H. Jeffrey, J. S. Watts, W. G.	1 Walter. 2 Watts. 3 Owen. 4 McKay. 5 Fee. Broome. Poe. 8 Craig, H. 9 Calvert. Holtby. Jeffrey.	1 Madge. 2 Owen. Fee. 4 Broome. 5 Power. Calvert. 7 McKay.	1 Holtby. 2 Macfarlane. 3 Broome. Fee. Jeffrey. Notman. McKay.	1 Macfarlane. Brown. 3 Calvert. 4 Fee. Notman. Power.
PASS. III.	1 Menzies, R. M. 2 Macfarlane, A. D. 3 Notman, C. R. 4 Cobb, C. Broome, A. H.	1 Cobb. Notman. 3 Macfarlane. 4 Power. Idington. Menzies.	1 Holtby. 2 Watts. Notman. 4 Jeffrey. 5 Idington. Cobb. Menzies. 8 Macfarlane.	1 Power. 2 Cobb.	1 Watts. Menzies. Broome. Holtby. Jeffrey. 6 Cobb. McKay.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURAL CHEMISTRY.	ENTOMOLOGY.	VETERINARY PATHOLOGY.	JUDGING HORSES.	ENGLISH LITERATURE.
HONOURS. I.	1 Madge. 2 Sturge. 3 Brown. 4 Zavitz. 5 Owen.	1 Madge. 2 Sturge. 3 Brown. 4 Owen. 5 Zavitz. 6 Fee.	1 Owen. 2 Madge. 3 Sturge. 4 Zavitz.	1 Owen. 2 Holtby. 3 Craig. 4 Sturge. 5 Poe. 6 Walter.	1 Calvert. 2 Madge. 3 Owen. 4 Sturge. 5 Watts. .....
HONOURS. II.	1 Fee. 2 Calvert. 3 Cobb. 4 Holtby. 5 McKay.	1 Holtby. 2 Calvert. 3 Watts. 4 Jeffrey. 5 Power. 6 Cobb. 7 Idington.	1 Holtby. 2 Walter. 3 Brown. 4 Calvert. 5 McKay.	1 { Brown. { Madge. 3 Jeffrey. 4 Zavitz. 5 Calvert.	1 { Broome. { Fee. 3 Zavitz. 4 { Brown. { Holtby. 6 Cobb. 7 McKay. 8 Jeffrey.
PASS. III.	1 Jeffrey. 2 Watts. 3 Notman. 4 Menzies. 5 Power. 6 Idington. 7 Broome. 8 Macfarlane.	1 Broome. 2 Notman. 3 McKay. 4 Menzies. 5 Macfarlane.	1 Fee. 2 Poe. 3 Jeffrey. 4 { Power. { Idington. 6 Watts. 7 Craig. 8 Cobb. 9 Notman. 10 Broome. Menzies. Macfarlane.	1 Fee. 2 McKay. 3 Menzies. 4 Watts. 5 { Idington. { Power. 7 Notman. 8 Macfarlane. 9 Broome. 10 Cobb.	1 Power. 2 Notman. 3 { Idington. { Macfarlane. Menzies. ....

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

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.		POLITICAL ECONOMY.	MECHANICS.	GENERAL PROFICIENCY.
HONOURS.	I.	1 Jeffrey. 2 Madge. 3 Sturge. 4 Owen. 5 Brown. 6 Fee. 7 Holtby.	1 Brown. 2 Zavitz.	1 Madge. 2 Sturge. 3 Brown. 4 Owen. 5 Zavitz.
	II.	1 Calvert. 2 Zavitz. 3 McKay. 4 Watts.	1 Sturge. 2 McKay. 3 Madge.	1 Calvert. 2 Fee. 3 Holtby. 4 Jeffrey. 5 McKay.
PASS.	III.	1 Power. 2 Cobb. 3 Notman. 4 Idington. 5 Macfarlane. 6 Menzies. 7 Broome.	1 Owen. 2 Jeffrey. 3 Holtby. 4 Fee. 5 Calvert. 6 Power. 7 { Menzies. { Macfarlane. 9 Broome. 10 Idington. 11 { Watts. { Cobb. 13 Notman.	1 Watts. 2 Power. 3 Cobb. 4 Idington. 5 Notman. 6 Broome.

DEPARTMENT.		FIRST-CLASS MEN IN THE DEPARTMENTS.
I.	AGRICULTURE AND LIVE STOCK.	1 Zavitz. 2 Brown. 3 Sturge. 4 Madge. 5 Owen.
II.	NATURAL SCIENCE.	1 Madge. 2 Sturge. 3 Brown. 4 Zavitz. 5 Owen. 6 Fee.
III.	VETERINARY SCIENCE.	1 Owen. 2 Sturge. 3 Madge. 4 Holtby. 5 Zavitz. 6 Walter.
IV.	ENGLISH LITERATURE AND POLITICAL ECONOMY.	1 Madge. 2 Sturge. 3 Owen. 4 Jeffrey. 5 Calvert. 6 Fee.
V.	MATHEMATICS.	1 Brown. 2 Zavitz.

		SPECIAL CLASS. GENERAL PROFICIENCY.
HONOURS.	I.	Walter, J. R.
	II.	Poe, J. P.
PASS.		Craig, H.

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.

II.—MIDSUMMER EXAMINATIONS, 1886.

FIRST YEAR.

Classes.	Agriculture.	Dairying.	Geology.	Botany.	Veterinary Materia Medica.
Honours. I.	1 Sleightholm, J. 2 Scrugham, J. G. 3 Lick, E. 4 Donald, J. C. 5 Morgan, J. H. 6 Creelman, G. C. / Hart, J. W.	1 Donaldson. 2 Scrugham. 3 Ewing. / Hart, J. W. 5 Craig J. A 6 McCallum. 7 Lick. 8 Elton. 9 Morgan. / Pady.	1 King. 2 Scrugham. 3 Elton. 4 Craig, J. A.	1 Scrugham. 2 Craig, J. A. 3 King. / Elton. 5 Lick. 6 Morgan.	1 Scrugham. 2 Hart, J. W. 3 King. 4 Lick. 5 Sleightholm. / Donald. 7 Craig, J. A. ....
II.	1 Ewing, W. 2 Craig, J. A. 3 Elton, C. W. 4 King, R. E. 5 Donaldson, F. N. / Pady, W. J. 7 Howes, J. S. 8 Bishop, W. R. / Gilbert, W. J.	1 Bishop. / Donald. / Gilbert. 4 Howes. 5 Paterson. 6 Williams. 7 Schofield. 8 Hart, J. A. 9 Sleightholm. / Scott. / Creelman. 12 King. / Meikle. 14 Orsman.	1 Paterson. 2 Ewing. 3 Hart, J. W. 4 Howes. 5 Morgan. 6 Donaldson. 7 Creelman. 8 Sleightholm. / Pady. 10 Bishop.	1 Sleightholm. 2 Ewing. / Donaldson. 4 Gilbert. 5 Hart, J. W. 6 Paterson. / Williams. 8 Livesey. 9 Pady. 10 McCallum. 11 Orsman.	1 Elton. 2 Morgan. 3 Pady. 4 Hart, J. A. 5 Creelman. 6 Gilbert. 7 Bishop. ....

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	DAIRYING.	GEOLOGY.	BOTANY.	VETERINARY MATERIA MEDICA.
PASS. III.	1 Bayne, S. R. 2 Hart, J. A. 3 McCallum, E. G. Williams, J. B. Harkness, A. D. 6 Meikle, W. F. Livesey, E. M. 8 Paterson, B. E. Coutts, W. F. Miller, J. R. 11 Schofield, E. A. Orsman, C. P. 13 Scott, J. A. 14 Sullivan, R. Warner, F. C. 16 Lyster, G. R. Smithers, A. S. 18 Leavens, D. H. Kellogg, C. A. McDonald, P. F. 21 Kellogg, W. J. 22 Graham, G. M. 23 Furness, D. 24 DeMauritz, R. Price, V. Taylor, F. O. Donelly, P. E.	1 Leavens. 2 Bayne. 3 Coutts. Harkness. 5 Sullivan. 6 Livesey. Smithers. 8 Price. Furness. Donelly. Miller. 12 Graham. Lyster. Kellogg, W. J. 15 DeMauritz. 16 Kellogg, C. A. McDonald. 18 Warner. Taylor.	1 Lick. 2 Bayne. Gilbert. 4 Livesey. 5 Williams. 6 McCallum. 7 Meikle. 8 Donald. 9 Warner. 10 Harkness. 11 Hart, J. A. 12 Schofield. 13 Coutts. 14 Sullivan. 15 Orsman. 16 Leavens. 17 Graham. 18 Price. 19 DeMauritz. Scott. Donelly. Kellogg, C. A. Smithers. Taylor. McDonald. Kellogg, W. J. Furness. Miller. Lyster.	1 Bayne. Creelman. 3 Bishop. 4 Hart, J. A. 5 Donald. 6 Harkness. 7 Howes. 8 Schofield. 9 Leavens. 10 Meikle. 11 Coutts. 12 DeMauritz. 13 Price. 14 Miller. 15 McDonald. Sullivan. Kellogg, W. J. Warner. Smithers. Donelly. Scott. Furness. Graham. Kellogg, C. A. Taylor. Lyster.	1 Paterson. Howes. 3 Orsman. 4 Ewing. Livesey. 6 McCallum. Donaldson. 8 Williams. 9 Meikle. 10 Coutts. Leavens. 12 Harkness. Smithers. 14 DeMauritz. Schofield. Price. Miller. Sullivan. Warner. Furness. Kellogg, W. J. Donelly. Taylor. Scott. McDonald. Kellogg, C. A. Lyster. Bayne. Graham.

☞ 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.

CLASS.	ENGLISH LITERATURE.	MENSURATION.	GENERAL PROFICIENCY.	DEPARTMENTS.	FIRST-CLASS MEN IN THE DEPARTMENTS.
HONOURS. II.	1 Scrugham. 2 Elton. 3 Hart, J. W. Donaldson. 5 Donald.	1 Lick. Scrugham. 3 Hart, J. W. 4 Howes. 5 De Mauritz. 6 Pady. 7 King. 8 Sleightholm.	1 Scrugham. 2 Hart, J. W. 3 Lick. 4 King.	I. AGRICULTURE AND DAIRYING.	1 Scrugham. 2 Lick. 3 Hart, J. W. 4 Ewing. Morgan. Donald. 7 Donaldson.
HONOURS. I.	1 Pady. 2 Sleightholm. 3 Gilbert. 4 DeMauritz. 5 Craig, J. A. Lick. 7 King.	1 Hart, J. A. 2 Harkness. 3 Orsman. 4 Bishop. 5 Donaldson.	1 Sleightholm. 2 Craig, J. A. 3 Elton. 4 Pady. 5 Morgan. 6 Donald. 7 Donaldson. 8 Ewing. 9 Creelman. 10 Gilbert. 11 Bishop. 12 Howes.	II. NATURAL SCIENCE.	1 King. 2 Scrugham. 3 Elton. 4 Craig, J. A.
PASS. III.	1 Creelman. 2 Bishop. 3 Morgan. 4 Ewing. 5 Paterson. 6 Hart, J. A. 7 Price. 8 Harkness. 9 Howes. 10 Meikle. 11 Williams. 12 Orsman. McCallum. 13 Sullivan. Livesey. 16 Graham. 17 Schofield. 18 Leavens. 19 Scott.	1 Creelman. 2 Ewing. 3 Meikle. McCallum. 4 Craig, J. A. Elton. Donald. 7 McDonald. 9 Gilbert. 10 Morgan. 11 Schofield. 12 Bayne. 13 Livesey. 14 Kellogg, C. A. 15 Miller. 16 Kellogg, W. J. 17 Patterson. 18 Sullivan. 19 Leavens.	1 Hart, J. A. 2 Paterson. 3 McCallum. 4 Orsman. 5 Livesey. 6 Harkness. 7 Meikle. 8 De Mauritz. 9 Schofield. 10 Leavens.	III. VETERINARY SCIENCE.	1 Scrugham. 2 Hart, J. W. 3 King. 4 Lick. 5 Sleightholm. 6 Donald. 7 Craig, J. A.
PASS. III.	Warner. Furness. Bayne. Coutts. Taylor. Lyster. Miller. Kellogg, W. J. McDonald. Donelly. Kellogg, C. A. Smithers.	Coutts. Warner. Furness. Williams. Smithers. Price. Lyster. Graham. Scott. Taylor. Donelly.		IV. ENGLISH LITERATURE.	1 Scrugham. 2 Elton. 3 Donaldson. Hart, J. W. 5 Donald.
				V. MATHEMATICS.	1 Lick. Scrugham. 3 Hart, J. W. 4 Howes. 5 De Mauritz. 6 Pady. 7 King. 8 Sleightholm.

☞ 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.		AGRICULTTRE.	DAIRYING.	PRACTICAL HORTICULTURE.	SYSTEMATIC AND ECONOMIC BOTANY.	METEOROLOGY.
HONOURS.	I.	1 Brown, C. R. 2 Sturge, E. 3 Zavitz, C. A. 4 Madge, R. W.	1 Brown. 2 Madge. 3 Zavitz. 3 Sturge. 5 Owen.	1 Madge. 2 Sturge. 3 Brown. 4 Zavitz. 5 Owen. 6 Calvert.	1 Madge. 2 Sturge. 3 Owen. 4 Brown. 5 Zavitz. 6 Fee.	1 Sturge. 2 Madge. 3 Brown. 4 Zavitz. 5 Owen. .....
	II.	1 Owen, W. H. 2 Acres, A. G. 3 Jeffrey, J. S.	1 Jeffrey. 2 Acres. 3 Holtby. 3 Fee. 5 Calvert. 6 Power. 7 Idington.	1 Fee. 2 Power. 3 Cobb. 4 Holtby.	1 Calvert. 2 Cobb.	1 Calvert. 2 Fee. 3 Holtby. 4 Jeffrey. ....
PASS.	III.	1 Calvert, S. 2 Power, R. H. 2 Cobb, C. 2 Macfarlane, A.D 2 Idington, P. S. 6 White, S. A. 7 Birdsall, W. G. 7 Menzies, R. M. 7 Fee, J. J. 10 Notman, C. R. 11 Holtby, R. M. 11 Ritchie, H.	1 Macfarlane. 2 Menzies. 3 Notman. 4 Ritchie. 5 White. 6 Cobb. 7 Birdsall.	1 Notman. 2 Birdsall. 3 Acres. 4 Menzies. 5 Jeffrey. 6 Ritchie. 7 Idington. 8 Macfarlane. White.	1 Holtby. 2 Power. 3 Acres. 4 Jeffrey. 5 Menzies. 6 Ritchie. 7 Notman. 8 Birdsall. 9 Idington. 10 Macfarlane. 11 White.	1 Birdsall. 2 Ritchie. 2 Power. 4 Cobb. 5 Idington. 6 Notman. 7 Menzies. 8 Macfarlane. 9 White. 10 Acres. .....

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

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

SECOND YEAR.

Classes.		Analytical Chemistry.	Veterinary Materia Medica.	Breeds of Horses.	English Literature.	Road-making, Leveling, and Surveying.
Honours.	I.	1 Madge. 2 Zavitz. 3 Sturge.	1 Brown. 2 Sturge. 3 Owen. 4 Madge. 5 Jeffrey.	1 Brown. 2 Sturge. 3 Madge. 4 Owen.	1 Madge. 2 Owen. 3 Sturge. 4 Calvert. 5 Brown.	1 { Madge. { Zavitz.
	II.	1 Fee. 2 Owen. 3 Calvert. 4 Cobb. 5 Brown.	1 Holtby. 2 Birdsall.	1 Calvert. 2 Holtby 3 Jeffrey.	1 Fee. 2 Holtby. 3 Cobb. 4 Zavitz. 5 Jeffrey. 6 Acres.	1 Sturge. 2 Brown.
Pass.	III.	1 Ritchie. 2 Holtby. 3 Birdsall. 4 Jeffrey. 5 Power. 6 Notman. 7 Macfarlane. 8 Acres. 9 Menzies. 10 Idington. 11 White.	1 Cobb. 2 Zavitz. 3 Fee. 4 { Calvert. { Macfarlane. 6 Idington. 7 Power. 8 Notman. Ritchie. Acres. White. Menzies.	1 { Fee. { Idington. 3 Zavitz. 4 Power. 5 { Cobb. { Acres. 7 { Menzies. { Notman. Birdsall. Macfarlane. White. Ritchie.	1 Ritchie. 2 Idington. 3 Birdsall. 4 Macfarlane. 5 Power. 6 Menzies. 7 Notman. White.	1 Owen. 2 Holtby. 3 Fee. 4 Jeffrey. 5 Calvert. 6 Birdsall. 7 Cobb. 8 { Notman. { Idington. 10 Power. Macfarlane. Acres. Menzies. White. Ritchie.

Classes.	General Proficiency.	Department.		First-class men in the Departments.	Department.		First-class men in the Departments.
I.	1 Madge. 2 Sturge. 3 Brown. 4 Zavitz.	I.	Agriculture and Dairying.	1 Brown. 2 Sturge. 3 Madge. 4 Zavitz.	IV.	English Literature.	1 Madge. 2 Owen. 3 Sturge. 4 Calvert. 5 Brown.
II.	1 Owen. 2 Holtby.	II.	Natural Science.	1 Madge. 2 Sturge. 3 Zavitz. 4 Owen.			
III.	1 Jeffrey. 2 Fee. 3 Calvert. 4 Power. 5 Notman. 6 Cobb. 7 Idington.	III.	Veterinary Science.	1 Brown. 2 Sturge. 3 Madge. 4 Owen.	V.	Mathematics.	1 { Madge. { Zavitz.

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

APPENDIX 4.

COLLEGE IN ACCOUNT WITH FARM AND GARDEN.

(*a*) With Farm.

To 320 bags potatoes, at 55c	$176 00
" 3,738 gallons milk, at 12c	448 56
" Cartage for College	20 00
" Feed of College horse (without attendance)	75 00
" Feed of Matron's horse (without attendance)	75 00
" Carpenter work, etc., by students	20 00
	$814 56

(*b*) With Garden.

To fruit and vegetables (for items and prices, see Mr. Forsyth's report, Part VII)	634 98
	$1,449 54
By amount paid by College for Students' labour on farm and garden	2,939 70
	$1,490 16

In addition to this, all College work done by the Farm Carpenter has been deducted from the Farm Expenditure and charged to the College, under the head of "Maintenance and Repairs of Government Buildings."

PART II.

REPORT

OF THE

PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December 31st, 1886.

To the President of the Ontario Agricultural College:

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

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

1. COLLEGE MUSEUM.

A Museum for an Agricultural College should partake more largely of an instructive character than for the gratification of public curiosity; while it may, to a certain extent, possess features of popular interest; still these should be subservient to the objects of instruction. Our museum hitherto has been an attempt to satisfy the ordinary sight-seer who visits the College from time to time. Many of the specimens are foreign to the Province, and serve in a very indirect way to instruct our students. During the past year an attempt has been made to render the collection more instructive, by altering the arrangement and adding specimens of more practical value in advancing the education of students in agriculture. The collection is so arranged that students may come from the lecture-room and observe illustrations of the subjects discussed. By a proper use of these facilities, inquiring, thoughtful young men have impressed upon their minds much of the instruction received in the class-room. There is no doubt, that the more we can illustrate our lectures by specimens, easy of access, the more successful we will be in developing an interest in the different studies of our curriculum. To effect this, we should make our collection of specimens largely provincial and closely associated with the instruction imparted.

While it is gratifying to mark the progress in the number, character and arrangement of our specimens, I regret to have to direct your attention to the inferior condition of the room itself, which at the present time is in sad want of repair, and equipped with cases which take up much space and display but little.

I hope you will be able to impress those who have means at their disposal to do something to improve the accommodation and equipment of the room. The introduction

of more modern cases, the raising of the roof, and construction of a gallery around the sides, would effect most satisfactory results in the appearance and utility of this valuable adjunct to college work. I am quite confident, if we could secure these necessary improvements we would soon possess a museum unique in its character, as an important factor in the progress of agricultural education, instructive to students and interesting to the ordinary visitor.

During the year we have been indebted to the following for, in some cases, very valuable donations to this department:—

1. J. Townsend, Esq., Durham. Forty specimens of fossils from the Guelph formation.

2. Entomological Society, London, Ont. Three cases of *noxious* insects and one of *beneficial*.

3. R. E. King, student. Twenty-three specimens of fossils from the Oriskany and Corniferous formations of Ontario.

4. S. A. K. White, student. One stuffed squirrel.

5. Messrs. Sutton & Sons, Reading, England. Twenty-four species of grass, beautifully arranged.

6. J. S. Jeffrey, student. An excellent specimen of the moth, *Platysamia Cecropia*.

7. J. A. Hart, student. Specimens of the American Tent-caterpillar (*Clisiocampa Americana*.

8. R. W. Madge, student. Specimens of chess.

9. James Newton, Esq. Economic products from the rocks at Limehouse.

10. J. C. Donald, student. Thirty-six species of shells.

11. A. Gilchrist, Esq. Thirty-five varieties of fruit, and twenty specimens illustrating bees and their work.

12. J. A. Creelman, ex-student. A collection of plants illustrating the *flora* of the North-west.

13. Messrs. Hart, J. W., Warner, F. C., Livesey, E. M., Bayne, S. W., Scrugham, J. G., Creelman, G. C., Kellogg, W. J., Craig, J. A., Paterson, B. E., and Bishop, W. R., students. Specimens from outcrops visited by the class in geology.

14. Prof. J. Hoyes Panton. Specimens of the seeds of fifty-four different species of weeds; ten fragments of boulders; four injurious microscopic plants, and thirty-five illustrating the development of some noxious insects.

15. Messrs. F. & A. Dickson & Sons, Chester, England. Thirty-two species of grasses mounted and named.

16. J. A. Craig, student. A collection of grasses showing the whole plants.

17. C. Zavitz, ex-student. A collection of weeds illustrating the nature of the roots.

Our geological specimens are arranged in the crude cases we have, so as to give an idea of the different systems in the series of rocks as well as the minerals and fossils found in them, together with rocks that form the earth's crust and the minerals of which they are composed.

Each case represents a system. These are so arranged, that by commencing at one side and passing to the left, the sixteen systems in the geological series pass in review, each with its characteristic fossils.

By this means our students soon become familiar with the rocks which have been important factors in the formation of soil. One case is devoted to popular geology. In this no scientific names are employed; every specimen is labelled with some common name by which it can readily be understood as regards its character and formation.

The collection of birds is classified and labelled as far as we have been able, so as to be of practical use to students. The birds that are beneficial and injurious being placed in separate groups, thus enabling the student to observe at once the farmer's friends and foes. We have also during the past year advanced in the arrangement of the specimens

used in the study of economic entomology. The noxious and beneficial insects being in separate cases and labelled, so that the insects affecting the different kinds of fruits, vegetables, etc., are at once recognized by their common and scientific names. In addition to the specimens of mature insects, many larval forms have been added, so that at a glance the life history of some of our insect pests is readily understood. Our object is to make this collection as instructive as possible, by having specimens of egg, larva, pupa and imago, together with illustrations of how they affect farm crops, etc.

As soon as suitable accommodation is secured, a collection of fruits will be made, consisting of typical forms illustrating the fruits of Ontario. These will be preserved in a condition which will enable the students to compare with little difficulty the fruits discussed in lectures on Horticulture.

An examination of the list of donors to our museum, shows a greater interest on the part of the students than in any former year, and indicates that when we are ready to receive specimens and place them in proper cases, it will not be long before the museum is a credit to our College and to the wealthy Province in which it is located. If we fail to make the improvements suggested, we can scarcely expect to reach the ideal of success in this important part of College work.

2. Library.

The improved arrangement for study in the afternoon of each day is observed, when a comparison of the books taken from the library now, is made with those before the change took place. The faithful, industrious student soon finds there is much to learn in agriculture, and that every moment of time in college life can be profitably employed by taking advantage of the books readily obtained from the library.

The following summary shows the number of books taken out during the respective terms and the departments to which they belong :—

	Winter Term.	Spring Term.	Summer Term.	Fall Term.	Total.	1885.
Agriculture	298	194	12	216	720	508
Chemistry	24	9	8	27	68	49
Natural History	100	72	8	74	254	197
Literature	147	65	16	55	283	231
Veterinary	48	25	2	65	140	130
Mathematics	23	8	....	3	34	30
History	66	14	10	25	115	110
Travel	21	8	7	8	44	81
Biography	30	9	4	4	47	148
Miscellaneous	87	62	16	25	190	93
1886.	844	466	83	502	1895	1577

The library contains at present 5,068 volumes, of which 165 have been added this year. The latter may be grouped as follows :—

Reports, chiefly agricultural	68
Natural History, including Botany	13
Veterinary	2
Agriculture	30
Chemistry	3
Literature	24
Encyclopædias	2
Bound Journals	8
Directory	2
Dairying	4
Geology	1
History	4
Pamphlets	4

Although the number of agricultural reports appears large in comparison with that

of other books added during the year, it must be remembered that in many of these some most valuable papers are found, and these are now so indexed that our students can readily find them. On this account these reports may be considered valuable acquisitions to our library, and in many respects almost equivalent to text-books upon agricultural subjects. The library is, no doubt, a very important factor in our work, and, if properly used by the students, will from year to year influence their minds in the line of study and thought.

3. Reading-room.

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

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 the 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.	Weekly Herald	Stratford.
13.	Bee Journal	Beeton.
14.	North York Reformer	Newmarket.
15.	Acton Free Press	Acton.

(b) *Furnished by the College.*

1.	The Daily Globe	Toronto.
2.	" Mail	"
3.	" Mercury	Guelph.
4.	" Herald	"
5.	Rural Canadian	Toronto.
6.	Grip	"
7.	The Week	"
8.	Farmers' Advocate	London, Ont.
9.	Canadian Dairyman	Montreal.
10.	Canadian Stock-Raisers' Journal	Hamilton.
11.	Nor'-West Farmer	Winnipeg.
12.	Popular Science News	Boston.
13.	Rural New Yorker	New York.
14.	Gardeners' Monthly	Philadelphia.

15. Canadian Breeder ..... Toronto.
16. North British Agriculturist ..... Edinburgh (Scotland).
17. Farmers' Gazette ..... Dublin (Ireland).
18. Mark Lane Express ..... London (England).
19. American Garden ..... Greenfield (Mass.).
20. American Naturalist ..... Philadelphia.
21. Veterinary Journal ..... London (England).
22. Veterinarian ..... "
23. Cultivator and Country Gentleman ..... Albany, N.Y.
24. Scientific American ..... New York.
25. " Supplement ..... "
26. Live Stock Journal and Fanciers' Gazette ..... England.
27. Live Stock Journal ..... Chicago.
28. American Agriculturist ..... New York.
29. American Dairyman ..... "
30. Eclectic ..... "

4. Practical Work.

During the past year my efforts in this line of work have been observations made for the purpose of obtaining data necessary for the preparation of bulletins in connection with the Natural History Department.

The results of my work are embodied in the papers in this report on Potato Rot, Hardy Shrubs, Grapes, and the Germination of Seeds.

Some experiments were carried on in connection with a study of the root distribution of plants; these, together with some yet to be made, will form the subject matter of a future bulletin.

A considerable number of plants have been identified for persons who sent them from different parts of the Province. Among them I find the so-called "French Weed" of the Red River Valley—a most pernicious weed belonging to the same family as the mustard. The specimen sent was from some place near Almonte. In all likelihood it has come in seed wheat from the North-West, and if not kept under or extirpated will prove a troublesome weed. It is sometimes called "Penny Cress" from the shape of its pods, and to botanists is known as Thlaspi Arvense.

From near Stratford a specimen of the perennial Sow Thistle (Sonchus Arvense) was received. This, too, is a very bad weed, and wherever it appears every effort should be made to destroy it. It is distinguished from the common Sow Thistle, an annual, by the hairy nature of the stem near the flower. The other specimens identified were chiefly common weeds and plants which require no notice. But the appearance of "Penny Cress" and the perennial "Sow Thistle" should be regarded with alarm. Several insects have also been identified for correspondents, and methods given for their destruction.

The following are papers which I have prepared for publication in connection with the College work during 1886:—

The Potato Rot—Its Cause and Remedies.

The use of the microscope in the fields of scientific research has revealed much that is of importance to man. Many forms of disease, about whose origin little was known, have had much light shed upon them since this instrument was employed in their study, both among animals and plants. We find now that man is constantly lashed by invisible foes—some attacking himself and others the food which he eats. During the summer and fall of 1885 a striking example of this occurred in the prevalence of the so-called "potato rot," which has proved a great loss throughout the Province and in many parts of the United States. In the bulletin issued in November from the Bureau of Industries, we learn that the "rot" prevailed throughout the whole southern belt of the Province. In many cases one-half to three-fourths of the crop was destroyed, and in some it was not worth digging. With such disaster around us, the questions are naturally suggested, what is the cause of the "rot," and what remedies can be adopted?

Cause.—This disease has received a great deal of attention from botanists since the days when it became a scourge in Ireland and other parts of the British Isles; and it is now conceded to be the result of a minute fungus, *Phytophthora infestans.* This attacks all parts of the plant—leaf, stem and tubers. By those ignorant of the life history of this tiny parasitic plant little attention is paid to its appearance on the tops, and no alarm is experienced until the potatoes are effected. But being very contagious, its presence on the leaves should become a serious matter, especially when we remember that it spreads with great rapidity. It is usually indicated by the tops presenting a blotched, brownish, spotted, dead appearance. A close examination of the potatoes showing this will discover innumerable slender stems growing up out of the surface of the leaves and stems of the affected plants. These branch and swell out at the ends into pear-shaped minute bodies (spores), which are produced by millions. When ripe they separate from the stem and being exceedingly light pass into the atmosphere, where they are wafted about, many of them finally reaching the ground or settling upon plant. Under favourable conditions of moisture and heat, the contents of a microscopic spore may push out a long minute tube, which can penetrate into any part of the potato plant, and give rise to the fungus; or may separate into several distinct portions (swarm spores) which burst through the spore-wall and become the source of the parasitic plant. The mature plant which lives in the tops and tubers is very minute, and can be seen only by the aid of the microscope. It consists of many colourless, branching, thread-like structures. These penetrate the tissues of the potato and feed upon the juices, so that it soon weakens and begins to waste away. From the thread-like structures tiny stalks arise, assuming beautiful plant-like forms and bearing upon their branches the spores already referred to. They live but a short time, but the thread-like structure is perennial and hardy, and from fragments of it new fungi may arise. It is said by some that another kind of spore is produced which can winter, and thus give rise to the organism in another season. These are the so-called resting spores, apparently for the purpose of keeping the species over certain periods, while the spores already considered are produced rapidly, so as to hasten the spread of the fungus under favourable conditions. This minute microscopic plant is certainly a low form of vegetable life, incapable of manufacturing food from the mineral kingdom, but fastening upon other plants and feeding upon their juices. A wet season supplies conditions well adapted for its development, and hence we find the "rot" associated with such weather. There is no doubt that many spores are always more or less present, but they are prevented from being a source of trouble, because the weather is not suited for their growth.

Remedies.—The "rot" usually appears about the first two weeks in August, and if the weather is favourable its spread is very rapid, for as soon as the thread-like structure which arises from the spore is developed, it immediately becomes spore-bearing. Hence the importance of examining the plants for the appearance of the brownish spots that indicate the presence of the fungus:—

1. As soon as discovered, dig the potatoes. Delay will allow it to spread to the stems, and thence to the tubers. If it reaches these and damp weather comes, "rot" will certainly appear.

2. After digging, the potatoes should be put in a cool, dry place, thus surrounding them with conditions unfavourable for the growth of the fungus, if any happens to be upon them.

3. Growing early varieties is worthy of consideration, so that they may mature before the season arrives when this parasite is likely to affect the crop.

4. All potato stalks, in affected lands, should be gathered and burned, so as to destroy the millions of spores which may be upon them.

5. Use none but good seed. If at all affected, reject them; and plant in well-drained land. If the potatoes to be used for seed have been taken from cellars where affected ones were kept, they are likely to have the microscopic spores on them and escape notice. It would be best to get seed from unaffected districts.

6. It is scarcely necessary to remark that it would be injudicious to plant potatoes in the same field the following year, after a visitation of the "rot," inasmuch as the ground may retain the germs of the disease.

7. Avoid planting upon heavy clay soil, but prefer a light and dry soil. This presents the fewest conditions suitable for the growth of the fungus.

8. Plant the varieties least affected.

The nature of our climate is not so favourable for the development of this injurious fungus as that of Britain; yet as we are sometimes visited by it, and although scarcely viewed as a scourge, it is well that we should remember its nature and habits, and always be ready to guard against failure if it appears. As last summer was favourable for its propagation, great care should be exercised in the selection of seed this spring.

Hardy Shrubs.

Six years ago an Arboretum was established at the Ontario Agricultural College for the purpose of testing trees and shrubs on the college grounds. Upwards of 400 species have been planted, so that we are now in a position to give some results of our work in this line of investigation. The space for a bulletin being limited, I shall in this refer only to the shrubs which have done well, and reserve for a future occasion remarks upon those which have failed, and our success in tree planting. At the present time, when the beautifying of country homes is commanding the attention of farmers, our results in shrub culture may be of interest. However, it must be remembered that some varieties, which have failed with us, may be grown successfully in some parts of Ontario where the climate is less severe. Whatever is remarked in this bulletin refers to results on the college grounds only.

1. Conditions surrounding the shrubs.

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

Exposure: The lawn on which the shrubs are planted, slopes S.S.W., and is surrounded by a belt of evergreens, the north side being well protected.

Soil: Clay loam.

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

2. Management.

The shrubs have been carefully planted in clumps, each containing several genera of the same family. In some cases they are cultivated around them for a distance of about two feet, in others the whole space between the shrubs is kept thoroughly worked and as free from weeds as possible.

On the approach of winter the tender varieties are protected by using coarse manure as a mulch above the roots, and covering the shrub with evegreen brush in the way best suited for protection. Any weeds which may appear from time to time between periods of cultivation after being hoed are left as a sort of mulch around the shrubs.

3. Results.

The following have proved hardiest in our collection, and having withstood the comparatively severe climate of this locality, while many which have completely failed may be grown with success in most parts of Ontario.

Anacardiaceae (Sumach Family).

Rhus (Sumach).—This genus is represented by four species which seem hardy.

Berberidaceae (Barberry F.)

Berberis (Barberry).—Both species, common and purple, have done well. The latter is a very handsome shrub, but the family has a bad reputation for being a source of the rust we find on wheat.

Caprifoliaceae (Honeysuckle F.)

Lonicera (Honeysuckle).—Six species of this genus are hardy and flowering early and are among the most attractive shrubs on the lawn.

Viburnum (Snowball).—Seven species, hardy. In some the berries give the shrub a beautiful appearance.

Weigela.—This genus is not quite so hardy as the preceding, but its beautiful bell-like flowers are well worth some extra care.

Sambucus (Elder).—Two species do well.

Symphoricarpus (Snowberry).—More attractive for the beauty of its white berries than the small flower it bears.

Cornaceae (Dogwood F.)

Cornus (Dogwood).—Three hardy species thrive in this family. C. stolonifera is interesting on account of its reddish bark.

Leguminosae (Bean F.)

Caragana (Pea-tree).—This genus of Russian shrubs is represented by several hardy forms which are dwarf-like in appearance, but seem to be doing well. This spring some bore beautiful golden flowers.

Colutea (Bladder senna).—Attractive for its yellow flowers and peculiar bladder-like reddish pods.

Oleaceae (Olive F.)

Syringa (Lilacs).—Eight species, hardy.

Forsythia (Golden Bell) and Ligustrum (Privet).—Do well.

Chionanthus (White Fringe).—Has not been as thrifty with us as the preceding, but the shrub seems to have been injured by some other means than the climate.

Rosaceae (Rose F.)

Spiraea.—This genus is represented by ten hardy varieties that are among the most beautiful shrubs we have. Some flowering in spring, S. chamaedrifolia, S. aurea; others in July, S. Billardi, S. callosa.

Pyrus Japonica (Japan quince).—Not so hardy as some of the preceding.

Rosa.—In this genus the briers are thrifty.

Saxifragaceae (Saxifrage F.)

Philadelphus (Mock Orange).—Six varieties in this genus are very interesting for their hardiness and the beautiful white fragrant flowers with which some of them are covered in June.

Ribes (Flowering Currants).—Five varieties have done well, and in early spring beautify the lawn with their golden and crimson flowers.

Hydrangea-paniculata (Shrub Hydrangea).—This beautiful shrub, flowering in August, blooms at a time when few are in flower. It is not quite so hardy as the other representatives of this family.

4. CONCLUSIONS FROM OUR EXPERIENCE.

1. Where shrubs are planted in clumps they grow better by having all the land tween them cultivated.

2. Shrubs should be thoroughly cultivated around them for a distance of about three t, so as to keep the soil clean and loose.

3. In the selection of shrubs, their hardiness should be considered, otherwise their rchase is money thrown away. It often happens in a climate like ours that the most pensive varieties are the most tender, and not likely to succeed.

4. Shrubs which withstand the climate of Guelph may be termed very hardy and y be grown successfully in most parts of Ontario.

5. The following thirteen shrubs are the best adapted for ornamental purposes on count of their size, time of flowering and hardiness:

(1) Berberis purpurea (Purple-leaved Barberry), 3 to 5 feet high, flowering May.
(2) Ribes aureum (Golden Currant), 5 to 7 feet high, flowering May and June.
(3) Syringa Persica (Persian Lilac), 4 to 6 feet high, flowering May and June.
(4) Lonicera Tartarica (Tartarian Honeysuckle), 5 to 9 feet high, flowering May d June.
(5) Viburnum opulus (Snowball), 5 to 9 feet high, flowering May and June.
(6) Spirae chamaedrifolia (Germander-leaved Spiraea), 3 to 5 feet high, flowering y and June.
(7) Weigela rosea (Rose-colored Weigela), 3 to 6 feet high, flowering June.
(8) Philadelphus coronarius (Mock Orange), 5 to 10 feet high, flowering June.
(9) Spiraea aurea (Golden-leaved Spiraea), 5 to 7 feet high, flowering June.
(10) Symphoricarpus racemosus (Snowberry), 3 to 5 feet high, flowering June.
(11) Colutea arborescens (Bladder Senna), 4 to 6 feet high, flowering June.
(12) Spiraea sorbifolia (Ash-leaved Spiraea), 4 to 7 feet high, flowering July.
(13) Spiraea Billardi (Pink Spiraea), 4 to 6 feet high, flowering July and August.

GRAPES.

The College vineyard is situated in a field at the rear of the College. This location s chosen in 1881 as the best available at that time, and 440 vines were planted the e season, in lines twelve feet apart each way. In the following spring 210 vines re added, making a total of 650, and representing ninety-six varieties. Having had experience of five years with this varied collection, we are enabled to give some ults, which may prove both interesting and instructive to those who read them.

Our success may be a surprise and disappointment to some who can readily ripen es which fail to mature with us, but the results are what have been obtained at the ge under conditions which are given, and when considered they become an important r in accounting for failures among varieties that elsewhere in Ontario are prolific. reader will therefore remember that these data have been collected from the College yard only.

1. *Conditions surrounding the Vines.*

Location—Latitude north 43°-38'; height above sea level, 1,100 feet; above Lake rio, 858 feet.

Exposure—High and airy position, with southern aspect, but unduly exposed to west.

Soil—Clay loam, with a somewhat springy bottom, and in need of more draining.

Meteorological—Mean annual temperature for 1880-86, 42.2°; mean summer, °; mean winter, 27.3°; highest temperature (1881), 98°; lowest (1884), -35°; ge number of days rain fell per year, 72; rainfall (including snow), 24.7 inches; ailing winds—S.W., 43 per cent.; N.W., 31 per cent.

2. *Management.*

In the third year (1883) two canes were grown from each vine and carefully tied up throughout the growing season to stakes, these canes being intended for permanent limbs from which the young and bearing wood was to grow. This mode of training seemed the best adapted for this section of the Province, where it is necessary to lay down the vines and cover for winter protection.

The next spring, posts were put between the vines, and four rows of fence wire (No. 8) strung from post to post, the lowest wire eighteen inches from the ground, the top five feet, and the two remaining, twenty-one inches. This arrangement forms an excellent trellis for the vines.

The ground between the rows has been thoroughly cultivated, kept clear of weeds, and manured with farmyard manure. This year some night-soil was applied, but with no marked results.

About the end of October or beginning of November, the vines are pruned by cutting back the canes which bore the fruit to the main arms, and leaving between each a cane of the present year's growth to bear next year. They are then laid down and covered with three or four inches of earth. During the summer, pruning is also done by pinching the shoots bearing fruit back to the second joint beyond the fruit, and the young shoots, as soon as the wood is well formed, are kept back even with the top of the trellis by the same process.

The two main lines are trained in opposite directions and thus form the so-called laterals from which the bearing canes rise vertically, three or four on each lateral.

3. *Results.*

Waverly, Rogers' 5, Purity, Dempsey's 18 and 25, Croton, Centennial, Louisiana, Concord, Chasselas, Triumphant, and Herbemont, have died and have not been replaced. Accident may have been as much the cause of failure as severity of climate.

Rogers' 31, Eldorado, Prentiss, Rochester, Black Eagle, Monroe, Beauty, Icna, Senasqua, Grein's Golden, Autuchon, and Telegraph, are weak in appearance. This may have resulted from some being transplanted to another part of the vineyard in the second year.

Jessica, Faith, Rogers' 30, Canada, Dempsey 4, Walter, Amber, Cuyahoga, Transparent, Amber Queen, Alvey, Lady, Isabella, Advance, Salem, Creveling, Delaware, Rogers' 2 and 39, Echland, New Haven, Worden, and Antionello, are medium vines.

Naomi, Wilding, Brant, Jefferson, Barry, Pearl, Duchess, Una, Lady Washington, Eva, Janesville, Maxatawney, Ives' Seedling, Elvira, Black Hawk, Cottage, Vergennes, Pocklington, Early Dawn, Eumelan, Gaertner, Missouri, Riesling, Merrimac, Herbert, Brighton, Lindley, Martha, Hartford, Champion, Agawam, Moore's Early, Wilder, Clinton, Massasoit, Concord, Rogers' 41, 28 and 33, Uhland, Mary Ann, Cornucopia, Othello, Venango, Noah, Dracut's Amber, Cynthiana, and Norton, are all vigorous vines.

The following notes made this fall at stated times will show the condition of these varieties when visited :

September 8th, Brant, Janesville, Champion, Moore, Early Dawn, coloring and ripe before the week ends ; Wilder commencing, Othello freely coloured, but unequally ; 14th, Lindley, Hartford, Wilder, Massasoit, just showing color , Telegraph, Ives' Seedling, Cottage, Israella, Eumelan, Barry and Concord, apparently later than the preceding; 21st, Creveling and Concord about the same, and Cornucopia nearly so.

October 2nd, the best were cut, viz.: Lindley, Delaware, Moore, Salem, Massasoit, Wilder, Merrimac, Eumelan, Herbert, Concord ; 7th, Clinton, Brighton, Agawam, and Martha, ripe.

4. *Conclusions.*

1. Grape vines in this locality must be well sheltered with warm exposure, and grown in a warm, well-drained soil, or little fruit will be secured.

2. Our vines are vigorous and show much fruit, but it ripens very irregularly and late in the season.

3. The Concord, known as the grape for the million, scarcely ripens with us before well into October, and even then but irregularly.

4. A grape which does not ripen earlier than the Concord is of little use here.

5. Our earliest seems to be Moore's Early, Champion, Lady, and Massasoit,

6. In a district at all suited for grapes, we would recommend the following for flavour, hardiness, and yield:

Black:—Wilder, Worden, Moore, Concord, Barry.
Red:—Delaware, Brighton, Lindley, Agawam.
White:—Niagara, Lady, Martha.

Seed Testing.

1. *Object.*

For some years past, especially in England, farmers have had their attention directed to the condition of the seed sown on the farm, and in many cases have found that seed is far from being pure, and suited for the purpose intended. It fails in being true to its kind, other seeds are mixed with it, especially among grass seed. In some samples many seeds of weeds are found and in not a few cases there is a lack of germinating power in the seed. These facts have led to the practice, among prominent seedsmen, of guaranteeing the *purity, cleanness* and *vitality* of seeds sold, and it has been observed, that during the past few years a marked improvement has resulted in the condition of seed sold. Leading American and Canadian seedsmen have also adopted the idea of testing their seeds before recommending them to the public, and find that the expense is well repaid by securing the confidence of their customers. With a view to calling the attention of our Canadian farmers to this question of testing seeds, this bulletin is written.

While all the failures in germination cannot be attributed entirely to poor seed, yet there is no doubt that much seed is sown which has very little vitality, and in some cases, especially grass, the seed is far from being true to its kind, there being several varieties where one only was expected.

The seeds of weeds too, unfortunately, are not uncommon in seed grain, and thus at a period in Canadian farming, when there is so much interchange of grain for seeding purposes, as the present, it is not a matter of surprise, if care is not taken, that we find weeds on the increase both in regard to number and variety. Having made some tests in the germinating of seeds at the College during the past year, some of the results are now published with a hope that they may prove interesting and instructive to the readers of this bulletin.

2. *Methods.*

There are several methods for testing the vitality of seeds. Some are very simple and may be performed by any one interested.

1. Place 100 seeds between sheets of blotting paper laid on sand, and keep the paper wet in a place where the temperature is about 78°–85° F. The number of seeds germinating will indicate the percentage good.

2. Place the seeds on a piece of flannel in a saucer with sufficient water to moisten it thoroughly. After scattering the seeds (100) on the flannel, put a piece of damp blotting paper over the whole and place in a warm room. Keep it continually damp and in a short time the seeds will germinate. The number sprouting will be the percentage of good seeds.

3. The following method is much more complicated than the preceding and can only be adopted where the subject is made a study. This is the apparatus used at the College. It consists of a hemispherical copper boiler one foot in diameter, fastened to the bottom of a galvanized iron pan, two feet wide, four feet long and five inches deep. The water passes from the copper boiler into the pan through four small holes, and is made to circulate over every part of it by guides; these are three-fourths of an inch high. Another bottom resting on the top of these is firmly soldered around the edges; at one corner a tube passes through the bottom for the purpose of filling the boiler and under-pan with

water. After coming from the copper vessel the heated water runs back and forth several times in the lower pan, and is finally conducted by a return tube back to the copper boiler, entering near the bottom. Some sand (about 2 inches deep) is put in the upper part of the pan, and on this the boxes, etc., containing the seeds to be tested rest. This tin box and boiler is set in something like an office desk about four feet high, standing on four legs. This desk-like structue has a hinged glazed top. Heat is produced by a small coal oil stove placed below. This form of apparatus is well adapted for testing many samples at the same time and gives very satisfactory results.

4. For examining seeds as to purity, scatter them on a piece of black card-board and the foreign grains are readily observed. If a good collection of seeds true to their kind is kept for comparison the impurities can be easily identified.

3. *Results of Some Tests in the Germinator.*

(100 seeds of each variety.)

TABLE I.—Temp. 78° 85'.

	Per cent. at end of 3—5—7—12 days.
Clover, Red	48, 68, 72, 79
" White	12, 36, 80, 96
" Alsike	18, 52, 67, 70
Lucerne	36, 75, 81, 86
Blue Grass	5, 10
Red Top	8, 10, 12, 22
Timothy	3, 19, 58, 70
Perennial Rye	5, 23, 55, 63
Orchard	4, 15, 20, 38
Hard Fescue	2, 2, 16, 32
Sheep "	4, 12
Meadow "	2, 60, 72, 96
Tall "	4, 18, 60, 80
Meadow Foxtail	2, 6, 16, 20
Yellow Oats	8, 18, 26

TABLE II.—Temp. 70°.

	Per cent. at end of 5—7—12—15 days.
Sweet Vernal	1, 5, 14
Italian Rye	15, 20, 21
Crested Dogstail	4, 18, 26
Wood Meadow Grass	3, 6, 6
Fine-leaved Fescue	3, 3
Rough Stalked Meadow	1, 2
Timothy	19, 52, 61, 70
Perennial Rye	6, 37, 47
Orchard	3, 8, 10
Hard Fescue	1, 18, 34
Meadow "	3, 23, 65, 85
Tall "	2, 13, 22
Meadow Foxtail	2, 16, 23
Yellow Oat	2
Thistles	10, 48, 54

TABLE III.—Seeds 10 years old taken from Museum.

	Per cent. at end of 12 days.
Pease, 9 samples	0
Beans, 10 "	0
" 2 "	36
Turnips	32
Mangolds	72
Rye	0
Timothy, 8 samples	2
Millet	54
Hungarian Grass	27
Clover	6
Tares	90
Buckwheat, 9 samples average	13
Oats, 1 sample	0
Barley, "	0
Rusted Wheat, '86	12

TABLE IV.—Frosted Wheat from Manitoba.

	Per cent. at end of 3—4—5—7—8 days.
No. 1	16, 26, 32, 46, 48
" 2	16, 24, 48, 56, 58
" 3	32, 56, 58, 68, 72
" 4	8, 14, 24, 30, 30
" 5	26, 42, 50, 68, 70
" 6	2, 6, 16, 38, 52
" 7	10, 24, 42, 56, 58
" 8	38, 46, 58, 66, 66
" 9	10, 16, 28, 42, 52
" 10	0, 10, 24, 35, 42
" 11	16, 26, 44, 52, 52
" 12	24, 38, 54, 56, 60

Inferences.

1. Age has a marked effect on the vitality of certain seeds.

2. That many seeds have lost much of their vitality from improper curing or other causes.

3. Frozen wheat is not reliable for seed, even though germinating a fair per cent., its growth in the field is of a more or less weakly nature. The seeds of Table IV. were grown in the field as well as in the germinator.

4. All seeds should be tested for vitality and purity.

5. Seeds are more likely to be good from seedsmen than commission agents.

6. A small percentage of impure seeds means very many in a bushel.

7. Thistles can be grown from seed. A fact contradicted by some, who maintain that the plant is propagated from the root only, and all seed imperfect. This view was held by some at Farmers' Institutes last winter.

8. Grass seed is very liable to impurities; some kinds containing much chaff.

9. Temperature has considerable effect in hastening germination.

5. Lectures.

Concerning this department of work little requires to be said by me. An examination of your report on class-room work, will give the reader a clear conception of the work performed by the different professors in the various departments.

But I wish here to remark 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. The Grand Trunk Railway authorities have kindly reduced the rates to our students on scientific trips, so that they can visit places of geological interest some miles from the college at comparatively little expense.

They have availed themselves of this kindness and have evinced a greater interest in the practical study of science than in former years. The late additions to the museum and excellent diagrams drawn by Messrs. Ritchie and Gilbert (students), have also aided much in the teaching of natural science. We are now in a position to make the subject interesting, attractive and instructive.

Trees and Shrubs Planted on the Ontario Agricultural College Grounds.

Those marked "dead," in some cases came in bad condition for planting; some were destroyed by accident, while others were too tender to withstand the severity of the climate. Those marked "fair" are growing but not vigorously, while those referred to as "tender," live but are protected during the winter. Specific characters are not referred to in the list. Information regarding any particular shrub or tree, can be obtained from works on the subject, or by consulting either the Professor of Natural History or the practical Horticulturist at the College.

Anacardiaceæ. Sumach or Cashew Family.

Deciduous Shrubs:

Rhus aromatica. Fragrant sumach. Good.
R. copallina. Copal sumach "
R. Cotinus. Smoke tree. Mist shrub. Fair.
R. glabra. Smooth sumach. Good.
R. Osbecki. Chinese sumach. Dead.
R. trilobata. Three-lobed sumach. Dead.
R. typhina. Staghorn sumach. Good.

The Sumachs are large shrubs, generally of peculiar growth. Nearly all of them have leaves changing to a scarlet colour in autumn.

Anonaceæ. Custard-Apple Family.

Deciduous Trees:

Anona triloba. Pawpaw or custard-apple. Dead.

Aquifoliaceæ. Holly Family.

Ilex opaca. American holly. Dead.
I. verticillata. Black alder. "
I. aquifolia. English holly. "

Araliaceæ. Ginseng Family.

Deciduous Shrubs:

Aralia spinosa. Hercules club. Fair.
A. Japonica. Dead.

Berberidaceæ. Barberry Family.

Deciduous Shrubs:

Berberis Vulgaris. European barberry. Good.
B. V. purpurea. Purple-leaved barberry. Good.
B. Fremonti. Dead.
B. Darwini. Dead.
B. Thunbergi. Fair.
Mahonia aquifolia. Holly-leaved Mahonia. Fair. An evergreen.

Most of these shrubs are prized for their flowers and dark red fruit, which becomes ornamental in July and continues till late in the season. The foliage is small and attractive.

Betulaceæ. Birch Family.

Deciduous Trees:

Alnus glutinosa. European alder. Good.
A. g. laciniata. Cut-leaved alder. Good.
A. maritima. Seaside alder. Good.
Betula alba. European white birch. Good.
B. a. purpurea. Purple-leaved birch. Dead.
B. a. laciniata. Cut-leaved birch. Good.
B. a. pendula. Weeping birch. Good.
B. populifolia. Poplar birch. Good.
B. lenta. Sweet or black birch. Good.
B. lutea. Yellow or gray birch. Good.
B. papyracea Paper or canoe birch. Good.
B. Rubra. Red birch. Dead.

The birches are interesting trees, possessing beautiful foliage and bark of different hues.

Bignoniaceæ. Bignonia Family.

Deciduous Trees:

Catalpa bignonioides. Catalpa. Tender.
C. p. nana. Dwarf catalpa. Tender.
C. kæmpferi. Japan catalpa. Tender.
C. Bungei. Tender.
C. speciosa. Western catalpa. Good.

Calycanthaceæ. Calycanthus Family.

Deciduous Shrubs:

Calycanthus floridus. Sweet shrub. Poor.
Chimonanthus praecox. Dead

Caprifoliaceae. Honeysuckle Family.

Deciduous Shrubs :

Weigela amabilis. Light rose weigela. Fair.
W. hortensis nivea. White weigela. Fair.
W. Desboisii. Deep rose weigela. Fair.
W. Groenewegenii. Dark rose weigela. Fair.
W. rosea. Rose weigela. Fair.
W. variegata. Variegated weigela. Fair.
W. Isolone. Fair.
W. purpurea. Fair.
W. Van Houtti. Fair.

The Weigelas are beautiful shrubs, bear handsome flowers of several colors ; the bushes from three to five feet high. They are somewhat tender, but, with protection, do comparatively well.

Lonicera grandiflora. Bush honeysuckle. Good.
L. Orientalis Bush honeysuckle. Good.
L. Philomelæ. Bush honeysuckle. Good.
L. Sibirica. Bush honeysuckle. Good.
L. Tartarica. Tartarian honeysuckle. Good.
L. Xylosteum. Fly honeysuckle. Good.

The Honeysuckles form an attractive group of shrubs, flowering early in spring, and afterwards bear red berries, which hang on until fall. Bush, five to eight feet high.

Sambucus variegata. Variegated-leaved elder. Good.
S. racemosa. Red berried elder. Good.
Symphoricarpus racemosus. White-fruited snowberry. Good.
S. vulgaris. Coral berry, red-fruited snowberry. Good.
S. v. variegata Variegated-leaved snowberry. Good.
Viburnum acerifolium. Maple-leaved viburnum. Good.
V. lantanoides. Hobble bush. Good.
V. lantana. Way-faring tree. Good.
V. lentago. Sweet viburnum. Good.
V. nudum. Good.
V. opulus. Snowball. Good.
V. oxycoccos. Bush cranberry. Good.
V. plicatum. Japan snowball. Good.
V. prunifolium. Sheep berry. Good.

The Viburnums bear attractive flowers, followed by beautiful red berries, which give the bushes a striking appearance in autumn.

Celastraceae. Staff Tree Family.

Deciduous shrubs :

Euonymus Americanus. Strawberry bush. Good.
E. Europæus European burning bush. Dead.
E. E. Variegata. Variegated bush. Tender.

Coniferae. Pine Family.

Chiefly Evergreens, trees and shrubs. Good.
Abies alba. White spruce. Good.
A. Canadensis. Hemlock spruce. Good.
A. Douglasii. Douglas spruce. Good.

A. Engelmannii. Engelmann's spruce. Good.
A. Excelsa. Norway spruce. Good.
A. Menziesii. Menzies' spruce. Good.
A. orientalis. Oriental. Fair.
Biota orientalis. Chinese arbor vitæ. Good.
B. O. Aurea. Golden arbor vitæ. Tender.
Juniperus Chinensis. Chinese juniper. Tender.
J. communis. Common juniper. Good.
J. prostrata. Trailing juniper. Good.
J. Sabina. Savin juniper. Good.
J. Suecica. Swedish juniper. Tender.
J. Virginiana. Red cedar. Fair.
J. occidentalis. Rocky Mountain juniper. Good.
Libocedrus decurrens. Decurrent-leaved arbor vitæ. Dead.
Pinus Austriaca. Austrian pine. Good.
P. Benthamiana. Good.
P. Banksiana. Scrub pine. Good.
P. Cembra. Swiss pine. Good.
P. Jeffreyi. Dead.
P. Laricio. Corsican pine. Good.
P. Mughus. Mountain pine. Good.
P. mitis. Yellow pine. Dead.
P. pinaster. Sea pine. Dead.
P. ponderosa. Heavy pine. Dead.
P. pungens. Table mountain pine. Good.
P. rigida. Pitch pine. Good.
P. strobus. White pine. Good.
P. S. pumila. Dwarf white. Good.
P. sylvestris. Scotch pine. Good.
P. inops. Jersey pine. Dead.
P. Lambertiana. Giant sugar pine. Good.
Podocarpus Japonicus. Japan yew. Tender.
Retinospora ericoides. Heart-leaved Japan cypress. Tender.
R. filifera. Thready Japan cypress. Tender.
R. leptoclada. Tender.
R. obtusa. Obtuse-leaved Japan cypress. Tender.
R. plumosa. Plum-like Japan cypress. Tender.
R. squarrosa. Tender.
R. pisifera. Tender.
Salisburia adiantifolia. Maiden hair tree. Tender.
Taxus Canadensis. American yew. Tender.
Taxodium distichum. Bald cypress. Tender.
T. d. pendulum. Weeping bald cypress. Tender.
T. Chinensis. Tender.
Glyptostrobus pendula. Chinese cypress.
Thuja gigantea. Giant arbor vitæ. Good.
T. occidentalis. American arbor vitæ. Good.
T. o. aurea. George Peabody arbor vitæ. Tender.
T. o. ericoides. Heath-leaved arbor vitæ. Fair.
T. o. glauca. Tender.
T. o. globosa. Globe arbor vitæ. Fair.
T. o. Hoveyi. Hovey's arbor vitæ. Tender.
T. o. Meehani. Meehan's arbor vitæ. Tender.
T. o. pyramidalis. Upright arbor vitæ. Good.
T. o. Siberica. Siberian arbor vitæ. Good.
T. o. spiralis. Fair.
T. o. Tom thumb. Dwarf arbor vitæ. Fair.

Cornaceæ. Dogwood Family.

Deciduous Trees:

Cornus florida. White flowering dogwood. Tender.
Nyssa multiflora. Northern sour gum. Dead.

Deciduous Shrubs:

Cornus alba. Red-twigged dogwood. Tender.
C. alternifolia. Blue dogwood. Fair.
C. mascula. Cornelian Cherry. Fair.
C. sanguinea. English dogwood. Good.
C. paniculata. White-fruited dogwood. Fair.
C. sericea. Silky dogwood. Tender.
C. stricta. Stiff cornel dogwood. Good.
C. Siberica. Red Siberian dogwood. Good.

Cupuliferæ. Oak Family.

Deciduous Trees:

Castanea Americana. Sweet chestnut. Fair.
C. vesca. Spanish chestnut. Dead.
Fagus ferruginea. American beech. Good.
F. sylvatica. English beech. Dead.
F. s. incisa. Cut-leaved beech. Dead.
F. s. asplenifolia. Fern-leaved beech. Dead.
F. s. purpurea. Purple-leaved beech. Tender.
Ostrya Virginica. Iron wood. Good.
Quercus alba. White oak. Good.
Q. aquatica. Water oak. Dead.
Q. bicolor. Swamp white oak. Dead.
Q. Catesbæi. Turkey oak. Dead.
Q. cerris. Burgundy oak. Dead.
Q. cinerea. Upland willow oak. Dead.
Q. coccinea. Scarlet oak. Dead.
Q. falcata. Spanish oak. Dead.
Q. imbricaria. Northern laurel oak. Dead.
Q. lyrata. Lyre-leaved oak. Dead.
Q. macrocarpa. Mossy cup or burr oak. Good.
Q. nigra. Black Jack oak. Good.
Q. obtusiloba. Post oak. Dead.
Q. palustris. Pin oak. Dead.
Q. prinoides. Dwarf chestnut oak. Dead.
Q. rubra. Red oak. Good.
Q. robur fastigiata. Dead.
Q. r. sessiflora. Dead.
Q. tinctoria. Black oak. Dead.
Q. Bannisteri. Scrub oak. Dead.

Deciduous Shrubs:

Carpinus Americana. American hornbeam. Dead.
C. Betulus. European hornbeam. Dead.
Corylus Avellana. Hazelnut. Good.
C. purpurea. Purple hazelnut. Good.

The Oaks of this family which died were injured by being transplanted twice, owing to a re-arrangement of the trees upon the lawn.

Elæagnaceæ. Oleaster Family.

Deciduous Shrubs :

Elæagnus longipes. Japanese oleaster. Dead.
E. parvifolia. Silver thorn. Tender.
E. flava. Tender.
E. argentea. Silver berry. Fair.
E. dulcis. Dead.

Ericaceæ. Heath Family.

Deciduous Shrubs :

Andromeda Mariana, Stagger bush. Dead.
A. racemosa. Dead.
A. calyculata. Dead.
A. arborea. Sorrel tree. Deciduous tree. Dead.
Azalea Viscosa. Clammy azalea. Dead.
Clethra alnifolia. Sweet pepper bush. Fair.
Erica carnea. Fair.
Vaccinum corymbosum. Blueberry. Dead.
V. stamineum. Deerberry. Good.

Evergreen Shrubs :

Calluna vulgaris. Scotch heath. Fair.
Kalmia augustifolia. Narrow-leaved laurel. Dead.
K. latifolia. Broad-leaved laurel. Dead.

Euphorbiaceæ. Spurge Family.

Buxus sempervirens. Common box. Evergreen box. Tender.
B. s. Handsworthi. Handsworth's box. Evergreen. Tender.
Euphorbia corallata. Tender.

Hamamelaceæ. Witch-hazel Family.

Deciduous shrubs :

Fothergilla alnifolia. Good.
Hamamelis Virginica. Witch-hazel. Good.

Deciduous Tree :

Liquidambar styraciflua. Sweet gum. Tender.

Hypericaceæ: Saint John's Wort Family.

Deciduous Shrubs :

Hypericum ascyron. Siberian, St. John's wort. Dead.
H. patulum. Japan, St. John's wort. Dead.
H. prolificum. American, St. John's wort. Fair.
H. Kalmianum. Shrubby, St. John's wort. Dead.

Juglandaceæ. Walnut and Hickory Family.

Deciduous Trees :

Carya alba. Shellbark hickory. Good.
C. amara. Swamp hickory. Good.
C. olivæformis. Pecan nut hickory. Dead.
C. porcina. Pignut hickory. Dead.
C. sulcata. Large fruited hickory. Dead.
C. tomentosa. White hickory. Dead.

C. Microcarpa. Small fruited hickory. Dead.
C. aquatica. Water hickory. Dead.
Juglans nigra. Black walnut. Good.
J. cinerea. Butternut. Good.

Lauraceæ. Laurel Family.

Sassafras officinale. Sassafras. Dead.
Laurus Benzoin. Spice bush shrub. Dead.

Leguminosæ. Bean Family.

Deciduous Trees:

Acacia julibrissin. Sensitive tree. Dead.
Cercis Canadensis. American Judas tree. Fair.
C. Japonica. Japan Judas tree. Fair.
C. siliquastrum. European Judas tree. Dead.
Cytisus albus. White broom. Dead.
Gleditschia triacanthos. Honey locust. Good.
G. sinensis. Chinese honey locust. Good.
G. horrida. Fair.
Gymnocladus Canadensis. Kentucky coffee tree. Good.
Robinia hispida. Rose acacia. Good.
R. h. grandiflora. Dead.
Sophora Japonica. Japan Sophora. Dead.
Virgilia lutea. Yellow wood. Fair.

Deciduous Shrubs:

Amorpha canescens. Lead plant or indigo shrub. Fair.
A. fruticosa. False indigo. Fair.
Caragana arborescens. Siberian Pea. Good.
Colutea arborescens. Bladder senna. Good.
Indigo dosua. Dead.
Lespedza bicolor. Dead.
Genista scoporinus. Scotch broom. Dead.

Magnoliaceæ. Magnolia Family.

Deciduous Trees:

Liriodendron tulipifera. Tulip tree. Dead.
L. integrifolia. Entire-leaved tulip tree. Dead.
Magnolia acuminata. Cucumber magnolia. Tender.
M. glauca. Sweet bay. Dead.
M. Soulangeana. Dead.
Cercidiphyllum Japonicum. Dead.

Malvaceæ. Mallow Family.

Deciduous Shrubs:

Hibiscus Syriacus. Rose of Sharon. Dead.
H. s. alba. White althæa. Dead.
H. s. purpurea. Purple althæa. Dead.
H. s. variegata. Variegated althæa. Dead.
H. s. carnea. Red althæa. Dead.

Myricaceæ. Sweet Gale Family.

Deciduous Shrubs :

Comptonia asplenifolia. Sweet fern. Dead.
Myrica cerifera. Wax myrtle. Dead.

Oleaceæ. Olive Family.

Deciduous Trees :

Fraxinus Americana. White ash. Good.
F. A. Bosci. Bosc's ash. Dead.
F. A. ancubæfolia. Aucuba-leaved ash. Fair.
F. A. spectabilis. Dead.
F. A. juglandifolia. Walnut-leaved ash. Fair.
F. excelsior. European ash. Good.
F. ex. heterophylla. Cut-leaved ash. Dead.
F. ex. angustifolia. Willow-leaved ash. Fair.
F. ex. jaspidea. Striped-barked ash. Dead.
F. ex. pendula. Weeping ash. Dead.
F. Americana lutea. Dead.
F. ornus. Flowering ash. Dead.
F. pubescens. Red ash. Dead.
F. platycarpa. Water ash. Fair.
F. quadrangulata. Blue ash. Fair.
F. sambucifolia. Black ash. Good.
F. Theophrasti. Dead.
F. viridis. Green ash. Dead.
Chionanthus Virginica. White fringe. Fair.
Forsythia viridissima. Golden bell. Fair.
F. suspensa. Golden bell. Fair.
Ligustrum vulgare. Privet. Good.
L. buxifolium. Box-leaved privet. Good.
L. Japonicum. Japan privet. Fair.
L. variegatum. Variegated privet. Dead.
L. myrtifolium. Myrtle-leaved privet. Fair.
L. ovalifolium. Californian privet. Fair.
L. Stauntoni. Staunton's privet. Fair.
Syringa Josikea. Josikea's lilac. Good.
S. Persica. Persian lilac. Good.
S. vulgaris. Purple lilac. Good.
S. v. alba. White lilac. Good.
S. v. Ambroise Verschaffelt. Good.
S. v. Charles X. Reddish purple lilac. Good.
S. v. Dr. Stockhardt, White. Good.
S. v. Gloire de Moulins. Good.
S. v. ligustrina. Good.
S. v. oblata. Good.
S. v. Princess Maria. Good.
S. v. rubra insignis. Good.
S. vallettiana. Good.
S. purpurea florepleno. Good.
S. racemosa. Dead.
S. variegata. Dead.

Platanaceæ. Plane Tree Family.

Deciduous Trees :

Platanus orientalis. Oriental plane. Good.
P. occidentalis. Button wood. Good.

Rhamnaceæ. Buckthorn Family.

Deciduous Shrubs :

Ceanothus Americana. Red Root, New Jersey Tea. Dead.
Rhamnus catharticus. Common buckthorn. Good.
R. Carolinianus. Carolina buckthorn. Good.
R. frangulus. Good.

Rosaceæ. Rose Family.

Deciduous Trees :

Amelanchier botryapium. June berry. Good.
A. nana. Dwarf variety. Fair.
Cerasus Padus. European bird cherry. Dead.
Prunus Americana. Wild plum. Good.
P. Virginiana. Choke cherry. Good.
P. chicasa. Chickasaw wild plum Dead.
P. umbellata. Southern wild plum. Fair.
P. spinosa flore pleno. Double-flowering sloe. Fair.
Pyrus aucuparia. European mountain ash. Good.
P. coronaria. Sweet-scented crab. Good.
P. hybrida. Hybrid mountain ash. Good.
P. malus spectabilis. Chinese double-flowering apple. Dead.
P. Americana. American mountain ash.
P. A. nana. Fair.

Deciduous Shrubs :

Amygdalus nana. Flowering almond. Tender.
A. n. alba. White flowering almond. Tender.
Cerasus pumila. Dwarf Cherry. Tender.
C. p. pendula. Weeping dwarf cherry. Tender.
C. carnea. Good.
C. florepleno. Fair.
Cotoneaster acuminata. Tender.
C. buxifolia. Box-leaved cotoneaster. Tender.
C. baccilaris. Tender.
C. floribunda. Tender.
C. frigida. Tender.
C. Simmondsi. Tender.
C. obtusa. Tender.
C. nummularia. Tender.

The Cotoneasters are attractive shrubs with small leaves and bright-coloured berries in autumn, but are rather tender for this part of Ontario.

Crataegus Oxycantha. English hawthorn. Fair.
C. o. variegata. Variegate-leaved hawthorn. Dead.
C. o. apiifolia. Parsley-leaved hawthorn. Fair.
C. o. Douglassii. Fair.
C. o. rubra splendens. Dark red. Fair.
C. o. Crus-galli. Cockspur hawthorn. Fair.
C. cordata. Washington hawthorn. Fair.
C. coccinea. American white thorn. Fair.
C. flava. Southern hawthorn. Dead.
Kerria Japonica. Tender.
K. flavescens. Tender.
K. Kalmiana. Dead.

Potentilla fructicosa. Shrubby cinquefoil. Fair.
P. verna. Dead.
Prunus triloba. Double-flowering plum. Dead.
P. glabra. Fair.
Pyrus (Cydonia) Japonica. Japan quince. Fair.
P. floribunda. Japan choke berry. Dead.
P. Jap. cardinalis. Crimson Japan quince. Fair.
P. J. semipleno. Double-flowering Japan quince. Dead.
P. J. variegata. Variegated Japan quince. Fair.

The large striking flowers of the Japan quince appearing in early spring make the shrub attractive and popular.

Rosa blanda. Early wild rose. Good.
R. rubiginosa. Sweet brier. Good.
R. rugosa. Good.
R. lutea. Dead.
R. florepleno. Good.
Spiraea Billardi. Good.
S. callosa. Good.
S. c. alba. Good.
S. carpinæfolia. Good.
S. chamædrifolia. Good.
S. Hookeri. Fair.
S. opulifolia. Good.
S. o. aurea. Good.
S. paniculata. Fair.
S. prunifolia. Fair.
S. rotundifolia. Fair.
S. Reevsii. Tender.
S. salicifolia. Good.
S. sorbifolia. Good.
S. Regeliana. Dead.
S. Thunbergii. Fair.
S. vaccinæfolia. Fair.
S. ulmifolia. Good.
S. crenata. Fair.

Spiraeas are among the most beautiful of shrubs, flowering at all seasons and differing in foliage, flower and habit of growth.

Rubiaceæ. Madder Family.

Cephalanthus occidentalis. Button-bush. Dead.

Rutaceæ. Rue Family.

Deciduous Trees:

Zanthoxylon fraxineum. Prickly ash. Dead.
Ptelea trifoliata. Hop tree. Fair.

Salicaceæ. Willow Family.

Decidious Trees:

Populus alba. White poplar. Good.
P. angulata. Angled cottonwood. Good.

P. angustifolia. Narrow-leaved poplar. Good.
P. balsamnifera. Balsam poplar. Good
P. crispa. Curled-leaved poplar. Good.
P. Eugenie. Dead.
P. grandidentata. Large-leaved aspen. Good.
P. monilifera. Cottonwood. Fair.
P. rotundifolia. Japan poplar. Fair.
P. Van Gaerti. Dead.
Salix alba. White willow. Good.
S. annularis. Curled or ring willow. Good.
S. Babylonica. Weeping willow. Good.
S. B. Salamoni. Dead.
S. Japonica. Japan willow. Dead
S. caprea. Goat willow. Fair.
S. candida. Silvery willow. Fair.
S. discolor. Glaucous willow. Good.
S. Forbyana. Fair.
S. myricoides. Fair.
S. pentandra. Shining willow. Dead.
S. purpurea. Fair.
S. Russelliana. Good.
S. rosmarinifolia. Rosemary-leaved willow. Good.
S. Villarsiana. Dead.
S. Sieboldiana. Dead.
S. vitellina. Golden willow. Good.

Sapindaceæ. Soapberry Family.

Deciduous Trees:

Acer campestre. English maple. Good.
A. nances. Good.
A. dasycarpum. Silver maple. Good.
A. d. Weiri. Weir's cut-leaved maple. Good.
A. laetum. Colchican maple. Good.
A. marcrophyllum. Oregon maple. Good.
A. platanoides. Norway maple. Good.
A. p. Reitbachi. Reitbach's maple. Fair.
A. p. Schweidleri. Schweidler's maple. Good.
A. p. laciniatum. Eagle's claw maple. Good.
A. p. dissectum. Cut-leaved Norway maple. Good.
A. saccharinum. Sugar maple. Good.
A. pseudo-plantanus. Sycamore maple. Good.
A. p. purpureum. Purple-leaved sycamore maple. Good.
A. Tartaricum. Tartarian maple. Good.
A. Tauricum. Fair.
A. striatum. Stripped maple. Good.
Aesculus hippocastanum. Horse-chestnut. Fair.
A. glabra. Ohio or smooth horse-chestnut. Fair.
A. flava. Yellow horse-chestnut. Fair.
Pavia macrostachya. Dwarf white horse-chestnut. Fair.
Negundo fraxinæfolium. Ash-leaved maple. Good.
N. Californicum. California ash-leaved maple. Good.
Staphylea Bumalda. Japan bladder nut. Good.
S. trifolia. American bladder nut. Good.
Kœlreuteria paniculata. Dead.

Scrophulariaceæ. Figwort Family.

Paulowina imperialis. Empress tree. Dead.

Simarubaceæ. Quassia Family.

Ailantus glandulosa. Tree of Heaven. Dead.
A. Chinensis. Dead.

Styracaceæ. Storax Family.

Halesia tetraptera. Snowdrop shrub. Dead.
H. Meehani. Dead.

Saxifragaceæ. Saxifrage Family.

Deciduous Shrubs:

Deutzia crenata. Fair.
D. c. floreplena. Fair.
D. Pride of Rochester. Fair.
D. fortuni. Fair.
D. gracilis. Fair.
D. scabra. Fair.
Hydrangea paniculata. Good.
H. quercifolia. Oak-leaved. Dead.
Itea Virginica. Dead.
Philadelphus coronarius. Mock orange. Good.
P. Gordianus. Good.
P. grandiflorus. Good.
P. Columbianus. Good.
P. odoratissimus. Good.
P. tomentosus. Good.
P. Zeyheri.
Ribes aureum. Yellow-flowering currant. Good.
R. aureum Utah. Yellow-fruited currant. Good.
R. floridum. Wild black currant. Good.
R. Gordianum. Fair.
R. sanguineum. Red-flowered currant. Tender.
R. nigrum. Fair.
R. luteum. Good.

The shrubs of this family are very attractive, varying in foliage, flower and nature of the shrubs. They flower in early spring.

Tamariscineæ. Tamarix Family.

Deciduous Trees:

Tamarix Algerica. Tender.
T. tetandra. Tender.
T. Africana. Tender.
T. Chinensis. Tender.
T. Narbonne. Tender.

Tiliaceæ. Linden Family.

Deciduous Trees:

Tilia Americana. Basswood. Good.
T. Europæa European linden. Good.
T. Eu. laciniata. Cut-leaved linden. Good.
T. heterophylla. White linden. Good.

Urticaceæ. Nettle Family.

Deciduous Trees:

Celtis occidentalis. Nettle tree. Dead.
C. pumila. Dwarf nettle tree. Dead.
C. Australis. Dead.
Maclura aurantica. Osage orange. Tender.
M. a. variegata. Variegated orange. Tender.
M. a. aurea. Golden-leaved orange. Tender.
Morus rubra. Red mulberry. Fair.
M. Downingii. Downing's mulberry. Fair.
Ulmus Americana. American White elm. Good.
U. campestris. English elm. Good
U. c. adiantifolia. Dead.
U. c. monumentalis fastigiata. Dead.
U. c. montana. Scotch elm. Good.
U. c. pendula. Weeping elm. Dead.
U. c. purpurea. Purple-leaved elm. Dead.

Verbenaceæ. Vervian Family.

Deciduous shrubs:

Callicarpa purpurea. Dead.
Vitex agnus-castus. Chaste shrub. Dead.

The following summary shows the orders, number of genera, species and varieties represented in the collection.

40 orders, 121 genera, of which 345 species are living, and 132 dead.

Orders.	Genera.	Species and varieties living.	Species and varieties dead.
Anacardiaceæ	1	5	2
Anonaceæ	1	0	1
Aquifoliaceæ	1	0	3
Araliaceæ	1	1	1
Berberidaceæ	2	4	2
Betulaceæ	2	10	2
Bignoniaceæ	1	5	0
Calycanthaceæ	2	1	1
Caprifoliaceæ	5	29	0
Celastraceæ	1	2	1
Coniferæ	12	55	5
Cornaceæ	3	9	1
Cupuliferæ	6	10	22
Elæagnaceæ	1	3	2
Ericaceæ	7	4	8
Euphorbiaceæ	2	3	0
Hamamelaceæ	3	3	0
Hypericaceæ	1	1	3
Juglandaceæ	2	4	6
Lauraceæ	2	0	2
Leguminosæ	14	12	8
Magnoliaceæ	3	1	5
Malvaceæ	1	0	5
Myrtaceæ	2	0	2

Orders.	Genera.	Species and varieties livings.	Species and varieties dead.
Oleaceæ	5	31	13
Platanaceæ	1	2	0
Rhamnaceæ	2	3	1
Rosaceæ	11	61	12
Rubiaceæ	1	0	1
Rutaceæ	2	1	1
Salicaceæ	2	21	6
Scrophulariaceæ	1	0	1
Simarubaceæ	1	0	2
Sapindaceæ	5	25	1
Saxifragaceæ	5	21	2
Styracaceæ	1	0	2
Tiliaceæ	1	4	0
Tamariscineæ	1	5	0
Urticaceæ	4	9	6
Verbenaceæ	2	0	2
40	121	345	132

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1886.

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.

At examination some of the instruments are brought into the class-room and the candidate asked to read them.

Form of Monthly Summary.

Meteorology.

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

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

Barometer—

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

Thermometer—

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

Pluviameter—

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

Anemometer—

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

Clouds—

Cloudy days.
Clear days.
Mean cloudiness for the month.

Summary of Meteorological Results for 1866.

—	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....	29.380	29.266	29.420	29.260	29.108	29.120	29.100	29.140	29.268	29.326	29.226	29.368
Lowest " ..	28.016	28.000	28.070	28.272	28.278	28.438	28.636	28.536	28.540	28.222	28.092	28.184
Highest mean barom ..	29.226	29.122	29.192	29.227	29.068	29.071	29.068	29.100	29.238	29.312	29.151	29.267
Lowest " "	28.091	28.138	28.062	28.286	28.482	28.488	28.644	28.889	28.580	28.341	28.190	28.270
Monthly " "	28.777	28.866	28.737	28.928	28.756	28.848	28.836	28.839	28.943	29.101	28.760	28.844
Monthly range.....	1.364	1.988	1.350	.988	.830	.682	.464	.604	.728	1.104	1.134	1.184
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..	48.9	47	51.1	81.1	78.8	86.1	90	92.3	86.5	76	66.5	42.5
Lowest " ..	-10.5	-23.5	-10.2	14.6	30.5	37.0	41.4	41.5	34.5	27.2	8.6	-12.1
Highest mean " ..	43.5	36	43.4	63.3	66.8	76.1	77.4	75.9	71.7	60.4	52.1	36.7
Lowest " " ..	-.5	-11.2	1.9	23.5	44.3	50.1	60	56.0	45.0	31.8	13.5	-.9
Monthly " " ..	13.6	16.2	27.3	44.1	54.2	62.1	65.9	64.5	42.1	47.0	29.6	17.4
Monthly range	59.4	70.5	61.3	64.5	48.3	49.1	48.6	50.8	52.0	48.8	57.9	54.6
Pluviameter—												
Number days rain fell.	3	2	5	8		12	6	7	13	8	4	1
" snow fell	12	11	6	4	2	.....	.....	.....	.....	.....	9	13
Greatest rainfall, inches	.69	.32	.32	.78	.72	.67	1.1	1.25	.54	1.21	1.4	.08
Rainfall for month, in.	1.16	.35	1.30	2.53	1.22	2.77	1.99	4.31	2.79	2.34	2.13	.08
Greatest snowfall, in.	6	2.6	.50	.6	.33	.....	.....	.....	.....	.....	1.0	5.0
Snowfall for month, in.	19.6	15.9	2.20	7.61	.36	.....	.....	.....	.....	.....	3.55	21.5
Total precipitation....	3.12	1.94	1.52	3.31	1.26	2.77	1.99	4.31	2.79	2.34	2.48	2.23
Anemometer—												
Predominating wind ..	N. W.	S. W.	N. W.	E.	N. W.	N. W.	N.	N. W.	W.	N. W.	W.	S. W.
Greatest No. of miles in 24 hours.	659	819	703	743	473	480	410	545	485	943	1008	619
Mean velocity for the month.....	15.2	15.9	5.3	12.2	11.5	9.9	8.4	9.2	10.2	11.2	12.2	13.2
Clouds—												
Cloudy days	19	18	18	14	16	15	11	23	10	18	22	20
Clear "	5	6	11	11	14	12	15	7	13	8	7	5
Mean cloudiness for month	7.8	6.5	5.7	5.2	4.8	4.9	4.4	6.7	4.8	5.7	6.7	7.1

Mean Meteorological Results for the Year 1886.

—	1886. — Guelph.	Average of 40 Years. — Toronto.
Barometer.		
Month of highest mean pressure	October.	September.
Highest mean monthly	29.312	29.664
Lowest " "	28.062	29.572
Month of the lowest mean	March.	June.
Highest pressure	29.420	30.358
Lowest "	28.016	28.692
Thermometer.		
Mean temperature of the year	40.3	44.17°
Warmest month	July.	July.
Mean temperature of the warmest month	77.4	67.64°
Coldest month	January.	February.
Mean temperature of the coldest month	13.6	22.73°
Highest temperature	92.3	91°
Lowest temperature	−23.5	11.9°
Range of the year	115.8	102°
Pluviameter.		
Total depth of *rain* in inches	22.97	28.30
Number of days on which *rain* fell	74	110
Month in which the greatest depth of *rain* fell	August.	September.
Greatest depth of *rain* in one month	4.31	3.55
Month with most *rainy* days	September.	October.
Greatest number of *rainy* days in one month	13	13
Total depth of *snow* in inches	70.72	.....
Number of days on which *snow* fell	57	.....
Month in which the greatest depth of *snow* fell	December.	.....
Greatest depth of *snow* in one month	21.5	.....
Month with most *snowy* days	December.	.....
Greatest number of *snowy* days in one month	13	.....
Total precipitation in inches	30.04	.....

Diagram Illustrating the Mean Meteorological Results for 1886.

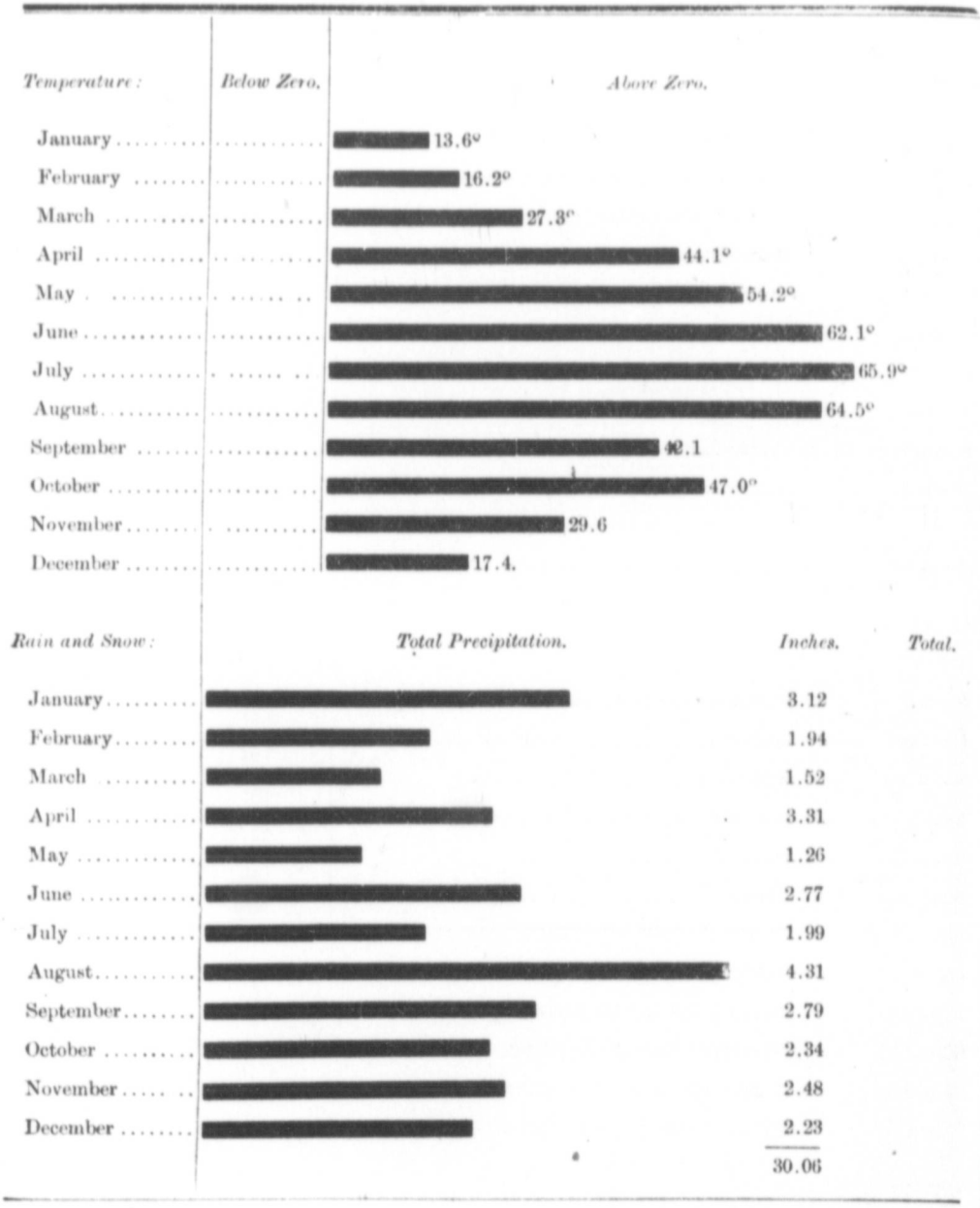
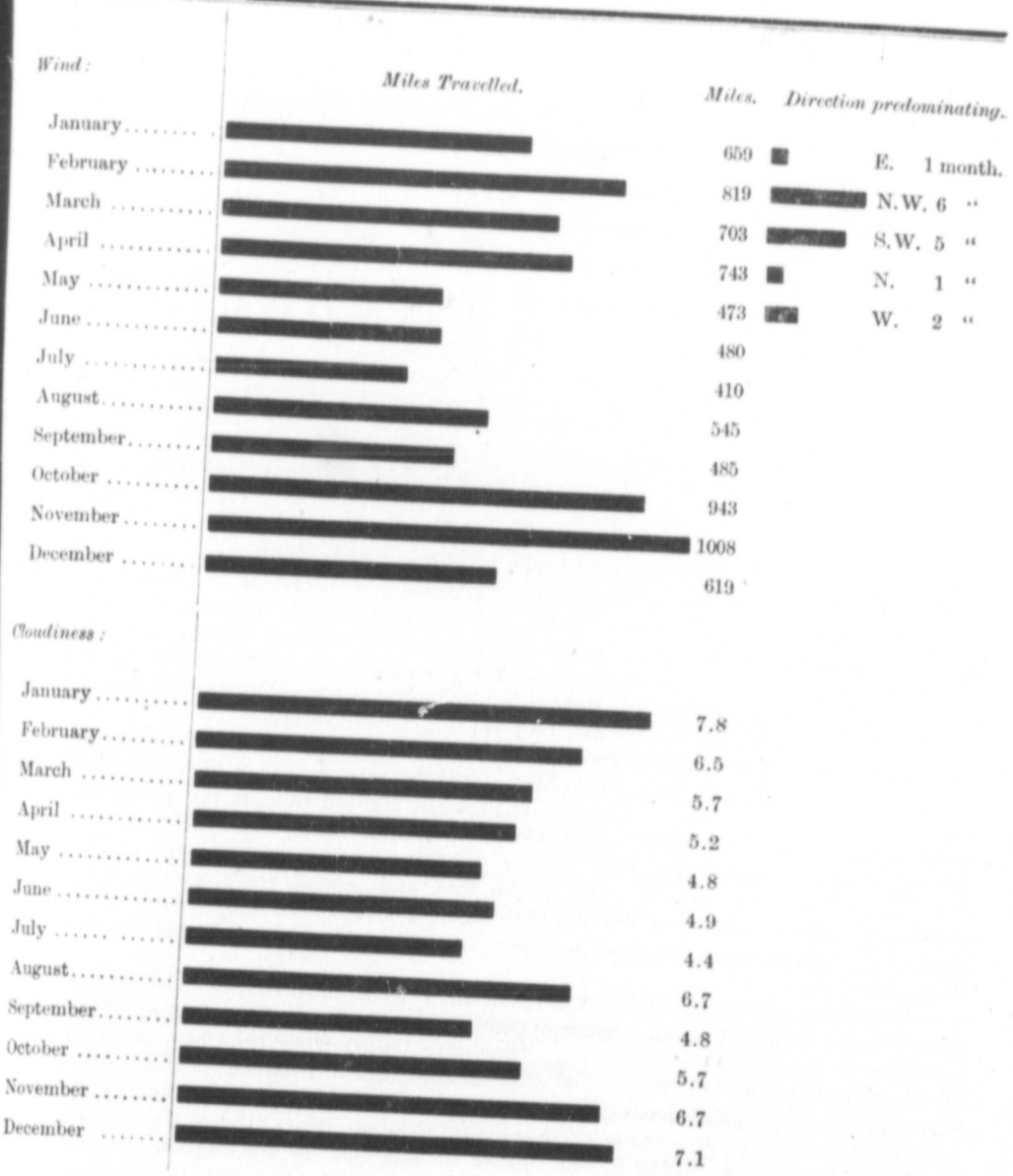


DIAGRAM ILLUSTRATING THE MEAN METEOROLOGICAL RESULTS.—*Continued.*



J. HOYES PANTON,
Professor Natural History and Geology.

PART III.

REPORT

OF

THE PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
December, 1886.

To the President of the Ontario Agricultural College, Guelph, Ontario:

DEAR SIR,—In presenting to you my first report, as Professor of Chemistry, I beg to offer to yourself, to Prof. Brown, and to the Commissioner of Agriculture, Hon. A. M. Ross, my sincere thanks for your hearty co-operation and assistance in meeting my wishes and the wants of the Chemical department during the past year. I trust that the evidence of the past will be the earnest of greater things in the future. Further, I feel indebted to all connected with this College for the reception I have received.

The subjects of the first and second year were continued by myself until the end of the winter term. In Practical Chemistry, with the second year, I have endeavoured to reduce the work so as to be practicable within the limited time of the spring term. It being found impossible to give any instruction in quantitative analysis within the time allotted, that subject has been reserved for the third, or post-graduate year. With that exception, I think the whole work of the first and second years, as laid down in the published *syllabus*, has been covered; though, of course, no single subject has been exhausted. The subjects handled in these two years are to be enlarged and developed in the third year.

As regards apparatus and accommodation, I have endeavoured to make the best of what I found at my disposal. Some of the results of the work accomplished have been published in bulletin form. Two bulletins were issued from the Chemical department. The first one was on the subject of salt—a comparison between leading English and Canadian brands. There has existed, in past years, a strong prejudice against Canadian salt, everything under the name or brand of Canadian being at once condemned by the public as inferior to anything of the nature of salt bearing an English name or brand. The origin of this prejudice was doubtless well founded, but its continuance being a subject of doubt, I undertook an investigation of the subject. The analyses were not made to compare or contrast one Canadian brand with another, but to compare average Canadian salt with average English salt. All the Canadian brands were not obtained, nor were all the English; those analyzed were procured in the Guelph market, and may be taken as fair representatives of the two classes. In cases where a manufacturer asked me for the analysis of his own salt, I gave it, but gave to him that of no other.

The comparison results very favourably to Canadian brands; all the samples of Canadian salt may be considered as being very good, though there is room for still further improvement.

Five Canadian and four Liverpool salts were analyzed. Each was analyzed twice and the average taken, as given in the table below. While these analyses were in progress, a sample of salt was sent to the Dairy department for investigation. It was handed to me for analysis, and as the name neither of manufacturer nor of user was given me with the salt, I added it as "No. 10, unknown." It was appended merely to shew the composition of an impure salt for contrast with the others. The comparison stands between Nos. 1 to 5, and Nos. 6 to 9.

Common salt consists of sodium chloride (97 per cent. to 98 per cent.), water, calcium sulphate or gypsum ($1\frac{1}{4}$ per cent. to $2\frac{1}{2}$ per cent.), calcium chloride, magnesium chloride, with traces of sand, clay, iron and dirt. The gypsum should not exceed $1\frac{3}{4}$ per cent. to 2 per cent.; in excess it makes the salt difficultly soluble and produces a slime. The chlorides of magnesium and calcium are very soluble, and attract moisture from the air. The magnesium salts impart whatever bitter taste may be apparent.

Most of the samples were taken from sacks of fine dairy or table salt, procured for the Dairy department by Prof. Robertson.

The following is the

Chemical Analysis.

No.	BRAND.	Order as to purity.	Sodium chloride.	Water.	Calcium and magnesium chloride.	Calcium sulphate.	Residue.	Total impurity.
1	Canadian	2nd.	97.66	0.49	0.13	1.63	0.09	1.85
2	Canadian	4th.	97.11	0.71	0.23	1.87	0.08	2.18
3	Canadian	8th.	94.26	3.29	0.47	1.93	0.05	2.45
4	Canakian	5th.	97.18	0.58	0.24	1.95	0.05	2.24
5	Canadian	6th.	96.61	1.11	0.27	1.86	0.15	2.28
	Average	.....	96.564	1.236	0.268	1.848	0.084	2.200
6	Liverpool	1st.	97.12	1.09	0.26	1.45	0.08	1.79
7	Liverpool	3rd.	97.20	0.75	0.25	1.72	0.08	2.05
8	Liverpool	7th.	96.93	0.69	0.31	1.88	0.19	2.38
9	Liverpool	9th.	96.47	0.94	0.23	2.26	0.10	2.59
	Average	.....	96.930	0.868	0.263	1.828	0.113	2.203
10	Unknown	10th.	93.00	1.79	0.55	3.70	0.96	5.21

The "residue" in the above table is the insoluble or difficultly soluble portion.

The average impurity of the five Canadian salts is 2.200 per cent.; the average impurity of the four Liverpool salts is 2.203 per cent. There is as much difference between the various English brands as between the English and Canadian, and the average of the latter is a little ahead of the average of the former. If allowance be made for the water, the apparent advantages of the Liverpool salt will disappear and the average stand about equal.

Physical Analysis.

By means of fine sieves, each sample was divided into four classes; these were weighed, and an estimate made of the uniformity and fineness of the different brands. Taking 100 as the maximum of uniformity and fineness, the salts were arranged in the following order: No. 6, 88; No. 4, 87; No. 7, 86; No. 1, 84; No. 9, 83; No. 2, 72; No. 8, 69; No. 3, 66; No. 5, 54; or (1) Liverpool, (2) Canadian, (3) Liverpool, (4) Canadian, (5) Liverpool, (6) Canadian, (7) Liverpool, (8) Canadian, (9) Canadian. In this respect the Liverpool salts are a little ahead, being on the average a little more uniform.

Solubility.

On the average the Liverpool salts are a little more readily soluble than the Canadian. The purer a salt the more thoroughly it dissolves, but not necessarily the more quickly. The rapidity of solution depends upon the *shape* of the grain as well as upon the *size*: the more soluble salts are flat, thin, disc-shaped; the more insoluble are compact and cubical in grain. No 1, for instance, is quite pure and small in grain, but very difficultly soluble; it is gritty in feel; No. 6, the purest and finest, stands fourth. In choosing a salt, then, attention should be paid to the shape of the grain; for a quick pickle the flat grain is preferable, and for dry-curing and slow pickle the compact grain. The best Canadian salts are slow in solution, the best Liverpool a little more rapid. Too often Canadian salts have been condemned because a slowly dissolving salt has been used where a rapidly dissolving salt was required; for instance, in the salting of butter for immediate use. Dealers and users of salt seem to pay too little attention to this important question of solubility.

In the salting of food for immediate use, butter and pork for example, also in the case of vegetable pickling, the rapidly dissolving salts are best. In the dry-curing of meat, the making of a lasting pickle, the salting of dairy products to be stored for some time, a more slowly dissolving salt is preferred. For table use a fine salt of uniform grain, clean and white, dry and quickly dissolving, is required. Such a salt as the latter is required also for butter-making, and there seems to be lacking just such a salt among the Canadian brands. The best Canadian salts are either too hard in grain or too large for this immediate use. If such a brand were available Canadian salt would have no fear of competition with Liverpool salt.

Strength of Brine.

The value of a salt cannot be accurately determined from the specific gravity of the brine it produces, as the weight can be increased by increasing the soluble impurities. In mixing brines a hydrometer, or salometer, as it is termed in this connection, does not give exact results as to the purity of a salt or the saltiness of a brine; for ordinary purposes, however, it may be used.

Colour of Salt.

A first-class salt should be pure white in colour. All of the Liverpool salts have faint bluish tinge; two of the Canadian salts, from the same locality, have a faint reddish cast. These colours are perhaps due to the shells of animals deposited in or beside the salt brines. Enough of the red colouring matter was obtained to determine it to be due to the presence of iron. A very decided red or blue cast should condemn a salt for use. One packer gave as his experience that a dark salt colored the outside of the meat dark also, though he was of the opinion that neither that nor the sliminess produced by some salts affected the interior of the meat.

Characteristics of a Good Salt.

A first-class salt should be: 1st, clean; 2nd, white; 3rd, comparatively dry; 4th, uniform in grain; 5th, quite thoroughly soluble in water; 6th, scale-like in grain for quick, and compact for slow solution.

In following such directions no one should have been deceived in purchasing or in using such a salt as No. 10, since its appearance showed its impurity quite distinctly. With such a guide, also, any intelligent purchaser should be able to select a Canadian salt suitable for his purpose. The only difficulty he will meet with will be in finding a quickly soluble salt suitable for some grades of butter. The manufacturers should endeavour to meet the demands of the butter makers, and produce a salt fully equal to the best Liverpool, being clean and pure in composition, uniform in grain and quick in solution.

There are doubtless some poor brands of Canadian salt, but so there are also poor brands of English salt. Whether the Government should allow poor brands to be manufactured or whether they should be killed out by compelling the manufacturer to publish the analysis of his salt is a question worth considering. From the investigation I am convinced that we can compete with the English manufacturers. The analysis of a single sample is not sufficient to guarantee or condemn any brand as a whole; the best way in which to obtain a good Canadian salt is to buy only from reliable makers and use the eyes, hands and tongue, in determining the requisites of a good brand.

I spent considerable time among the packers and dealers of Toronto, and found that the prejudice was being removed; that Canadian salt would be used if guaranteed pure enough, and if suitable for the work. In some cases Canadian salt is being used although the consumers believe their food is preserved and flavoured with Liverpool salt.

Marl.

From time to time samples of marl are received for identification and analysis. The enquiries in reference to the nature, use, and value of such deposits, led me to make an investigation of the samples at my disposal. The common occurrence of marl, and the general desire for information in reference to all natural supplies of fertilizers, warrant a reproduction of the conclusions in this report.

Marl is frequently found below deposits of muck or humus, in swamps and low land, sometimes quite near to the surface. It is then of a slate or bluish-white color, wet and spongy, darkened a little on top from the overlying dark soil. Upon exposure to the air it dries to a white crumbly mass, light in weight, and showing its origin in the shells of various sizes with which it is filled. Of such a nature is No. 4 of the table below, which was dug up on the Experimental Farm, Guelph.

In some localities the marl bed is found exposed, high and dry, ready for immediate application to land. When found lying low and soaked with water, it should be dug out and exposed to the weather. The fall is the best time for excavating. Let it lie in heaps; in the Spring it will be found thoroughly pulverized by the winter's frosts.

Its deposit beneath humus or swamp muck can be accounted for in the same way as the deposit of salt in the ocean; inflowing streams of hard water bring their loads of lime and sand to the swamp basin: the water having no outlet, accumulates, or evaporates, and drops its load of lime upon the bottom of the basin. Years serve to increase the accumulation. Being heavier than the humus it falls through and forms a bed or layer underneath. Many beds are nothing else than beds of more or less decomposed and disintegrated shells. If compacted together the deposit is not marl but limestone. When largely composed of fossils, phosphoric acid will be found, sometimes forming a very large percentage. Fossiliferous limestone, or shell marl, will be on this account more valuable than the common deposits of carbonate of lime.

To distinguish marl from clay, pour upon it a small quantity of acid, and if it be marl it will effervesce. To test its value quickly, place a small lump in an earthen dish and pour upon it a little hydrochloric acid; the less residue undissolved the better the better the sample of marl. The efferverscence is caused by the setting free of carbonic acid gas from the carbonate of lime, of which marl is principally composed. The carbonate of lime or calcium is the most valuable ingredient. In addition will be found small quantities of sand, magnesium carbonate, oxides of iron and aluminum, and variable quantities of phosphate of lime. Marl, however, is generally a lime fertilizer, and is used as such.

The results of analyses are given in the following table, in which some of the percentages are wanting, though the important ones are given. The first seven were analyzed lately at the laboratory of the Ontario Agricultural College by myself. Nos. 1, 2 and 3 came from north-eastern Ontario; No. 4 is from the Experimental Farm, direct from a low-lying bed; No. 5 is a weathered sample, locality unknown; No. 6 is from near Toronto; No. 7 is from Quebec; No. 8 is an Ontario marl, analyzed by the

Connecticut Station ; Nos. 9, 10, 11 and 12 are Michigan marls, analyzed at the Michigan Agricultural College, Lansing ; Nos. 13 and 14 are from North Carolina.

No.	Water.	Sand—insoluble matter.	Oxide of Iron and Aluminum.	Magnesium Carbonate.	Lime or Calcium Carbonate.
1	2.82	1.13	1.84	1.29	92.92
2	11.10	2.48	1.37	1.27	83.78
3	20.64	1.09	0.92	0.98	76.37
4	53.90	1.42	0.52	1.18	42.98
5	2.25	5.51	1.16	1.84	89.24
6	1.56	1.54	1.89	0.72	94.29
7	2.41	0.83	0.76	96.00	
8	2.51	0.41	0.29	2.10	94.69
9	1.43	13.00	1.43	4.54	79.60
10	.....	36.79	1.05	6.00	56.16
11	.....	5.50	.....	2.00	90.00
12	.....	16.00	.....	2.50	80.00
13	.....	74.86	.....	.....	10.57
14	.....	0.48	.....	.....	94.00

The following is an analysis of a fossiliferous limestone ; it might also be taken as the analysis of an extra rich phosphatic marl :—

Sand, 6.89 per cent. ; Carbonate of Lime, 70.00 per cent. ; Phosphate of Lime, 14.87 per cent.

Such a sample would be worth about $7 per ton.

According as the lime, clay or sand predominates, the marl is classed as calcareous, clayey or sandy. The Ontario samples are calcareous ; the 13th is a sandy marl.

As before noticed marl is generally a lime fertilizer ; phosphoric acid when present adds to its value. The effects of an application of marl are either physical or chemical. Physically it serves to give lightness and looseness to soils and thus render them more workable. Chemically it serves as a direct food to the plant, being used in the building up of stem and stalk. It will be found of especial value, therefore, to plants developing stem and leaf—grasses are especially benefitted by lime ; clover demands lime in the form of gypsum ; so also with roots. It corrects acidity or sourness in soils. It helps to decompose and render available the mineral matter of the soil, especially the silicates. It greatly assists in the decay of vegetable compounds, whether found in the compost heap or in the soil.

Application.

The nitrogen of swamp muck, (humus) is unavailable in its ordinary condition. Thoroughly drain the swamp and apply sixty to seventy-five bushels of marl per acre. No benefit will result unless draining be done, as marl is a great absorbent of moisture.

On light soils apply about 25 bushels per acre, sufficient to help the decomposition of organic matter and supply lime to the crops. If the soil be very porous and subject to drouth apply more—the marl will improve its water-holding power. Since lime quickly filters through a soil, it will be found better to harrow in the marl lightly than to plow under.

For clay lands apply by the waggon-load ; hardly too much can be added. The more marl applied the deeper it should be worked in ; apply muck also if available. Neither marl nor muck should be applied to *undrained* wet land, as they are both great absorbents of water.

Farmers having marl deposits will do well to test their value on different lands. Small plots in a couple of fields will be sufficient. Those not having them should examine their swamps and marshy lands, digging a few feet beneath black soils will often disclose the whitish marl.

Lime, in the form of burnt lime should not be used with farmyard manures. In the changes resulting, ammonia is formed and set free; this is a volatile compound. Lime, in the form of sulphate, *i. e.*, gypsum or land-plaster, is better; it produces ammonium sulphate, a stable compound—in other words, it *fixes* the ammonia.

There is no market for marl at present established in Canada. Its value depends upon its situation and the nature of the surrounding land. The commercial value for lime in fertilizers is sometimes placed at $5 per ton. At that rate, Ontario dried marls are worth from $2 to $3 per ton. Rich marls are sometimes utilized for burnt lime. Phosphoric acid, when present, may be reckoned at the rate of six cents a pound.

Dairy Analyses.

During the summer, fall and early winter, twelve samples of whole milk were analyzed for Prof. Brown, and for Prof. Robertson thirty-two samples of skimmed milk, twenty samples of butter-milk and twenty samples of cheese—eighty-four in all. This work devolved principally upon Mr. Zavitz, the assistant in the Experimental Department.

General Work.

Samples of soils, oil cake, cream, water, etc., have been received from various sources and a most varied series of correspondence, all of which have been attended to, so far as the other duties permitted. Being new to the surroundings I was a little later with some of the practical work than I hope to be during the future.

Soil Thermometers.

The observations of ground temperature were recorded from June 1st to November 1st, on August 15th the 24in. thermometer was broken by an inconsiderate steer. August 1st, Prof. Brown added to our collection three additional pairs of thermometers, which were placed in the three lysimeters containing clover on sand, clay and loam. They registered at the depths of three and nine inches. A careful study of the effects of air and surface temperature upon deep soil temperature will prove interesting.

The soil in which the soil thermometers stood was sandy, bare on top.

One of the principal benefits to be derived from such observations will donbtless be in the study of nitrification in its variation with temperature.

These observations were made at the time and as recorded by Mr. Zavitz.

As shewing the connection between soil temperature and the formation of nitrates in the soil, the following extract from Lawes and Gilbert's report on drainage waters will be appropriate:—

"Nitrification is the work of a living ferment contained in the soil, which is capable of oxidising ammonia and probably other nitrogenous bodies, into nitric acid; the action is, in fact, quite similar to that of the vinegar ferment, which oxidises alcohol into acetic acid. The investigation and establishing this fact we owe to MM. Schloesing and Müntz; their results have been amply confirmed by experiments made at Rothamsted.

The nitrifying ferment is apparently present in all fertile soils; it requires for its activity a sufficient supply of water and air, and also some salifiable base, as chalk; a certain degree of warmth is also necessary. No nitrification will take place in a dry soil; the production of nitrates will increase in activity as the soil becomes wetter, up to the point at which water begins to interfere with the free aëration of the soil. Nitrification is at a standstill near the freezing-point, and gradually increases in activity as the temperature rises, reaching its maximum of energy about 98° Fahr. (37°c.) At a higher temperature it diminishes in activity and ceases altogether at 131° (55°c.). The process of nitrification is probably chiefly confined to the surface soil, where nitrogenous matters are most abundant, and the supply of air greatest; it will proceed with greatest energy in summer time, and be especially active during a wet summer. The nitrate produced in soil is chiefly nitrate of calcium."

The readings given in our tables are all centigrade.

Observations of Ground Temperature from June 1st to November 1st.

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth.							
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.
June	1	7 a.m.	28.810	57.0	.....	54.5	.....	.....	.....	56.5	52.0	53.0	56.0	56.0	53.5	51.0	48.5
		2 p.m.	28.810	86.5	.....	74.5	.....	.....	.....	84.2	75.2	62.0	57.5	56.2	53.7	51.2	48.8
		9 p.m.	28.822	64.0	.....	58.0	75.0	46.0	.....	62.0	65.0	65.0	61.0	59.0	54.0	51.3	48.8
"	2	7 a.m.	28.700	60.1	.....	59.1	.....	.....	.....	58.8	58.0	58.6	58.2	58.0	54.4	51.7	48.8
		2 p.m.	28.554	75.0	.....	70.2	.....	.....	.....	71.3	69.1	65	59.3	58.5	54.6	51.8	49.0
		9 p.m.	28.708	53.1	.....	52.2	74.8	50.5	.120	56.7	60.0	61.9	60	59	55.6	51.9	49.1
"	3	7 a.m.	28.824	47.5	.....	47.0	.....	.....	.....	50.7	51.2	54.2	56.2	56.8	54.8	52.0	49.3
		2 p.m.	28.940	57.5	56.2	56.8	.....	.....	.....	66.4	60.8	57.5	55.6	56.0	54.8	52.1	49.4
		9 p.m.	28.958	52.7	46.9	46.1	58.2	42.7	.....	51.2	55.9	58.9	57.8	57.0	54.6	52.1	49.6
"	4	7 a.m.	28.958	48.1	45.7	47.6	.....	.....	.....	52.8	47.7	50.2	54	55.0	54.7	52.4	49.8
		2 p.m.	28.846	71.5	57.5	67.8	.....	.....	.....	72.8	69.0	62.4	55.1	54.8	54.4	53.5	49.8
		9 p.m.	28.844	61.7	49.8	54.0	69.0	33.3	.....	57.1	60.1	61.8	58.8	57.7	54.2	52.5	50.0
"	5	7 a.m.	28.784	56.7	53.0	55.4	.....	.....	.....	56.7	53.0	54.1	55.8	56.0	54.5	52.2	50.0
		2 p.m.	28.700	66.0	57.0	62.0	.....	.....	.....	63.5	62.2	60.7	56.8	56.1	54.3	52.2	50.0
		9 p.m.	28.808	58.0	52.0	53.0	69.8	44.2	.....	55.2	57.5	59.3	57.5	57.0	54.3	52.3	50.0
"	6	7 a.m.	28.896	55.0	51.5	53.3	77.5	73.5	.....	55.6	51.8	52.7	54.7	55.4	54.5	52.3	50.0
"	7	7 a.m.	28.794	59.1	57.1	58.0	.....	.....	.....	58.8	57.8	58.3	58.0	57.8	54.8	52.7	50.1
		2 p.m.	28.740	73.1	61.2	67.1	.....	.....	.....	71.6	69.2	64.4	58.6	57.8	54.9	52.6	50.0
		9 p.m.	28.974	52.2	46.0	48.2	70.2	47.8	.202	53.5	57.6	60.8	59.8	59.0	55.0	52.7	50.2
"	8	7 a.m.	29.002	49.2	47.0	48.0	.....	.....	.....	52.0	48.5	52.1	55.6	55.4	55.3	52.8	50.3
		2 p.m.	29.044	72.0	55.5	67.0	.....	.....	.....	81.0	75.8	67.1	57.8	57.8	55.1	53.0	50.5
		9 p.m.	28.968	67.6	54.9	56.0	70.1	39.2	.....	62.1	65.0	66.6	62.0	60.1	55.0	53.0	50.5
"	9	7 a.m.	28.832	53.7	51.0	51.4	.....	.....	.....	54.8	53.7	55.7	57.8	58.2	56.8	53.0	50.6
		2 p.m.	28.736	75.0	59.0	66.5	.....	.....	.....	73.8	67.0	61.4	57.5	57.3	55.5	53.0	50.8
		9 p.m.	28.652	68.0	60.7	63.0	73.0	40.8	.....	65.0	65.6	65.6	61,2	60.0	55.7	53.2	50.8
"	10	7 a.m.	28.628	58.5	57.0	57.0	.....	.....	.....	58.0	57.1	58.1	58.8	59.0	56.0	53.3	50.9
		2 p.m.	28.184	76.8	63.0	67.0	.....	.....	.....	76.5	72.8	65.2	59.0	58.5	56.0	53.4	51.0
		9 p.m.	28.732	59.0	53.0	54.2	70.0	52.0	.416	56.0	58.8	61.5	60.5	60.0	56.0	53.7	51.0
"	11	7 a.m.	28.834	56.0	50.4	55.0	.....	.....	.....	53.7	50.7	53.0	56.3	57.2	56.2	53.8	51.1
		2 p.m.	28.884	77.5	58.5	68.5	.....	.....	.....	79.3	73.2	66.0	58.1	57.2	56.2	53.8	51.1
		9 p.m.	28.926	69.0	54.0	56.1	71.2	41.5	.....	62.0	64.4	66.4	62.3	60.7	56.2	54.0	51.3
"	12	7 a.m.	28.952	57.0	53.0	53.1	.....	.....	.....	56.7	55.4	56.8	58.5	58.8	56.5	53.8	51.3
		2 p.m.	29.032	81.5	61.0	69.5	.....	.....	.....	78.3	71.0	64.8	58.8	58.4	56.4	54.0	51.3
		9 p.m.	28.914	65.4	52.2	56.7	71.0	46.0	.....	62.7	64.5	66.1	62.8	61.2	56.4	54.0	51.3

"	9	7 a.m.	28.832	53.7	51.0	51.4	.....	.....	.....	54.8	53.7	55.7	57.8	58.2	56.8	53.0	50.6
		2 p.m.	28.736	75.0	59.0	66.5	.....	.....	.....	73.8	67.0	61.4	57.5	57.3	55.5	53.0	50.8
		9 p.m.	28.652	68.0	60.7	63.0	73.0	40.8	.....	65.0	65.6	65.6	61.2	60.0	55.7	53.2	50.8
"	10	7 a.m.	28.628	58.5	57.0	57.0	.....	.....	.....	58.0	57.1	58.1	58.8	59.0	56.0	53.3	50.9
		2 p.m.	28.184	76.8	63.0	67.0	.....	.....	.....	76.5	72.8	65.2	59.0	58.5	56.0	53.4	51.0
		9 p.m.	28.732	59.0	53.0	54.2	70.0	52.0	.416	56.0	58.8	61.5	60.5	60.0	56.0	53.7	51.0
"	11	7 a.m.	28.834	56.0	50.4	55.0	.....	.....	.....	53.7	50.7	53.0	56.3	57.2	56.2	53.8	51.1
		2 p.m.	28.884	77.5	58.5	68.5	.....	.....	.....	79.3	73.2	66.0	58.1	57.2	56.2	53.8	51.1
		9 p.m.	28.926	69.0	54.0	56.1	71.2	41.5	.....	62.0	64.4	66.4	62.3	60.7	56.2	54.0	51.3
"	12	7 a.m.	28.952	57.0	53.0	53.1	.....	.....	.....	56.7	55.4	56.8	58.5	58.8	56.5	53.8	51.3
		2 p.m.	29.032	81.5	61.0	69.5	.....	.....	.....	78.3	71.0	64.8	58.8	58.4	56.4	54.0	51.3
		9 p.m.	28.914	65.4	52.2	56.7	71.0	46.0	.....	62.7	64.5	66.1	62.7	61.2	56.6	54.0	51.5
"	13	7 a.m.	28.864	67.2	61	66	84.1	47.4	.....	68	61	59.4	59.4	59.6	57	54.1	51.7
"	14	7 a.m.	28.742	67	64	64.2	.....	.....	.....	68	64.2	63.8	63.2	63	58	54.7	51.9
		2 p.m.	28.768	94	....	83.5	.....	.....	.....	94.5	88.5	78.9	66.3	64	59.5	55	52.1
		9 p.m.	28.756	76	66.5	68	84.9	57.5	.120	71.6	75	75.6	70.2	67.7	58.8	55.1	52.2
"	15	7 a.m.	28.772	69.2	66	65.7	.....	.....	.....	70	67.7	67.5	66.2	65.8	59.7	55.5	52.5
		2 p.m.	28.720	95.5	76.5	84.3	.....	.....	.....	95.5	87.3	78.2	68	66	60	55.8	52.6
		9 p.m.	28.690	79	69.3	72.1	85	61	.....	73.5	75.8	75.8	71	68.7	60.3	56	52.8
"	16	7 a.m.	28.624	72	68.8	69	.....	.....	.....	70.8	68.8	68.8	67.7	67	62	56.6	53
		2 p.m.	28.656	88.5	74.9	79.9	.....	.....	.....	85.6	80.5	74.7	68.8	66.5	61.1	56.8	53.1
		9 p.m.	28.582	77	71	72	83	66.6	.465	71.7	73.5	74.2	70.8	69	61.5	57	53.4
"	17	7 a.m.	28.434	70	65.4	66	.....	.....	.....	69.4	67.3	68	67.6	67.3	63	57.5	53.8
		2 p.m.	28.456	77.8	67.2	72	.....	.....	.....	73.5	74.8	73.2	68	67	62	57.8	54
		9 p.m.	28.576	57	54	56	74.5	55	.693	58.2	63	68	67.8	67.3	62	57.7	54
"	18	7 a.m.	28.734	62	48	50	.....	.....	.....	58	54.6	57.8	62.5	63.6	62	58.1	54.2
		2 p.m.	28.788	65	53.5	61	.....	.....	.....	67	66.1	65.3	62.6	62.7	61.6	58.3	54.4
		9 p.m.	28.702	57	46.8	49.2	61.8	44	.....	50.3	57.9	62.5	63.7	63.7	62.3	58.3	54.7
"	19	7 a.m.	28.972	50	46.7	48	.....	.....	.....	56.2	49.6	52.8	58.7	60	61	58.1	54.7
		2 p.m.	29.036	74	57.5	67	.....	.....	.....	82.5	77	70	61	60.3	60.3	59.2	55
		9 p.m.	29.020	77	56	59.3	69	35	.....	62.3	68.2	70	65.3	64	60	58	55
"	20	7 a.m.	29.036	64	54.6	61.2	70.5	42.2	.....	66	58.6	58.4	60.5	61.2	60.4	57.9	55
"	21	7 a.m.	28.968	61	59.3	60	.....	.....	.....	60.8	60.1	61.4	62.4	62.7	60.6	57.9	55
		2 p.m.	28.980	72	62.2	65	.....	.....	.....	66.7	65.7	64.5	62.2	62	60.5	58	55
		9 p.m.	28.988	66	60	61	65.9	55.3	.....	61.4	63	63.8	62.8	62.8	61.7	58	55
"	22	7 a.m.	28.898	61.8	59.9	60	.....	.....	.....	61.4	60.6	61.3	61.3	61.8	60.4	58	55
		2 p.m.	28.874	76.2	65.2	68	.....	.....	.....	72.7	68.7	65.7	61.9	61.7	60.2	58	55
		9 p.m.	28.800	63	58.6	58.4	68	58.2	.202	61	62.7	63.5	63.7	62.8	61	58	55.1
"	23	7 a.m.	28.696	57.5	55	55.2	.....	.....	.....	58	58.1	59.7	60.7	61.2	60	57.8	55.2
		2 p.m.	28.710	71	59	62.2	.....	.....	.....	69.9	67.1	63.8	61	61	59.8	58	55.2
		9 p.m.	28.678	60.2	58	58.2	64	58.9	.037	60.7	61.7	63	62.2	62	59.6	57.6	55.2

OBSERVATIONS of Ground Temperature—*Continued.*

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth.							
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.
June—*Continued*	24	7 a.m.	28.694	62	59.2	59.8	.....	.....	.....	63.2	60.8	61	61	61.1	59.8	57.7	55
		2 p.m.	28.718	71.1	63.2	66	.....	.....	.....	69.7	68	66.2	62	61.6	59.7	57.7	55.1
		9 p.m.	28.690	63	59	59.2	68.7	56.7	.090	62.2	63.9	55.1	62	62.8	59.7	57.7	55
"	25	7 a.m.	28.672	63	59.8	60.6	.....	.....	.....	63	61.2	61.6	61.3	61.8	57.7	57.7	55
		2 p.m.	28.682	73	63.6	66.2	.....	.....	.....	71.8	69.8	66.9	62.8	62.2	59.6	57.7	55.2
		9 p.m.	28.708	61.4	58.7	60	69	56.3	.026	61	63	64.8	63.2	62.1	59.8	57.6	55
"	26	7 a.m.	28.722	62	59	59	.....	.....	.....	61	60.3	60.9	61.2	61.8	59.9	57.7	55.2
		2 p.m.	28.782	72.5	63.8	68.1	.....	.....	.....	73	68.8	65.4	61.8	61.8	60	57.8	55.2
		9 p.m.	28.840	66.2	59	61	70.9	57.4	.....	60.6	62.9	65	63.4	62.8	59 8	57.7	55.2
"	27	7 a.m.	28.880	67.2	60.5	66	74.8	49	.....	69.2	60	59.5	60	60.8	60	57.7	55.3
"	28	7 a.m.	28.936	61.2	57	61.4	.....	.....	.....	63.2	56.8	57.7	60.3	61.4	60.2	57.8	65.3
		2 p.m.	28.984	82	63.4	75.2	.....	.....	.....	87.8	82.6	72.7	63.1	62	60.2	57.9	55.5
		9 p.m.	28.958	69	67.6	61.2	76.2	60.2	.....	65	70.5	73.2	67.7	66	61	58	55.2
"	29	7 a.m.	28.926	60.2	54.8	58.8	.....	.....	.....	62.8	58.8	60.2	62.7	63.3	60.8	58	55.5
		2 p.m.	28.902	80	65	75.5	.....	.....	.....	82.7	78.9	71.8	64.2	63.4	60.7	58.2	55.6
		9 p.m.	28.910	65.6	57.2	60.2	76.2	46.2	.....	63	68.2	70.3	67.3	66.1	60.9	58.2	55.5
"	30	7 a.m.	29.036	63	55	61.2	.....	.....	.....	62.8	59	60.3	63	63.7	61.2	58.2	55.6
		2 p.m.	29.110	79	59	69.2	.....	.....	.....	84.6	80	71.1	63.9	63.8	61.2	58.8	55.7
		9 p.m.	29.068	64	52	54	70 8	48.8	.....	60.5	67.2	70.3	67.4	67.2	62.4	58.9	55.8
July	1	7 a.m.	29.050	55	51.6	54	.....	.....	.....	57.8	56	59	62.7	63.5	61.7	58.7	55.8
		2 p.m.	29.112	79	71	71.5	.....	.....	.....	81.2	73	65.8	62.2	62.4	61.4	58.8	56
		9 p.m.	29.028	61 6	64	53.2	74.8	41	.....	59	65.8	68.9	67.1	66.1	62.9	58.8	56
"	2	7 a.m.	29.032	58	.....	58.3	.....	.....	.....	63.8	57.8	59.3	62.4	63.1	61.8	59	56.2
		2 p.m.	29.099	87.2	67	81	.....	.....	.....	93.8	84.5	75	65.2	63.8	61.9	59.2	56.8
		9 p.m.	28.988	73.4	61.5	65.2	82	42.2	.....	67.7	72	73.2	69.1	67.4	61.7	59	56.6
"	3	7 a.m.	29.024	62	57.8	61.1	.....	.....	.....	65.9	61	62.4	64.5	65	62.1	59.1	56.8
		2 p.m.	29.056	90.4	68	82.2	.....	.....	.....	94.5	86.1	76.1	67	65.6	62.3	59.8	56.9
		9 p.m.	29.002	75.2	62.8	65.2	83	46.9	.....	67.7	73.2	71.8	70.6	68.7	62.2	59.4	56.8
"	4	7 a.m.	29.040	47	62.6	65.3	87.1	48.6	.....	69.2	75	76.3	72	69.8	63	60	57
"	5	7 a.m.	29.064	64.2	60.1	62.8	.....	.....	.....	67.8	63.4	65	67	67.2	63.7	60	57.1
		2 p.m.	29.102	94	72	87.6	.....	.....	.....	97	87.5	78.5	69.5	67.8	63.9	60.7	57.6
		9 p.m.	29.026	79.1	64.4	69.3	88	48.5	.....	70.5	75.2	77	72.9	70.8	63.9	60.6	57.7
"	6	7 a.m.	28.996	68.2	63.4	67.2	.....	.....	.....	76.8	66	66.7	69	.....	.....	.....	.....
		2 p.m.	28.996	94.2	72.5	88.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

"	2	7 a.m.	29.032	58		58.3				63.8	57.8	59.3	62.4	63.1	61.8	59	56.2
		2 p.m.	29.099	87.2	67	81				93.8	84.5	75	65.2	63.8	61.9	59.2	56.8
		9 p.m.	28.988	73.4	61.5	65.2	82	42.2		67.7	72	73.2	69.1	67.4	61.7	59	56.6
"	3	7 a.m.	29.024	62	57.8	61.1				65.9	61	62.4	64.5	65	62.1	59.1	56.8
		2 p.m.	29.056	90.4	68	82.2				94.5	86.1	76.1	67	65.6	62.3	59.8	56.9
		9 p.m.	29.002	75.2	62.8	65.2	83	46.9		67.7	73.2	71.8	70.6	68.7	62.2	59.4	56.8
"	4	7 a.m.	29.040	47	62.6	65.3	87.1	48.6		69.2	75	76.3	72	69.8	63	60	57
"	5	7 a.m.	29.064	64.2	60.1	62.8				67.8	63.4	65	67	67.2	63.7	60	57.1
		2 p.m.	29.102	94	72	87.6				97	87.5	78.5	69.5	67.8	63.9	60.7	57.6
		9 p.m.	29.026	79.1	64.4	69.3	88	48.5		70.5	75.2	77	72.9	70.8	63.9	60.6	57.7
"	6	7 a.m.	28.996	68.2	63.4	67.2				76.8	66	66.7	68	68	64.3	60.7	57.5
		2 p.m.	28.996	94.2	72.5	88.5				97.2	88.3	78.9	69.8	67.9	64.3	60.8	57.6
		9 p.m.	28.868	79.5	65.3	74.5	89.8	52.5		74	77	77.2	73	70.9	64.4	61.1	57.8
"	7	7 a.m.	28.848	74	67	71.8				75.8	70	70.2	69.8	69.3	65	61.2	58
		2 p.m.	28.850	87.5	71	83.7				93.5	85	78.5	71.1	69.5	65	61.3	58
		9 p.m.	28.916	67.5	59.6	64.8	84.5	63.4		67.8	73.9	75.7	73	71.6	65.2	61.5	58.1
"	8	7 a.m.	29.024	65	56.2	63				67.3	64.3	66.3	68.2	68.4	65.5	61.7	58.3
		2 p.m.	29.036	81.2	62	74.8				88.3	80.9	75	69	68.1	65.6	62	58.7
		9 p.m.	28.982	72.5	57	61	80	52.4		66	73.2	74.9	72	70.6	65.2	62	58.7
"	9	7 a.m.	28.910	60	55.5	58.2				63.4	63.2	65.4	67.2	68	65.3	62	58.8
		2 p.m.	28.904	83	63	73.2				80.4	76	72.1	68	67.4	65.3	62.1	58.9
		9 p.m.	28.868	73.8	58.1	61.3	77.7	52.5		65.2	72.8	75.2	72.4	70.2	65.3	62.2	58.9
"	10	7 a.m.	28.810	65	60.6	64.2				67.8	64	65	66.5	67	65	62	59
		2 p.m.	28.812	83.2	67.8	77.8				85.8	81	74.7	68.1	67.2	65.1	62.2	59.1
		9 p.m.	28.768	67.1	69.9	64.2	79	51.9		65.2	69.2	72	70.1	69	64.8	62.2	59.1
"	11	7 a.m.	28.802	63	58.7	61.3	78.8	51.8		66.3	63.2	64	66	66.8	65	62	59.1
"	12	7 a.m.	28.840	56.5	52	57.3				69.6	61	61	64.6	65.8	65	62.1	59.2
		2 p.m.	28.850	82.3	62.2	74				89.5	82.6	74.8	66.8	65.9	64.8	62.2	59.2
		9 p.m.	28.798	68.4	54	57	76.1	36.9		62.8	69	72.6	70.2	68.9	64.4	62	59.3
"	13	7 a.m.	28.764	61.2	55.8	60.2				67.6	62	62.6	65.4	66.2	64.7	62	59.3
		2 p.m.	28.772	78.5	59.2	70.2				75.3	73.5	70.5	66.3	65.6	64.5	62	59.3
		9 p.m.	28.712	66	56	62.2	73.4	48.9	.491	64.8	67	69	67.8	67	64.2	62	59.3
"	14	7 a.m.	28.568	63.2	61	62				62.2	62.2	63.7	65.7	65	64.1	62	59.3
		2 p.m.	28.692	62.5	59.4	60				61.8	62	63.2	63	64.3	64	61.9	59.2
		9 p.m.	28.702	58.8	57	57.2	64.2	56.3	.008	58.9	59.9	62.2	63.3	64	63.8	61.9	59.2
"	15	7 a.m.	28.632	59	57	58.2				58.8	58.8	60.3	61.8	62.6	63	61.6	59
		2 p.m.	28.636	64.3	60.2	61.2				64	63.2	63	62	62.2	62.8	61.6	59
		9 p.m.	28.664	62	59.9	61	64	55.1	.028	61.4	62	63.2	62.8	63	62.6	61.2	59
"	16	7 a.m.	28.682	60	57.3	58.2				60	59.3	60.8	61.8	62.3	62.2	61	58.8
		2 p.m.	28.740	82.1	68	73.3				81.5	76.5	71	64	63.1	62.1	61	59
		9 p.m.	28.706	72.1	62.5	65.1	78.1	56		65.5	67.3	69.2	67	65.8	62.2	61	59

OBSERVATIONS of Ground Temperature—*Continued.*

Month.	Day.	Time of Reading.	*Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth.							
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.
July—*Continued*	17	7 a.m.	28.728	62.3	58.2	60.5				61.8	59.7	61.3	63.3	64	62.5	60.7	58.7
		2 p.m.	28.792	83.5	68.2	75.8				84.8	80.8	72.2	65.3	64.3	62.7	60.8	58.8
		9 p.m.	28.804	60.8	57	59	78.1	52.9		61.8	67	70.3	68.1	67	62.6	60.8	58.7
"	18	7 a.m.	28.820	55	52.8	54	60	52.6		57.7	59	62.2	64	64.8	62.9	60.8	58.5
"	19	7 a.m.	28.746	54.5	52	53				61.8	55.1	57.4	60	61.2	62.2	60.6	58.5
		2 p.m.	28.742	78.3	62.8	71.2				83	76.7	72.2	63.1	62.1	62	60.7	58.7
		9 p.m.	28.720	64.2	59.7	61.5	73	42.2	.040	63.3	66.2	68	66	65	62	60.6	58.6
"	20	7 a.m.	28.714	61.3	58	59.1				64.4	60	61	63	63.5	62	60.5	58.6
		2 p.m.	28.748	81.2	65	73.1				86.2	78.7	73	64.7	63.7	62.2	60.5	58.5
		9 p.m.	28.708	68	61	64.1	75	51.8		67.7	70.6	71.7	68.1	66.7	62.1	60.5	58.4
"	21	7 a.m.	28.662	60.3	56	58				67.2	60.7	61.7	63.9	64.6	62.6	60.5	58.5
		2 p.m.	28.638	83	66.6	78				87.3	80.9	76	66.7	65.2	62.7	60.5	58.5
		9 p.m.	28.648	67.1	58.5	62	78	47		66	71	72.8	69.2	67.9	62.7	60.5	58.5
"	22	7 a.m.	28.790	53	48.6	52.2				63.5	58.5	60.2	64	65	63	60.5	58.5
		2 p.m.	28.866	77.9	60	71				89.4	81.9	76	66	65	63.1	60.9	58.7
		9 p.m.	28.894	65.6	56.2	59.1	74	41		64.7	71	73	64.8	68.1	63	60.9	58.6
"	23	7 a.m.	28.940	56.8	52.5	55.5				65.6	59.7	61	64.4	65.1	63.3	60.8	58.6
		2 p.m.	29.022	79	62.5	74.2				86.8	79.6	74.6	66.2	65.2	63.4	61.2	58.9
		9 p.m.	29.010	58	56.7	60.6	75.7	40.7		63.5	70	72.4	69.5	67.9	63.2	61	58.8
"	24	7 a.m.	29.026	60	56.2	59.2				66.4	60.8	61	63.2	64.8	63.5	61.1	58.8
		2 p.m.	29.002	89	66.8	79.2				93	82.6	76	66.1	65.1	63.7	61.4	59
		9 p.m.	28.874	70.5	61.5	65.4	80.1	40		69.1	71.9	73	59.8	68.4	63.4	61.2	59
"	25	7 a.m.	28.712	69	63	67.2	87.5	60	1.260	71	66.7	67	67	67	63.8	61.2	58.9
"	26	7 a.m.	28.708	66.5	64	65				66.6	66.2	67.5	68	68	64.6	61.6	59
		2 p.m.	28.708	80.1	70.3	71.7				83.8	77	72.8	68	67.5	64.8	61.8	59.4
		9 p.m.	28.682	69	64.8	65	77.3	60		66.8	69	70.2	69	58.2	64.7	62	59.1
"	27	7 a.m.	28.686	68.7	64.8	66.5				70.6	65.8	65.7	66.2	66.8	64.7	62	59.2
		2 p.m.	28.782	87.4	69.5	79.8				84.2	80.4	76.4	68.8	67.6	64.7	62.2	59.5
		9 p.m.	28.754	73.2	59.5	61.5	80.2	59	.170	61.6	56.8	70.2	70	69.1	64.7	62	59.4
"	28	7 a.m.	28.716	59.2	57.1	58.5				62.3	59.1	61.7	65.1	66.2	65	62	59.4
		2 p.m.	28.726	81	68.2	74				76	70.5	68.8	66.2	66	64.8	62.2	59.6
		9 p.m.	28.692	75	65.3	69	77.5	50	.044	66.1	68.2	69.7	68	67.2	64.6	62.2	59.6
"	29	7 a.m.	28.648	69	64	67				64.7	64						
		2 p.m.	28.712	84.4	72.5	79.9											
		9 p.m.															

"	27	7 a.m.	28.686	68.7	64.8	66.5	....	....	....	70.6	65.8	65.7	66.2	66.8	64.7	62	59.2
		2 p.m.	28.782	87.4	69.5	79.8	....	....	....	84.2	80.4	76.4	68.8	67.6	64.7	62.2	59.5
		9 p.m.	28.754	73.2	59.5	61.5	80.2	59	.170	61.6	56.8	70.2	70	69.1	64.7	62	59.4
"	28	7 a.m.	28.716	59.2	57.1	58.5	....	....	....	62.3	59.1	61.7	65.1	66.2	65	62	59.4
		2 p.m.	28.726	81	68.2	74	....	....	....	76	70.5	68.8	66.2	66	64.8	62.2	59.6
		9 p.m.	28.692	75	65.3	69	77.5	50	.044	66.1	68.2	69.7	68	67.2	64.6	62.2	59.6
"	29	7 a.m.	28.648	69	64	67	....	....	....	64.7	64	65	65.4	66	65.6	62.2	59.6
		2 p.m.	28.712	84.4	72.5	79.2	....	....	....	77.8	74.1	71.9	67	66.2	64.5	62.4	59.8
		9 p.m.	28.744	70.8	64.1	67.1	82.3	63.1	....	66.2	68.7	70.2	68.7	68	64.4	62.2	59.8
"	30	7 a.m.	28.804	61	56	59.3	....	....	....	64.4	60.1	62	65	65.8	64.7	62.2	59.8
		2 p.m.	28.868	79	64.2	75.6	....	....	....	85.4	78.7	72.7	66.2	65.8	64.7	62.4	60
		9 p.m.	28.868	66.4	63.1	63	76.2	52	....	64.8	68.6	70.7	69	68	64.4	62.3	60
"	31	7 a.m.	28.850	61.8	59.4	61	....	....	....	64	61.2	62.2	64.8	65.5	64.5	62.2	59.8
		2 p.m.	28.892	90.2	....	79	....	....	....	94.4	86.8	78.8	67.8	66.5	64.5	62.5	60
		9 p.m.	28.834	76.1	62.5	65.2	81.4	51.9	....	69	74.4	76	72	59.8	64.4	62.3	60

Observations of Ground Temperature—*Continued.*

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth. 1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	Temperature of different Soils. Loam. 3 inches.	Loam. 9 inches.	Clay. 3 inches.	Clay. 9 inches.	Sand. 3 inches.	Sand. 9 inches.
August	1	7 a.m.	28.702	65	62	64.7	81.5	53.1	......	68.8	64	65	67	67.3	65	62.3	59.9	65	68	64.7	68	66.8	69.8
"	2	7 a.m.	28.692	57.7	54	56.2	......	......	......	63	60	62.5	66	66.7	65.2	62.7	60	60	65.8	60	66.8	62.5	68
		2 p.m.	28.712	66.7	54.3	63	......	......	......	76	74.4	71.1	66.5	66	65	62.8	60.1	74.3	69.8	73	67.2	76.3	68.3
		9 p.m.	28.716	54	48.7	52.2	66.1	50.3	......	56.1	63	67.1	68	67.6	65	62.7	60.1	65	70.2	60.1	67.9	64.6	70
"	3	7 a.m.	28.766	54.7	50	53	......	......	......	57.1	57	59.4	63.1	64.1	64.7	62.7	60.1	57.7	62.2	56.2	62.8	58.8	64.5
		2 p.m.	28.870	66.5	56.5	64	......	......	......	74	70.8	69.6	63.7	63.8	64.5	62.8	60.2	76	66	70.5	63.8	73.2	64.8
		9 p.m.	28.870	56	49.6	52.2	65.7	47	......	55.7	62.1	65.6	65.8	65.4	64	62.7	60.1	64	68.2	60.2	65.7	63.3	67.5
"	4	7 a.m.	28.896	55.1	50.1	52	......	......	......	62.3	54	56	61	63.2	63.8	62.4	60.5	53.5	59.2	56	60.7	56.7	62
		2 p.m.	28.922	73.1	60.1	69.8	......	......	......	81.4	75.6	70	62.8	62.8	63.7	62.5	60.4	82	66.7	77.7	63.8	78.5	64
		9 p.m.	28.878	57.3	49.7	53 1	71	39.1	......	57	63.4	66.8	65.9	65	63	62.5	60.4	65.8	69.4	62.1	66.5	64.7	68.1
"	5	7 a.m.	28.904	50	47.8	48.8	......	......	......	53.8	54	56.7	61	62.1	63	62	60	55	60	55.5	61	56.2	62.2
		2 p.m.	28.926	77.2	58	65	......	......	......	76	75.3	72	64.2	63.2	62.8	59.9	60	79	69.8	74.8	65.7	78.6	65.7
		9 p.m.	28.910	64	52	55.5	71	39.2	......	59.1	65	68	65.4	64.5	62.8	61.7	60	66.7	69.2	64.1	66.3	56.6	67.3
"	6	7 a.m.	28.894	58.1	54.8	58.6	......	......	......	65	56.6	57	60.7	62	62.7	61.7	60	55.3	59.5	58.7	60.8	58.2	61.9
		2 p.m.	28.894	77.3	60	69.2	......	......	......	78.5	76.3	72	63.5	62.6	62.7	61.8	60	78.6	67.8	75.9	64.7	76	64.4
		9 p.m.	28.854	64	52.4	56.8	72.2	38.2	......	59.8	66.1	68.8	66.2	65.1	62.2	61.4	59.8	67.2	69.8	64.7	67.4	66.8	67.9
"	7	7 a.m.	28.846	54	54	59	......	......	......	64.6	56.8	57.8	61.3	62.5	62.6	61.2	59.6	55.6	60.2	58.7	61.6	58.1	62.8
		2 p.m.	28.878	64.7	64.7	77	......	......	......	92	82.8	74.8	64	63	62.8	61.5	59.7	87.7	69	85.5	65.6	83.7	65
		9 p.m.	28.888	63	55	57.2	77.5	40	......	61.4	67.8	70.6	68	66.7	62.4	61.2	59.6	69.8	72.8	67	69.2	69.1	70.2
"	8	7 a.m.	28.988	58	55.2	57.5	84	46.3	......	64.1	59	60.8	63.4	64	63	61.2	59.5	59	63.4	61	63.9	60.8	65.4
"	9	7 a.m.	29.076	61.2	59	61.2	......	......	......	63.8	66	62.6	65	65.2	63.3	61.2	59.4	61.1	65.7	62	65.8	62.5	67.6
		2 p.m.	29.120	88.5	71	85	......	......	......	91.8	82.4	76.1	67	65.8	63.7	61.8	59.7	89.4	73	86	69.3	87.4	69.4
		9 p.m.	29.074	73.5	63	68	86	51	......	67	72.3	73	70	68.5	63.7	61.8	59.5	74.5	75.6	71.6	72	74	73.3
"	10	7 a.m.	29.028	70.5	66	69.2	......	......	......	71.7	65	65	66	66.2	64	61.8	59.6	65	67.1	67.3	67.1	67.3	68.9
		2 p.m.	28.952	89	72.4	86.2	......	......	......	93.2	84.2	78	68.7	67	64	62	59.9	91.4	75	88.2	71.2	89.8	71.2
		9 p.m.	28.866	76	66.2	72.3	87	55	......	72.1	74	74.6	71	69.2	64.1	62	59.8	77.1	76.6	74.6	72.8	77.2	74.6

"	9	7 a.m.	29.076	61.2	59	61.2				63.8	66	62.6	65	65.2	63.3	61.2	59.4	61.1	65.7	62	65.8	62.5	67.6			
		2 p.m.	29.120	88.5	71	85				91.8	82.4	76.1	67	65.8	63.7	61.8	59.7	89.4	73	86	69.3	87.4	69.4			
		9 p.m.	29.074	73.5	63	68	86	51		67	72.3	73	70	68.5	63.7	61.8	59.5	74.5	75.6	71.6	72	74	73.3			
"	10	7 a.m.	29.028	70.5	66	69.2				71.7	65	65	66	66.2	64	61.8	59.6	65	67.1	67.3	67.1	67.3	68.9			
		2 p.m.	28.952	89	72.4	86.2				93.2	84.2	78	68.7	67	64	62	59.9	91.4	75	88.2	71.2	89.8	71.2			
		9 p.m.	28.866	76	66.2	72.3	87	55		72.1	74	74.6	71	69.2	64.1	62	59.8	77.1	76.6	74.6	72.8	77.2	74.6			
"	11	7 a.m.	28.814	73.2	67	69.6				73.5	68.7	68.5	68	67.8	64.8	62	59.8	70	70	70.5	69.3	71.2	71.1			
		2 p.m.	28.738	85.4	73.8	83.3				87	81.7	77	69.3	68.1	64.8	62.2	60	88	75	84	71.8	86	72			
		9 p.m.	28.744	66.1	62	64.1	86	63		65.6	70.3	72.4	70.7	69.1	65	62.2	60	72.5	75.3	70	72.6	73	74.2			
"	12	7 a.m.	28.826	64.6	58	63				67.8	62.8	64	65.3	67	65.1	62.5	60	62	66.7	63.2	67.2	64.2	69.4			
		2 p.m.	28.852	81.2	66	78.5				90.6	82	76	68	67	65.1	62.8	60.2	89	72.3	86.2	69.8	85.6	69.8			
		9 p.m.	28.788	62	57.2	57	80	52.3		60.3	66.8	70	70	69.4	65	62.6	60.2	69	73.8	67	71.8	69	73.2			
"	13	7 a.m.	28.738	61	59	63.4				66.8	62.2	64	66.6	67	65.2	62.7	60.2	62.2	67.2	64	67.8	64	69.6			
		2 p.m.	28.688	87	72	82.3				82.5	76.4	71.2	66.7	66.6	65.2	63	60.5	79.5	69	79	67.7	80	68.7			
		9 p.m.	28.608	66.1	63	64	84	49	.590	64.1	66	68.1	67.8	67.8	65	62.9	60.7	66.9	69.6	66.8	69.1	67.7	70.5			
"	14	7 a.m.	28.714	65.2	62.3	64				66.2	64	65	66	66.3	65	62.9	60.4	64.2	66.7	65	67	65.2	68			
		2 p.m.	28.802	73.4	62	71.6				78.2	73.6	71.8	67	66.5	65	63	60.6	80.1	70.8	77.7	68.8	79.4	69.6			
		9 p.m.	28.828	58	56	56	72.6	54.4		57.4	63	67.1	68	67.8	64.8	62.8	60.5	64.2	70.6	63.1	69.7	66.2	71.9			
"	15	7 a.m.	28.940	55.2	53	55	74.8	43		59.1	64.8	58.5	62.8	64.2	64.7	62.8	60.6	53.6	61.2	56.2	63.6	56.6	64.8			
"	16	7 a.m.	28.730	60.1	56	59.4				60.5	60.7	62.8	64.6	65.3		62.8	60.5	60.8	64.4	60.6	65.3	61.8	66.3			
		2 p.m.	28.564	61.4	58	58.9				61.6	62.1	62.2	63.6	64.1		62.7	60.6	61	63.1	61	63.5	61	64.1			
		9 p.m.	28.960	60	54.1	52.3	61	53.4	1.102	53.2	57.8	58.8	59.9	60.1		62.4	60.5	58.2	63.2	57.8	63.4	58.2	63.1			
"	17	7 a.m.	28.822	58	56	57				59	59	60.3	61.9	62.8		62.3	60.4	59.3	61.3	59.7	62.3	59.8	62.2			
		2 p.m.	28.888	64.8	58.8	63				64.4	64.3	63.8	62.3	62.7		62.2	60.6	65.2	63.2	65	63	65.3	62.8			
		9 p.m.	28.938	58	53.4	54.2	65.9	53.7		54.8	59.2	62.2	63.2	63.3		62.3	60.3	60.1	64	59.6	64	60	64			
"	18	7 a.m.	29.002	54.2	53.2	54.2				58	53 2	55.1	59.3	61		62	60.3	53.2	57.7	55	60	54.4	59.6			
		2 p.m.	29.030	68	59	66.4				70.8	67.8	65.7	61.4	61.2		62	60.4	70	63.2	68.9	62	69.7	61.8			
		9 p.m.	29.054	60	50.1	52	71	43		53.5	59.1	63	63.5	63.3		62	60.2	61	65.1	60	64.4	61.1	65.1			
"	19	7 a.m.	29.072	50	48.2	49.3				56	50.7	53.8	59	60.7		61.8	60.4	51	57.3	53.2	59.5	52.7	59.8			
		2 p.m.	29.122	77.8	61.5	70.4				75.8	72.7	68.1	61.3	61		61.8	60.4	74.4	64.5	75	62.4	75.8	62.5			
		9 p.m.	29.100	62.3	53.3	55	72	38.5		56	61.2	64.6	64.1	64.0		61.5	60.4	62.8	67	62.2	66.1	63.8	67			
"	20	7 a.m.	29.054	56.2	55.1	57.2				60.5	54.4	57.2	60	61.5		61.5	60.4	54.9	59.2	57	61.1	56.8	61.6			
		2 p.m.	29.028	85	67	77				84.2	75	69.4	62.3	61.5		61.5	60.4	79.5	66.5	79.6	64	78.8	64.2			
		9 p.m.	28.976	68	60,9	64	77.2	42.3		64.5	66.3	67.8	65.8	64.7		61.3	60.2	67.8	69	67	67.4	68.3	68.3			
"	21	7 a.m.	28.936	66	63.1	65				63.7	62.8	63.2	63.5	63.8		61.2	60.2	63.4	64.7	63.6	64.8	64.3	65.7			
		2 p.m.	28.916	80.9	70.8	73.2				78.2	73.4	69.5	64.2	63.9		61.2	60.2	75.3	67.5	74.3	65.8	76	66.3			
		9 p.m.	28.860	70	65.5	67.2	77	55.2		67	67.5	68	66.1	65.4		61.2	60.2	68.5	68.8	68	67.4	69.1	68.4			
"	22	7 a.m.	28.740	84	71	76	76	55.1	.095	80.8	74.1	70	64.9	64.7		61.4	60.2	77	68.3	76	66	77.5	67			
"	23	7 a.m.	28.656	67	65	65.5				66.2	65.8	66.1	65.7	66		61.7	60.2	66.1	67	61.5	66.8	66.6	67.5			
		2 p.m.	28.704	82.5	71.8	75				80.4	75.8	72.2	66.8	66.1		61.8	60.2	77.8	70	77.8	68.1	79.5	69			
		9 p.m.	28.750	66	64.5	65.5	75.1	63.2	66.9	67	68.1	69	67.8	67.5		62	60.2	67.8	70	68.2	69	69	70.1			

Observations of Ground Temperature—*Continued.*

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth.								Temperature of different Soils.					
																		Loam.		Clay.		Sand.	
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	3 inches.	9 inches.	3 inches.	9 inches.	3 inches.	9 inches.
August—Con	24	7 a.m.	28.800	63.2	61.1	62.3				63.5	64	65.5	66	66.2		62	60.2	64.8	66.5	64.7	66.8	65	69.5
		2 p.m.	28.892	69.5	64.8	66.1				70	69.5	68.3	65.7	65.6		62	60.2	70.7	67.1	70	66.7	71.1	67
		9 p.m.	28.895	65.3	62.4	64.5	68.5	62.4		64	66.5	68	67.5	67		62	60.2	65.7	68	66	67.8	66.2	67.6
"	25	7 a.m.	29.004	64	61.1	64				63.7	63.7	64.6	65	65.2		62	60.2	64.2	65.6	64.5	66	64.8	66.4
		2 p.m.	28.980	78	67.2	73.3				83.5	75.6	71	65.8	65.4		62.1	60.2	79.6	69.8	79.1	67	78.2	67.4
		9 p.m.	29.002	67.5	60.1	62	78	60.5		63	66	70.3	67.8	67.8		62.4	60.2	68.7	71.2	67.5	69.8	69	70.7
"	26	7 a.m.	28.952	60	60	60				61.8	60.2	61.9	64.2	65		62.3	60.2	61	63.8	61.7	65	61.8	65.8
		2 p.m.	28.972	85.6	73	81.8				89.5	81.6	74.5	66.5	65.7		62.4	60.2	87.7	71.2	86.4	68.8	83.2	68
		9 p.m.	28.916	73.1	65.1	68.2	85.6	49.5		67	71.4	73.2	70.6	69		62.4	60.2	72.5	74	71	71.5	72.3	72.5
"	27	7 a.m.	28.874	60	59.1	59.8				64.3	61	63.2	66	66.4		62.4	60.3	61.5	66	63	66.8	62.8	67.7
		2 p.m.	28.918	90	75	86				93.5	85	78.2	68	66.7		62.5	60.4	91.5	73.5	90.5	70	86	69.5
		9 p.m.	28.868	77	69	72	86.2	50		70.2	74	75.2	72.2	70.1		62.5	60.4	75.5	76.5	73.6	73.6	74.9	74.2
"	28	7 a.m.	28.830	64.4	65	65.2				69.5	64	65.8	67.6	68		62.7	60.5	64.5	68	65.8	68.5	65.6	69.5
		2 p.m.	28.824	93	76	88				95.5	85.8	79.2	69.5	68		62.8	60.5	89	74.5	90	71.6	86.2	71
		9 p.m.	28.792	69	63	63.4	88.5	61.3	1.280	66	69.4	72	71.3	70.2		63	60.5	69.5	73	69.5	71.6	68.5	72.3
"	29	2 p.m.	28.640	93	76	84.7	85	58.5		85.5	81	76.8	69.5	67.2		63.3	60.8	81.3	74	82.8	71	81.8	70.8
"	30	7 a.m.	28.548	70	67	68				68.7	68	68.9	68.5	68.7		63.3	61	68.5	69.9	69	70	69	70.4
		2 p.m.	28.526	71	66	66.7				69.5	69.5	69.9	68.5	68.5		63.5	61.2	70.5	70	70.7	69.8	70.8	70
		9 p.m.	28.592	63	60.2	61.2	85	60	.556	61.3	64.1	66.9	67.8	68		63.4	61	65.2	68.8	65.7	69.1	65.1	69.2
"	31	7 a.m.	28.662	56	53.3	55				59.4	56.8	60.7	63.8	65.2		63.4	61	57.8	63	59.7	65	58	64.7
		2 p.m.	28.742	67	56.7	63.8				66.6	65.8	65.8	64.3	64.8		63.6	61.1	70	65.7	70.6	67	70	65.3
		9 p.m.	28.844	55	49.7	54	64.2	46.7		52.9	56.3	60.8	64.1	65		63.2	61.1	59	69.6	59.4	65.8	59.2	65.9
September	1	7 a.m.	29.034	50.2	46.3	49				53.1	51.2	55	60.3	62		63.2	61.1	52.6	59.2	54.7	61.8	53	61.2
		2 p.m.	29 142	67.8	54.2	61.8				71.2	68	65.2	61.7	62		63.2	61.2	73	63.5	74.8	63.2	73	62.8
		9 p.m.	29.138	55.2	48	50.1	64.7	43.3		49.6	56	61	63.3	63.8		62.9	61.1	58.4	65.6	59	65	59.2	65.8

		9 p.m.	28.592	63	60.2	61.2	85	60	.356	61.3	64.1	66.9	67.8	68	.....	63.4	61	65.2	68.8	65.7	69.1	65.1	69.2
"	.....	31	7 a.m.	28.662	56	53.3	55	.....	.....	.....	59.4	56.8	60.7	63.8	65.2	.....	63.4	61	57.8	63	59.7	65	58	64.7
			2 p.m.	28.742	67	56.7	63.8	.....	.....	.....	66.6	65.8	65.8	64.3	64.8	.....	63.6	61.1	70	65.7	70.6	67	70	65.3
			9 p.m.	28.844	55	49.7	54	64.2	46.7	.....	52.9	56.3	60.8	64.1	65	.....	63.2	61.1	59	69.6	59.4	65.8	59.2	65.9
September	.....	1	7 a.m.	29.034	50.2	46.3	49	.....	.....	.....	53.1	51.2	55	60.3	62	.....	63.2	61.1	52.6	59.2	54.7	61.8	53	61.2
			2 p.m.	29.142	67.8	54.2	61.8	.....	.....	.....	71.2	68	65.2	61.7	62	.....	63.2	61.2	73	63.5	74.8	63.2	73	62.8
			9 p.m.	29.138	55.2	48	50.1	64.7	43.3	.....	49.6	56	61	63.3	63.8	.....	62.9	61.1	58.4	65.6	59	65	59.2	65.8
"	.....	2	7 a.m.	29.194	45.2	44.2	45	.....	.....	.....	52	47.3	51.9	58.6	60.4	.....	62.5	61.1	49.2	57	51.2	59.8	52	59.7
			2 p.m.	28.252	76.2	60.8	68.8	.....	.....	.....	77	71	66.2	60.8	60.8	.....	62.7	61.1	73	63	75.8	62.5	75.2	62
			9 p.m.	29.232	53	52.8	54.7	70	43.2	.....	53	58.2	62.2	61.9	62.3	.....	62	61	58.2	66.8	59.6	65.3	60.2	65.9
"	.....	3	7 a.m.	29.222	53	52.3	53.3	.....	.....	.....	55.7	51.7	54.7	59.4	61	.....	62	60.7	53	58.7	54.8	60.8	54.2	60.9
			2 p.m.	29.268	81	63.7	73	.....	.....	.....	81	73.5	68	61.1	61.4	.....	62	60.9	73.8	64	74	63.1	75.3	63
			9 p.m.	29.174	60	54	57.2	74.1	35.2	.....	56.4	60.7	63.7	64.1	63.8	.....	61.8	60.7	61	65.3	60.7	65	63.1	66.2
"	.....	4	7 a.m.	29.148	58.1	56.4	58.2	.....	.....	.....	56.2	55	67	60.3	61.3	.....	61.8	60.4	56.3	60	57.5	61.3	57.5	62
			2 p.m.	29.130	80	68.4	76	.....	.....	.....	82.7	74.2	68.2	62	62	.....	61.8	60.5	74.2	64.7	74.3	63.3	75.6	63.5
			9 p.m.	29.150	65	60	61.	76.1	49.1	.....	62	64.9	65.4	65	64.2	.....	61.8	60.6	65	66.7	64.6	66.3	66.2	66.6
"	.....	5	7 a.m.	29.118	62	59	61	78.5	56	.....	63.8	59	60.2	62.2	63	.....	61.8	60.7	59.2	62.8	61	63.2	60.6	63.9
"	.....	6	7 a.m.	29.146	56	55	56	.....	.....	.....	60.1	56.4	60.2	62.8	63.7	.....	61.6	60.2	57.2	62.2	58.4	63.2	58.6	64.2
			2 p.m.	29.190	87.5	71.2	81.4	.....	.....	.....	92.8	83	75.2	65.6	64.4	.....	62	60.8	82.8	69	81.8	66.5	81.2	66.2
			9 p.m.	29.152	70	62.8	64.3	82.2	53.8	.....	65.3	70	71.9	69	67.7	.....	61.8	60.3	69	70.8	67.8	68.8	69.5	69.7
"	.....	7	7 a.m.	29.130	59	57.3	58.2	.....	.....	.....	63.5	59	62.2	64.2	65	.....	61.9	60.3	59.2	68.8	60.8	64.6	60.5	65.4
			2 p.m.	29.168	89.2	73.6	84	.....	.....	.....	91.5	83.2	77	67.4	65.7	.....	62.2	60.8	84.5	71.3	82.8	68.3	82.8	67.8
			9 p.m.	29.080	72	64	67.8	84.2	48	.....	65.8	69.6	71.5	69.7	68.8	.....	61	60.5	68.9	71.6	68	69.6	69.2	70.4
"	.....	8	7 a.m.	29.024	62	60.6	61.2	.....	.....	.....	66.3	61.2	63	65.4	66	.....	62.2	60.4	61.2	65.2	62.4	65.8	62.4	66.6
			2 p.m.	29.014	87.2	72.2	83.8	.....	.....	.....	90	80.7	76	67.8	56.2	.....	62.3	60.7	82.6	71	80	68.7	79.5	68
			9 p.m.	28.920	74	68.2	70.2	85	54	.....	71.2	78.6	74	70.6	69	.....	62.4	60.7	73	73	72	70.8	73.2	71.2
"	.....	9	7 a.m.	28.910	63.2	62	62	.....	.....	.....	63.8	65.3	66.8	67.3	57.2	.....	62.4	60.7	65.2	67.8	65.1	67.7	65.9	68.4
			2 p.m.	28.856	62.8	61	61.1	.....	.....	.....	65.8	65.8	66.4	66.3	66.4	.....	62.8	60.7	65.2	65.4	65	66.4	65.2	67
			9 p.m.	28.772	61.2	60	60	71	58.6	.314	62.1	68.7	65	65.8	66	.....	62.8	60.7	63.2	65.7	63.4	66	63.7	66.2
"	.....	10	7 a.m.	28.662	66	64.8	65.2	.....	.....	.....	64.8	63.6	64	64.4	65	.....	62.8	60.8	63.6	64.2	64	64.8	64	64.8
			2 p.m.	28.666	76.7	74	74	.....	.....	.....	72.6	71	69.8	65.8	65.4	.....	63	61	71.8	68	71.8	66.8	72.4	66.6
			9 p.m.	28.722	64	57.6	61.8	77.2	57.6	.052	59.3	63	65.8	66.4	66.2	.....	62.8	60.8	63.2	67.2	63.5	67	64	67.5
"	.....	11	7 a.m.	28.846	51.7	44.8	50.3	.....	.....	.....	55	62.3	56.3	61.8	63.1	.....	62.8	60.8	52.5	60	54.8	62.2	52.9	62.1
			2 p.m.	28.142	67.6	55.3	64	.....	.....	.....	71.3	65.8	64.7	62.1	62.6	.....	62.9	61	69	63	67.8	63	67.8	62.4
			9 p.m.	28.684	59.2	53.4	57.5	65.6	45	.....	45	58.1	61.8	63.4	63.8	.....	62.8	60.7	58.5	63.6	58.4	64	59.5	64.4
"	.....	12	7 a.m.	28.616	53	51	51.6	62.2	50.9	.....	52.6	55.2	58.4	61.3	61.7	.....	62.7	61.8	55.2	60.2	56	61.5	55.8	61.8
"	.....	13	7 a.m.	28.692	44.2	40.2	42.6	.....	.....	.....	45.6	46.5	50.8	56.8	58.5	.....	61.8	60.4	56.4	53.8	48.5	56.6	47.8	56
			2 p.m.	28.764	60	48.8	55.6	.....	.....	.....	61.3	58.3	58	57	58	.....	61.8	60.6	61	56.8	61.8	57.6	60.6	56.3
			9 p.m.	28.692	51.4	52.8	52.6	57	38.4	.040	45.2	51.3	56.1	57.5	59.8	.....	61.6	60.4	60.5	57.8	60.4	59.3	60.1	59.8
"	.....	14	7 a.m.	28.706	51.4	50.3	50.2	.....	.....	.....	51.6	51	53.5	56.8	58	.....	61	60	51.2	55	52.5	56.6	51.8	56.2
			2 p.m.	28.804	65	54.2	62	.....	.....	.....	65.5	62.8	61.5	58.2	58.3	.....	60.8	60.2	65.3	59.3	65.9	58.8	64	57.9
			9 p.m.	28.882	51	45	47	62.9	38.4	.463	46.7	52.7	57	59.2	59.8	.....	60.8	59.8	54.8	59.4	54.6	60	54.4	60

Observations of Ground Temperature—*Continued.*

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth. 1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	Temperature of different Soils. Loam. 3 inches.	Loam. 9 inches.	Clay. 3 inches.	Clay. 9 inches.	Sand. 3 inches.	Sand. 9 inches.
Septemb'r—*Con.*	15	7 a.m.	28.982	47.3	47	49.4	......	......	......	49	45	48.6	55	56.7	......	60.2	59.7	46.7	52.4	48.2	55.3	47	54.6
		2 p.m.	28.944	67	55.2	60.4	......	......	......	64.4	61	59.2	56.4	56.8	......	60.2	59.7	61.7	56.8	59.2	56.7	59.2	55.7
		9 p.m.	28.876	56	54	55	62.3	35	......	54.8	55.2	57	57.8	58	......	60	59.4	55.2	57.3	55	57.6	55.7	57.4
"	16	7 a.m.	28.804	64.6	64.2	64.2	......	......	......	63.2	60	59.2	58	58.2	......	59.7	59.2	60.2	58.2	60.4	58	60.3	57.8
		2 p.m.	28.792	78	69.2	72.2	......	......	......	72.8	69.5	66.1	60.3	59.7	......	59.7	59.2	69.7	63	69.1	60.7	70.2	60.8
		9 p.m.	28.724	66.1	62.7	63	75 8	54	.258	62.8	63	63.8	62.2	61.5	......	59.8	59.2	63.4	63.8	63.5	62.6	63.8	63.4
"	17	7 a.m.	28.846	61.2	63.2	65.6	......	......	......	64.3	62	64	59	59.3	......	59.9	59	59	59	60.1	58.7	60	58.5
		2 p.m.	28.906	66.2	58	62.1	......	......	......	66.2	65.8	64.6	61.8	61.5	......	59.8	59.2	67.2	63.5	66.7	62.3	66.2	62.7
		9 p.m.	29.020	54.5	50	51	64.8	50	.208	51	56	59.8	62	62	......	59.8	59	57.6	62.2	57.8	62.2	57.7	63
"	18	7 a.m.	29.168	47.2	45	46	......	......	......	51	47.8	51.3	57	58.8	......	60	58.7	49.1	55.3	51.4	57.2	49.3	57.2
		2 p.m.	29.200	67	55.4	62.2	......	......	......	69.2	64	61.4	58.2	58.3	......	59.8	59	66.8	59.2	66.4	59	64.1	57.8
		9 p.m.	29.074	56.2	50.2	52	63.7	39	......	52	56.2	59.2	60.4	60.3	......	59.8	58.8	57.2	61	59.6	60.8	57.4	60.7
"	19	7 a.m.	28.788	54.2	53.4	53.4	67.3	48.8	.204	54.8	54.6	55.8	57.7	58.7	......	59.8	58.8	55	57	55.2	58	54.8	57.8
"	20	7 a.m.	28.960	44.6	42	43	......	......	......	47.8	45.8	50	55	56.4	......	59.2	58.6	47.6	53.6	49	55.4	47.6	54.1
		2 p.m.	28.950	57	50.8	54.2	......	......	......	57.8	56.2	56	55.5	56 2	......	59.4	58.6	57	55	57.5	55.6	56	54.8
		9 p.m.	28.958	50	47	49	56.2	38	......	48.8	50.8	54	56.2	57	......	59	58.5	51.7	55.6	52.3	56.3	51.7	58
"	21	7 a.m.	29.012	41.2	38.5	39.5	......	......	......	46.7	42	46.2	42.3	54.2	......	58.8	58.1	43.3	50.1	46	52.5	43.2	51.4
		2 p.m.	29.010	62.5	51	57.4	......	......	......	66.8	60.7	57.4	54	54.3	......	58.8	58.2	61.8	54	61.9	54	58.6	52.8
		9 p.m.	29.012	48	43.2	45.6	57.8	31.5	......	46.2	50.5	54.2	55.8	56.2	......	58.5	58.2	51.8	55.9	52.2	56.1	51.1	55.3
"	22	7 a.m.	28.990	47	44.9	46.4	......	......	......	47.5	47.8	50	53.2	54.7	......	58	58	48.7	52	48.8	53.2	48.4	52.8
		2 p.m.	28.908	61	52.5	55.2	......	......	......	58.4	58	57.5	55	55.2	......	58	57.8	57	55.4	56.5	55	57	54.5
		9 p.m.	28.788	47.8	53.5	53	61	42	......	44.1	49.3	55.3	54.3	56.4	......	58.6	58.1	51.6	58.1	51.2	59.3	51.3	55.4

"	23	7 a.m.	28.894	53.2	59.8	51.8	.....	.....	.....	54.2	53.2	54	55	55.5	.....	57.8	57.5	53.8	53.4	54	54.8	53.6	54.8										
		2 p.m.	28.964	68.1	59	62.2	.....	.....	.....	71.4	68.7	59.8	55.8	55.9	.....	57.8	57.5	63	56	62.3	55.6	62	55.3										
		9 p.m.	29.020	55.7	52	52	66.6	43	.....	55.8	58.2	60	59.1	58.5	.....	57.8	57.5	57.9	60	58	59	58.5	59.4										
"	24	7 a.m.	29.040	49	47.2	47.2	.....	.....	.....	51	52	54.7	56.8	57.7	.....	57.6	57.5	52	56.6	63.5	57	52.7	57.1										
		2 p.m.	29.084	76	63	68.2	.....	.....	.....	74.7	68.2	63	51.9	57.5	.....	57.8	57.4	67.6	59	66.4	57.7	66.5	57.7										
		9 p.m.	29.026	62	53.2	55	70.5	43.2	.....	58.2	61.2	63	62.1	60.6	.....	57.8	59.3	59.6	61.4	59.3	60.5	59.4	60.3										
"	25	7 a.m.	26.048	60.8	60	60.2	.....	.....	.....	61	58.7	58.8	58.8	59	.....	57.8	57.5	58.6	59.1	59	58.7	58.7	59.1										
		2 p.m.	28.932	82.6	71.2	81	.....	.....	.....	77.3	71.5	67.6	60.8	59.7	.....	58	57.5	73	63.5	71.8	61	74.8	62.2										
		9 p.m.	28.848	70	65	67	81.2	59	.110	63.5	63.8	64.6	62.8	62	.....	58	57.2	64.3	64.8	64.4	63.1	64.8	64										
"	26	7 a.m.	28.682	65	61.2	63.2	70.1	62.3	.200	62.3	62.3	62.6	61.7	61.2	.....	58.1	57.2	63	63	63	62.1	63	62.5										
"	27	7 a.m.	28.744	55	53.1	53.6	.....	.....	.....	56.8	56.5	58.2	60	60.3	.....	58.5	57.1	57.8	60.4	58.2	60.4	57.8	60.8										
		2 p.m.	28.720	66.8	58.8	61	.....	.....	.....	66.3	63.3	62	60.1	60.1	.....	58.6	57.4	63	61.1	62.2	60.4	62.8	60.7										
		9 p.m.	28.628	57	55.5	55.9	61	51	.....	57.5	58.7	60.5	60.6	60.7	.....	58.8	57.5	58.9	60.9	58.8	60.6	59	60.1										
"	28	7 a.m.	28.748	57	55	56	.....	.....	.....	57.2	58	59.1	59.7	60	.....	58.8	57.5	58.2	59.8	58.7	59.8	58.7	60										
		2 p.m.	28.786	55.5	50	54.1	.....	.....	.....	56.2	58.8	60.1	59.8	59.8	.....	58.9	57.6	59.4	60	59.5	60	59.5	60										
		9 p.m.	28.800	48.8	45.5	46.6	60.7	45.2	.....	48	52.3	55.9	58.4	59.1	.....	58.9	57.8	53.8	58	54.7	58.8	54	58.9										
"	29	7 a.m.	28.810	40	38	38.5	.....	.....	.....	42.3	43.5	49	54.8	56.9	.....	58.9	57.8	46	53.2	48.2	55.3	46	55										
		2 p.m.	28.820	59.4	49	56.9	.....	.....	.....	59.4	56.8	56.1	55	55.8	.....	58.5	57.6	59	55	58.2	55.5	56	54.5										
		9 p.m.	28.770	47.6	42	42.5	56.9	35	.....	42.8	48	52.8	56	56.9	.....	58.7	57 6	50	55.2	51	56.1	49.1	56										
"	30	7 a.m.	28.632	46.3	43.5	45.1	.....	.....	.....	47.1	44	47.3	52.3	54.1	.....	58.1	57.2	45.7	50.8	47.3	53	46	52.2										
		2 p.m.	28.528	67	55.5	62	.....	.....	.....	63.1	58	56	53.8	54.1	.....	58.2	57.7	58.7	54.8	58	53.8	57.5	53										
		9 p.m.	28.538	43.1	40.5	41.7	62.7	35	.070	45.2	50.7	54	55.3	55.8	.....	58	57.5	50.8	55	51	55.2	51.2	55.1										
October	1	7 a.m.	28.686	36.6	35	36	.....	.....	.....	39.8	41.2	46.3	51.8	53.7	.....	57.8	57.4	42.5	49.8	44.2	52	43.1	51.8										
		2 p.m.	28.818	45	39.2	42.4	.....	.....	.....	51	48.7	50.8	51.7	52.8	.....	57.6	57.2	50.7	56.1	50	57.5	49	56.8										
		9 p.m.	28.896	37.2	55.2	55.5	47.2	34.1	.....	37 8	42	47	51.2	52.8	.....	57.2	57	43.3	49.2	44.9	51.2	40.8	51										
"	2	7 a.m.	28.998	44.2	37.9	37.8	.....	.....	.....	39.8	41.6	46.1	50.7	52.6	.....	51	56.9	41.8	49.6	43.8	51.6	42.9	51.5										
		2 p.m.	29.084	51.8	43.3	48.4	.....	.....	.....	51.5	49	49	49.5	50.8	.....	56.8	56.8	49.8	48	49.2	49.1	48.8	48.8										
		9 p.m.	29.116	40	35.3	36	50.8	34.8	.....	36.6	42.1	47	50.8	51.6	.....	56.4	56.5	41.1	50	42.8	50.7	42.2	50.3										
"	3	7 a.m.	.....	...	34	34	57.9	26	.....	37.8	37.2	41.6	47.3	49.1	.....	55.7	56.4	36	46.7	37.8	48.2	36.8	48										
"	4	7 a.m.	28.854	46	45	46	54.6	33	.....	45.2	44.2	46.1	48.8	50	.....	55.2	55.8	44.2	48.1	45	49	44.5	48										
		2 p.m.	28.842	53	54.5	54.5	.....	.....	.....	51.5	51	50.8	49.8	50	.....	55.2	55.6	44.2	49	50.8	49.2	51	49.2										
		9 p.m.	28.926	52	50.2	51	54.6	33	.096	51	50.6	51.4	51	51.3	.....	54.1	55.6	50.3	50.1	50.3	50.2	50.2	50.4										
"	5	7 a.m.	29.034	49.4	48	48.3	.....	.....	.....	49.5	48.8	50.6	51.2	51.8	.....	54.7	55.5	48	50.8	49.5	50.9	49.2	50.9										
		2 p.m.	29.060	60	51	55	.....	.....	.....	59.5	56.2	54.8	52.2	52.2	.....	54.8	55.2	55.8	51.4	55.2	51.2	55.8	51.6										
		9 p.m.	29.030	47.8	42.5	43	55.1	41.5	.....	44	49	52.2	53	53.2	.....	54.8	55	47.2	52.8	48.8	52.8	48.4	53.8										

OBSERVATIONS of Ground Temperature.—*Continued.*

MONTH.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	TEMPERATURE OF SOILS VARYING FROM 1 TO 48 INCHES IN DEPTH.								TEMPERATURE OF DIFFERENT SOILS.					
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	Loam.		Clay.		Sand.	
																		3 inches.	9 inches.	3 inches.	9 inches.	3 inches.	9 inches.
October—*Con*...	6	7 a.m.	29.020	39	39.2	39.3	.....	.....	.....	42.9	44	46.2	49.8	51.2	.....	54.5	55	42.2	49.1	43.2	50	42	50
		2 p.m.	29.024	66	57.2	63	.....	.....	.....	69.7	62.6	58.2	52.1	52	.....	54.8	54.7	62.8	50.7	59.2	50.3	61.6	50.4
		9 p.m.	28.990	53	47	47.4	64.1	33	.....	57.8	42	55	54.8	54.6	.....	54	55.1	51.2	54.2	51.3	53.2	52.1	54.2
"	7	7 a.m.	29.000	40	38.1	38.1	.....	.....	.....	41.2	42.3	46.6	50.8	52.2	.....	54.4	54.7	41.4	51	43	51.2	41.9	51.4
		2 p.m.	29.048	66.5	60.1	67	.....	.....	.....	70.6	64	59.7	53.2	52.8	.....	54.7	54.8	64.1	51.8	60.8	51.3	63.1	51.4
		9 p.m.	29.016	56	51	51.3	67	34.9	.....	48.2	53.6	55.4	55.3	55.1	....	54.8	54.8	52.4	55.2	52.4	53.9	53.8	54.8
"	8	7 a.m.	29.004	42	40.4	40.6	.....	.....	.....	44.3	44.5	48.1	52	52.8	.....	54.6	54.7	43.8	52	45	52	44.1	52.2
		2 p.m.	29.038	75.4	63	72	.....	.....	.....	69.7	63.2	59.8	54	53.7	.....	54.8	54.8	64.6	53.1	61.6	52.5	64	52.7
		9 p.m.	29.016	60	55.5	57.3	72.5	36	.....	53	55	56.5	56	55.5	.....	55	54.8	55	56.1	53.9	54.9	55.9	55.8
"	9	7 a.m.	29.048	52	52	53	.....	.....	.....	48	48.2	50.2	53.7	53.7	.....	54.7	54.6	48.7	53	48	53	47.9	53.2
		2 p.m.	29.068	77.2	64.5	72.3	.....	.....	.....	72.2	65.4	61	59.7	54.1	.....	54.8	54.8	66.9	54	64	54.1	64.8	53.5
		9 p.m.	29.044	60.1	54.1	55.1	73.2	41.8	.....	52.4	56	57.7	57.1	56.8	.....	54.8	54.8	55.9	58	55.7	56.4	57	56.9
"	10	7 a.m.	29.044	46.7	44	44	74	42	.....	44.8	47.6	51.2	54	54.8	.....	55	54.6	47.6	54.5	48.1	54.1	48.1	55
"	11	7 a.m.	29.026	47.7	45	45.2	.....	.....	.....	49	47.8	51.2	54.4	55.2	.....	55.1	54.7	47.8	55.1	48.3	54.8	48.4	55.2
		2 p.m.	29.030	77	63.1	71	.....	.....	.....	69.7	65	62	56.1	55.7	.....	55.2	54.8	66	55.9	63.5	54.8	65.2	55
		9 p.m.	28.980	62	56.5	58	72.2	44	.....	55.4	57.1	58.7	57.8	57	.....	55.6	54.9	57.2	58.5	57	56.9	58	57.8
"	12	7 a.m.	28.908	55.0	53.2	54	.....	.....	.....	54	53.2	54.4	55.4	56	.....	55.6	54.9	53.6	55.8	53.4	55.4	53.5	56.9
		2 p.m.	28.872	71.2	62.2	67	.....	.....	.....	67.5	62.2	59.5	56.3	56.1	.....	55.7	55	63.4	56.4	62	55.8	63	56
		9 p.m.	28.904	67.2	56	55.5	67.2	51.8	.....	54.2	56.1	57.2	57.4	57.4	.....	55.7	55	56.3	56.4	54.6	55.8	57.6	57.5
"	13	7 a.m.	28.894	55	52.1	52	.....	.....	.....	54.8	55.6	56.5	56.7	56.9	.....	55.8	54.9	55.6	57.1	55.2	56.4	55.7	57
		2 p.m.	28.866	62	55	55.9	.....	.....	.....	61.2	59.7	58.6	56.6	56.7	.....	55.7	55	59.2	56.8	58	56	59	56.7
		9 p.m.	28.794	53.1	51	51	67.8	49.7	.....	53.2	55.4	57.2	57.2	57.2	.....	55.7	55.2	54.8	57.3	54.2	56.2	55.3	57.1
"	14	7 a.m.	28.560	53.2	53	54	.....	.....	.....	53.9	53.3	54.3	55.9	56.4	.....	55.9	55	53.3	56	53.5	55.4	53.5	56.1
		2 p.m.	28.192	63.4	62.6	63.5	.....	.....	.....	62.1	58.8	58	56.1	56.1	.....	56	55	60.1	56.1	59.1	56	59.7	56
		9 p.m.	28.210	54.9	52.3	53	64.5	50	.665	54.7	52.2	56.7	57	57	.....	56.2	55.4	54.8	57.1	54.7	56.6	54.8	57
"	15	7 a.m.	28.642	47.5	44	47	.....	.....	.....	48	50.4	53	55	55.7	.....	55.9	55.1	58.8	55	49.6	55.1	49.2	55.2
		2 p.m.	28.836	47	42.2	45.2	.....	.....	.....	51.3	52	53.5	54.3	55	.....	55.8	55	49.8	53.7	49	53.8	50	54
		9 p.m.	28.988	34.5	33.3	34.4	54.2	33.3	.....	37.4	41.4	47	52.2	53.9	.....	55.8	55	40.7	51.3	40.9	51.9	40	52

"	12	7 a.m.	28.908	55.0	53.2	54	.....	.....	.....	54	53.2	54.4	55.4	56	.....	55.6	54.9	53.6	55.8	53.4	55.4	53.5	56.9
		2 p.m.	28.872	71.2	62.2	67	.....	.....	.....	67.5	62.2	59.5	56.3	56.1	.....	55.7	55	63.4	56.4	62	55.8	63	56
		9 p.m.	28.904	67.2	56	55.5	67.2	51.8	.....	54.2	56.1	57.2	57.4	57.4	.....	55.7	55	56.3	56.4	54.6	55.8	57.6	57.5
"	13	7 a.m.	28.894	55	52.1	52	.....	.....	.....	54.8	55.6	56.5	56.7	56.9	.....	55.8	54.9	55.6	57.1	55.2	56.4	55.7	57
		2 p.m.	28.866	62	55	55.9	.....	.....	.....	61.2	59.7	58.6	56.6	56.7	.....	55.7	55	59.2	56.8	58	56	59	56.7
		9 p.m.	28.794	53.1	51	51	67.8	49.7	.....	53.2	55.4	57.2	57.2	57.2	.....	55.7	55.2	54.8	57.3	54.2	56.2	55.3	57.1
"	14	7 a.m.	28.560	53.2	53	54	.....	.....	.....	53.9	53.3	54.3	55.9	56.4	.....	55.9	55	53.3	56	53.5	55.4	53.5	56.1
		2 p.m.	28.192	63.4	62.6	63.5	.....	.....	.....	62.1	58.8	58	56.1	56.1	.....	56	55	60.1	56.1	59.1	56	59.7	56
		9 p.m.	28.210	54.9	52.3	53	64.5	50	.665	54.7	52.2	56.7	57	57	.....	56.2	55.4	54.8	57.1	54.7	56.6	54.8	57
"	15	7 a.m.	28.642	47.5	44	47	.....	.....	.....	48	50.4	53	55	55.7	.....	55.9	55.1	58.8	55	49.6	55.1	49.2	55.2
		2 p.m.	28.836	47	42.2	45.2	.....	.....	.....	51.3	52	53.5	54.3	55	.....	55.8	55	49.8	53.7	49	53.8	50	54
		9 p.m.	28.988	34.5	33.3	34.4	54.2	33.3	.....	37.4	41.4	47	52.2	53.9	.....	55.8	55	40.7	51.3	40.2	51.9	40	52.2
"	16	7 a.m.	29.128	30	28.5	29.6	.....	.....	.....	34.2	38	43.1	49	51.1	.....	55.8	54.8	35.2	47.6	37	48.8	36.8	49
		2 p.m.	29.182	41	35	39	.....	.....	.....	49.8	47.3	47.8	48.7	50	.....	55.8	54.9	43.9	46.1	44.1	47.4	44	47.2
		9 p.m.	29.138	31	27.8	28.4	48.1	27.2	.....	33.6	38.7	44	48.8	50.3	.....	55.6	54.8	37.1	46.7	37.2	47.7	36.9	47.6
"	17	7 a.m.	28.992	32.8	31.7	32.6	43.6	26.5	1.246	35	37	40.8	45.9	48	.....	55	54.8	35.5	43.6	36.6	45	35	45
"	18	7 a.m.	29.062	35.0	33.9	34.1	.....	.....	.....	36.2	37	40.7	44.2	46	.....	53.8	54.6	36.7	42.2	37	43.7	35.8	43
		2 p.m.	29.158	49.4	39.8	42.3	.....	.....	.....	50.3	49.8	48.5	45.7	46.2	.....	53.6	54.2	46	43	46.8	44	46.2	43.3
		9 p.m.	29.174	37.2	35.5	36	44.2	31.5	.....	38.2	41	44.8	47	48	.....	53.2	53.8	38.8	44.7	39.2	45.4	38.1	45
"	19	7 a.m.	29.198	35.2	34	34	.....	.....	.....	37.9	39	42	45.1	46.6	.....	52.8	53.6	38	43	38.7	44	37	43.8
		2 p.m.	29.218	61.3	52	55	.....	.....	.....	62.2	55.8	51.7	47	47.1	.....	52.8	53.7	53	44.8	52.8	45	53.5	44.8
		9 p.m.	29.156	47.5	42.2	42.2	55	32.6	.....	43.9	47.1	50.6	49.1	49	.....	52.6	53.6	45.8	47.4	45.9	47.4	45.4	47.2
"	20	7 a.m.	29.168	40.1	40	40.6	.....	.....	.....	41.5	39.9	43	46.4	47.8	.....	52.1	53	39	43.8	39.4	45.4	38	45.4
		2 p.m.	29.034	73	62	69.7	.....	.....	.....	65.2	58.8	54.2	48.8	48.5	.....	52.1	52.8	57	47	57.7	46.8	58	46.3
		9 p.m.	28.824	61	57.7	59	70.1	34.5	.....	57	55.4	54.8	51.7	51	.....	52.2	52.8	54.7	50.5	55.1	50.2	55.6	50.4
"	21	7 a.m.	28.974	42	39	41.6	.....	.....	.....	42.8	43.6	46.8	50.7	51	.....	51.8	52.5	43	50	43	49.8	42.2	50.2
		2 p.m.	29.020	51.2	64	64	.....	.....	.....	53.4	54	52.6	50.7	50.6	.....	52	52.7	49.4	49.1	49.2	58.9	49.9	49.2
		9 p.m.	28.994	40	36	37	60	36.2	.204	38	41.9	46.6	49.9	50.8	.....	52.1	52.4	40.8	48.4	41	48.9	39.4	49.1
"	22	7 a.m.	28.898	48	37.1	38.1	.....	.....	.....	38	37.8	41.8	46.5	48	.....	52	52.2	37.5	44.8	38	45.5	36.7	45.8
		2 p.m.	28.892	64.4	55	61.6	.....	.....	.....	60.8	55	52.1	48.1	48.2	.....	52.1	52.6	52.8	46	53.4	46.1	53.7	46
		9 p.m.	28.920	50.7	45.1	46.3	62.2	33.9	.....	43.8	46.2	48.8	49.8	50	.....	52	52.2	45.7	48.5	45.5	48.7	44.8	48.8
"	23	7 a.m.	29.032	42	40.2	41.5	.....	.....	.....	40.6	39.4	42.8	47	48.2	.....	51.8	52.2	39.8	45.6	40	46.2	39	46.4
		2 p.m.	29.094	58	45	48.1	.....	.....	.....	58	53.1	51	48.1	48.2	.....	52	52.2	49.2	46.3	49	46.4	49.5	46.2
		9 p.m.	29.018	42	38	39.6	49.2	34	.....	39.8	43.4	47.2	49	49.2	.....	51.8	52.2	42.3	47.4	42.2	47.2	42.1	47.8
"	24	7 a.m.	28.896	40	39.6	40	59.2	37.5	.010	39.8	40.5	43.5	46.3	47.8	.....	51.8	52.1	41	45	41	45.2	40.4	46
"	25	7 a.m.	28.892	49	48.2	49	.....	.....	.....	48.2	47	48.1	49	49.5	.....	51.6	51.9	47	48	47.2	48.2	46.8	48.4
		2 p.m.	29.026	41.8	38.6	40.3	.....	.....	.....	44.5	47.2	49.6	49.6	48.8	.....	51.7	51.8	45.9	48.8	45.8	48.7	47.4	48.8
		9 p.m.	29.162	36	33.2	35.1	52.9	34.4	.....	37.5	40.8	45.1	48.2	49.3	.....	51.8	51.8	41.4	47.2	40.1	47.5	40.8	48.2

Observations of Ground Temperature.—*Concluded.*

Month.	Day.	Time of Reading.	Barometer.	Attached Thermometer.	Wet bulb Thermometer.	Dry bulb Thermometer.	Maximum Thermometer.	Minimum Thermometer.	Amount of Rain in Inches.	Temperature of Soils varying from 1 to 48 inches in depth.								Temperature of different Soils.					
										1 inch.	3 inches.	6 inches.	9 inches.	12 inches.	24 inches.	36 inches.	48 inches.	Loam.		Clay.		Sand.	
																		3 inches.	9 inches.	3 inches.	9 inches.	3 inches.	9 inches.
October—*Con.*	26	7 a.m.	29.258	29.8	28	29.1	.....	.....	.....	33.8	36.5	40.8	45.2	47	.....	51.5	51.6	36	43.8	35.4	44.4	36	45.2
		2 p.m.	29.248	37.4	32.8	34	.....	.....	.....	42.5	42	43	44.2	45.8	.....	51.4	51.7	40	42.4	41.2	43	41.8	43.8
		9 p.m.	29.194	34	32	33.1	39.8	34.2	.....	35.2	37.6	41.2	44.7	45.9	.....	51.4	51.6	36.8	42.8	36	43.2	37.3	44.1
"	27	7 a.m.	29.040	34	33.8	34	.....	.....	.....	35.8	37	39.8	43.1	44.8	.....	51.2	51.5	36.4	41.2	36.8	41.9	36.5	42.6
		2 p.m.	28.862	39.2	38.4	38.6	.....	.....	.....	40.7	39.8	41.8	43.4	44.2	.....	50.9	51.5	38.2	41.4	39.8	42.1	39.8	42.5
		9 p.m.	28.806	41.2	40.4	41.2	41.2	30.9	.....	41.3	41.2	42.8	44	44.8	.....	50.8	51.3	40.7	42.2	41.1	42.8	41	43
"	28	7 a.m.	28.736	41.5	41.0	41	.. ....	.....	.....	42.2	42	43.3	44.2	45.1	.....	50.6	51.3	41.8	42.7	42	43.2	41.8	43.5
		2 p.m.	28.744	49	44	45.2	.....	.....	.....	49	47.2	46.8	45	45.8	.....	50.6	51.2	46.9	44	47.2	44	47.8	43.1
		9 p.m.	28.763	41.2	42.3	42.7	45.8	39.7	.128	42.5	42.7	43.9	44.3	45.2	.....	50.2	51	40.9	42.2	41.3	43	41.3	42.8
"	29	7 a.m.	28.828	43.6	43.2	43.2	.....	.....	.....	44.2	44.2	45.1	45.8	46.4	.....	50	50.8	43.9	44.8	43.8	44.8	43.7	45
		2 p.m.	28.862	50.3	47.2	49.5	.....	.....	.....	56	49.5	49	46.8	47	.....	50	50.6	48.8	45.9	49	44.7	49.4	45.8
		9 p.m.	28.932	47	45	47	51.2	39.7	.020	46.7	46.8	47.7	47.6	47.8	.....	49.8	50.6	46.2	46.8	46.3	46.6	46.9	46.8
"	30	7 a.m.	29.010	40.8	40.1	40.9	.....	.....	.....	40.8	41.8	44.7	46.6	47.4	.....	49.8	50.6	41.1	45.8	41.6	45.8	40.5	46
		2 p.m.	29.036	62.2	50.6	59	.....	.....	.....	60	55.2	52.4	47.5	47.5	.....	50	50.7	53	46.8	53.7	46.2	54.8	46.6
		9 p.m.	29.038	46.2	38.9	41	60	37.5	.....	47.2	47.4	47.9	48.6	48.8	.....	50	50.4	47.6	48.2	47.7	48.5	48.4	48.7
"	31	7 a.m.	28.972	40	37.2	38	62.4	36.2	.....	36.4	37.2	41	45.2	46.6	.....	49.8	50.1	36.8	43.8	37	44.5	35.8	44.8

Observations and Analyses of Drainage.

The rain gauge and six lysimeters were first in operation during the summer of 1884. For fuller information consult the reports of 1883 and 1884. In 1885, owing to the illness and death of Dr. Hare, then in charge of the Chemical Department, accurate and detailed observations and analyses were not preserved.

There are six lysimeters, as follows :—

I. Permanent Pasture, on soil of experimental field.
II. Bare Fallow or Fall Wheat on soil of experimental field.
III. Fall Wheat or Bare Fallow " " "
IV. Four years rotation, on loam.
V. " " on clay.
VI. " " on sand.

Each lysimeter covers 1-10,000 of an acre, is three feet deep, and contains the soil preserved in its natural position. In the accompanying tables the drainage is given calculated to pounds per acre.

The following is the description of the soil of Nos. I, II and III :—

"The surface soil is a sandy loam eight inches in depth—the humus being abundant. The sub-soil consists of three distinct layers: first is a firm clay ten inches deep, having a reddish tinge and a slight sprinkling of gravel; second is a gravel loam fourteen inches deep, the gravel varying from one inch to the one-tenth of an inch in diameter; third a layer of pure building sand four inches deep."

No. I. was manured in 1884 at the rate of fourteen tons of farm-yard manure to the acre.

Nos. II. and III. have a two years' rotation, fall wheat and bare fallow, manured fourteen tons to the acre before sowing every other year.

The rotation in Nos. IV., V. and VI. is roots (manure), barley, clover, spring wheat. This is the third year; manure was fourteen tons to the acre, applied to the turnips—none since.

Lysimeter.	Month.	Rainfall, lbs. per acre.	Drainage, lbs. per acre.	Solids in Drainage, lbs. per acre,	Lbs. of Nitrogen per Acre.				Chlorine, lbs. per acre.
					As Ammonia.	As Organic Matter.	As Nitrites and Nitrates.	Total.	
I. Permanent Pasture	May ..	290,870	121,220	1,922	.0039	.0290	.6011	.6340	.0002
II. Bare Fallow	" ..	290,870	171,600	2,705	.0184	.0269	.9002	.9455	.0004
III. Fall Wheat	" ..	290,870	62,920	1,031	.0047	.0083	.1404	.1534	.0002
IV. Clover on Loam	" ..	290,870	18,304	306	.0235	.0100	.0612	.0947	.0002
V. " Clay	" ..	290,870	32,780	696	.0042	.0097	.2343	.2482	.0002
VI. " Sand	" ..	290,870	94,050	569	.0016	.0387	.7117	.7520	.0001
Total, 6 acres	" ..	1,745,220	500,874	7,229	.0563	.1226	2.6489	2.8278	.0013
None ran	June ..	536,172	.....	.....	.....	.....	.....	.....	.....
"	July ..	177,061	.....	.....	.....	.....	.....	.....	.....
II. Bare Fallow	Aug ...	974,857	31,900	561	.0026	.0118	.0684	.0828	.0002
II. Bare Fallow	Sept....	430,751	44,220	814	.0022	.0026	.1195	.1243	.0001
II. Bare Fallow	Oct.....	535,038	151,360	2,866	.0062	.0105	.4861	.5028	.0002
III. Fall Wheat	Nov....	583,781	190,300	3,930	.....	.....	2.4300	2.4300	.....
V. Clover on Clay	"	583,781	12,584	205	.....	.....	.3505	.3505	.....
Total for	"	583,781	28,160	375	.....	.....	.3817	.3817	.....
Total for 6 acres for 7 months	....	3,502,686	231,044	4,510	.....	.....	.....	3.1622	.....
		21,171,180	959,398	15,980	.....	.....	.....	6.6999	.0018

Notes.

II. Bare Fallow.—On September 25th of this year, this plot was manured with farmyard manure, at the rate of 14 tons to the acre; it was ploughed under on same day. On October 2nd, wheat (Rodger), was sown.

III. Fall Wheat.—The wheat was cut about July 27th; the stubble ploughed under about August 7th; no manure was added. In September and October, therefore, it was a fallow, the name, Fall wheat, being in above table, still applied to No. III.

IV., V. and VI. Clover on Loam, Clay and Sand.—These were turned under October 2nd; no manure added; they were fallow, therefore, during October and November.

The clay on No. V., is a little sandy.

In 1884, the first year of operation, drainage water was received from only two lysimeters, viz., from II., the bare fallow, and V., the clay. For complete analysis see Report of 1884, pp. 101-3.

The total drainage for all the lysimeters during this year, was 4.53 per cent. of the total rainfall, somewhat below the average.

For comparison or contrast, I append a few observations taken elsewhere :—

Inches of Rainfall.	Drainage.		Time.	Observer.	——
	Inches.	Per cent.			
26.6	11.3	42.5	1836-43.	Dickinson.	Grass in Sandy Loam.
13.93	10.39	74.5	October to March.	"	" "
12.67	0.90	7.1	April to September.	"	" "
26 to 28	6.5 to 7	25	.....	Dalton.[1]	
.....	.....	27	.....	Greaves.	
31.45	14.06	44.7	1871-1880.	Lawes and Gilbert.	
26	10.1	39	.....	Maurice.	
41	12.3	20	.....	Risler.	
28	5.6	30	.....	Gasparin.	
25.7	5.14	20	May to Sept., 1877.	Stockbridge.	
45.34	6.76	14.9	1876 to 1879.	Sturtevant.	

The rainfall at the Experimental Farm during the seven months, 1886, (May to December), was 15.574 inches and the drainage 0.71 inches (4.53 per cent.), both rainfall and drainage being quite low.

The total drainage, solids and nitrogen loss, were made up as follows :—

——	Drainage.	Solids.	Nitrogen.
	Lbs.		
I. Permanent Pasture	121,220	1,922	.6340
II. Bare Fallow	589,380	10,876	4.0854
III. Fall Wheat	75,504	1,236	.5039
IV. Clover on Loam	18,304	306	.0947
V. " Clay	60,940	1,071	.6299
VI. " Sand	94,050	569	.7520
Total from six acres for seven months	959,398	15,980	6.6999

The amount of Nitrogen received by an acre of soil through the rain varies between five and seven pounds *per annum*, six being about the average.

The small amount of Nitrogen washed out of the various soils, in comparison with some results from other stations, can easily be accounted for by the small percentage of total drainage. This summer it amounted to 1-10 of what it has reached in some seasons in England. The above results, however, are available for comparison one with another.

Post Graduate Course.

The work of the third year is, of course, in a formative condition and will gradually develop into more perfect form. Since November 1st, the time of its commencement, the

class have made good progess. They have continued the work of the second year. The work during the first term has consisted of the following :—

(*a*) Laboratory Work :—The preparation of Hydrogen, Oxygen, Nitrogen, Ozone and Sulphuretted Hydrogen gases, and experimenting with the same ; a review and fuller treatment of the subject of Qualitative Analysis ; including Blow-pipe Analysis, Volumetric Analysis ; experiments with the following soils—clay, sand, loam, marl, humus, vegetable mold—to determine their chemical and physical properties.

(*b*) Theoretical Work :—The work in Agricultural Chemistry has been confined principally to the writing of theses on subjects prescribed. Each week a thesis is handed in by one of the members of the class : this is read by myself, criticized, and then handed to the others for reading and for making notes. The subjects of the first term have been "Humus," "Green Manuring," "Fallowing," "Bones." In addition I have prescribed technical books, reports and pamphlets for reading and study. The attention and interest so far manifested, justify the inception of this work and promise success for the future. Though it has thrown much additional work upon the Chemical Department, I hope to see it continued and developed still farther. After the New Year we shall commence the Quantitative Analysis of soils, water, dairy products, etc.

Needs.

A chemist, while thankful for past favours, is always anxious for further improvement. You will therefore please permit me to refer to the pressing needs of the Chemical Department.

At present the lecture room, the laboratory of the college, the laboratory of the Experimental Department, and the private room of the chemist are all in one, a room poorly lighted, with but few conveniences, and situated in immediate conjunction to the private dwelling of yourself, and also to the sleeping and dining rooms of the student. I think that you and every one else of sound thinking will readily admit the following : That a laboratory where vapours and gases, unwholesome and poisonous, are constantly being liberated, should not be situated beside or near inhabited rooms : that a chemist should not be compelled to lecture to a class in the laboratory where analytical work is proceeding all the time ; that where we attempt to give the complete and practical course mapped out in our chemical curriculum, we should have equipment and conveniences commensurate with the work. Further progress is barred unless we have better equipment; we are enabled to continue the analysis of water, manures and dairy products through this winter because of the additional conveniences added to the College laboratory. By having both departments in the same room, I have been able to conduct analyses and oversee the practical work of the third year without much inconvenience ; but we are working against great difficulties, and our field is limited because of the lack of accommodation, convenience of arrangement, and scanty apparatus. The laboratory of the only Agricultural College in the Province of Ontario should certainly be as complete as that of the Agricultural Colleges of the neighbouring states, and we should not be thrown too much in the shade by the accommodation and equipment of the laboratory about to be established at the Dominion station near Ottawa. I trust, sir, that the Government will give speedy realization to what all must certainly feel is a great necessity, viz., a new, commodious and well equipped laboratory.

The retention of Mr. Zavitz as assistant in the Experimental Department has proved wise ; work has developed sufficient to demand his services. Since his appointment last summer all of his time allotted to the laboratory has been fully occupied. He has shown himself careful and reliable.

Trusting that I have not trespassed too far upon the pages of the Report and that this record will prove satisfactory,

I remain your obedient servant.

C. C. JAMES,
Professor of Chemistry.

PROFE

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PART IV.

REPORT OF THE

PROFESSOR OF VETERINARY SCIENCE.

To the President of Ontario Agricultural College : GUELPH, December 31st, 1886.

SIR,—The duty of writing my Annual Report for the year just ended is a comparatively pleasant one, as the health of the live stock on the Experimental Farm has been, on the whole, so good that I have no very serious losses to give an account of.

One circumstance that, of course, has had an influence in lessening the loss, is the reduction in the number of stock kept, on account of the housing accommodation being limited, the result of the fire.

Amongst the sheep, I have to report the death of an imported ewe, which occurred in the early spring. She died pretty suddenly after developing marked signs of sickness, as the first intimation I had of anything being wrong was the announcement of her death, which I found on *post mortem* to be due to exactly the same condition in connection with the liver as described in my report of last year, and from which two ewes succumbed.

Two black mares, that are worked regulary on the farm, have been very unfortunate with their foals for two years in succession. The first year they were bred to an English cart horse, and foaled without any difficulty, but the foals were weak, the muscles of their limbs seeming undeveloped and flaceid, and incapable of enabling the bones to support the body, consequently they could not seek the teat, and although constantly attended, gained no strength and within a few days died. The milk given by the mares was translucent and watery, and evidently lacking in that thickness and richness characteristic of the first milk, and which gives it its laxative action on the bowels of the newly-born foal, which action is so important in establishing a healthy condition. The dilligent use of rectal injections, castor oil, and syrup of rhubarb, were futile in bringing about this healthy action in these cases. This spring these mares dropped foals to a Suffolk Punch, and with exactly the same result, which is, of itself, some evidence in favour of the mares' responsibility for their lack of success. Last year both mares were worked steadily up to the time they foaled, and appeared in fair condition—not over fleshy —but this year, after the team was broken by the one that foaled first, the other one had a full month at grass without work, which altered condition seemed to confer no benefit. It should, however, be mentioned that the one that foaled last went about a month over the usual eleven months' term. They were certainly not fleshy this year.

Of the other accidental troubles to which my attention has been called during the year, such as coughs, colds, touches of colic, indigestion, injuries and lameness, perhaps the most interesting case was one of Eversion of the Vagina that occurred in a Devon cow. The trouble I so designated, but in reality there was a complication of disorders, one of the most prominent symptoms of which was the appearance of a conjested or somewhat inflamed mass of the walls of the passage to the womb (vagina) between its

lips, and often being extended as a pendulous mass the size of a man's head. This was more paticularly the case when the cow was recumbent. An important feature of her trouble, and one that first presented itself, was a difficulty in the use of the hind legs, shown by a stiffness in moving them, and the exercise of a great effort in rising from the recumbent position, several attempts being often made before she was successful in getting on her feet. The difficulty in using her hind legs was noticed fully a month before she calved, and gradually became more pronounced until that act was satisfactorily accomplished, and then rapidly disappeared, she soon gaining her accustomed freedom of movement. When first attacked she occupied a loose box, but on account of the chronic displacement of the vaginal walls, it was deemed necessary to tie her in a stall, in order that she could be elevated behind, which was accomplished to the extent of a foot by packing in long horse-manure. This raising of the hind parts has a tendency to encourage the gravitation of the displaced walls into their normal position. No doubt the almost constant lying, induced by the difficulty of getting up and standing, and the relaxed state of the tissues, due to the imperfect supply of nerve power, combined to cause the displacement described. The paralytic symptoms were in no measure controlled or relieved by the administration of general and nervine tonics in the form of drachm doses of each of the following constituents, viz: powdered nux vomica, gentian and sulphate of iron, mixed and given in crushed oats three times a day for two weeks. But treatment of the more immediate source of danger in connection with the displaced vagina was decidedly satisfactory. After thorough cleansing of the passage by syringing with luke-warm water, and the subsequent disinfection with a two per cent. solution of carbolic acid, an astringent and anodyne ointment was freely applied twice a day to the swollen and congested walls; this had the effect of allaying the irritation, and causing their contraction into something like a normal condition, and averting what was anxiously feared would be a sequel to delivery, viz, expulsion of the womb and vagina. She, however, calved with ease, and gave birth to a strong, healthy calf, the delivery of which was followed by complete restoration to health.

Two imported Shorthorn cows, "Madamoiselle" and "Princess Royal," have been barren for a length of time. They were put to the bull regularly for some months, but as they did not hold, I was asked to examine them and see if I could determine the cause. Upon passing my hand in as far as the mouth of the womb I found, in both cases, that the neck of this organ was so much contracted that the canal through it was completely closed up, so much so as to render it impervious to even a slender body like a knitting needle. There was no doubt that this state of affairs was of itself quite sufficient to account for sterility.

Many breeders labour under the erroneous impression that the penis really enters the mouth of the womb during copulation, but it only passes into the vagina, and a much smaller opening than that necessary to admit the penis even of the bull, suffices to render conception possible in any female. If the canal in the neck of the womb in a cow admits of communication between the vagina and the womb, even although it may be only a third of an inch in diameter, or even less, conception can take place, as the living particles in the semen, commonly called the seed, have the power of working themselves along for a considerable distance, and do not require a large opening for their passage in travelling to meet the egg of the female, contact having to take place before conception can occur.

In these cases of complete occlusion, unless the neck has become thickened and hardened from an abnormal growth of tissue, due in some cases to injury at the time of giving birth, it is generally possible to bring about dilatation.

It should be understood that the neck, which is cylindrical in form, and from four to six inches in length, is made up of tissue that has the power of expansion and contraction. The former quality is amply demonstrated by the passage of the calf through it at birth-giving, and the latter by its speedy return to its usual calibre after the completion of that act. But in some cases normal contraction is exaggerated, thus bringing about the condition under consideration. Although no easy task, still it is quite possible in many cases to open up the occluded canal and thus restore normal relationships in so far as this is concerned. The best method of doing this is to tie the

cow up tightly with a halter, or use the "bull-dogs" in her nose. Place her against a wall, with an attendent on the other side to keep her there and hold the tail out of the way. Passing a rope over the loins round under the flanks, and tying it tightly tends to prevent kicking and straining. The operator should warm his hand and arm with warm water, and smear them with oil or cream preparatory to passing them into the vagina. After passing the hand as far into the vagina as possible, at the end of it will be found a projecting ring, in the centre of which a depression may be felt, which should continue in the form of a canal into the womb in a natural state of affairs. But as before stated the canal is sometimes closed up, nothing more than a depression being detectable. In order to open up communication nothing is better than the finger. Apply moderately firm pressure with it on the depression for a time, moving it in a screw-like manner. The index finger answers best at first, but it may be relieved occasionally by the middle one. It is a very laborious undertaking and two hours may be occupied in accomplishing it. Although a slow process the operator can realize that he is making progress by the finger passing in a little deeper, until there seems to be no barrier between the end of the finger and the cavity of the womb. It is well, however, to continue the dilatation until two fingers will pass in. The manipulations necessarily cause some irration and straining, so that it is desirable to smear plenty of an oily substance, which should contain one part of carbolic acid in it to ten of oil, repeatedly on the hand.

The process of dilating should be carried out the day before the cow is likely to be in season, as the manipulations lead to straining, which is opposed to the retention of the semen after service.

We are very hopeful that one of the cows—Princess Royal—is in calf, as she has gone over twelve weeks since the last service. Madamoiselle has also passed several terms, but as she has shown irregularity in coming in heat before, we are not so sanguine regarding her. Both of these cows have a fleshy appearance, but they are not highly fed, having received no grain since they arrived at the Experimental Farm.

Spaying.

The first work that has been done of an experimental character in the Veterinary department of this College was begun during the past summer. The question of the usefulness or uselessness of the removal of the ovaries from heifers or cows, with the object of getting a better return in the shape of either beef or milk, has not yet been satisfactorily settled in this country; and every now and then articles are written in not only agricultural, but other papers, commending the course as a good one, and expressing surprise that it is not more generally adopted. It has been tried in the different countries of Europe, but the opinions regarding it differ, so that it is impossible to glean a correct estimate of its value. Some of the advantages claimed for Spaying are the following:

1st. It increases the quantity and improves the quality of milk.

2nd. It lengthens the period of lactation to nearly twice the usual one.

3rd. It lessons the losses of the dairyman from the diseases and accidents incidental to parturitions.

4th. Spayed animals more rapidly accumulate flesh, and which is of high quality.

If the results of the operation were so generally favourable as above indicated, there is every likelihood that it would be more generally practised.. There is very little doubt, however, about the beneficial influence it has upon fattening females, but as the number of heifers fattened is comparatively few, it is of limited application in this direction. It is further claimed that dairy cows, after having milked for a couple of years, or until it is not profitable to keep them for that purpose any longer, are then fit for the block, having accumulated flesh so rapidly while milking. Before we can settle this question satisfactorily, it will be necessary to carry out a number of observations systematically. So far we have only made a start, but think it well to announce that something is being done. It was not considered advisable to buy a number of cows and heifers all at once, and keep them for the sole object of testing this matter, but from

time to time, as cattle are required to carry out other experiments, some of them can be subjected to spaying, and its effects noted.

Professor Robertson procured a number of cows last spring, and will very likely have a number more this spring for experimental purposes, which will afford a valuable opportunity for this purpose. We, however, purchased two cows and two heifers in August to begin with, and largely for the purpose of observing the immediate effects of the operation.

One of the cows—a spotted one—had had her fourth calf about seven weeks previously, while the other—a red cow—had dropped her fifth one some three months before. These animals looked like Canadians, improved by one cross of Shorthorn. The spotted cow was a good milker, but the red one was only middling, and unfortunately before the operation had some sores on the bag, which caused the loss of one quarter, and subsequently all the quarters of her bag became blind, one by one. The two heifers were about thirteen months old, one of which was a pretty common one, while the other showed a moderate amount of breeding.

I operated on the cows by a method suggested by a French veterinarian named Charlier. Instead of making any external opening, the hand is passed in to near the mouth of the the womb, and an incision made in the roof of the vagina large enough to admit two fingers, which are passed through it, and the ovaries reached for one by one and drawn into the passage (vagina), and there removed by a suitable instrument which completes the operation. The only means of restraint resorted to were tying the cows up short and applying a rope tightly tied round the loins and abdomen.

The passage is so small in heifers of thirteen months that it will not admit of the practice of the method already described, so that an opening has to be made in the side through the abdominal muscles. The left side is most convenient, for being occupied by the stomach, the bowels do not get in the way of the necessary manipulations. I find it necessary to throw in operating through the side, as the subject is apt to throw herself while the operation is going on.

All four animals survived the operation and its effects; the heifers particularly continued to feed and showed no indisposition whatever, the wounds healing in a very short time, with a marked absence of discharge. The heifers did not lose in weight nor in healthfulnesss of appearance. They received no extra attention except being kept in a box stall for a couple of days as the flies were bad; after that they took their chance with the rest of the herd. The cows did not do so well and lost considerable in weight, but I cannot charge the operation as accountable for all the loss. They were put on an acre of pasture and kept there, which had been eaten so close before they were put on it, that it did not appear to me to be capable of affording sufficient food. They did not show any marked evidence of ill health as they appeared to be ready for food, and their temperature was never more than one degree above normal.

It is an operation that requires practice, and I dare say if I had been more expert in its performance, it might have made some difference in the result. It is the first time I had ever either seen or performed the operation.

The percentage of losses from the vaginal operation is given by some operators as very small, not exceeding two per cent., while that through the side in adult cows is estimated at fifteen per cent. Certainly the vaginal operation is much preferable for cows or heifers over two years of age; but I am of the opinion that very few deaths need occur in young heifers, and that it is better to perform the operation pretty early in life—say at five or six months old.

In herds of fattening cattle in which there are heifers coming in heat, there is no doubt there would be much beneft derivable from Spaying, not only to the animal altered, but to the rest of the herd, on account of the general uneasiness produced by a rutting heifer.

I must defer further comments on this subject until next year, when we hope to have something more definite and elaborate to submit.

Respectfully submitted,

F. C. GRENSIDE, V. S.

PART V.

REPORT OF THE PHYSICIAN.

To the Honourable A. M. Ross,
Commissioner of Agriculture:

GUELPH, 31st December, 1886.

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

We have had nothing of an unusual character in the way of sickness or accident during the year just closing.

We had one case of diphtheria, that of a servant girl, but by promptly removing her to her home the disease was prevented from spreading to others.

I beg leave to call your attention to one very important matter regarding the sanitary condition of the College. Owing to the storage of large quantities of vegetables in the cellars, through which the steam pipes must pass to reach other parts of the building, the cellars become so heated that decomposition takes place very rapidly, and at times the odour of decomposing vegetable matter is unpleasantly perceptible throughout the building. To remove this difficulty I would strongly urge the necessity of providing a proper root-house apart from the College.

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

E. W. McGUIRE.

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To the Honourab

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PART VI.

REPORT OF

THE PROFESSOR OF AGRICULTURE,

FARM MANAGER, AND EXPERIMENTAL SUPERINTENDENT.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,

To the Honourable A. M. ROSS, 31st December, 1886

Commissioner of Agriculture:

SIR,—I have the honour to report upon the Farm, Live Stock, Experimental and Mechanical Departments for the year 1886, being the twelfth of the Institution and eleventh of my time.

As introductory, I beg to submit some thoughts with reference to what we are learning from the farmers of the Province through the agency of their Institutes. Having, with my colleagues, assisted at these meetings during the past two years, we are necessarily in a position to distribute some points of practical importance, bearing directly upon our profession and the agriculture of the country.

A primary fact is the responsive spirit of our people to anything well organized, giving variety, and of a thoroughly practical stamp. It is good evidence of how much may be done by any Government in drawing out the self-culture of a class that is naturally isolated, self-reliant and retiring. This is no case of state aid really, as the $25 contributed to each Institute is so small and upon such conditions as draw out many times more from the very men who previously did not, and may be would not now, so organize. It is also evidence of an appreciation by the farm mind of what their country expects them to do towards building up a new nation. The numerical pre-eminence, and as being holders of our estate value, with very much of the comforts of others in their hands, should long ago have made farmers national leaders. The demand for organization has become so full that it is impossible to overtake help to each from the College—even with the three separate pairs of Professors now arranged for 1887. No doubt the increasing interest thus exhibited says something decidedly favourable of the assistance thus allowed by the Government, and to remove any view of newness being a drawer of men in this particular walk of life, we have the important fact that all the already established Institutes are asking for a renewal of this help.

But the striking feature of every piece of the work has been the high merit of discussions by farmers. The average character of the papers read by them, with some marked exceptions, has not been so strong and far-reaching as many expected. I am saying this upon the testimony of others, and not the Faculty of the College, for though as yet somewhat diffident in preparing papers, there has been, in our opinion, no want of merit in those given. Thoughts through pen and paper are not yet the easiest for men constantly at outdoor labour, and hence the superior nature of the discussions. It has been very refreshing indeed to witness the invariable objection at first to taking part at these meetings by many, until drawn out through a simple question as to his own practice in a particular operation—a mere "yes" or "no" at first, and then to find the man roused and overflowing with the best of crisp facts in response to another who had struck a corresponding note—either too high or too low in his belief. We have thus had material equal to any Legislature and superior to most debating societies, because their hand was on the plough, and they are ploughmen.

At the same time it seems curious that farmers have not as yet of themselves been able to keep up the vigor and freshness of clubs and societies. This is true of the average of all countries and may be more so here, where by reason of the necessity of manual labour on their part, the leisure and desire for mental work are wanting. At the same time Europeans are saying that Canadian and American associations among farmers for mutual benefit is a much more prominent thing than with them; this is true to the extent of realising the immediate or the near prospect of an increased dollar, but not so very prominent when mental culture is the crop in question. However, we must rejoice rather than complain of anything in connection with the Ontario Farmers' Institutes. Danger, if anywhere, lies in want of variety and interest, should the contributing element be withdrawn—mind, not money I mean.

I have been particularily struck by the absence of grumbling at these meetings, and I also speak of those held in 1887. Since 1871 we have branched and are now fruiting into the arena of competitive nations—the budding was previous to that. So much solid history in a few years has been the harvest of agricultural improvements and development. The honor belongs to the plough and the people.

In closing, therefore, the twentieth Dominion year we are met by the oddity of absence of "grumbling" in our farm life. Grumbling, 'tis said, is the right of the farmer, if not his characteristic, which, it is not worth while to enquire, for it could be shown that both are but the natural accompaniment of his position as universal caterer. But discontent is a more serious thing than grumbling—the latter is more often a habit, the noise whereof is worse than the bite. We have had some large enough discontent amongst farmers more than once in the period named, and the fact of its evaporation is good evidence of the quiescent rural mind, in comparison with other professions.

The interesting question for December 1886 is—Why has Canada so much contentment, with low prices for most agricultural products? That she is so, solidly, is undoubted. The press, the Parliamentary aspirant, the banks and railways, the Tariff, manufactories, our Bureau of Industries, and the universal discontent himself, says so. But what of the cause or causes?

The argument of long use and wont begetting indifference does not apply to a young and vigorous nation, and even the spirit of the people would not brook the deadness of even one decade; still migratory in our disposition, we would assuredly have made for new pastures. If we hold any indigenous trait, it is not by any means that of submission to successive "bad times" in any business—nor, allow me to add, are we characteristically steady in public policy and national devotion. Nor can it be said that abundance of wealth has fattened us to the extent of engendering a sleepy indifference. This feature is prominent enough in some districts of other lands, but our physical conditions, in conjunction with comparative newness, and the love of change, precludes any such ground to place the contentment in question.

Neither are the prospects so bright as to account for our problem. Few things are so wordly certain as the long, low prices of grain and flesh in coming years, and the newer fields of the dairy cannot be called highly inviting at present. What, then, is it?

I am of opinion that the contentment of the Canadian farmer is the result of several things. One is the having measured himself with the world and found his place and his superiority. I mean by this that we are now tied with all the appliances of civilization, and all the civilization itself, to make and maintain a market, and that we have just learned how much we can and cannot do in the great competition—the satisfaction being our ability to do a good deal of everything well. Another reason is the distinctly better average cropping. This—not the result yet of much better management—but of decidedly more reliable physical conditions. Many of us have wandered, of late, in search of the ideal home, and most would like to return again.

Then, also, we are gradually, though slowly, settling down to a fixed rural economy—eratic as we be, no doubt. This is much the result of realising the steadiness for any branch of the profession, and that unwholesome speculations live but a day, to be nipped by the common sense of latitude 43° and upwards.

Our contentment, then, is the being able to live well on what we produce, and to conserve "for better, for worse."

II.—THE FARM.

It will be interesting to give an abstract of the principal operations undertaken—some finished and others still in progress—to make the farm what it should be.

Tree Clearing.

In Fields 3, 4, 6, 12, 14, 15, 16, forty-four acres have been cleared of trees and underbrush, some spots thick brush, and others scant second growth. The greater part of the work was performed by students. We have just finished the stumping of Field 12 and the hillside of No. 4. This kind of reclamation will be completed on Field 18, and the swamp between 16 and 21, which extend to about twenty-five acres.

Drainage.

Every field of the farm, twenty-one in number, has been wholly or partly underdrained with tile, most of the mains six-inch and all the lateral with three and four inch, according to circumstances. Depths have varied from two to four feet, and the distance apart not closer than fifty feet, where systematic work was necessary. A great wash from adjacent land compelled us to use two sixes and one four across the farm, through Fields 12, 10, 2, 3 and 4. We have also had to work up some of our outlets for nearly a quarter of a mile through other properties at considerable expense. The natural drainage of the farm is from east to west.

Stoning and Levelling.

In Fields 1, 2, 3, 4 and 13 especially a large amount of labour has been expended in levelling large open ditches, filling swamp holes and old gravel pits. Many hundred tons of stones have been removed from Fields 3, 4, 6, 15 16, 18 and 19, both in the form of old accumulated hillocks, fast boulders, and fence-side deposits; some of these, but not much, have yet to be undertaken.

Road-making.

Not much of this has yet been done; part of the centre lane, in neighbourhood of the farm buildings, and northward to Field 16, was blocked out with centre tabling and sidewalks, and the formerly impassable track through the swamp between 16 and 21 has

been made roughly servicable for farm work, but otherwise no finished road-making has been undertaken. By desire of the Commissioner, we are now about to begin a systematic grading and gravelling of the lane in question, so as to secure a uniform piece of engineering the whole length of the farm—nearly one and one-half mile. For this I have concluded to adopt the following specification, and am making levels accordingly so as to get into some progress next season.

A centre of eighteen feet will be boxed and gravelled, the sidewalks of twelve feet each will be levelled and laid down to grass, at the same time that a variety of the best shade trees will be planted thirty feet apart. It is thought best to plant these shades close to fence in place of the inside of walk, so as to avoid trouble with live stock going from fields to buildings daily, as, with the very best of protection, damage is unavoidable, and the fence with the necessary V form of protection of course gives much less chance of trouble, and ensures greater progress even by reason of soil and moisture than is possible near the waterway. A good deal of road-making will also be immediately required beside the new farm buildings.

Fencing.

We have to date erected five miles of fencing, principally in sub-dividing fields, and as it would be unnecessary detail to speak of each, the following abstract will suffice :—

Post and board	5,082 yards.
Post and rail	1,980 "
Wire	2,640 "
Dyke	110 "
	9,812

2. The New Farm Buildings.

1. These are situated on the old experimental plots, butting on the centre lane of the farm and running with the roadway that forms the back or northern access to the College grounds. All the buildings and courts cover an area of fully one acre.

2. They have a south-eastern aspect, with drainage to the north, and stand upon a very stiff deep clay loam.

3. The general plan is a square, having the barn, with the cattle under, on the west, the sheep on the north, the bulls on the east, and the horses on the south side.

4. The nature of the ground necessitated an excavation of seven feet on the west corner of the barn, so that the term "bank" may be partially applied to the whole, though the ground slope leaves a clear wall half upon the barn one way, and at a right angle down along the horses the other way.

5. The barn is 130 feet by 70, the horse range 150 by 30, the sheep 150 by 30, and the bull shed 40 by 80 feet. There is a thirty-feet outside court for the sheep the whole length of their building, inside the square, and thus facing the south, and the bulls have separate outside courts on each side in connection with their separate inside boxes.

6. The barn is built upon twelve feet stone walls, twenty-four inches thick, so that the cattle have a clear overhead ten feet. Entrances to barn are on the ends, and having taken advantage of the seven feet bank, the south access rises six in a length of thirty feet from the roadway; the north entrance will be practically an egress only, as owing to the depth caused by the ground slope, we have had to make a sharp-curved, and somewhat steep roadway, keeping close to the building as shown on plan.

7. The barn proper is entirely of pine timber, with twenty feet posts, and twenty-two feet between bents, which are thirty-eight feet in height, thus giving six division son

each side of the fifteen-feet roadway, usually called mows, but in this case without division fences. The total height of barn from floor to apex is forty-five feet and to top of cupola sixty-five feet, so that from the cattle floor the building measures seventy-seven feet in height. The barn floor has two detached granaries, with feed-room between, corresponding to that below, and where straw-cutter and grinder are placed. There are also fourteen straw and turnip shoots, passages to horse and sheep lofts, and twelve doors equally distributed all round, in addition to windows and ventilators.

8. The principal entrance to the cattle is on the angle between barn and horses, where steps descend to level of all the buildings. All the cattle are immediately under the barn and occupy the whole space with the exception of sixteen feet the whole length of the barn on the west side, which is cut off by a fourteen-inch brick wall for root-cellars and feed-room. These cellars are floored with grout and cement, the outside walls being first lined with inch boards, then laid with tar-felt paper, and covered with finished tongue and grooved narrow boards. The feed-room is 21 by 16 feet in centre of building between cellars, having sliding-doors two-thirds of the front upon passage way to cattle-stalls, where a two-ton platform weigh scale is placed. The root pulper stands in feed-room in line between cellar doors, and is driven by belt from engine shaft above. The stair, as access from barn, breaks upon the feed-room from north side. The accommodation is for sixty-seven cattle in seven single rows, as follows :—

For large cattle tied up	34 head.
For small cattle tied up	14 "
Calves in pens	11 "
Loose boxes	8 "
	67

These boxes are on both ends, the calves between two rows of cows with a door on each side, and all the rows cross the building, or edge on the feed-room. Watering troughs are attached to the feeding troughs in every row, the floor grouted and cemented, and box stalls laid with cedar blocks. Feed passages are six feet apart between water troughs, and main passages eight feet in width. Double stalls, 7 feet 4 inches, centre to centre ; single, 5 feet ; half the boxes are 20 by 17, and half 15 by 11 feet ; calf pens, 7 by 8. The space behind the cattle is six feet, a door opens into manure court at each row of cattle, and passages lead to horses and sheep. Light is admitted by thirteen windows in addition to those over the six doors to court.

9. The horse range has stalls for fourteen single and one double, with three boxes. Three of the stalls are six feet, all others 5½ feet in width, boxes 12 by 12 ; feeding passage seven feet, and the space behind horses is eleven feet. The floor is cedar block pavement. At the end adjoining barn is a small room for extra harness, that for daily use being in a press upon the wall behind each team. The feed-room, 30 by 10 feet, will hold cut hay and oats. As it is proposed to use cut hay only, there are no racks, and the mangers are divided for hay and oats. Straw is got by four shoots behind horses, and there are corresponding openings in front should long hay be wanted from the loft. Double doors, with an eight feet passage between, divides the building—the one to the manure court and the other from roadway, with two ordinary doors to said court, and two on end near bull shed. Water is got from three hydrants inside on the head passage, and light by eighteen windows. All the stalls and boxes are fitted with Telford's pillars and top rails. The horse loft is arranged to be filled with hay by a horse hay-fork.

10. The sheep range is divided into five inside and six outside compartments—dry, solid soil inside and gravel outside. A five-feet passage runs throughout, with hay-racks upon sub-divisions opposite shoots from loft ; water is supplied by three hydrants. There is a wool-room, grain bin, separate lambing pens, and pens for each of the stock

rams. Eight-feet doors open into the special court, which is fenced from the large manure court by a four-feet stone and lime wall.

11. The bull shed is a separate building, 40 by 80 feet, having a ten-feet centre passage, with six boxes on each side, 14 by 14 feet, and one for straw. Each box has an outside fenced yard of 14 by 14 feet. Overhead is for hay, straw and grain.

12. The yard enclosed by the four ranges just described is surrounded by an eight-feet causewayed sidewalk, excepting on the sheep side, which is taken up by a special court for them. The manure from all classes of animals is taken immediately into the large court, in centre of which are two-cemented brick tanks—one for the liquid from stables, the other for rainfall from buildings. Any over accumulation of mixed liquid from the manure is taken into the first tank, and both tanks have an overflow with the open ditch north of the buildings. This manure court is laid with rough broken stones, and blinded to an average of four inches with sharp gravel and cinders. Many other items could be enumerated, such as galvanized iron shingles, horse stable walls inlaid with brick, ventilators all over, rope and pulley covers for all trap openings overhead, three coats of paint everywhere outside, a 17 horse-power portable engine, with cable rope for a separate house fifty feet distant, driving straw-cutter, root pulper, grain grinder, and threshing machine as required in the barn and feed-room.

My opinion of these new buildings is, that with the exception of a few things, they are the most complete of their kind. I say of their kind, for I do not believe in having $20,000 worth of cattle in *one compartment under a barn*. I am satisfied that a system of concentrated isolation is best for the holder of a large valuable herd of cattle, but I can follow the object of the Government in choosing what is looked upon as something that can be copied, on a larger or smaller scale by our own breeders and farmers.

We have certainly got a very fine *suite* of farm buildings—creditable to the Institution and worthy of the Province.

3. Report of Farm Foreman.

To Professor William Brown:

Sir,—In submitting my annual report of the Farm and Live Stock Department, permit me to say that during the past year the Institution has in those branches fully sustained its high reputation. I have been engaged since my last report, among other duties, in giving instruction to the students in class and field, on live stock and farming. In class we deal two hours each day with theory of farm work and the raising and feeding of live stock. Practical illustrations are frequently given on the latter subject. The class subjects embrace—store cattle, how to select them; how to judge fat cattle; method of feeding; breeds of swine, and the attention necessary in the management of them; management of sheep, cows, calves, etc.; how to prepare land for seeding; quantities of seed to be sown, etc. In the field, practical instruction is given in ploughing, hand-sowing, mowing by hand, etc. The students have displayed praiseworthy aptitude in all these subjects. I would call your attention to the condition of Field No. 12. When I forwarded my last report only half of that field had been drained. I am pleased to be able to say that since then the whole field has been thoroughly under-drained. But the outlet is not sufficient to carry off the superfluous water. By enlarging the outlet (say to a 6 and 4-tile drain) the condition of this field would be greatly improved. In Field No. 9, in which was a crop of turnips, we this year tested the cheapness of the two methods of taking up the roots. We topped three acres by hand, and when delivered in the cellar cost $29.94; while those topped with the hoe and harrowed out and delivered as above cost $23.35.

The following is the result of the field cropping for the past year:—

No. 1 Field.—Nineteen acres; hay, yield 1½ tons per acre.

No. 2 Field.—Twenty acres; seventeen acres pasture, remaining three acres form the gardens of the Mechanical Foreman and Shepherd.

No. 3 Field.—Seventeen acres; summer fallow.

No. 4 Field.—Twenty acres; uncultivated and bush.

No. 5 Field.—Twenty acres; golden vine peas, yield 35 bushels per acre.

No. 6 Field.—Twenty acres; sown with white Australian and Egyptian oats; yield 50 bushels per acre.

No. 7 Field.—Seventeen acres; fall wheat; Rodger and Bonnell varieties, yield 24 bushels per acre.

No. 8 Field.—Twenty acres; Mensury barley; yield 40 bushels per acre.

No. 9 Field.—Twenty acres; one acre, white Belgium carrots, yield 450 bushels; 4½ acres, mangolds, yield 795 bushels per acre; five acres, large Rose potatoes, yield 170 bushels per acre; 9½ acres, turnips, yield 700 bushels per acre.

No. 10 Field.—Twenty acres; eight acres, under barley and green fodder, as follows: three acres Mensury barley, 25 bushels per acre; four acres green corn, 20 tons per acre; one acre of vetches and oats, yield 6 tons per acre. The balance of this field is occupied by the Creamery Buildings and a small fruit orchard.

No. 11 Field.—Twenty-three acres; hay, yield 2½ tons per acre.

No. 12 Field.—Uncultivated.

No. 13 Field.—Nineteen and a-half acres; 9½ acres under spring wheat—red and white Fife. This was badly rusted and was a poor sample; it has not been thrashed yet, so it is impossible to give the yield; ten acres of black barley, yield 60 bushels per acre.

No. 14 Field.—Twenty-four acres; seven acres sown with Egyptian oats, badly rusted, yield 35 bushels per acre; balance of field used for experimental plots.

No. 15 Field.—Twenty acres; permanent pasture.

No. 16 Field.—Twenty-five acres; hay, yield 1¾ tons per acre.

No. 17 Field.—Twenty acres; sixteen acres hay, yield 1½ tons per acre. Four acres of this field is under cultivation as a vineyard.

No. 18 Field.—Thirteen acres; hay, yield 1½ tons per acre.

No. 19 Field.—Thirty acres; hay, yield 1½ tons per acre.

No. 20 Field.—Uncultivated.

No. 21 Field.—Twelve acres; four acres of white Fife spring wheat, rusted, not thrashed yet; eight acres of Mar's spring wheat, also rusted, not thrashed yet.

INVENTORY AND VALUATION OF LIVE STOCK AND IMPLEMENTS ON HAND DECEMBER 31ST, 1886.

	$ c.	$ c.
HORSES:		
8 working horses on farm	1,435 00	
2 instruction and experiment horses	275 00	
		1,710 00
CATTLE:		
1 Short Horn bull		
3 " cows	2,500 00	
	2,050 00	
		4,550 00
1 Hereford bull		
2 " cows	2,600 00	
	1,060 00	
		3,660 00
1 Polled Angus bull		
3 " cows	2,000 00	
	2,900 00	
		4,900 00
1 Galloway bull		
2 " cows	600 00	
	700 00	
		1,300 00
1 Devon bull		
1 " cow	325 00	
	300 00	
		625 00

CATTLE—*Continued:*	$ c.	$ c.
1 Ayrshire bull	300 00	
2 " cows	500 00	
		800 00
1 Guernsey bull	350 00	
1 " cow	275 00	
		625 00
1 Jersey bull	325 00	
2 " cows	550 00	
		875 00
1 Holstein bull	1,000 00	
2 " cows	400 00	
		1,400 00
1 West Highland bull	200 00	
		200 00
20 Grade cows	899 00	
3 " yearlings	52 00	
1 " heifer calf	20 00	
12 feeding cattle	421 00	
1 steer calf	20 00	
		1,412 00
SHEEP:		
1 Leicester ram	30 00	
4 " ewes	206 64	
3 " ram lambs	30 00	
		266 64
2 Cotswold rams	285 00	
9 " ewes	190 00	
1 ram lamb	10 00	
1 ewe lamb	10 00	
		495 00
1 Lincoln ram	160 00	
3 " ewes	180 00	
1 " ewe lamb	10 00	
		350 00
1 Cheviot ram	60 00	
2 " ewes	36 00	
1 " ram lamb	5 00	
1 " ewe lamb	5 00	
		106 00
1 Hampshire ram	200 00	
2 " ewes	160 00	
1 " ram lamb	10 00	
1 " ewe lamb	10 00	
		380 00
2 Oxford Down rams	250 00	
10 " ewes	480 00	
1 " ram lamb	10 00	
3 " ewe lamb	30 00	
		770 00
1 South Down ram	270 00	
5 " ewes	260 00	
1 " ram lamb	10 00	
2 " ewe lamb	20 00	
		560 00

SHEEP—*Continued :*		
1 Highland ram	$ c. 60 00	$ c.
1 " ewe	18 00	
		78 00
2 Shropshire rams	520 00	
7 " ewes	245 00	
4 " ram lambs	40 00	
4 " ewe lambs	40 00	
		845 00
2 Merino ewes	25 00	
1 " ewe lamb	8 00	
		33 00
SWINE :		
1 Mid York sow	80 00	
2 Berk boars	60 00	
		140 00
		26,080 64
IMPLEMENTS :		
Valuation of farm implements, per inventory		5,130 00
		$31,210 64

P. J. WOODS.

III—THE LIVE STOCK.

The following is detailed account of the cost of producing thoroughbred cattle and sheep in Ontario—an abstract of which was given in No. 1 Bulletin, issued in May last :—

Allow me to say that the great majority of farmers take strong exception to the prices obtained for individuals of certain breeds—characterizing them as fanciful, unsound, temporary, and often false. They look upon the owners of such herds and flocks as pure speculators, who use every possible means to overvalue their property and beget an unhealthy position for them on the public market. To the average Canadian agricultural mind there is nothing in cattle life that need be more than $150, and in sheep not over $20 per head. A good deal of this is true, and much of it unreasonable. Every profession is subject to what may be termed unnatural development, and hence to a somewhat just suspicion on the part of those who admire steady progress. It is for the purpose of removing any misconception as to the actual value or cost of an animal that I make these notes. We find few farming matters so roughly understood as that of the cost of producing a thoroughbred yearling bull or heifer, or a shearling ram and ewe. This is not only the case on the part of the purchaser, but even those old in years as breeders cannot show how, and cannot place and explain the debit and credit of what they are disposing of every year.

The Position of the Question in Ontario.

The cost of production in this branch of our profession is really very much more serious to us than to the Americans, because of our physical conditions, our smaller numbers, and their keenness. What will always give us the advantage is the comparative immunity from disease and the peculiarly favourable climate that has already told so well in upholding vigorous animal life. It is thought by some, however, that the cost of production must necessarily be more in consequence of our compulsory six months' housing of all live stock, and hence of the use of more high feeding—so called it may be—as against the more natural and equally effective pasture and green fodders of the right

kinds. Then, also, we have hitherto been getting prices from the States that possibly have ruled higher than we are likely to secure again on an average; for extension of breeding there, and even here, will tend to over supply in some particular lines. Otherwise, no doubt, we will have increasing demand, particularly in view of Dairying and Ranching. But this demand may not keep up the prices of the past, for the very simple reason that the average farmer—who is the sound source of all such demand—will not give as much, is less particular about individual animals, and has no reputation at stake, as in the case of special breeding. It therefore stands as a matter of unusual importance at this day to ascertain exactly the cost of production, and place ourselves amongst competitors and and on a sound basis with our own farmers.

The Importer vs. *The Home Breeder.*

There are no more unreasonable jealousies than those existing between the direct importer and the home breeder. These do exist; for no commoner expressions at exhibitions and elsewhere than—"It is all very well for these wealthy men to import;" "We have no chance against them;" "It is not fair to home products." And now, in fact, some of our larger exhibitions are actually making separate classes for these men, in response to the complaints long made by the home breeder. In all this, due credit is not accorded to men who, at great risks, keep up the standard of our herds and flocks by frequent systematic importations. We are not complaining of the distinction now being inaugurated at exhibitions, but of the unreasonable criticisms anent importers. It has to be admitted, however, that the average judge of this country is not yet able to throw off the influence of a new importation when in the ring with home bred animals. There is no other way of accounting for this than that of want of confidence, and the feeling to "hedge" upon the known or unknown of the new comer. Of course we have had some exceptions to this rule in judging. Importers deserve special encouragement, for in many cases the profits are not so special under the circumstances, as we shall soon find out.

Show Herds and Flocks vs. *Others.*

Here also we have ground of complaint between parties. All countries have exhibition parasites—the unfailing competitors under any circumstances, who year by year prepare a few gems and make them pay directly. Our regular breeders do not take this field often, but keep to the more legitimate sale of their stock through a few purposely spoiled specimens. But in this they are also severely criticised by the ordinary farmer. Our average man is not thinking enough, or if he be so, is not yet liberal enough to see the value, to himself and such others, of knowing what the male source at least can do in the way they require his progeny to act. The high condition of a bull and ram is really a more important factor to the purchaser of their "get" than indeed it often is to the owners of the sires. Some good breeders never send an animal to the show yard, but it is only the very tops of the profession who can disregard such a source of advertisement in these keen competitive times. The cost of production is affected largely by the show yard results, and this is the excuse for this touch of the subject.

The Increasing Importance of Pedigree.

We are enquiring into the cost of producing certain animals as if it were a new or unknown thing, and at the same time our country is possibly on the eve of a rebellion upon what goes more than half-way to make that cost. This is not the place at present to discuss the position of the "Dominion Short Horn Herd Book," but this may be said, that in our Canadian future, if everything is thoroughly done, this book will materially lessen the cost of production, relatively to prices got.

A good few of our leading breeders and agricultural thinkers do not, I respectfully submit, understand just what pedigree is. The common idea of a short pedigree being comparatively valueless to a long one, for example, is theoretically right, but not so in real truth. What originated Herd Books was of course the desiring to know what had

been and was being done in the changes and improvements amongst certain animals, and hence the farther we get from the original source of such work the more danger there is of errors and of impositions. When Bates and J. Booth followed the Collins, and others also followed them, their cattle pedigrees were short ; but how valuable and much less subject to errors they were ! Why is it we would all like to tie our herds with the short pedigrees of the eighteenth century? So then the value of a pedigree is only partly because of its source, and very much indeed, now more than ever, of the thoroughness of the breeding and correctness of the records *since then*. In 1822 when Coates began the herd book, the short pedigrees running back say to 1750 were of the highest possible value, and in 1886, or twice the distance since, pedigrees kept up from and through the like blood are certainly no more valuable because of that length of time. The cost of producing an animal being affected by what is called its pedigree, we must be cautious therefore in saying that a short one is always less value than a long one. The most pure-bred animals are those in nature, so that the buffalo are clearly superior to the best families of the Short Horn in that respect, and we must not forget that pedigree should be valued according to breeds and not necessarily by the Short Horn standard with which most people are familiar. If we can only obtain three or four removes in a Hereford or Jersey pedigree there is a greater certainty of their shortness being free from any impurities than in the other example—not only because of shortness being nearer the fountain head, but that, as *original breeds*, the Hereford and Jersey did not require to be looked after in the maintenance of purity, for no outside improvements were ever thought of ; this of course has reference to the whole breed and not to particular families.

It is quite true then that the farther we get into the nineteenth century with so many Herd Books in different countries, so many more breeders, and so many more risks from various causes, the increasing length of pedigrees will be the more valuable, according as thoroughness is insisted upon, and short pedigrees may become the most valuable if better management obtains.

The Influence of Reputation on Prices.

Another cause—indirect to some extent as regards the first point—influencing the cost of production and profits, is that of the reputation of the breeder, and the records of his herd. Some men are so reliable, and stand so high in their profession, in all their herd work, that their good name is above the best managed book anywhere. Were all breeders so conditioned, Herd Books might have no place in our economy, and indeed a few good British herds do not patronise the present public registrations. This no doubt is wrong to the public and perhaps themselves, but it is an illustration of the value of reputation, for no ordinary herd could live in such independence. At the same time I am of opinion that a carelessly managed Herd Book is worse than none, and that the average breeder has such a fair amount of conscientious conduct as to command the public respect of his private registrations.

The point of a reputation old in the business has a strong influence in holding up prices where even the pedigree and individual animal merit are not better than those of the beginner, who cannot command two-thirds of the figures. We have several examples of this in Ontario, and in this connection I am justified in noting that the cause of the prominent patronage of the Experimental Farm live stock public sales is not altogether the name of the place, nor animal merit, as the knowing that everything is right.

The Items of Debit and Credit Considered Generally.

It is not such an easy matter to submit, and get everybody to agree, on what should be charged and discharged to any animal's cost of production. Practice varies to some extent, but not so much as to demand attention. The making of a good thoroughbred in Ontario a somewhat uniform process, and while the facts about to be submitted will apply to any first-class breeder in the Province, it will be necessary to work from data largely those of this experimental station.

Abstractly, there are but three things that have to do with the production of stock animals fit for sale and for use when eighteen months old—

1. The particular source of the animal.
2. [illegible] individual merit.
3. Its management.

By source is meant the breed, the special family and pedigree, the stamp of the sire and dam, and whether they are from distant or recent importations. The market value of each of these sub-points (the breed excepted of course) has, I think, never been placed in our live stock study. If there is no good source, there can be no reliability for reproduction; but there is all that man wants in the form of the sire and dam in the majority of cases with very ordinary bred animals, so that we meet at the very outset of our valuation with this apparent anomaly so well known to everybody. But individual merit along with pedigree is the desideratum, and having secured these we have only to rely on management to complete the animal for the best market price. Management implies such judicious liberal treatment—in food, exercise and handling—as shall help the pedigree and form to secure the weight, condition, temper and animal vigour necessary for immediate use to the purchaser. With such explanation I venture to place these abstract points at the following valuation :—

1. Source	60	per cent.
2. Individual merit	30	"
3. Management	10	"
	100	

The beginning of the debit of the individual is the sire's service, and the value of this varies according to his cost, and, it may be, his special reputation. From the $100 given for some particular bull, down to the $1 that most men would rather give, it may be said that $5 would be a fair service fee. To check this, take the case of the full use of the bull among his own herd, where the maximum is thirty cows. Let us say $400 were paid for the bull, and that during the year he was used to all. The interest on his cost is $50, and the annual maintenance is worth $50, so that $100 can be looked upon as the total annual cost of the service of the thirty cows. As, however, there would be on an average twenty-five calves got, the charge per calf stands at $4. This, remember, is the breeder's own cost, and has nothing to do with what he considers a profit from those who patronize him. All things considered, therefore, $5 is a reasonable fee, and that for sheep is usually worth $1. The second item of debit begins when the cow has been relieved of her previous calf, say two months before next calf, when properly the cow's keep must be charged to the coming calf. In order to follow the argument more intelligently, take the following as an example journal:—

Service, 1st July, 1884.

Weaning of previous calf, 1st February, 1885.
Calved 1st April, 1885.
Calf weaned 1st November, 1885.
Calf winter fed six months to 1st May, 1886.
Calf on summer keep until sold in September, 1886.

With service on 1st July, 1884, the weaning of the previous calf takes place about 1st of February, 1885, or two months before the coming of the calf we have to handle.

Then follows the keep of both cow and calf for seven months, from 1st April to 1st November, 1885. From weaning to sale there are nine months' food, care, and risks to be accounted for against the animal ready for disposal in September, 1886, when about eighteen months old.

In the case of cattle particularly, it will be contended by some that allowance ought to be made for manure; and, indeed, sheep properly managed give proportionately more value, if not bulk, of manure than cattle do. In regard to this I have decided to look upon it as part of the profits realized, as to which see special paragraph. Then also in calculating the cost of sheep, I have taken credit for one lamb per ewe only, while one-fourth more at least is usually got, according to kinds and management. This point will also be considered in the profits.

The Original Cost of Different Breeds of Cattle and Sheep.

I mean by this the cost of importations, without which we cannot come to exact figures of cost of production in many Canadian herds and flocks. Allowing for every possible outlay—including British cost, quarantine and home, say to Toronto as a centre, and with a sufficient number to reduce cost per head—the following may be taken as an average of what have been imported from Britain to Ontario during the last ten years; in every case first-class stock:—

ORIGINAL COST OF CATTLE AND SHEEP IMPORTATIONS TO ONTARIO, 1876-1885.

CATTLE.	Bull.	Heifer.	SHEEP.	Ram.	Ewe.
	$	$		$	$
Aberdeen Poll	500	350	Southdown	150	50
Hereford	450	200	Shrops	150	40
Short Horn	400	300	Hamps	130	40
Holstein	350	275	Leicester	100	35
Galloway	350	250	Cotswold	100	35
Jersey	300	250	Oxford	75	40
Devon	250	200	Lincoln	75	30
Ayreshire	250	200			
Mean	$360	$260		$110	$40

I do not expect that this table will satisfy every breeder, nor is it supposed to be exact, but the approximation is close enough to serve all practical purposes.

Bulls and Heifers from Birth to Eighteen Months.

Basing upon paragraph 6, this shall be a simple practical statement of debit calculated upon a herd of thirty cows that keep one cattleman fully employed.

Sire's service	$4 00
Two months' keep of cow previous to calving	6 50
Keep of cow and calf for seven months during nursing (summer)	15 00
Keep of calf for nine months	36 00
	$61 50
Share of attendance	11 00
Proportion of losses	17 50
Actual cash cost	$90 00

It appears then that even on a large scale it is not possible to produce a good yearling bull at less than $90 cash; heifers will be $15 less. As to profits see another paragraph.

Rams and Ewes from Birth to Eighteen Months.

Taking the same date of birth for sheep as for cattle, namely 1st of April, and service therefor having been about 1st November, weaning in middle of July, with 200 ewes to keep a shepherd in full employment, we have the following account:—

Keep of ewe 3½ months between weaning and service—15th July to 1st November, 1884	$1 75
Sire's services 1st November, 1884	0 75
Keep of ewe—1st November to 1st April, 1885	3 50
Keep of ewe and lamb until weaning	2 50
Keep of lamb for 14 months—sold September, 1886	9 00
Share of attendance	2 00
Proportion of losses	1 50
	$21 00
Credit one clip of wool from ewe and shearling	3 00
Actual cash cost	$18 00

I am prepared for more comment upon this result than that of cattle, because usually breeders are not in the habit of calculating their position even with the best of pure bred sheep, as they certainly do not do with common ones. I have not given the details of rations either for cattle or sheep as our previous reports have done so several times, and the general statement is enough that their management in this respect consists of neither of the extremes, but a good liberal allowance of all that practice in our provincial conditions has shown to be best for the ends in view,—*i.e.*, the production of first-class animals up to the requirements of the time.

A shearling ewe will cost $4 less than the ram, and it will be obvious to all who study the figures of cost that more profit is derived by selling the ram lambs the previous fall, under the well-known fact that most men give about as much for a vigorous lamb as they usually do for a shearling, and as the difference of cost of production is about $10, there is the very important item of nearly that amount in favour of selling the lamb as against the shearling.

Cost of Producing Different Breeds of Cattle and Sheep in Ontario.

That animals eat according to size, age and other conditions is true, and as our Experimental Farm has had the longest experience of the largest variety of cattle and sheep that cover these "other conditions," we should be able to place them fairly well under this heading.

COST OF PRODUCING CATTLE AND SHEEP IN ONTARIO.

CATTLE.	Bull.	Heifer.	SHEEP.	Ram.	Ewe.
	$	$		$	$
Short Horn	115	95	Lincoln	21	16
Aberdeen Poll	110	90	Cotswold	20	16
Hereford	95	80	Leicester	19	15
Galloway	90	75	Oxford	19	15
Devon	90	75	Shrops	18	14
Holstein	75	65	Hamps	17	14
Ayrshire	70	60	South Down	15	11
Jersey	65	60			
Mean	$90	$75		$18	$14

In the making of this table I have had to consider the cost of imported sires and dams, their reliability in breeding, freedom from disease, general well doing under Ontario conditions, cost of keep and the ability of the cow and ewe to make good calves and lambs. Our experience has been comparatively short with Galloway, Holstein and Jersey Cattle, and with Lincoln and Hamps sheep.

The Prices Got for Different Breeds in Ontario.

This need not be a lengthy paragraph, nor a difficult one, though we do not claim to strike figures to please every breeder in the country. Neither do we expect so make any relative prices with either the cost of production or those paid for importations, although no doubt both considerably affect the actual selling prices throughout the country, whether for home or American use. Then also it may be that we shall meet with the rather odd position of getting less price than the real cost of production; for a good many men, as we have already hinted, do not know what the latter is in their own experience or that of others.

PRICES OF CATTLE AND SHEEP IN ONTARIO.

CATTLE.	Bull.	Ewe.	SHEEP.	Ram.	Ewe.
	$	$		$	$
Aberdeen Poll	350	210	Shrops	40	30
Hereford	300	200	Hamps	35	25
Jersey	300	170	Oxford	30	25
Galloway	275	200	South Down	30	23
Holstein	250	200	Leicester	30	15
Short Horn	210	175	Cotswold	30	15
Ayrshire	100	70	Lincoln	28	15
Devon	80	80			
Mean	$235	$167		$32	$21

The Ontario Experimental Farm has handled 177 of these cattle during the last ten years, and as many as 1200 head of the sheep named, all thoroughbred. With this experience, with also other public sales throughout the Province, and many private sales of the most reliable kind, we have no hesitation in asking our farmers to accept of the foregoing prices as representing Ontario during the last ten years. It must be remembered, in commenting upon these prices, that the very lowest have been used in making up the averages, cases that some would have omitted as being exceptional. An average of anything is usually an unexpected thing.

Profits of Cattle and Sheep Breeding in Canada.

And now we are likely to create some controversy. Take first this balancing table :—

Cattle.	Cost of Production.	Price obtain'd	Profit.	Sheep.	Cost of Production.	Price obtained	Profit.
	$	$	$		$	$	$
Aberdeen Poll	100	280	180	Shrops	16	35	19
Jersey	63	235	172	Hamps	15	30	15
Hereford	87	250	163	South Down	13	26	13
Holstein	70	225	155	Oxford	17	28	11
Galloway	83	237	154	Leicester	17	22	5
Short Horn	105	193	88	Cotswold	18	22	4
Ayrshire	65	85	20	Lincoln	[illegible]	21	3
Devon	83	80	.....				
Mean	$80	$200	$120		$16	$26	$10

The first thing objected to will probably be the low cost of production as considered by the respective producers, in which argument will be advanced that sufficient allowance has not been made for risks, and may be also as regards actual food and care. It is worth noting that there is practically no difference in the actual cost of producing a thoroughbred animal of eighteen months and a well done steer of the same age that usually weighs 1,200 lbs. I am ready with every detail when required. This will apply nearly altogether to cattle, as sheep have not been much under the consideration of any one particularly. The only example of no profits is with the Devons, where there is even a small touch of a loss. The market for these has, however, very much improved within two years from the American side; for, indeed, a very strong and considerably successful attempt was made recently to buy up all the Devon herds of Ontario. In these dairy times this breed should not be neglected, and their patrons may reasonably expect a renewal of better prices.

Where pure-bred cows are used directly for the Dairy, in addition of course to the production of their kind, prices, and therefore profits, cannot be such a prominent thing; and on the other hand, where any breed is used more immediately to improve or produce something through a commoner source for a particular purpose, or are comparatively new to a country, prices and profits stand much higher. The Ayrshire is a good example of the former position, which, as shown here, on an average gives a profit of only $20 per head. But, with a breed as prominent in dairy circles, we have the Holstein (Dutch properly) giving a profit of $150, a result coming with their comparative newness and their fame as heavy milkers. The other dairy breed of the list (the Jersey) is just a little

ahead of its Dutch neighbour in profits at present, a position not so much from any newness, but an unusually vigorous continental exposition of their merits.

The strictly beef field is well contested in the item of profits—the exception being the old Durham, and this is easily accounted for by age and numbers. It may be said that $88 is no small profit on an eighteen months bull or heifer ; but, as yet, the greater field of production occupied by them makes this even a handsome profit. The Galloways have stood the competition remarkably well, and compared with cost of importations, are making a better balance sheet than most others. Naturally the American market is also giving the Hereford and Aberdeen Poll a high place in our revenue, and it will not escape observation that the Hereford and Galloway hold a very distinct place as regards cost of production.

It cannot fail to stand as a striking fact in the live stock breeding of Canada, that with over eight distinct breeds of cattle we have been realising an average per head profit of $120, or one and one-half more than their cost of production. Now, what does this mean? It certainly looks a large thing, but after all is it more *per acre* than any other popular and well managed farm product? We have no time to show this now, but close meantime with the reflection that as a branch of our profession the production of thoroughbred cattle and sheep demands a larger profit than possibly any other.

We submit the sheep averages with even more confidence than those of cattle. Comment is hardly required. An average of $10 is small encouragement, and still there is a fair return per acre. If it cannot be *per acre* with live stock, we are not up to time.

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2. Conduct of Different Breeds of Cattle at the Ontario Experimental Farm.

It is four years since we gave any detailed account of the general behaviour and standing of the herds of this Farm, and having had extended experience not only of the old but of new breeds, we think it desirable in the interests of the Province to bring materials up to date. This is true experimental work.

Aberdeen Angus Polls.

Our extended acquaintance with this breed has been a favourable one in several respects. In nursing, however, there is no very marked improvement; neither can we speak of them as better than their competitors in ability to withstand extremes of climate. Their early maturing properties are very marked, and we consider not second to anything in our experience. First crosses with Short Horn grade cows are not only hornless but free of any scur ; indeed, in all the markings, form and other characteristics, we would have no difficulty in disposing of such crosses as pure bred Polls—male or female. We possess an entirely *red* cow of this class, imported from Scotland, secured purposely as a specimen of the older type in respect of colour. This cow is giving calves as black and mossy as any of the others ; and, by the way, she is a good dairy cow. We are prepared to venture her with a red Poll bull and get black calves also. What do Messrs. Geary, Boyd and Paton say to this?

Ayrshires.

Not much new about this old dairy breed ; still the trouble of high milk before and after calving. With twins at foot we had to milk twice a day by hand for three weeks after calving, and milk had also to be removed two weeks before calving. They are true and reliable breeders, and yet we have not had any transmission of their prominent milking properties by use of the bull with grade cows. The conduct of one of these cows will be remembered in our last year's testing of breeds, when her milk made an usually strong record in richness, and now in suckling a calf she still upholds the reputation.

Devons.

Of this distinctly intermediate class of cattle—milk and beef combination—we have to repeat the observation that none can make better calves, few so content and hardy, and but one richer in dairy products. The Devon has not held the world's patronage because of undersize, and possibly, also, of moderation in maturing and milk quantity, but it is difficult to conceive of a more desirable cow on upland, rangy pastures for the butter factory.

Galloways.

Looking back ten years we have to acknowledge to a share in the general ignorance regarding this breed. As nearly all available literature has been old country, and that of itself old, our conceptions of Galloway characteristics were slow maturers, indifferent milkers, and difficult to manage. The lovers of them in Canada have been too diffident in correcting the teachings thus conceived ; for unquestionably if true long ago it is not true now, by specimens in our herds, and from what we know of others in Ontario. Particularly the milking in quantity and quality of the Galloway is no uncertain thing, and we have had them suckling calves in winter with all the good doing of many, and superior to the Aberdeen Poll and Hereford in this respect.

Guernsey.

We are not yet sure what to make of this breed of cattle—where to place them in these competitive days, and say with any exactness what they can do. The bull retains full vigor and weighs 1,500 at four years, but the cows impress us as possessing a somewhat delicate constitution, and in milking have not yet made anything unusual either in quantity or quality. We hope ere long to be able to speak upon the result of crossing with the common grade cows.

Herefords.

For the first time in our management we have a dairy Hereford cow—a good, fair milker in all respects, and taking her place amongst the ordinary dairy cows. This is more likely to be a transmitted property than any other circumstance, for, as "Cronkill Duchess," she traces straight back to the old Downton Castle herd that did not want for milk. We are still treated to doubtful headshakings when introducing another Hereford cow, weighing 2,100 pounds and that is unduly full of flesh, without any grain winter and summer. We have refused $3,000 for Conqueror (7510), and Her Majesty's Commissioner at Windsor has asked if we will return him to their Herd.

Holsteins.

I have not been able to read all the controversy that has resulted from our testing of cows during 1885-6, and especially as regards Holstein and Jersey, nor have we considered it necessary—with one exception—to respond to any of the many invitations, actual or implied, from those who have been unable to throw aside "self" in criticising our experimental work. No answer is needed when men speak or write so strongly under the influence of the great dollar. Our Holsteins are doing well: "Adanc, 190," weighs 2,200 pounds at four years, and receives very favourable praise even from Short Horn lovers. We think three-year-old cows should average more than 1,075 pounds. They have good constitutions, strong in impressive power, and we have on hand for fall exhibition a steer from a very common grade cow and the bull of this breed that may serve to give light on the "general purpose" to some.

Jerseys.

Were it possible to apply this saying of Ruskin, that "it is a matter of the simplest demonstration that no man can be really appreciated but by his equal or superior" in

criticising this breed of cattle from the standpoint of another breed, the lesson would be a good one; but as they have no equals and no superiors in a certain way, we stand without the usual ground of comparison. We are not so satisfied with the way St. Mary's Boy (535), is marking his calves this year, but very much so with the development of the cows in all the form and room and quality of their milk field.

Short Horns.

"Rob Roy" (45,484), has got back about twelve cows from sixty that came to him since importation; hence so long as this continues we can assuredly say it is not his fault. The trouble, and therefore expense, of irregular breeding continues with some cows, as to which Professor Grenside will likely say something ere long.

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3. Different Breeds of Sheep at the Experimental Farm.

Our nine breeds of sheep are making such a prominent record this year with lambs that we give a special paragraph to that subject. In other respects they are worth mentioning. Of the newer breeds to us, the Cheviot ewes have for two seasons in succession been thinning off their wool in midwinter without any of the ordinary causes—such as vermin, overheating with food, or otherwise out of trim apparently. In trying to attribute this to climatic changes we are met by the want of similar shedding among the black-faced Highland of Scotland, that are holding their wool similar to natives, and it may be urged that they would more likely be the first to change. The Cheviot ram, however, has been regular in this respect. Both these breeds are evidently feeling the five months' house confinement; they do not settle down at any time to the quieter sleepy conditions of the heavy breeds, and do not even *flock* with them when being handled in close quarters, but will take the fence or hurdle with great ease. We cannot see anything in the Highland breed to recommend for any Canadian conditions, but it is certainly worth while to prosecute experiment with the Cheviot. If we could retain the wool, the hardiness, the mutton quality, and at the same time increase size one-half, this breed would claim a considerable recognition on our upland pastures. We are not prepared as yet to recommend the Hamps against the Shrops. If we ever do it will be owing to a better texture and closer crop of wool, and possibly better constitutions—not yet to our experience in the other good things among sheep, as to which we require more time. South Down good-doing has not been so prominent with us of late, and of all the Downs we are handling the Oxford has unquestionably stood the all-over comparison best. The recuperative power of the Leicester has been well exemplified with the ewes imported in 1884, that then looked no better than any roadside scrub and that now command offers of $60 per head. Lincoln and Cotswold are maintaining their weight of wool and good conditions.

We have got the following average of lambs per ewe this season—beginning on 3rd March and ending in May:—

Shrops	1.75
Hamps	1.75
Lincoln	1.67
Oxford	1.62
Leicester	1.50
Cotswold	1.50
Merino	1.50
Cheviot	1.50
South Down	1.40
Highland	1.00
Average over all	1.52

There are about equal numbers of male and female. The crop of lambs in 1385 was unusually poor in numbers and quality, caused undoubtedly by all the ewes being shearlings, and mostly in high condition as recent importations. Hence, possibly, the resumption of fertility this year, both of rams and ewes, by sufficiently liberal management and a full change to pasture only in summer, and on hay, roots and bran during winter. We have also to note stronger and fresher lambs and more milk by timing the lambing one month later than usual.

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4. Are Many Good Calves the Natural Following of an Epedimic Abortion in a Herd of Cattle?

As reported by Professor Grenside, we experienced serious loss in 1884-5 by abortions throughout all the breeds of cattle, and no doubt he was right in attributing this to direct importation. A point of much value to everybody, and though perhaps known to many, has not been impressed, is the question I have asked above. We are now running over with calves from all sources, and though we can count two dead ones, they were on full growth. The aborting cows were allowed, in most cases, to go on to their natural time and get the ordinary management of the place, summer and winter. Whatever had been the cause and particular physiological trouble, it seems to have all disappeared. The condition, freshness and vigour of the cows since have been cause of comment, and this upon pasture and the following winter rations daily:—Cut hay, 12 lbs.; pulped turnips and mangels, 20 lbs., mixed in a heap with 2 lbs. of wheat bran, fed thrice per day. Now, is all this reliable calving and bloom immediately after the epidemic the natural following of most troubles and diseases in all animal life, and to be accounted for only by good vigorous constitutions, youth and good management? If more, what?

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5. Public Sale of Live Stock, 23rd September, 1886.

Lot.	Class.	Purchaser.	Amount.	Total.
	Cattle.		$ c.	$ c.
	Short Horns:			
1	Heifer	John Lamont, Caledon, Ont.	75 00	75 00
	Herefords:			
2	Bull	H. A. Muntz, Alport, Muskoka	140 00	
3	do	do do do	210 00	350 00
	Aberdeen Polls:			
4	Bull	Thomas McRae, Guelph, Ont.	160 00	
6	Heifer	R. Shortreed, do	120 00	280 00
	Galloways:			
7	Bull	T. McRae, Guelph, Ont.	105 00	105 00
	Devons:			
8	Heifer	W. J. Rudd, Guelph, Ont.	65 00	65 00
	Ayrshires:			
9	Bull	W. Keough, Owen Sound, Ont.	45 00	
10	Heifer	J. Healey, Strathroy, Ont	85 00	130 00
	Holsteins:			
11	Heifer	John Leys, Toronto, Ont.	100 00	
12	do	do do	70 00	170 00
	Jerseys:			
13	Bull	Charles Cumming, Troy, Ont.	42 00	
14	Heifer	Sydney Fraleigh, St. Marys, Ont.	120 00	162 00

Public Sale of Live Stock—(*Continued*).

Lot.	Class.	Purchaser.	Amount.	Total.
	Cattle—*Continued.*		$ c.	$ c.
	Guernseys:			
15	Heifer	T. Ballantyne, Stratford, Ont.	85 00	
				85 00
16	Hereford Grade Steer	W. West, Guelph, Ont.	140 00	
17	Shorthorn do	W. Weir, St. Marys, Ont.	136 00	
18	do do	do do	105 00	
19	do do	do do	131 00	
				512 00
22	Milch Cows	Patrick Malone, Guelph, Ont.	26 00	
23	do	George McGill, do	25 00	
24	do	Robert Howie, do	24 00	
25	do	Edwin Gray, Puslinch, Ont.	21 00	
				96 00
		Gross total for cattle		2,030 00
	Sheep.			
	Leicesters:			
1	Ram	A. C. Willett, Durham, Ont.	10 00	
2	do	J. Speers, Mosboro', Ont.	15 00	
5	Ewe	A. C. Willett, Durham, Ont.	13 00	
				38 00
	Cotswolds:			
6	Ram	Henry Swayzee, Aspedin, Muskoka..	17 00	
7 & 8	1 pair Ewes	James McIrvine, Paris, Ont.	16 00	
				33 00
	Lincolns:			
12 & 13	Pair Ewes	John Morgan, Strathroy, Ont.	11 00	
				11 00
14	Highland Ram	Thomas McRae, Guelph, Ont.	5 00	
				5 00
	Oxfords:			
18	Ram	W. Brockie, Paisley, Ont.	21 00	
19	do	H. R. Pattison, Brantford, Ont.	23 00	
22 & 23	Pair Ewes	George Robinson, Claude, Ont.	22 00	
24 & 26	do	John Morgan, Strathroy, Ont.	22 00	
				88 00
	Shropshires:			
33	Ram	T. McRae, Guelph, Ont.	40 00	
35	do	R. Rennelson, Galt, Ont.	16 00	
36	do	J. C. Wood, Florence, Ont.	19 00	
37	do	John Morgan, Kerwood, Ont.	17 00	
39 & 42	Pair Ewes	T. McRae, Guelph, Ont.	52 00	
				144 00
		Total for sheep		319 00
	Horses.			
	Brown Mare	John Shortreed, Barrie, Ont.	120 00	
				120 00
		Total for horses		120

ABSTRACT.

Cattle	$2,030 00
Sheep	319 00
Horses	120 00
Total amount of sale	$2,469 00

6. Enquiries on Hand.

We have arranged to make two important enquiries during the winter, 1886-7—the value of bran in feeding store cattle; and for this purpose will set aside eight head in two lots—one to alternate with the other each month, and to receive equal weights of bran, hay and roots, and equal weights of a mixture of corn, peas, oats and barley, with hay and roots also. It will be necessary to chemically analyze all those foods, as well as the manure obtained, in order to draw practical conclusions. The other enquiry is the feeding value for dairy purposes of the hay of permanent pasture as recently established by us, and of the ordinary timothy and clover of the Province, in which we will use four cows—noting quantity and quality of milk and the life sustaining properties of each among other things. We should have an interesting bulletin upon these two subjects in June next.

IV.—THE EXPERIMENTAL.

1. Experiments from 1876 to 1886, inclusive.

In view of the widening importance of experimentation, and in order to give the country an idea of the ground covered by us, I have pleasure in submitting a list of the experiments that have been undertaken here from 1876 to 1886, inclusive.

I beg respectfully to suggest that no better compliment could be paid our farmers than giving them a copy of these in a separate condensed form, immediately. No doubt, as in such work everywhere, a good deal may have been overlooked, a good deal requires further development, and a good deal has been closed up to the light of the times. Experimentation is to verify more than to discover, and by a near public criticism of what we have, and what we have not done, our future in this line should be considerably assisted.

Year.	No.	Subject.
1876	1	Feeding pigs; raw *vs.* cooked food.
"	2	Cereals, with and without fertilizers.
"	3	Turnips, mangels, carrots and potatoes; with and without manure.
"	4	Four kinds of peas in competition.
"	5	Seven kinds of spring wheat, five of oats, and three of barley in competition.
"	6	Characteristics of wool from seven sources.
"	7	Fifteen varieties of turnips and eight of mangels in competition.
"	8	Judging and valuing roots by specific gravity and texture.
"	9	Chemical analysis of roots by specific gravity and texture.
"	10	The growth of seven varieties of winter wheat, fifty-three of spring wheat, thirty-three of oats, and twelve of barley.
"	11	The feeding of sheep on raw and on cooked food.
"	12	The feeding of cattle on raw and on cooked food.
"	13	Turnips under special fertilizers.
"	14	Potatoes from different sized sets.
"	15	Mangels with and without liquid manure.
"	16	Wheat from different fertilizers.
"	17	Turnips and carrots with and without lime.
"	18	Barley from different fertilizers.
"	19	The fall and spring manuring of mangels.
"	20	Lucerne and other clovers under different manures.
"	21	Mangels and sugar-beet under four special fertilizers.
"	22	Testing of forty-one varieties of wheat, oats and barley, from American Centennial.
"	23	Corn—five kinds.
1878	24	Introduction to five breeds of sheep.
"	25	Cost of producing pure-bred shearling rams and ewes.
"	26	Classification and value of wool from ten sources.

EXPERIMENTS, ETC.—*Continued.*

Year.	No.	SUBJECTS.
1878	27	Some varieties of winter wheat as regards produce and liability to disease.
"	28	Oats and barley with different manures.
"	29	Fourteen kinds of spring wheat in opposition.
"	30	Spring wheat under fall and winter manuring.
"	31	Barley under fall and winter manuring.
"	32	Sugar-beet and sugar-cane.
"	33	Twenty-three varieties of grasses and clovers.
"	34	Lucerne and thousand headed kale.
"	35	Four kinds of peas in competition.
"	36	Thirteen kinds of turnips against each other.
"	37	Turnips from fall and spring manuring.
"	38	Turnips at various distances apart on the flat and drilled.
"	39	Twelve varieties of mangels, and the results of transplanting.
"	40	Mangels and carrots from late and early sowing and fall and spring manuring.
"	41	Mangels, turnips and carrots, under different manures.
"	42	House sewage on roots.
"	43	Four kinds of potatoes in competition.
"	44	Potatoes by different sized sets.
"	45	Potatoes from different manures.
"	46	Fattening steers upon turnips, straw and corn.
"	47	Feeding value of our turnips and mangels.
"	48	The milling properties of some wheats.
"	49	Our green fodder crops.
1879	50	Comparison of our breeds of cattle.
"	51	Comparison of our breeds of sheep.
"	52	Various manures on wheat.
"	53	Wheat, barley and oats, after roots and several manures.
"	54	Mangels, turnips, carrots and sugar-beet.
"	55	Nineteen forms of fertilizers on turnips.
"	56	Drilling and broadcasting of lucerne.
"	57	Our green fodders to date.
"	58	Condition of grasses and clovers to date.
"	59	Fourteen kinds of mangels and three of sugar-beet in opposition.
"	60	Nineteen kinds of turnips and thirteen of mangels, two of sugar-beet, and four of carrots.
"	61	Twelve varieties of potatoes.
"	62	A plot of permanent pasture.
"	63	Durham and Hereford grade steers in opposition.
"	64	Feeding sheep, different breeds and foods.
"	65	How much should be paid for store steers?
"	66	What it costs to make beef.
"	67	The scientific bearings of our winter feeding of live stock.
"	68	[Classification and relative value of wool at O. E. F.
1880	69	Cost of producing various crops.
"	70	The prematuring of young stores.
"	71	Fattening of young sheep.
"	72	Cream and butter from different breeds of cows.
"	73	Milk and cream from soiling and grazing.
"	74	The effects of special fertilizers applied in 1878.
"	75	Three years' cropping after F. Y. manure and special fertilizers.
"	76	Effects of manures upon wheat second year.
"	77	The effect of nineteen varieties of manures on wheat, from previous application to roots.
"	78	Five years' experience of thirty-three forms of fertilizers.
"	79	Apatite upon winter wheat.
"	80	Produce of roots at various distances apart on the drill.
"	81	An early catch of mangels and carrots.
"	82	Thirteen sorts of potatoes in competition.
"	83	Green fodder.
"	84	Permanent pasture.
"	85	Nine varieties of barley in competition.
"	86	Thirty varieties of oats in competition.
"	87	The growth of nine spring wheats.
1881	88	The washing of wool.
"	89	Carcass and wool of six kinds of wether lambs.
"	90	Comparison of diameter of fibre of twelve kinds of wool from lambs.
"	91	Prepared and unprepared hay and roots in the fattening of cattle.
"	92	The cost and profit of two and three-year-old steers.
"	93	Does it pay to fatten cattle for manure production only?

EXPERIMENTS, ETC.—*Continued.*

Year.	No.	SUBJECTS.
1881	94	The value of a manure heap.
"	95	Sir J. B. Lawes on our cattle-feeding experiments.
"	96	The comparative size, weight and value of various grades of fat shearling wethers.
"	97	Corn, oats and peas in the fattening of cattle.
"	98	The cutting up of our experimental cattle.
"	99	The third year of wheat after seventeen forms of manure.
"	100	The effects of four special fertilizers applied in 1878.
"	101	Permanent pasture.
"	102	Four years' cropping after F. Y. manure and three special fertilizers.
"	103	Thirteen varieties of potatoes.
"	104	F. Y. manure and special fertilizers on mangels, sugar-beet and carrots.
"	105	The growing of large roots in a dry season.
"	106	Continuous crops of cereals after clover and after fallowing.
"	107	Hay from nineteen forms of fertilizers applied in 1879.
1882	108	Corn in cattle fattening.
"	109	Peas " "
"	110	Oats " "
"	111	Oilcake " "
"	112	Cotton seed cake in cattle fattening.
"	113	The microscopic examination of twelve kinds of wool grown on the O. E. F.
"	114	Fat shearling wethers.
"	115	An example of the application of science in cattle feeding.
"	116	Fifteen new winter wheats.
"	117	Some oats and barley in opposition.
"	118	Seventeen forms of manure and grain.
"	119	Room, air and light *vs.* fertilizers.
"	120	Bone-dust telling from 1878.
"	121	Lucerne *vs.* F. Y. manure.
"	122	Permanent pasture and sheep.
"	123	Some new Swede turnips in opposition.
"	124	Mangels and sugar-beet—sixteen kinds.
"	125	Potatoes—ten kinds.
"	126	Prime cattle and sheep.
1883	127	Early finished beef.
"	128	The great beef contest at O. E. F.
"	129	Preserving corn fodder in a common root cellar.
"	130	Milk in quantity and quality from ensilaged corn.
"	131	Butter from ensilaged corn.
"	132	Damaged wheat in cattle feeding.
"	133	Rice meal " "
"	134	Barley meal " "
"	135	Corn meal " "
"	136	Pea meal " "
"	137	Sugar-beet, mangels and turnips in the growth of young cattle.
"	138	Testing milk, cream and butter from ten breeds of cows.
"	139	Wool and mutton.
"	140	Influence of food on milk.
"	141	Conduct of our silos.
"	142	Wool as a bi-annual crop, and the clipping of lambs.
"	143	Winter spring wheat and barley from special fertilizers.
"	144	Thick and thin seeding.
"	145	Deep *vs.* shallow seeding.
"	146	Potatoes—eight varieties.
"	147	Rotations in cropping.
"	148	Sixteen varieties of oats.
1884	149	Mixture of grain in cattle feeding.
"	150	" " and oil cake in cattle feeding.
"	151	" " and Thorley "
"	152	Corn in cattle feeding.
"	153	Peas " "
"	154	Oats " "
"	155	White barley " "
"	156	Black barley " "
"	157	Uncooked food in cattle feeding.
"	158	Cooked food "
"	159	Water and temperature in winter feeding of cattle.
"	160	Maturing of Short Horn, Hereford and Aberdeen Poll grade steers.
"	161	Oats and hay in sheep feeding.

EXPERIMENTS, ETC.—*Continued.*

Date.	No.	SUBJECTS.
1884	162	Peas and hay in sheep feeding.
"	163	Beans and hay " "
"	164	Low feeding of sheep.
"	165	High " "
"	166	The sale of forty head of winter-fed cattle.
"	167	The influence of food on wool.
1885	168	Testing Ayrshire, Holstein and Jersey cows.
"	169	Dairy products from ensilage and turnips.
"	170	Cream from deep setting under two temperatures.
"	171	Centrifugal separation of cream from milk of ten breeds, in comparison with deep setting.
"	172	The chemical analysis of winter milk.
"	173	" " summer milk.
"	174	Cream from different breeds in relation to prices paid by butter factories.
"	175	Butter globules from twelve sources.
"	176	Size of globules in relation to cream obtained.
"	177	Churning in relation to butter globules.
	178	Cheese from different breeds, winter and summer.
"	179	Feeding calves on skim milk.
"	180	Cost of producing dairy products.
"	181	Milk from permanent pasture.
"	182	Abortion among cows in relation to milk production.
"	183	Butter from milk and cream of different breeds.
"	184	The possibilities of the centrifugal separator.
"	185	The silo.
"	186	Buying and feeding cattle, and selling at same price.
"	187	The possibility of making yearling beef fit for exportation.
"	188	Closing beef contest.
"	189	Some wool clips.
"	190	Fattened shearling wethers.
"	191	Lambs from nine distinct breeds.
"	192	Cross-bred lambs from nine distinct breeds.
"	193	Three crops of wool in fifteen months.
"	194	Selected varieties of grasses and clovers for permanent pasture.
"	195	Black walnut and European larch clumps.
1886	196	Milk and beef from permanent pasture.
"	197	What takes place during the grazing of permanent pasture.
"	198	Special fertilizers and clovers.
"	199	Cost of producing thoroughbred cattle and sheep in Ontario.
"	200	Experience with cattle and sheep for eleven years.

2. REVIEW OF GENERAL PRINCIPLES, SUBJECTS OF ENQUIRY AND DETAIL MANAGEMENT.

I have not for ten years given anything in the form of public notes upon the A B C of Experimentation. It is now a profession distinct from farming, and from any of the sciences and arts, and thus a review of what guides, and what should be the principal subjects of enquiry in Ontorio, as well as some of the details of management, will interest many. Several of the notes were obtained from other authorities.

In all experimental work there are general governing principles, such as :—

1. (*a*) Scientific Investigations.
   (*b*) Practical Investigations.
   (*c*) Scientific Experiments.
   (*d*) Practical Experiments.

2. *Investigations* are usually conducted without reference to cost. *Experiments* are made with reference to practical economy.

3. Now-a-days it is not so much *Discovery* as *Verification*, and one of the objects of experimentation may be to establish a *principle* that seems wanting.

4. To ascertain the exact state of information regarding any line of experimental work, and select the subjects of enquiry.

5. To arrange for the solution of a definite question, upon a definite plan.

6. To consider as to the form in which the enquiry should be prosecuted.

It is very undesirable to undertake many experiments at once, as they cannot all be brought to a satisfactory termination; one good one is worth many indifferent ones: *in no other way can a single station make permanent contributions to Agricultural Science and Practice.*

8. All are useless, and worse than useless—misleading, without *minuteness*, system, uniformity and care.

9. An apparently lost experiment may be a step towards a more perfect one; "failures are a necessary consequence of progress."

10. The true experimental station must be the link between science and practice; investigations on the farm must keep pace with advanced science, and brought *home to the farmer himself.*

11. An experimental station is therefore purely *industrial.*

12. No generalizing without *long experience.*

13. The appliances should be abundant, and of the most modern kind.

14. The management must have skill, experience, time to plan, study, and to supervise constantly.

The most important subjects of experimental enquiry for Canada, at the present time are—

1. *Climate.*

1. The exact effect by kind, position, form of plantation, and area of trees, upon climate, especially on prairie.

2. Estimating the effects of *seasons* in the production of crops—in association with fertilizers.

2. *Soil.*

1. The effect of rainfall in washing away fertilizers, in various soils, with the same crop.

2. The effect of rainfall in washing away fertilizers, in the like soil, with different crops.

3. The exact physical relations of soil to plant food.

4. Chemical relations of soil to plant food.

5. The importance of having *contiguous* plots of *different* soils for testing weather, drainage, fertilizers, and crops.

6. The temperature of different soils at different depths in the same locality, and its relation to germination, rainfall, drainage, drought, conduct of fertilizers, and crops obtained.

3. *Fertilizers.*

1. The *exact effect* of a deficiency of supply of certain plant food to various crops.

2. *Relative* value of various fertilizers for particular crops.

3. Ascertaining market value of different fertilizers.

4. The value of the *mechanical* effect of certain fertilizers on various soils.

5. The *permanency* of various fertilizers.

6. Management of farm yard manure.

7. The special effects of apatite, gypsum, lime and salt, under various conditions.
8. Fertilizing at different *stages of growth*.

4. *Cultivation, Management.*

1. Methods of seeding and manuring.
2. Different rotations in the like, and in various soils.
3. Observations on daily growth of plants.
4. As to allowing for effects of *culture*.
5. As to the best possible means of distributing seed and manures in the soil.
6. What can be done for winter wheat in certain localities, until tree influences are re-established.
7. Identification and eradication of diseases among plants and animals.
8. Identifying noxious and beneficial insects in our rural economy—their encouragement and eradication respectively.

5. *Seeds.*

1. Germination and purity.
2. Paying for seed according to vitality and purity.
3. Depths of seeding in various soils.
4. Thick and thin seeding in the like soil.
5. The identification of plants and seeds for farmers.
6. Selection and introduction of varieties (cereals specially) from other countries.
7. The introduction of new varieties of forest and fruit trees.

6. *Crops.*

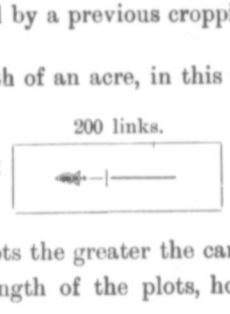
1. The suitability of various crops to the like and different conditions.
2. Comparative value of different crops—chemically and by feeding animals.
3. The conduct of plants under exactly similar conditions, (rootage).
4. Hybridising.
5. Pastures : variety of grasses and clovers.
6. Green fodders.
7. Rotations : effects on soil and crops.

7. *Selection and Preparation of Plots.*

1. Soil should not be in the *highest* or lowest state of cultivation, nor have received recent large manuring, when for testing fertilizers.
2. When to stand as a base of comparison the soil should be in the highest state of cultivation.
3. The field and plots should be of the greatest possible uniformity in—
(*a*) Quality, texture and sub-soil alike.
(*b*) General character.
(*c*) Drainage—natural or artificial.
(*d*) Aspect and exposure.
(*e*) Receiving rain and evaporating equally.

4. Proving uniformity of soil by a previous cropping, in addition to a physical and chemical analysis.

5. Size of plots to be one-tenth of an acre, in this form



and position. The smaller the plots the greater the care necessary.

6. If the field slopes, the length of the plots, however, must be up and down the slope.

8. *Management of Plot Experiments.*

1. Uniformity of treatment indispensable: manures, seeding, tillage, harvesting.

2. Every experiment should be in duplicate, as far apart as possible in the field, and several *without* fertilizers.

3. Care in *preparation* of fertilizers.

4. All seed should be tested for germination previous to planting.

5. Maturity to guide harvesting of each crop.

6. Note brairding, tillering, blooming, heading, maturing, diseases.

7. Keeping full records of rainfall, air temperature, ground temperature, maximum and minimum thermometers, hygrometers, barometer, sunshine, cloud and wind.

8. Care in noting and retaining *negative* results as well as positive ones.

9. All uselesss, and worse than useless,—misleading without *minuteness.*

10. An apparently lost experiment may be a step towards a more perfect one—failures are a necessary consequence of progress.

9. *Live Stock.*

1. Beefing and dairy breeds of cattle.

2. Effects of the first and subsequent crosses with the native cattle.

3. Adaptability of each to particular physical conditions.

4. Effects of food.

5. The systematic production of dairy products during winter.

MEMO.—Experimentation has to discover, verify, and disseminate; to tell why and wherefore, not so much to raise crops, *i.e.*, success is not to be measured by the crops raised, necessarily. Must learn how to interpret the results. Unavoidable that some efforts must be thrown away. All agriculture being artificial, may expect as many "noes" as "yeses."

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3. MILK AND BEEF FROM PERMANENT PASTURE.

The United States agricultural press has taught for many years that "Grass is King." This sound aphorism is built largely upon what nature gives, for with all their age, wealth and enterprise, our neighbors have done comparatively little with cultivated permanent pasture. They find, as Ontario can also tell in her experience, that it re quires fully three acres of the average cultivated hay and natural meadows to maintain one cow, or one two-year-old store. This is no adequate return for these days, when other agricultural products here and elsewhere are in such keen competition. There is no doubt of the fact that the present limit of North American pastures is 1,300 lbs. of milk

or 85 lbs. of beef per acre per season of five and one-half months. These at three-fourths of a cent and five cents per pound give $9.75 and $4.25 respectively, or an average value of $7 per acre, with the very marked difference of nearly 130 per cent. in favor of the milk product. If these deserve to be called "King," what may the future as indicated by the following?

The pasture seeded down in 1884 is still holding two cows per acre easily, and producing at the rate of 7,692 lbs. of milk per season of five and one-half months by common grade cows—cows which under any conditions never give over 25 lbs. per head daily. Were they Holsteins, Ayrshires, or Shorthorns, the season's produce would amount to about 14,000 lbs. of milk per acre. The two common six-year-old cows in this experiment are also adding to their weight at the daily rate of fully three-quarters of a pound each, which therefore may become an unfavourable feature of this pasture; for so far as known, matured cows in full milk on ordinary pasture hold their own good-condition weight only, and may reduce rather than increase in flesh.

Four acres of these experimental plots were laid down last year with our selected eight varieties of grasses and five clovers, the conduct of which is given in last year's annual report. This year, the first of their depasturing, one-fifth of the area consisting of low-lying spots was killed by frozen-lodged water in spring. Elsewhere the pasture is very wealthy. The continuous heavy spring rains delayed occupation until 20th May, when two two-year-old and two yearling store steers were put on. Had we disregarded poaching and spoiling otherwise, the animals could have had a full bite on 10th May; and were we followers of much of the ordinary practice, we could have cleaned our cattle's teeth by a four hours' run daily during the first week of that month, when rolling was done.

The rush of growth became so strong in the last week of May that, rather than mow so early, we added three two-year-old heifers to the four steers for a week, in order to keep pasture within sweet conditions. These heifers had to be removed to avoid the seasoning trouble, but we now realize that it would have been better to purchase six steers in place of four, as under proper management heavy stocking is better than allowing plants to seed and become rank. As it was, we kept under by mowing and mulching the early grasses on 11th June. I am of opinion that our mixture contains too much clover, and as cattle prefer good grasses to clovers our future recommendations will have to note this among other things. Why cattle also often choose dandelion and prefer the maturer but unseeded grasses on the outside of a field as against the more tender and less branchy ones of the like kinds in the closer conditions of the crop, we have yet to learn precisely.

The four steers are not able to keep down the four acres (or rather the three and one-fifth acres of full covered ground) which are divided into two fields of two acres each, the cattle being rotated weekly and receiving unlimited water and rock salt. No grain and no top-dressing has been given. The rain which fell on seventeen days during the period, amounted to 5.017 inches; maximum temperature in the shade, 89.8°; minimum, 33.3°; mean, 60.47°.

These ordinary Short-Horn grade steers made an average daily gain of 3.03 lbs. per head from 20th May, to 31st July. This is at the rate of 3.79 lbs. per acre per day.

That these facts will surprise many we do sincerely hope, and that they may have to be reduced when several years' experience is gathered is not unlikely. Meantime is the future to be $58 for diary produce, or $31 for beef per acre per summer?

A British authority in 1872 said that, "first-class grass land is that which will produce twenty imperial stone (280 lbs.) of meat per acre without artificial assistance"; and in the public press of last month it was stated that, "in Scotland the average of permanent pasture and rotation pasture requires 1.96 acres to each dairy cow." Compare these with the results we have obtained for nearly two seasons at this experimental farm.

We have in view to test the value as pasture of several of our best native grasses, and though not looking for results equal to a proper mixture of varieties, there may be other qualities that will show how much they are deserving attention by selection and proper management.

I submit to the Ontario farmer, under every measure of caution, that our pasture tests even now are decisive enough in the sense of showing how much we have yet to learn of certain lines of our profession, and that the possibilities of Canadian climate and soil are but being touched upon.

In addition to the foregoing, which appeared as a bulletin, we have to report that :— Steers were pastured up to 15th October, or 146 days for the season, and made an average daily rate of 2.15 lbs., hence we got 312 lbs. of live weight per acre for the short season.

Cows were also taken off same date, with a record of 23 lbs. of milk per head daily, and consequently a per acre crop of 6,670 lbs. for the season.

4.—What takes place during the Grazing of Permanent Pasture.

From the previous chapter will be learned what we are doing experimentally in the production of beef and milk from pasture composed of a variety of the best grasses and clovers.

Here we desire to submit some introductory light on what coming years may say in the way of renewal of fertility under such circumstances. Necessarily the figures must be taken with caution, but in view of the attention being paid to this crop in Ontario, nothing, even of a preliminary nature, should be withheld even for one season.

In treating this subject in the future, I shall keep the store steers separate from the cows, so that we may gather some things for or against either.

In the first place we have the precise fact that the two cows on the one acre gave 6,670 lbs. of milk, and increased their own weight 217 lbs. During the season we gathered and weighed the *dried* manure, as well as took samples of the fresh droppings for chemical analysis. Allowing for a good deal left on the ground that could not be picked up easily, and for the difference between the old and the fresh manure, the two cows voided—urine excepted—about 4,680 lbs. fresh during the season, and of course from one acre.

The analysis of the milk—twice at six different times—is as follows :

Water	88.7518
Fat	3.3096
Solids other than fat	7.9386

The manure analysis, on a mean of four times, resulted thus :

Water	82.76
Organic matter	12.93
Insoluble matter	2.09
Iron and Alumina	1.03
Lime	.69
Magnesia	.21
Nitrogen	.25
Undetermined, such as soda and potash	.04

And the 217 lbs. of increase to live weight will be set down at its proper value.

So, altogether, the 11,567 lbs. of materials in three forms, removed from the acre of permanent pasture, can be valued at $65, according to the markets of the day, but as this gives no correct idea of the fertility removed, we have to value in some other way.

The four store steers on four acres gave 312 lbs. of additional live weight per acre, and the following is chemical analysis of their manure:

Water	
Organic matter	83.00
Insoluble matter	11.47
Iron and Alumina	3.60
Lime	1.32
Magnesia	.41
Nitrogen	.12
Undetermined, such as soda and potash	.24
	.07

How much fertility has been removed from these pastures and what should be done to recoup them?

Sir J. B. Lawes writes me as follows:

"Some years ago I spent a day or two in Leicestershire for the purpose of selecting for study one of the most celebrated of the many celebrated fattening pastures of that county. The field I settled upon pastured about 17 oxen on 14 acres, without artificial food; I calculated each acre produced between 5 and 600 lbs. in increased live weight, equal to 350 to 400 lbs. of beef; this is I expect the outside possible product. The herbage of the field was exceedingly simple and might be said to consist almost entirely of perennial rye grass and white clover, the other grasses forming quite an insignificent portion of the pasture. If English experience is of any value to your country, you will find that for three or four years your new pasture will yield very large crops, and this will be followed by a considerable falling off. I find that I can improve my pasture in a cheaper manner by feeding the stock with decorticoled cotton seed than I can by means of artifical manure. If your land has been under arable cultivation for a long period of time, you will find that you must accumulate a considerable amount of fertility under-ground before your pasture is established. I have pasture on my farm of all ages, from the unknown to 4 or 5 years in the form of turf. Decayed roots in each acre has to accumlate about 1,000 to 1,500 lbs of nitrogen before it can obtain the composition of the old pasture, although of course soil and climate affect the result materially, I am disposed to think that the accumulation of a large quantity of organic nitrogen in the soil is absolutely essential towards the formation of a pasture. For the last year or two we have been regulating the artifical food of the dairy cows to the milk, and I have some hopes that something is to be done is this direction. You cannot, it is true, increase the yield of milk of a cow two or three months after calving however highly you feed her, nor can you make a bad milker a good one. What you appear able to do, is to keep up the maximum flow, which is generally obtained two or three weeks after calving, with a comparatively slight decline for perhaps 20 weeks or more, by a proper regulation of the artifical foods. Our standard foods in winter being mangels, chaff, cake and bran, and in summer pasture, and later we give 4 lbs. of cake and 4 lbs. of bran, to each cow per day, which yield 28 or 30 lbs. of milk per day, and at the end of each week this food is increased or diminished by $\frac{1}{4}$ lb. for each rise or fall of 2 lbs. of milk. I have not sufficiently studied the result (the daily weights of food and milk of a herd of 50 cows, extending over $1\frac{1}{2}$ years is a serious matter), but I think that the regulation of the more costly foods to the amount of milk yielded is worthy of attention."

At end of next year the Ontario Experimental Farm should be able to say something more upon the maintenance of different kinds of grasses and clovers, and how much diminution there may be in dairy product per acre. Meantime the oldest plots have been top-dressed with ten loads of first-class F.Y. manure, to be followed with 200 lbs. of bone meal per acre in spring.

5.—Special Fertilizers and Clovers..

On 8th May, 1885, we seeded plots 71 to 80 inclusive, in range 4 of the Experimental plots, with orchard grass and red clover, at the rate of six pecks per acre, at same time taking a crop of barley.

These plots were treated in spring of 1884 with the respective fertilizers named below, when a crop of roots was taken, and the purpose is to ascertain the influence of such fertilizers through a rotation of (1) roots, (2) barley, (3) hay, and (4) spring wheat.

As we have three years' crops on hand for criticism, it is very tempting to submit results, but in view of a full and more reliable report next year, I deem it desirable merely to indicate now that some important and practically valuable facts may be looked for.

Plot 71. No Manure.
" 72. Farm-yard manure, 14 tons per acre.
" 73. Nitrogen mixture $\frac{1}{3}$ nitrate of soda, $\frac{1}{3}$ sulphate of ammonia and $\frac{1}{3}$ dried blood, 150 lbs per acre.
" 74. Superhosphate, 350 lbs. per acre.
" 75. Muriate of potash, 150 lbs. per acre.
" 76. Nitrogen mixture, } 150
Superphosphate, } 350 lbs., per acre.
" 77. Nitrogen mixture, } 150 " "
Muriate of potash, } 150 " "
" 78. Superphosphate, } 350 " "
Muriate of potash, } 150 " "
" 79. Superphosphate, } 350 " "
Nitrogen mixture, } 150 " "
Muriate of potash, } 150 " "
" 80. Quick lime, 400 lbs. per acre.

6.—Arrangements for Cereals, 1887.

I am much pleased to be in a position to inform the public, that we have set on foot an extensive arrangement to secure such kinds of new wheat, oats and barley, from various part of the world, as are most likely to succeed in Ontario. Early steps were taken, and thus we will almost certainly be in possession of several hundred varieties in early spring, both for distribution on a small scale to such parts of the province as will best test by variety of soil and climate, and of course also for our own Experimental plots. For this special purpose we have chosen a part of No. 3 field of the farm, and trust to be able to give important results in next year's report.

V—THE MECHANICAL.

To William Brown, Esq.:

Dear Sir,—The following statement will give you a general idea of how the Mechanical Department was employed from October 1885, to October 1886. On the morning of the 1st October, 1885, a fire occurred, which destroyed the main barn, and a portion of the other outbuildings. Hence our first concern was to prepare accommodation for sheltering the farm stock in a temporary way, until new barns and stables could be erected. This was accomplished partly by utilizing what buildings were not consumed by fire, and partly by repairing those that were partially consumed, using in this temporary repair over 50,000 feet of lumber, and although this being work which student

labour could have reached. we found that we could not wait for them to accomplish it, and were under the necessity of hiring outside help. About the end of November that work was all completed, so far as was thought advisable to do.

The general repairs about the class-rooms and College, such as desks, doors, windows, etc., were next seen to, as also the experimental engine to drive centrifical, or cream-separater, with counter-shafts, bands and pulleys. There were also made for farm use, six wheel-barrows, some ladders and hay racks. The farm implements and tools were overhauled ; there was likewise built for the use of the creamery, an ice-house 12x14, 16 feet high, and also a number of boxes to take exhibits to the Indian and Colonial Exhibition at London, England.

There were also a number of propogating boxes made for use in the garden, likewise lawn seats, new and old repaired, and also repairing glass in green-houses. Towards the spring season we fixed pens for ewes and lambs, and bins for seed grain. After Easter examinations, repairs in College were again attended to, winter sashes taken off and stored away, broken desks and seats repaired : a general repair of field fences, gates, etc. A new fence along side of field 18, commenced last year, was completed, as also wire fence in south lane repaired, and a barbed wire fence erected in field 17, enclosing vinery, and one enclosing walnut shelter clump. Our attention was now called to preparing accommodation for twelve cows purchased in connection with the the creamery, and also a pig-sty 24x70 feet. The erecting of these buildings interfered with time intended to be devoted to building new fences, as we had now to attend to erecting hay-forks for stacking hay in several fields, having no barn room, and preparing for the annual sale of stock, which was to be held in the City of Guelph during the week of the Provincial Exhibition. We repaired the tent which was to be used in connection with the sale, erecting it first two or three times on the College grounds, for the accommodation of visitors. Set it up on the show grounds, and erected a shed for the further accommodation of the stock. There was also a show-case made for exhibiting permanent pasture grasses, and likewise a number of shipping boxes for transporting sheep and other animals by railroad.

A number of shelves were made and put up in the experimental dairy, for the purpose of curing cheese, and also shelves, cupboards, and other fixings, in the re-arrangement of chemical class-room.

In accordance with a recommendation from the Board, that instructions in the several outside departments be as thorough as possible, (and after consultation with yourself) as a means to reach that end, we devote an hour each day with the students that are in this Department to general explanations—

1st. As to names and use of carpenter's tools.
2nd. Putting same in order.
3rd. Practical handling of tools.
4th. Terms used in carpentry.
5th. Framing buildings.
6th. Fence and gate making.
7th. General work and repairs.
8th. Comparative strength of materials.
9th. Rudimentary joinery.

After which they are set to perform various pieces of work, part of them under my assistant, and part under my own superintendence.

As to the work that is going on at the present time, the contract for the new farm steading being about completed, we begin to see the number of necessary articles yet required, not included in contract. These embrace sheep feeding racks, cattle feeding mangers, harness rooms, grain bins, wool room, pens for ewes and lambs, also house for engine, with all necessary gearing for driving cutting machines, separator, forks, etc.

These statements contain a general outline of the operations that have engaged the time and attention of this Department during the year.

Yours truly,

JAMES MCINTOSH,
Foreman.

VI—ARBORICULTURAL.

GUIDE TO PLANTING TREES AND SHRUBS ON THE SCHOOL GROUNDS OF ONTARIO.

General Advice from Students of the O. A. C.

1. Choose the best kinds of trees and shrubs for the *special* purposes—having regard to *soils*, *districts* and *exposures*.

2. Attend to every *detail thoroughly*, and adopt the *most approved* management.

3. The best *ornament*, *shade* and *shelter* are from *properly developed* trees and shrubs, so *disposed* as not to unduly check side branches.

4. Never plant upon naturally *poor* or *wet* ground, and remember that *drought* is more *dangerous* than *frost*.

5. Make no profuse *congratulations* when you have many *leaves* and some growth of *wood* the *first* and *second* years, nor *rejoice* unnecessarily if *fruit* is also abundant then, because neither are, necessarily, indications of well-doing.

6. Order your plants one month ahead of *time*, and place responsibility of *delivery* upon party supplying them.

7. In cases of *extensive* work it will pay to employ *skilled* labour, but the *education* of others at same time should not be overlooked.

Trees for Shade.

8. The best trees for *Shade* are the sugar maple, horse chestnut, Scotch elm, butternut, European linden and fern-leaved birch.

Trees for School-ground Shelter.

9. A mixture of maple, elm, oak, ash, beech, birch, black walnut, with evergreens of Norway spruce, Austrian pine, common white cedar and black American spruce.

Shrubs for Ornament.

10. A proper mixture of lilac (10), guilderose (6), high-bushed cranberry (10), hazel-filbert (8), hawthorn-English (15), barberry (6), and mock orange (8). The figures indicate the *branching diameter* of mature plants.

Soils.

11. All these trees and shrubs do well upon good, naturally *dry* loam, and the lighter character of *clay loams*.

Distance Apart.

12. *Shade* trees from 20 to 30 feet, *shrubs* from 6 to 12 feet, according to *diameters* given in No. 10 note; and for a *mixed* shelter bed, ten feet apart is best in view to future thinning and *selection* of *standards*.

Where to get Plants.

13. We have yet to be *educated* in knowing *how* to choose, *prepare* and *manage* the planting of young trees from our *forest*. Our *College* has in view to issue *special advice* on this *subject* next year. In any event, all trees and shrubs are *most reliable* from well managed *nurseries*, as being always kept in a *prepared* transplanting condition, they are ready to move at any time, and better able to do well on removal. The first cost is less from the neighbouring bush, but so is the success less on an average, even under the very best management.

Size or Age of Plants.

14. The *younger* the plants the *less risk* with all kinds; aim at not more than from *three to six years* in the nursery. Avoid *branchless* trees that have been standing *close together*.

Time to Plant.

15. From end of *April* to end of *May*. Transplanting with the buds and young leaves is not dangerous, but requires more careful attention; fall or autumn planting is not so safe.

Preparation for Planting.

16. On obtaining plants cut off any rough branches and roots, so as to balance *under* and *over* ground. Do not interfere with the evergreens in this respect. Take special care of small *fibrous* roots. Previous fall digging for shrubs and belting is good.

Weather for Planting.

17. If possible, choose mild, cloudy, and moist weather, but not so wet as to make the soil *sticky*.

Making Pits.

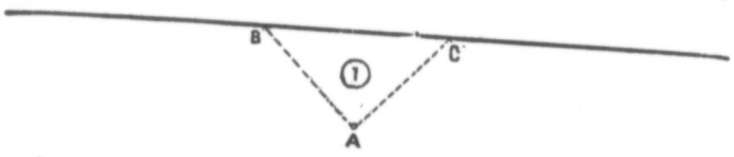
18. Make pits one-half wider and deeper than is actually required; remove any water or scum from old-made pits—squaring off the bottom well.

How to Plant.

19. Fill up pit to required depth of *special tree*; plant one inch deeper than the old mark on the stem; incline the tree slightly towards the *prevailing wind* of the district; spread out very carefully all the roots and fine fibres in the pit; fill in the best *loamy* soil first, shaking and gently pulling the plant up and down a little so as to *run* the soil amongst the roots. When half the pit is filled tramp moderately firm with the foot, and on finishing give another tramp—*heeling* close up to the stem. *Puddling* roots before planting is only required when both soil and atmosphere are dry. A *naturally* moist soil is the best.

Protection.

20. On public roadsides we would not require to protect shade trees were our laws properly administered; if the tree is planted close to fence the best guard is the triangle, thus:



This consists of one post at A with fence lumber from bottom to top nailed at B and C. If the line of shade trees is on the out-edge of sidewalk—eight or ten feet from fence—the best guard is an open one, strong, and with room to allow for growth. Never *tie* a tree nor allow it to *rub* against the guard.

After Attention.

21. If wind makes *openings* around stems, have them made good *immediately* as *drought* would damage seriously; use grass or other *rough* material as a *light mulch* in *midsummer* round each tree for the first *two years*, and place a *deeper* mulch during *winter* for the same period. Keep ground cultivated until the tree shades itself in after years. Do not cultivate *later* than August, as it tends to prolong growth that may be damaged by winter. If a severe and continuous *drought* occurs immediately after planting, it may be necessary to *water*—depending upon situation and a retentive soil; avoid watering if possible, as oft cultivation with mulch is better for future success.

Pruning.

22. No general rule can be given as to pruning: keep the tree well *balanced*, without interfering much with its *natural charaoter*; encourage the leader, or stem shoot; prune any time from fall of leaf to budding—never draw sap by pruning in early spring; remove all dead or damaged matter anywhere, as well as improper sapling growth from the lower stem.

2.—Special Note for Young People.

Every properly developed tree is a thing of beauty and utility. They are the nobility of vegetable life—man's companions and to some extent teachers. Trees supply us with food, clothing, medicine, and the many things of every day; they make nations and actually affect the individual, for men brought up in an oak or a pine forest, respectively, are differently constituted. Trees keep us warm and cool, they mellow and purify the air for our health; they break and soften the cold winds, and moisten the hot sunshine; they breathe, perspire, and sleep, and sing; they moan, and whistle, and groan; trees have electric affinity one to another, according to kind, area covered, distance apart, and the particular atmospheric conditions; they have also particular friends and enemies in nature, both animal and vegetable, and hence for these and many other reasons we do not deserve well of our country if every person does not plant one tree every year of his or her life.

VII.—MISCELLANEOUS.

1.—Bran as Cattle Food.

I think one of the weaknesses of agricultural things in these times is not knowing exactly what wheat bran is. Its commonness everywhere for hundreds of years may be the cause of this. Many men, no doubt, can tell of favourable experience in its use with calves, dairy cows, and possibly fattening cattle also, but its exact position, singly as a cattle food against grain of any kind, as well as its manurial value, are still largely unknown; hence the very important question of its value in the market remains a doubtful thing.

The subject demands more light, especially in these days of increasing wheat area, and lowering prices, for unquestionably, as we get about 200 lbs. of bran per acre, on an average, of winter and spring varieties—the crop may be worth so much more were we fully satisfied of its value, both for flour and for bran.

Bran, chemically, by the old and new process of milling, will average about :—

——	Old.	New.
Fat	4.27	5.25
Starch	66.12	61.54
Woody Fibre	9.23	8.46
Gluten	14.79	17.64
Ash	5.59	7.11

Both these analyses are free of water, which is usually about 13 per cent. Compare them with whole wheat that on an average contains 1.75 per cent. of fat, starch, 65; gluten or albummioids, 13; ash, 1.90; water, 13; and crude fibre about 6 per cent. Do the same with flour as represented by the following:—

Fat	1.2
Water	16.5
Gluten	12.0
Starch	69.6
Ash	.7

Now, as by the old process of milling, the bran took most of the gluten with it, and as by the new, the greater part of the gluten is left in the flour, it follows that the bran from the new process should be stronger, richer and fatter. Even by the old process bran contains $2\frac{1}{2}$ times more fat than the whole wheat, and exactly *three times* more than flour.

In his report on ensilage this year, Sir J. B. Lawes says:—"It is somewhat remarkable that the composition of bran bears a very close relation to that of milk, in the proportion of the digestible nitrogenous and digestible non-nitrogeous constituents, thus:—

	Dig. Nit.	Dig. Non-Nit.
$3\frac{1}{2}$ lbs. bran will supply	0.42	1.41
$11\frac{1}{2}$ lbs. milk will contain	0.42	1.49

If these chemical constituents are of equal value, relatively, to its own source—that is the bran and the milk—and as the $3\frac{1}{2}$ of bran costs with us about 2 cents, and the milk 9 cents; we are again in possession of a fact highly favourable to bran as cattle food.

Some years ago our experimental station made a test with 18 head of store cattle, during winter, by feeding 12 lbs. hay, 35 lbs. turnips, and 9 lbs. bran per head daily; this large quantity of bran, (about one and one-quarter pressed patent pail full) was given against several other foods—grain principally, and as we had an extensive series of them, all the comparisons are most interesting and valuable. The mean of all the testing was 2.05 lbs. of a daily rate of increase per head—at a cost of 10 cents per pound—the highest 2.70, at a cost of $12\frac{1}{3}$, the lowest 1.60, at a cost of $11\frac{3}{4}$. The bran gave a daily rate of 2.14, at a cost of 9 cents per pound of the added live weight, and as the *lowest cost* of production or $8\frac{1}{2}$ cents, was with a mixture of the best grains—corn, peas, oats, barley,—giving a rate of 2.25 lbs., we get another good idea of the importance of wheat bran.

Then, again, looking at the manurial value of foods, when used to cattle, and building upon what British experience and analysis have shown as the actual fertilizing properties of the manure from them, we are struck with the position taken by bran.

2.—Manure Value of Wheat Bran.

	Per cent.	Value, per ton.
Nitrogen	2.47	$8 38
Phosphoric Acid	2.75	3 83
Potash	1.43	1 15
		$13 36

So at the present price of $12 per ton, we get $13.36 of manure, or, in other words, when we feed store cattle with one ton of bran that cost $12, the residue in the form of manure is actually worth more than the original cost. If this be doubted, or laughed at, or pooh-poohed, it simply places the sceptical party outside the pale of all modern science and practice.

The mean cost of the four kinds of grain referred to as having given the cheapest cost of production, being $21.85 per ton, before feeding, and valued at $9.33 when got as manure, is is evident that if we take this as a standard of comparison, we could give about $20 per ton for bran, if we believe in *manure* as a primary consideration.

To conclude, meantime it is indicated :

1. That bran is more valuable than its own whole grain, or flour, for feeding purposes.

2. According to chemical analysis, or nutritive ratio, bran is worth $21 per ton.

3. According to actual feeding tests, it is worth $20 per ton, irrespective of the manurial value.

4. The new process bran is more valuable for feeding cattle because, while it contains less of the starchy matter, it has, in per cent. considerably more valuable protein, or albuminoids, so valuable in forming bone and muscle.

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

W. BROWN.

PART VII.

REPORT ON

PRACTICAL HORTICULTURE.

To the Honourable A. M. Ross,

Commissioner of Agriculture:

SIR,—For several years past, in consecutive reports I have endeavored to describe somewhat minutely the various alterations and improvements from time to time made in the Horticultural Departments, the grading and re-modelling of the grounds, change of drives and laying out of flower beds, the planting of an arboretum, a vineyard and orchard, noting as clearly as possible the success and failures in each. This year I am to a large extent relieved of this duty by Professor Panton, who has taken close and copious notes throughout the season, and in his report I have no doubt may be found many particulars of interest.

The orchard as you know has been but a partial success, due principally to a succession of severe winters. Pears, of which we had fifty-five varieties, were all but a complete failure. Plums, twenty-nine varieties, have also suffered much from the same cause, and in the apple orchard, although the destruction has not been so extensive or general, yet many vacancies have occurred from year to year, and with many of the trees, although still living, their constitutions are so impaired and their vitality so weakened that each successive winter will have its victims. We are thus forced to the conclusion that the low temperature of our altitude is unsuitable to many of the standard varieties of fruit trees that may be (and in fact are) grown successfully in more favoured localities throughout the Province. To fill up blanks last spring, we procured from Fonthill nurseries, where they are making a speciality of hardy varieties, several new sorts highly commended as the hardiest at present obtainable, the proof of which may be noted in the near future.

We would here acknowledge a donation from the Fruit Growers' Association of Ontario (and we do so with gratitude), one hundred young apple trees, embracing fifty varieties of Russian origin two years from graft, the scions imported directly by the above Association. Although young for permanent planting, we have filled some vacancies in the orchard and planted the remainder in our nursery ground as a reserve for future use. The small fruits, viz.: Raspberries, Currants and Goosberries grown in a portion of the apple orchard, were fairly productive in their season, sufficient to meet all demands from the College and a surplus over, which was disposed of to hucksters and to private individuals in the neighbourhood. Of the fifteen or sixteen varieties of raspberries that we have in stock, the Philadelphia for a time proved the most prolific, but from the the small size and dark colour of the berry it was less attractive than some of the others, and from the extreme hot and dry atmosphere of the month of July the crop was early over. For general purposes the Cuthbert is perhaps the most desirable

variety that we have. Its large size, deep red colour and firm flesh, will always commend it as a good market sort. We would name Herstein next in the order of merit, a hardy vigorous grower and good bearer, but its rather dark colour and soft watery texture tells against it for shipping purposes. Clark, Thwack, Highland-hardy, Brandywine, Niagara and Turner, were all more or less injured by the preceding winters, as well as some of the Black-caps, Davidson's thornless, Gregg, Dorchester, and Mammoth Cluster.

Gooseberries and Currants were an average crop, although as usual they were sadly punished by the caterpillar. Of the nursery ground and tree clumps but little need be said; no new planting has been done during the year, the young trees consisting of Norway and Native Spruce, Larch, Ash (English and American), Butternut, Birch, Elm, Linden, Hickory, Maple and Oak, as well as some of the larger shrubs. Buckthorn, Barberry, Spindle tree, etc., etc., are all very healthy plants and require transplanting in the spring, either in the nursery or into new clumps, as may be decided on.

GREENHOUSES.

In this department no change has been made for the year, further than some indispensable patching to keep them in working order. The whole structure, as has been repeatedly reported, is in a very unsatisfactory condition, constructed at first on a very primitive system and finished in the roughest style. Heated by flues, which have never wrought well, the smoke and gases frequently escape in the houses to such an extent that it is difficult throughout the firing season to keep the plants in anything like a healthy condition.

Our stock of plants consists principally of the soft-wooded or herbaceous sorts—in fact the houses in their present state are quite unfit to grow the more valuable class of hardwooded plants, and apart from the unsightly appearance the dilapidated buildings present in the position they occupy, they stand in the way of carrying out the adopted plan for this section of the grounds, and I trust now that the old buildings of the farm are being removed something may be done in this matter at an early date, so that the plan of the grounds may be completed throughout.

But notwithstanding the unsatisfactory state and limited space that the houses afford, we were enabled last spring, by the aid of a number of hot-beds, to raise from seeds and cutlings together, from eight to nine thousand bedding and ornamental plants of all sorts, to furnish the flower beds and borders for the summer, which we think both for quantity and variety were quite equal in appearance to what they have been in any former year.

This winter, from a more equitable distribution of the students, we were enabled to resume more systematic instruction during the months when but little can be accomplished to forward the work of the year. This instruction consists of practical lessons on grafting and budding, the various modes explained to and practiced by the students, the propagating, hybridizing, arranging and handling of plants generally, becoming familiar with their names, technical and common, composition and preparation of suitable soils, the potting, drainage, pruning and training, the various systems of heating, the temperature required, watering, moisture, air, light and ventilation necessary, also the construction, regulation and management of hot-beds, with the benefits to be derived from their use—in short, as far as we can, all that pertains to practical horticulture, and I am glad to say that the great majority of the students appreciate our efforts in this direction.

KITCHEN GARDEN.

As for several years past this department has done all that could reasonably be expected of it, the crops with scarcely an exception were abundant and good as far as the average year will permit of. Some of the late and more tender crops—corn, mellons and tomatoes—are rarely secured to the full extent in our locality before the early fall frosts pinch off their share. But all vegetables were plentiful in their season, and as usual, such sorts as can be preserved are stored in sufficient quantity for winter use.

Last spring, in making up our orders for vegetable seeds, we selected an unusual variety of each sort, with the idea of testing experimentally the comparative merits of each, and after the most careful observation throughout the season we have come to the conclusion that either the amateur or professional, by procuring a good descriptive catalogue from a reliable seed firm, of which we have now a good choice, will perhaps gain more information than the experience of a single individual will afford in a life-time, making (of course) full allowance for the many new and untried varieties often unduly puffed up by the originators, and frequently result only in the disappointment, and at the cost of the more hopeful and credulous.

The following fruits and vegetables were supplied to the College during the year:

January.

Carrots, 1¾ bush. at 25cts	$ 43	
Parsnips, 1½ bush. at 40cts	60	
Turnips, 2¼ bush. at 20cts	45	
Onions, 3¾ bush. at $1 00	3 75	
Celery, 18 doz. at 75cts	13 50	
Peppers, 2 doz. at 20cts	40	
Cabbages, 3 doz. at 70cts	2 10	
Herbs, etc	10	
		$21 33

February.

Turnips, 5½ bush. at 20cts	$1 10	
Carrots, 4 bush. at 25cts	1 00	
Onions, 6¼ bush. at $1.00	6 25	
Parsnips, 4½ bush. at 40cts	1 80	
Beets, 1 bush. at 30cts.	30	
Vegt. Marrow, 2 doz. at 60cts.	1 20	
Cabbages, 4 doz. at 70cts	2 80	
Celery, 1 doz. at 75cts	75	
Herbs, etc	30	
		15 50

March.

Carrots, 7½ bush. at 25cts.	$1 87	
Turnips, 11½ bush. at 20cts	2 30	
Parsnips, 7½ bush. at 45cts	3 37	
Beets, 1 bush. at 30cts.	30	
Onions, 8 bush. at $1.00	8 00	
Cabbages, 4½ doz. at 70cts.	3 15	
Sundries.	25	
		19 24

April.

Carrots, 3 bush. at 25cts	$ 75	
Onions, 8 bush. at $1.00	8 00	
Parsnips, 8¼ bush. at 45cts	3 71	
Turnips, 8¼ bush. at 20cts	1 65	
Beets, 7 bush. at 30 cts.	30	
Cabbages, 5½ doz. at 70 cts	3 85	
Herbs, etc	25	
Sundries.	15	
		18 66

May.

Parsnips, 11½ bush. at 45 cts	$ 5 17	
Onions, 3 bush. at $1.00	3 00	
Salsify, 1¼ bush. at 75 cts	94	
Turnips, 6 bush. at 20 cts	1 20	
Rhubarb, 21½ bush. at 70 cts	15 05	
Beets, 1 bush. at 30 cts	30	
Lettuce, 7¼ bush. at 70 cts	5 07	
Cabbages, 3 doz. at 75 cts	2 25	
Asparagus, 756 bunches at 4 cts	30 24	
Herbs, 8 bunches at 5 cts	40	
Sundries	20	
		$63 82

June.

Rhubarb, 19 bush. at 60 cts	$11 40	
Onions, 2 bush. at $1.00	2 00	
Lettuce, 8¼ bush. at 50 cts	4 12	
Spinach, 17½ bush. at 50 cts	8 75	
Peas, 2¼ bush. at $1.00	2 25	
Asparagus, 879 bunches at 4 cts	35 16	
Gooseberries, 96 qts. at 7 cts	6 72	
Herbs, etc	45	
		70 85

July.

Peas, 10½ bush. at 90 cts	$9 45	
Onions, 2 bush. at $1.00	2 00	
Lettuce, 3¼ bush. at 40 cts	1 30	
Beets, 1¾ bush. at 80 cts	1 40	
Carrots, 3¾ bush. at 60 cts	2 25	
Spinach, 1½ bush. at 40 cts	60	
Potatoes, 4¼ bush. at $1.25	5 31	
Beans, 1½ bush. at $1.00	1 50	
Apples, ¾ bush. at 80 cts	60	
Gooseberries, 32 qts. at 7 cts	2 24	
Currants, red and white, 196 qts. at 8 cts	15 68	
Currants, black, 45 qts. at 10 cts	4 50	
Raspberries, 624 boxes at 6 cts	37 56	
Asparagus, 110 bunches at 4 cts	4 40	
Herbs, etc	30	
		89 09

August.

Apples, 15 bush. at 70 cts	$10 50	
Potatoes, 22 bush. at 75 cts	16 50	
Rhubarb, 3 bush. at 65 cts	1 95	
Beans, 4 bush. at $1.00	4 00	
Onions, 1½ bush. at $1.00	1 50	
Beets, ¾ bush. at 25 cts	19	
Carrots, ¼ bush. at 20 cts	5	
Cucumbers, pickling, 5½ bush. at $1.50	8 25	
Peas, 3 bush. at 90 cts	2 70	
Tomatoes, 1 bush. at $1.25	1 25	
Plums, 24 qts. at 10 cts	2 40	
Currants, red, 4 qts. at 8 cts	32	

Currants, black, 9 qts. at 10 cts	$ 90	
Vegetable Marrow, 20 at 5 cts	1 00	
Cabbages, 2 doz. at 60 cts	1 20	
Cauliflower, 5 doz. at 75 cts	3 75	
Corn, 60 doz. at 8 cts	4 80	
Raspberries, 183 boxes at 7 cts	12 81	
Sundries	35	
		$74 42
September.		
Potatoes, 22 bush. at 60 cts	$13 20	
Tomatoes, 11 bush. at 80 cts	8 80	
Crab Apples, 2 bush. at $1.50	3 00	
Onions, ½ bush. at $1	50	
Apples, 2 bush. at 50 cts	1 00	
Pears, 2 bush. at $1.75	3 50	
Carrots, ¼ bush. at 25 cts	7	
Cabbages, 2 doz. at 60 cts	1 20	
Cauliflower, 20¾ doz. at 70 cts	14 52	
Corn, 23 doz. at 8 cts	1 84	
Cucumbers ½ doz. at 20 cts	10	
Plums, 200 qts. at 8 cts	16 00	
Grapes, 304 lbs. at 3 cts	9 12	
Vegetable Marrow, 3 at 5 cts	15	
Herbs, etc	20	
		73 20
October.		
Tomatoes, 3 bush. at 60 cts	$1 80	
" green, 4 bush. at 40 cts	1 60	
Beets, 1½ bush. at 30 cts	45	
Apples, Snow, 24 bush. at 80 cts	19 20	
" Baldwins 8 bush. at 70 cts	5 60	
" Northern Spy, 40 bush. at 65 cts	25 00	
" Mixed, 34 bush. at 50 cts	17 00	
Carrots, 4 bush. at 25 cts	1 00	
Onions, 4¼ bush. at $1.25	5 31	
Turnips, 3¼ bush. at 15 cts	49	
Parsnips, 2¾ bush. at 40 cts	1 10	
Citrons, 5 doz, at 70 cts	3 50	
Vegetable Marrow, 18 doz. at 60 cts	10 80	
Cauliflower, 7 doz. at 60 cts	4 20	
Cabbages, 4½ doz. at 50 cts	2 25	
Celery, 17 doz. at 70 cts	11 90	
Peppers, 1 doz. at 15 cts	15	
Grapes, 464 lbs. at 3 cts	13 92	
Sundries	40	
		125 67
November.		
Onions, 5 bush. at $1.50	$7 50	
Carrots, 6¼ bush. at 25 cts	1 56	
Turnips, 2 bush. at 15 cts	30	
Parsnips, 2 bush. at 40 cts	80	
Salsify, 6 bush. at 75 cts	4 50	
Artichokes, 3 bush. at 70 cts	2 10	
Beets, ½ bush. at 30 cts	15	

Celery, 28 doz. at 70 cts	$19 60	
Cabbages, 3 doz. at 60 cts	1 80	
" red, 100 6 cts.	6 00	
Herbs, 7 bunches at 5 cts	35	
Sundries	40	
		$45 06

To December the 15th.

Artichokes, 3 bush. at 70 cts	$2 10	
Salsify, 2 bush. at 75 cts	1 50	
Celery, 16 doz. at 70 cts	11 20	
Cabbages, 1 doz. at 60 cts	60	
Onions, 2¼ bush. at $1.50	3 37	
Carrots, 2 bush. at 25 cts	50	
Parsnips, 1 bush. at 40 cts	40	
Turnips, 1 bush. at 15 cts	15	
Sundries	30	
		20 12
		$636 96
Supplied to Prof. Brown at above rates		87 05
Sold and Cash paid to Bursar		146 62
Turnips delivered to Farm, 1,100 bush. at 6 cts		66 00
Total		$936 63

Inventory—Stock and Implements on hand as per list in Office $1,831 25

Your obedient servant,

JAS. FORSYTH.

PART VIII.

REPORT OF

THE PROFESSOR OF DAIRYING.

GUELPH, 1st February, 1887.

To the Honourable A. M. Ross,
Commissioner of Agriculture.

DEAR SIR,—I have the honour to submit a brief report of work done in connection with the Dairy Department during 1886.

My duties commenced on 1st April. The time consumed attending conventions and general farmers' meetings in the interests of the dairy industry of the Province, left less time for purely college work and experimental investigation than these matters would otherwise have received.

My trip to England, in charge of Ontario's contribution of butter and cheese, to the Colonial and Indian Exhibition—which mission you were good enough to entrust to me—occupied, with its associated duties, quite three and a-half months of the remainder of the year.

The work done outside, in our own Province, as well as that attended to while abroad, was doubtless valuable to the dairy interests of the country, though the results will not be found tabulated in this statement. For the sake of clearness, as well as for service to those seeking information from this report, it is framed into seven parts.

I. Creamery Management.
II. Dairy Investigations.
III. College Lectures.
IV. Outside Instruction and Experiment.
V. Cheese and Butter from Ontario at the Colonial and Indian Exhibition.
VI. The Farming and Dairy System of Denmark.
VII. General Remarks and Conclusions.

I. CREAMERY MANAGEMENT.

Three objects were sought to be attained in all that was done in connection with, at and for the Ontario Creamery and its patrons. I judge the same three-fold purpose to have been the essence of the Government's intention in the erection, equipment and operation of a creamery near the Agricultural College.

(*a*) The Government Creamery should have educational value and be of service in that sense to the whole farming community of the Province. The farmers in districts where none have yet been built and where cheese factories are not established, may learn from its reports what to expect in the way of returns from the creamery business, if introduced into their neighbourhood. Its working has been illustrative of the comparative suitability of the two systems of operation—cream gathering, or milk collecting—to different localities.

A study of the matter to follow will yield some reliable information on the details of methods best suited for the profitable handling of milk, cream and butter in the stages of the process of preparation for the market.

Enterprising farmers in backward sections may be encouraged by the measure of its success, in a neighbourhood where dairying had been neglected for the supposedly more remunerative branches of stock-raising and cattle feeding. The success on its own merits of a creamery near Guelph, is evidence that no district in Ontario which has not already a cheese factory can afford to be without the one or the other.

(*b*) The creamery has been made a school for practical dairy instruction to students. Butter-makers from other creameries may visit it; and all its acquired information is available for the trade.

(*c*) The Government Creamery affords its patrons no special benefit beyond what may be realized from any joint stock or private concern in any part of Ontario. Those who furnish cream are paid for it, at the price realized from sales of the butter manufactured, after all expenses for cream-gathering, management and labour and furnishings, tubs, fuel, ice, etc., etc., have been deducted. These expenses are kept as low as possible and close economy is practiced in all outlays. Notwithstanding that, the rate of expenses per lb. of butter is very high. The cost of cream-gathering depends so much upon the distance to be travelled for the quantity collected, that the number of patrons and cows within a given area largely determine the rate per lb. For the ground covered, the number of patrons and the quantity of cream supplied were unexpectedly and unnecessarily small. This rate of expense is correspondingly high. Such a difficulty will hardly be experienced another year.

The small number of cows kept by each patron and unfavourably dry weather lessened the supply rapidly after July, while the cost for gathering remained at a fixed sum per day.

At a public meeting of the patrons, held before the creamery opened for the season, an advisory committee of five gentlemen from their number was appointed. This committee has been helpful in the satisfactory conducting of the business. Its members have been consulted as to times for selling and prices at which to sell the butter. The committee has by its judicious advice made the task of running the creamery on a sound business basis, much easier of accomplishment. People look for so much more from any Government institution than from a private business concern.

The agreement with the patrons was to the effect that they were each to receive after the end of each month a cash advance on cream supplied at the following rates:—

For May—14c.	per	lb.	of butter yielded.
" June—14c.	"		"
" July—14c.	"		"
" August—14c.	"		"
" September and October	15c. "		"

After paying these prices and providing out of the receipts from sales of butter for all expenses, including $325.00 to the Government for the management and the partial

use of one horse, there is a balance on hand of $601.18, which is still due, and will be distributed to the patrons.

SUMMARY.

Receipts.		*Expenditures.*	
Total value of butter	$10,322.71	Total cash to patrons for cream.	$7,274.97
Total sales of buttermilk and profit from feeding buttermilk	322.63	Cream-gatherers	1,235.16
		Management and labour	750.46
		Furnishings, Marine Insurauce and Incidentals	783.57
		Balance due patrons	601.18
	$10,645.34		$10,645.34

Butter manufactured	50,281	lbs.
Number of gauges of cream received, (4 gauges to each inch; diameter of the can used 8½ inches)	413,210	
Number of gauges of cream per lb. of butter	8.21	
Average price per lb. of butter	20.53	cents.
Number of patrons	152	
Number of days in operation	118	
Seven routes were taken up. Average distance for each round trip, about	22	miles.
Cost of gathering cream	2.45	per lb. of Butter
Cost of management and labour	1.49	"
Cost of furnishings, etc	1.56	"
Total cost for expenses	5.50	"
Receipts from buttermilk account	.64	"
Net cost for manufacturing	4.86	"

I offer a few explanatory remarks on these facts.

The plan followed was that of collecting the cream only. The plain shot gun can, with side glass and measuring gauge divided into quarter inch markings, was used. The cream was gathered only every second day. The quantity of cream was reckoned by the gauges shown before the skimming was commenced.

Every other day's skimming was performed by the patrons, to permit them the use of the skim-milk every day for feeding calves. The average quality of the season's cream was below the standard for butter production. That was mainly due to the too early skimming of the cream.

A commencement was made to test the comparative value of each patron's cream. Samples were regularly and systematically collected by the cream gatherers. These samples were examined by the usual oscillating test-churn; but as all the samples were in various conditions of ripeness, with widely different degrees of acidity, the results were not accurate nor exactly reliable. So impractical, in our case, were the results considered, as a basis for adoption as the paying standard, that they were abandoned after the end of July. There is a very great difference between the fat qualities of some samples of cream. Cream itself bears no unvarying ratio to the quantity of milk from which it is taken. It may be defined as merely a portion of the milk into which the fat globules have been gathered in a comparatively large per cent. Sometimes seven-eighths of the whole butter-fat contained in the milk may be collected into a cream not measuring by bulk more than one-twelfth of the whole volume of the milk, while one-third of the bulk of the same milk might be separated as cream, and then contain exactly seven-eighths of the whole butter-fat of the milk. We are behind, in not having in use an efficient, easily-practicable,

accurate and reliable method of testing cream. Some attention has been paid to the lactoscope. It is valuable in examining sweet creams, but is altogether unsuited to the testing of cream even slightly sour. It is thus ruled out of everyday use in creameries collecting cream every second day. The ether-test has been found expensive and wanting when measured by the needs of the ordinary, or extraordinary, butter-maker. The centrifugal test is unworkable with sour cream.

The oil test churn is apparently the best apparatus so far invented for the purpose. Every creamery should have some method of making such tests; and payments for cream should invariably be made according to *quality* and quantity. The Ontario Creamery can seek no credit for taking the lead in this matter. For the coming summer I hope to see an oil-test churn in steady and satisfactory use.

The butter market has shared in the depression of prices for all farm products. The price realized—rather more than 20½ cents per lb—may be considered rather under than over what might be reasonably expected as the average for the next 5 or 10 years. The butter was sold at four times during the season, as soon as sufficient for economical export shipment was made.

By reason of the unfavourable conditions already mentioned—dry weather, etc.—the advisory committee recommended that the creamery be closed after the end of September; hence the short season—118 days—of operation.

The causes for the to-be-regretted high rates per lb. for cream gathering, etc., have already been discussed.

The receipts from butter-milk account were largely from sales for delivery in Guelph city, for house and bakers' use.

The butter was salted during May, June and part of July, at the rate of 1 oz. of salt per lb of butter. During the remainder of the season, ¾ oz. per lb was used.

A series of tests with different brands of salt—English and Canadian—was undertaken. These will be described under the head of Dairy Investigations.

The butter was packed for the most part in tin-lined tubs. This was done in compliance with the request of the customer in Scotland who purchased the bulk of our make. Satisfactory reports were received from the buyer.

Our butter-maker, Mr. McHardy, is to be commended for his skill and care in the making of the butter, as well as for the interest taken in giving the students practical instruction in the creamery.

The cold storage-room is not large enough. Advantage was taken of the College cellars for storing part of the butter.

The lower the temperature of the room in which butter is kept—if that be above freezing point—the better will the butter keep while there, and the better will it keep when brought into the warmer temperature of the English warehouses. The same conclusion is applicable to its treatment for shipment and during transmit. Therefore, every creamery should have, as part of its buildings, sufficient and suitable cold-storage for its make of butter. College or other convenient cellars are not adjacent to nor available by most creameries.

Before comparing the returns to the average farmer's from the cream supplied to a creamery, with those realised from home butter-making, let me point out a leak entailing serious loss upon those supplying cream who do not make adequate provision for the proper care of their milk for cream separation.

During the month of August, I visited the farms of a large number of the patrons, and by measurement and calculation learned that on the average, 33 lbs. of milk were taken to yield enough cream to make 1 lb. of butter. During the same period by the ordinary 12 and 24 hour setting in ice water, 28 lbs. of milk yielded sufficient cream to make 1 lb. of butter. Had the same milk been used with the centrifugal separator, 26 lbs. of milk would have give as much cream as would have given 1 lb. of butter.

From these figures it follows that by the ordinary and very insufficient care given to the setting and cold-keeping of their milk by patrons, the butter yield was 3.03 lbs. butter per 100 lbs. milk.

By ordinary setting in ice water the yield was 3.57 lbs. butter per 100 lbs. milk.

By use of centrifugal separator, 3.85 lbs. butter per 100 lbs. milk.

From these facts it will be seen that the increased yield of butter from a given quantity of milk, set in ice water, is 17.8 per cent. on the quantity realized by ordinary practice. The increase by the use of the centrifugal separator over ordinary practice would be 27 per cent. The increase by use of centrifugal separator over setting in ice water would be 7.8 per cent. Hence, where cream only is supplied to a creamery, every patron should provide for use a liberal supply of ice.

The larger returns in butter from the centrifugal separators point to an advantage from their use where the increased cost of drawing the whole milk and returning to the farms the skim-milk would not more than equal the value of the increase of butter realised.

As this is a live question for those interested in the starting of new creameries, I state four points for consideration in connection with the facts of circumstance in every locality.

(1) Proportion of cream separation that may be effected.
(2) Effect of the process on the quality and condition of the cream.
(3) Effect of the process on the quality of the skim-milk.
(4) Costs.

In connection with (1) the above stated ratio of separation may be taken as reliable.

(2) Where cream has to be carried a number of miles during hot weather its condition and quality are not as good for butter-making as where the separation is effected at the creamery.

(3) For profitable calf feeding the skim-milk must be sweet. Both processes, when well managed leave it at the farm in that condition.

(4) Under the head of "Costs" are to be compared; cost of machines and pails; cost of maintenance; expense of operation against increased cost for collecting milk over cream; saving in expense and labour in setting and caring for the milk at the farm.

The foregoing information should enable those interested to intelligently decide for themselves which plan to adopt. This general guiding conclusion may be added, where a small quantity of milk is available, and then only by collecting from long distances; the setting plan would be more economical; but where a large supply of milk may be obtained within a small area, the centrifugal plan will be most profitable.

In pointing out the advantage to the farmers of the creamery system of butter-making over the plan of home butter-making, I have little to say about the character and reputation of the average Canadian dairy butter. As many farmers' wives aver—and of course the farmers peacefully agree—it may be just as good or better than creamery butter when it leaves the churn, but the awkward and unfortunate fact still remains, that whereas the average price of creamery butter in Ontario during '86 would be about 20 cents per lb., the average price for dairy butter, made during the same months, was only 13 cents per lb.

In each neighbourhood of, say, ten miles square, over 300 farmers might as well be supporting a creamery at some central point, or two creameries at convenient centres, with the milk of 1,800 cows. If each cow yielded, during the summer, enough milk to make only 100 lbs. of butter (and with proper feeding and care during winter, spring, summer and fall, they would give at least 150 lbs.), the product from these 1,800 cows would bring just *$12,600* of *more money* into the neighbourhood through the creamery, than by the ordinary home methods of making and marketing. Every farmer would get his own share of the increased returns and his family would be spared the taxing work of butter-making during the hot summer months. Then the extra attention paid to dairying would result in the cows being better and more economically fed; more milk would be produced at less cost; the coarse grains would be mostly consumed on the farms; increased fertility of the fields would follow; the better condition of the skim-milk would make possible the rearing of more stock with more profit. How that may

best be done will be discussed under heads II. and VI. of this report. The destiny of profitable farming in Ontario will be found along the line of careful, economical and progressive dairying, and the sooner Canadians recognize the fact and shape their plans and course accordingly, the sooner will there be no occasion for complaint of "hard times."

II. DAIRY INVESTIGATIONS.

That the results of enquiry, observation, investigation, experiment and study may have the largest practical value, these should be carried on and out according to a systematic plan. The student in every line of science and practice will occasionally stumble into acquaintance with an unexpected fact, the knowledge of which will be serviceable. But in a field where so many painstaking scientists have ploughed and searched so long and thoroughly as that of dairy science it was not to be expected that one season's working would turn up much absolutely new. The plan laid down for guidance here during 1886 was made for the purpose of making accessible and acceptable to the general farmer such information, as would enable him to put into immediate and profitable practice better methods of managing the cows he already owns, the fields he presently tills for their feed, the milk he handles, the calves he tries to rear and the hogs he feeds on the products of his dairy. One summer's trial would be but a very inadequate experience from which alone to draw conclusions for the guidance of Ontario farmers. Hence I have not hesitated to supplement the information gained this season, by that formerly acquired by years of practice in dairy work, as well as by that available from the investigations of other reliable dairymen before framing any conclusions for publication. Four divisions will be made for the sake of plainness.

I. The management and feeding of milking cows.
II. The handling of milk.
III. The rearing of calves.
IV. The disposal of the by-products by hog feeding.

The Management and Feeding of Milking Cows.

Twelve ordinary cows such as might be obtained from almost any six farms in the Province were purchased. They were bought in the open fair. In passing I cannot suppress the thought that the fair is still too often used as a dumping place on which to weed out the poor milkers merely to have them transplanted to some other farm. Let every dairyman weed out his poor unprofitable milkers by fattening for the butcher and not by selling into another herd. The perpetuation of every kind of farm weed is a practice from which, all round, we are happily becoming free. In selecting a cow for milking purposes, a careful observation of certain "points" will guide the buyer in making a good choice. Where a reliable record of the animal's past performance may be examined, it is of unquestionable use in estimating her milk-producing value. Descent from stock with creditable records is of much worth. But so much depends upon the individuality of the animal that the values just mentioned can best be rated in conjunction with their apparent evidences in her body.

When buying cows on a fair ground the animals have to be taken for what they are worth by appearance. There are some general characteristics peculiar to all animals of individual merit in all the milking breeds; a course, rough bullish appearance is *not* one of these. Size is a matter of secondary consequence. Temperament is a matter of prime importance. Cattle as well as horses may be classified in temperament as nervous or lymphatic.

The "nervous" in the cow is indicative of good milking power; in the horse it is associated with speed and action. The "lymphatic" in the cow means a tendency to lay on beef; in the horse it stays with draught and heavy weight.

Milk and butter are essentially the products of nervous force. Hence a good milker should have abundant nerve power. That does not necessarily imply nervousness. Her organs are to be considered merely as so much nervous machinery for the accomplishment of a given end. The purpose of her life is to make the largest possible quantity of the best milk out of the least possible consumption of food. That faculty will generally reveal itself ih what are called the "points" of the animal. Specifically these might be described in the following order, which begins with the head and follows around the outline of the animal's body as viewe dfrom the side. The ideal cow should have a broad forehead, a wide poll. The *seat* of nervous power is in the brain and the room for that organ should be ample. Her eyes should be prominent, bright, and mild looking. All the better is the indication if they stand out so well as to give the face a dished shape—the hollow up and down the face. Such eyes promise nerve power if their owner be well used. A broad muzzle is a good point. Fairly large and open nostrils should be looked for; but a cow with constantly gaping nostrils is a little too expensive to keep. The face should be rather long, lean, and clean cut. An instructive model for comparison is the face of the blood horse. Waxy smooth horns and fine ears usually accompany the delicately yet strongly-strung nervous organization we seek. The head will be small in proportion to the weight of the body and tapering in fine lines. The neck should reveal a strong jointure between the backbone (containing the spinal cord) and the skull. There is a large nervous connection from the spine to the uterus and the udder. A fine tapering neck, with no superfluous flesh, is a desirable point. The top of the shoulder had better be sharp than broad. In a young cow a hollow back is often indicative of weakness. A slightly arched or straight back is preferable. The loin should be wide, flat and thin. The pelvis—the boney frame-work whereby the hind legs are attached to the backbone for locomotion—should be broad, large and somewhat arched. A hollow pelvis is the omen of danger from milk-fever or an early breakdown. The ham will be in-sloping and in-hollowing, leaving lots of udder-room. The shape is merely indicative of the tendency of the animal. The pitch or symmetry of the udder's shape may be ignore except in the case of a "fancy" animal. The surface extent of the udder's attachment to the body is all important. It is generally a measure of the arterial and nervous activity in the milk-secreting glands. Taking a side view of a cow in full milk, the line of connection or the line of absorption will be the direct measure between the upper and lower points of attachment between the udder and the body. The longer that line is the better is that "point." A fleshy udder is not wanted. The milk veins are mostly in size and prominence proportionate to the flow of venous blood from the udder, consequently the larger the better. Good barrel room is required to hold and permit of the proper digestion of abundance of suitable feed. In such a cow the energy of digestion is allied to the energy of milk secretion. The chest should be deep, leaving full play for the heart and lungs,—these vital organs for blood-circulation and purification. Good blood promotes the activity and energy of the nervous system and thus stimulates the secretion of milk. Many other "points" might be mentioned, some of them important, such as a soft, mellow skin, fine silky hair, etc., but enough has been written to help the ordinary farmer in the selection of a good milker. The form of a good milking cow might be briefly described as tending to the wedge-shape from three points of view: as looked at from the front, rather sharp on the top of the shoulder and widening to the chest; as looked at from behind, along the back, broad and wide across the pelvis and narrowing towards the shoulder; as seen from the side, deep from the back to the lower line of the udder and lighter in the forequarters.

When the twelve ordinary cows were bought, as many of these points as possible were sought for in each one. They were, with one exception, in poor condition as to flesh. The eleven had calved within a fortnight prior to the 24th of May. From the 25th May till July 7th, they each received 4 lbs. of wheat bran per day, besides the fair grass of a common pasture field, part of which was still bush. During that period, the average milk yield per day was 34½ lbs. per head. They were milked regularly between the hours of five and six o'clock in the morning and evening, in a stable. They had free

access to pure water and salt. From July 8th to July 20th, each cow received 2 lbs. of bran in the morning and a feed of fresh cut oats and vetches in the evening. By this time the grass had become comparatively bare and dry. The average yield per day during these thirteen days was 28 ibs. per head. These returns were not at all surprisingly large, but taking into account the poor body condition of the cows, they show what may be expected from ordinary Canadian cows when kindly cared for, regularly milked and supplied with the most economic feed. The supplying of bran as a supplementary feed, when the early grass is rank and watery, and when the pastures fail from drought, is a profitable plan for increasing the milk yield. It most satisfactorily takes the place of supplementary green feed, and saves the troublesome and expensive work of handling so much weight. The cost involved in the labour of partial soiling in early summer and autumn is the only objection to undertaking it and recommending its general adoption throughout Ontario.

On July 21st the cows were divided into three groups. No further bran was allowed. Group No. 1 had no feed besides the grass on the pasture field. Groups Nos. 2 and 3 received a feed of green oats and vetches just before milking, morning and evening. The first result apparent was an immediate loss in the weight of milk from group No. 1, equal to 16 per cent., and from groups 2 and 3 of 7 per cent. The feeding was continued in the same way till July 30. The average loss in weight of milk from the average of the previous eight days was—

Group No. 1 (no extra green feed) ..... 16.6 per cent. loss.
Group Nos. 2 and 3 (extra green feed)..... 12.2 " "

From July 31 to August 7, groups Nos. 1 and 3 received a supply of the same formerly mentioned kind of green feed, while the cows of group 2 had only pasture with the others.

Group No. 1 showed an immediate gain of 9.7 per cent. by weight.
" " 2 no appreciable change "
" " 3 " " "

On the period of eight days,

Group No. 1 showed an average gain of 9.3 per cent. by weight.
" " 2 no appreciable change "
" " 3 " " "

From August 8th to August 15, groups Nos. 2 and 3 received a supply of the same kind of supplementary green feed, while the cows of group No. 1 had only pasture with the others.

Group No. 1 showed an immediate loss of 14.3 per cent. by weight.
" " 2 " " gain of 14. " "
" " 3 " no apparent change.

On the period of eight days,

Group No. 1 showed an average loss of 3 per cent. by weight.
" " 2 " " gain of 4.4 " "
" " 3 " no appreciable difference "

After August 16th, all the cows were fed green corn stalks twice per day.

The conclusion has been drawn from other data, and with it the foregoing figures agree that a frequent change of feed during summer, even a change of pasture fields, will largely increase the flow of milk.

The extra yield of milk, from feeding supplementary green feed, will largely pay for the extra cost at the time, but the keeping of the herd up to a full flow while the pastures are bare, will enable them to give a much larger yield when feed is abundant on the stubble fields and aftermath.

The changes of feed had some uniform influence on the quality of the milk for butter-making. There was no perceptible difference in the milk to the taste or smell. The milk (from each group) was accurately weighed, set in deep setting pails, in ice water, at an average temperature of 86° Fahr. It was cooled to an average temperature of 40° Fahr. The skimming was performed after the lapse of about twenty-two hours. The cream was ripened and soured in the usual way, and after each churning the weight of salted butter (1 oz. salt per lb. of butter) was recorded. Over thirty analyses were made, and the following table shows the differences attributable to the use or absence of supplementary green feed :

	Lbs. of milk per lb. of Butter.	Lbs. of milk per inch of cream in a can 8½ in. diam.	Lbs. of butter per 100 lbs. milk.	Per cent. of fat in Skim milk.	Per cent. of fat in Buttermilk.	Per cent. of other solids in Skim milk.	Per cent. of other solids in Butter-milk.
Average results from milk when no supplementary green feed was supplied.	26.34	12.79	3.82	.514	.996	8.91	7.14
Average results from milk from same cows, during same total period, when green feed was supplied as before described..	25.47	12.61	3.95	.506	.748	8.84	7.75

It will be seen that while there is hardly any chemical difference in the composition of the whole milk (butter, fat and solids in skim-milk and buttermilk) from the two treatments of cows, there is an appreciable commercial difference in the readiness with which, under similar treatments of milk, the green feed milk yields its fat to the butter-maker. The supposition that when cows were given an extra supply of succulent feed, and gave a larger quantity of milk, that it was therefore poorer in quality as to per cent. of solids, has no foundation in fact. The larger the quantity of milk a cow can be made to give on suitable feed, the more the milk is worth per 100 lbs. When just made the butter from both qualities of milk seemed equally good. It is being kept to note the effects of age on its keeping properties.

For many years it has been recognised by observant and thoughtful dairymen that when milking cows were denied access to salt, the quantity and quality of the milk yield was at once affected. A little investigation, more to define into accuracy the facts known than to bring to light any new ideas, was undertaken with eleven of the cows already mentioned. Until August 15th these cows had access to salt at will in their pasture-fields. Then all salt was removed from places within their reach. Small boxes were procured for attachment to the mangers of the stable in which the cows were tied twice a day for milking. The cows were divided into four groups. Groups 1 and 2 (five cows) received no salt. In the boxes before the six cows of groups 3 and 4 a supply of common barrel salt was placed. No change was made for twelve days. Then salt was placed before the three animals of group No. 1, and still continued the three animals group No. 4. No salt was allowed to groups Nos. 2 and 3. This treatment was continued for a like period. The cows of group No. 4 could take as much salt as they liked twice a day during both periods. In every other respect all the cows received similar treatment. The feed was pasture as before mentioned, supplemented now by a feed of green corn fodder twice a day.

The following are the results from the observations and record : The average immediate loss (taking a period of two days after each change) was 17½ per cent. in the weight of the milk yield when salt was withheld. The average total loss in the weight of milk yield from the eight cows of groups No. 1, 2 and 3, which were insufficiently or irregularly salted, was 14½ per cent. for the whole period. There was no loss in the

weight of the milk yielded from cows of group No. 4, which had access to salt daily during the same period.

It was required that I should leave for England before the experiment was nearly completed. Still, I am safe in drawing the conclusion that the irregular and insufficient salting of cows is a cause which lessens their production of milk. Just *how* the cause brings about the result I do not yet know.

The quality of the milk as to its constituents and condition was examined. Cans of milk from the cows taking salt, and from those from which salt had been withheld, were placed under like conditions. The milk was set as usual for cream. Then after twenty-four hours it was exposed to the ordinary temperature of the room, about 65° Fahr. The milk from the cows not receiving salt was perceptibly sour to the taste and smell 24 hours sooner than that from cows taking salt. Moreover, an easily distinguishable difference in the flavor and "fullness" to the taste in favor of she salt-used samples was at once detected by all to whom the comparison was submitted. The conclusion drawn is, that the irregular or insufficient salting of cows leaves their milk not so easily kept sweet for supplying to cheese factories. The further examination and analysis of the milk was prevented by my absence at the Colonial and Indian Exhibition.

For butter making the observed result may be seen in the following table. The milk was set as formerly at an average of 86° Fahr, and cooled to under 42° Fahr. Both kinds were treated alike as to daily temperature and time set.

	Lbs. of milk per lb. of butter.	Lbs. of milk per inch of cream in can 8½ in. diam.	Lbs. of butter per 100 lbs. of milk.
Average results from milk when cows had access to salt regularly	29.67	14.58	3.37
Average results from milk when cows had no access to salt for periods of 12 days	30.7	14.48	3.26

The cows having a continuous supply of salt consumed on the average one-quarter pound per head per day. The exposure of rock salt to milking cows is evidently not sufficient. The cow's palate may be readily satisfied before she has licked off enough for her systems' needs. The cows from which salt had been withheld for twelve days were too greedy for it when supplied. They each licked enough to make their milk taste salty. The preferable plan, and one which leaves forgetfulness less wasteful, is to have a protected trough or salt-box from which the animals may help themselves as disposed.

An abundant supply of water—and pure water only—should be where milking cows may drink freely twice or three times a day.

Milk is so much the product of nervous operation that any undue excitement, no matter how induced, lessens the milk supply and injures its quality. The kind and gentle treatment of his cows by the sensible dairyman is one source of his profit.

The average yield of the eleven cows that milked during the whole period was 3,264 pounds of milk per head in 117 days, notwithstanding the changeful usage already referred to. Were the present herds of milking cows in Ontario but properly stabled and fed and watered and salted and handled, there would be an immediate increase of not less than 25 per cent. in their milk returns, and that at no extra cost to their owners.

The Handling of Milk.

The subjoined bulletin was issued early in the season:—

Agricultural College—Bulletin II.

Points for the attention of the patrons of cheese factories and creameries:

The business of dairying when intelligently and carefully followed insures to the farmer a safe and steady income. The Province of Ontario is favored with all the natural

advantage needed for the production of cheese and butter of the finest quality; and as the permanent success of the dairy industry depends upon the quality of the product, every dairy farmer is or should be interested in its improvement. To help in that direction is the purpose of this bulletin. In producing and supplying milk to cheese factories and creameries the following points require attention in order that the best results may be obtained.

General Rules.

1. Milk from healthy cows only should be used, and not until at least four days after calving.

2. Any harsh treatment that excites the cow lessens the quantity and injures the quality of her yield.

3. Cows should be allowed an abundant supply of wholesome, suitable food, and as much pure water as they will drink.

4. A supply of salt should be placed where cows have access to it *every day*.

5. Cows should not be permitted to drink stagnant, impure water, nor to eat cleanings from horse stables, leeks, turnip tops, or anything that would give the milk an offensive taint.

6. All milk vessels should be thoroughly cleansed; first being well washed, then scalded with boiling water, and afterwards sufficiently aired to keep them perfectly sweet.

7. Cows should be milked with dry hands, and *only after* the udders have been washed or well brushed.

8. Milking should be done and milk should be kept only where the surrounding air is pure and free from all objectionable and tainting odors. Milking in a foul smelling stable or yard imparts to milk an injurious taint. Sour whey should never be fed, nor should hogs be kept in a milking yard nor near a milk stand.

9. Tin pails only should be used.

10. All milk should be properly strained immediately after milking, and for that purpose a detached strainer is preferable to a strainer-pail.

For Cheese Factories.

11. In preparing milk for delivery to a cheese factory it should, immediately after straining, be *thoroughly aired* by pouring, dipping, or stirring. This treatment is as beneficial for the morning's milk as for the evening's, and is even more necessary when the weather is cool than when it is warm.

12. In warm weather all milk should be *cooled* after it has been aired, but not before.

13. Milk kept over night in small quantities—say in tin pails—will be in better condition than if kept in larger quantity in one vessel.

14. When both messes of milk are conveyed to the factory in one can, the mixing of the morning with the evening's milk should be delayed till the milk-waggon reaches the stand.

15. While the milk is warmer than the surrounding air it should be left uncovered, but when colder it may with advantage be covered.

16. Milk-pails and cans should be protected from the rain, and milk-stands should be constructed to shade the cans from the sun.

17. Only honest milk with its full cream and full share of strippings should be offered; violation of this requirement leaves the patron liable to a heavy penalty.

For Creameries.

18. In preparing milk for delivery once a day to a creamery where the whole milk is received, the treatment should be similar to that recommended for cheese factories.

19. For creameries receiving cream only, the milk should be well aired but not cooled before setting.

20. Milk should be set for the separation of the cream where no impure air will reach it.

21. Cream rises best with a falling temperature, and the separation of cream from milk is promoted by cooling, after setting, to at least 40°.

For Butter-Making at Farm Dairies.

22. When the cream is used for butter-making at the farm the foregoing treatments and conditions may be observed with profit.

23. Good ventilation for a milk-house, milk-cellar or dairy-room, is most essential, and may be provided for by leading an air-drain underground, for say 200 feet. Through it a supply of pure, fresh, cool air may be admitted. The foul or warm air may be allowed to escape through ventilators or windows in or near the ceiling.

24. Cream should invariably be removed from the milk before the milk is sour.

25. The cream for each churning should be gathered into and kept in one vessel.

26. The whole of the cream should be well stirred every time fresh cream is added.

27. In summer cream should not be left longer than three days before churning.

28. The best churning temperatures are between 57° and 60° during the summer, and between 60° and 64° during the winter.

29. Butter can be more thoroughly washed free from butter-milk while in the granular condition than after it is gathered or pressed into a roll.

30. Only the best pure salt of medium and uniform fineness of grain should be used, and from three-quarters to one ounce of salt per pound of butter will be found satisfactory for the summer.

31. The utmost cleanliness in milking, in vessels, in utensils, and in all surroundings must be observed to preserve the flavor and body of milk, cream, butter and cheese from contamination.

A Dairy Class.

A desire has been expressed for the formation of a Dairy Class, to be trained in butter-making at the Ontario Creamery during the forenoons, and to receive general instructions in dairying in the lecture-room during the afternoon. September would be the most suitable month. Farmers' sons and daughters and others proposing to attend will please address the Dairy Department, O. A. C., Guelph. No fee will be charged. Let applicants write soon.

Enquiries on matters pertaining to the dairy industry of the province, addressed to the undersigned at the Dairy Department, Ontario Agricultural College, Guelph, will receive attention.

JAS. W. ROBERTSON.

Later researches during the summer have but confirmed the correctness of each of the thirty-one points mentioned. To elaborate each paragraph would fill the pages of a large volume. Some examination was made of the temperature conditions most suitable for cream-raising. These have been partly presented and discussed under the head of Creamery Management. It was found that practically as full a separation of cream was effected by setting at any temperature between 85° and 98° Fahr., and then causing the temperature to fall to 40°, as by setting at 98°, and then causing the temperature to fall to the same point.

Samples of cream were churned at six different degrees of ripeness or sourness. The butter-milk was analyzed to discover the comparative effectiveness of the churning operation.

The following table shows the average per cent. of fat left in the butter-milk from cream in different stages of maturity. No. 1 represents the average from creams churned sweet, and No. 6 the average from creams churned quite sour. The degree of ripeness or perceptible acidity was gradual from No. 1 (sweet) onward to No. 6 (sour) :—

	Per cent. of fat left in Butter-milk.
No. 1.....	
2.....	5.255
3.....	3.101
4.....	3.344
5.....	2.542
6.....	1.019
.....	.739

These per centages of fat left in the butter-milk prove nothing absolute about the quantity of fat necessarily left in butter-milk.

The effectiveness of the process depends so much upon the construction, the motion, and the speed of the churn. But as the churning treatment in all these cases was similar, the varying percentages of fat left in the butter-milk were solely due to the condition of the cream.

Sour cream will yield its butter, by churning, in less time than sweet cream, other conditions being alike.

Besides the instructive fact, apparent on the face of the table, this may be learned : The mixing of creams of different ages and acidity together, just before churning, makes large loss of the butter-fat in the butter-milk unavoidable.

To points 25, 26, and 27 of the Bulletin, this may be added : The best method of preparing cream for churning is to have the whole cream kept cool and sweet till about twenty-four hours before the churning. Then add to it about two per cent. by bulk of cream that has been raised, exposed to pure air, and afterwards kept as warm as 70° Fahr., to promote souring. The best kind of fermentation, resulting in sourness, is thus induced, and all bitterness in flavour and loss of fat are avoided.

A series of tests, to throw light upon the comparative values of the Canadian and English brands of dairy salt in butter-making, was undertaken.

Some forty-five tubs, salted from 1 oz. per pound to ½ oz. per pound, are still on hand.

The matter of salting butter and the salt interests involved, are so important that this Department looks for the assistance of a committee of experts from the Creamery Association of Ontario, in judging of the present qualities of the butter, after having been kept for five months. A bulletin will be issued, stating the conclusions reached after such judging has been completed. Meanwhile a general standard, whereby to select a salt for butter-making, may be presented :

1st. The salt should be pure and clean.

2nd. It should be easily dissolved and not hard in the crystal from roasting.

3rd. It should be of medium fineness, and nearly uniform in the quality and size of its grains. If it be pure in composition, a salt with a velvety body to the touch is well suited for use in butter.

The addition of coarse, hard salt to butter not only injures its grain in the working, but remaining undissolved, is easily recognized by the *touch* of the butter trier, or tongue, as well as the *taste*. When such is the case the value is very much lessened, especially in the British market.

The Rearing of Calves.

Eight calves were reared on skim milk and supplementary feed after they were a fortnight old. They were sold for further rearing to a neighbouring farmer. The value

realized for the skim milk was slightly under two and three-quarter cents per gallon. That need not be accepted as applicable to all calf-feeding. According to conditions of stock and market, it may be more or less. This much is assured: fine, thrifty, healthy, and large calves can be reared without whole milk after they are two weeks old.

Following the style of communicating information already adopted in this Report, permit me to gather into a chapter of instruction and advice the knowledge on this subject, gleaned from experience during the past and previous years:—

The "heredity" and "individuality" of the farmer have more to do with the successful raising of profitable milking cows for his dairy, or steers for his stalls, than the "pedigree" of his herd.

Breed and blood are of much service to the stock-raiser. So are a good steam boiler and engine to the grain thresher. What fuel and oil are to the latter, feed and care are to the former. A good thresher with good fuel and skill, will get more efficient work out of a poor boiler and second rate engine than a shiftless, careless engineer will get out of the best machinery.

As a rule there is no profit in trying to raise the late calves. In any case the calves from the best milking cows only should be selected for rearing. The herd bull should have a pedigree linking him to a family distinguished for milking qualities. If a calf with a big body at one, two, three, or six months old be what is wanted, it had better be allowed to suck its dam. But if a calf, leaving a large profit on its rearing at two years old, and a large profit on its milking, or fattening be the object sought for, then it should be reared the other way. Where the calf is allowed to suck the cow, for even a few days, the cow is in a less contented condition of nerve to yield her milk to the hand for some weeks. The restlessness thus caused will tend to the lessening of the milk yield in most cases. The task of teaching the calf to drink is doubly difficult after it has acquired the habit of getting its supply in the natural way. Invariably where a calf has been permitted to run with its mother for ten days, I have found it to go back, or at least fail to gain in condition for a fortnight or more, when a change was made to hand feeding. The checking of its growth and thrift at that early stage in its development, entails more loss of possible profit in after years than a partial winter's starvation when eighteen months old. The organs of digestion, whose function it is to get for the animal all possible good out of its food, for maintenance, growth, beef, milk, or work, can never be injured with impunity. The treatment from the day of birth should be to preserve and, if possible, improve the assimilating power. Milk from the first six milkings of the mother should be fed to her calf three times a day. The first milk, "colostrum" or "beastings," is of medicinal as well as food value to the young calf. For two weeks the calf will not need nor take much besides the two or three quarts of whole milk of each feed. The milk should be fed as near the blood temperature, 98° Fahr., as practicable. After the lapse of a fortnight a gradual change, during the third week, may be made from whole milk to sweet skim milk. Such a change can be best effected by putting skim milk in gradually increasing quantity with the whole milk till it is wholly substituted for it. The skim milk should always be fed *sweet*. The sourness of milk is evidence that some of the feeding value of its large per cent. of sugar of milk has been lost by the change into acid. Besides, the sourness renders the food unsuited to the stomach of a yet tender calf. Sour feed in such a case favours growth in but two ways. The calf so fed will develop marvellous girth extension. "Pot-bellied" is hardly sufficiently expressive of the chronic enlargement from that cause. Then the growth of hair is effectually and speedily promoted. It becomes so strong in "stalk" that it stands out in daily protestation against that kind of feed. The skim milk should also be fed warm. The blood heat is the best. Where no better convenience exists for the heating of the milk, hot water may be added with advantage. A feed of ice-cold milk, such as comes from the deep setting cans—by the use of which fine dairy butter can be most economically made—will leave the calf uncomfortable. That is but the evidence that indigestion exists. It may easily be made partially permanent by a continuation of such injurious treatment. The power and practice of digesting and appropriating all that is possible out of its feed should be encouraged into a fixed habit, by giving the young animal only suitable feed in the best condition of

preparation. These points about the feeding of skim milk will apply to young pigs as well as calves. A gutty, thriftless hog is the necessary product of a careless and wasteful mode of feeding even excellent skim milk.

To make up for the fat taken out of the milk in the shape of cream, some supplementary feed should be given with the skim milk: Linseed, oil-cake, bran, oats and peas are all good. Bran is frequently mixed with chopped oats and peas, and fed raw in the milk. That practice is most objectionable, and frequently results in the loss of the full value of the grain fed, besides inflicting injury upon the calf by scouring. The better plan is to put the bran and chopped oats and peas, with linseed in a dry state, into a box conveniently placed within reach of the calf. Between the ages of one and three weeks most calves will begin to eat the mixture. The chewing necessary to a comfortable swallowing fits the feed for proper digestion, and prevents all risk of scouring from that cause. The chewing also favours the free flow in the mouth of a good deal of saliva, needed to thoroughly digest the milk gulped down so hurriedly from the feeding pail. Linseed and oil-cake may be boiled, or well scalded, and mixed in a syrupy state with the milk. Such preparation means time and trouble. Equally good results follow from the feeding of both, in the raw and dry state with the mixture of bran and chop. They should first have been ground very fine. The composition of the additional feed should be about equal parts by bulk of bran, oat, and pea chop, with a teacupful of ground linseed to each quart of the mixture. No fixed quantity per head for feeding need be mentioned. It has been found desirable to allow the calves to take as much as they care to eat. Handfuls of the best hay—and all hay for fodder should be cut on the green side—may be offered, and most calves will eat with relish at a month old. As soon as grass can be got it should be given in liberal quantity.

Opinions differ as to the relative advantages of keeping calves in the stable all summer and allowing them the run of a small pasture field. A grass plot with no shade from the sun, and where flies are numerous and diligent, is not the best place for calves. But if the calves be kept in a dark cool stable during the hot days of "fly time," and turned out for the evening and nights, the protection of the soiling system will be coupled with the benefits of exercise and feed outside. Some farmers report very satisfactory results from adding pulped turnips to the forementioned grain mixture from the time the calves are three weeks old. No matter where fed—in the stable or out—each calf should receive only its own allowance of milk. The distension of stomach by overfeeding is very harmful. The old-fashioned implements for the feeding of six calves in the field, being but three buckets and one big stick, had better be exchanged for more sensible and economical conveniences. Outside feeding from a trough is unsatisfactory, as the big and greedy calves get more than their share, while the weaker ones get barely enough. The construction of small stalls for the calves against a fence in the plot will make it easy to give every calf its own share in its own pail, and successfully avoid the respective risks of gorging and starving.

Calves reared in this way will gain in size and strength of constitution all spring and summer and autumn. When the severe weather of late fall and winter comes, it finds these calves accustomed to live mainly on grass and dry chop feed, so that the change to stable and winter conditions of existence is not very trying. The best conditions for profitable growth having been supplied by the intelligence of the owner, the inherited good qualities of the calf will get fair play. But if good qualities of breed inherited from the best of stock be baulked at the beginning by unsuitable conditions for growth and thrift, all chance of after-profit from milk or fattening is gone. The profits of dairymen are to be largely augmented by proper attention to the early feeding of early calves. Such stock-raising will foster the export trade of fat cattle, and enable farmers more numerously and satisfactorily to patronise either a cheese factory or creamery.

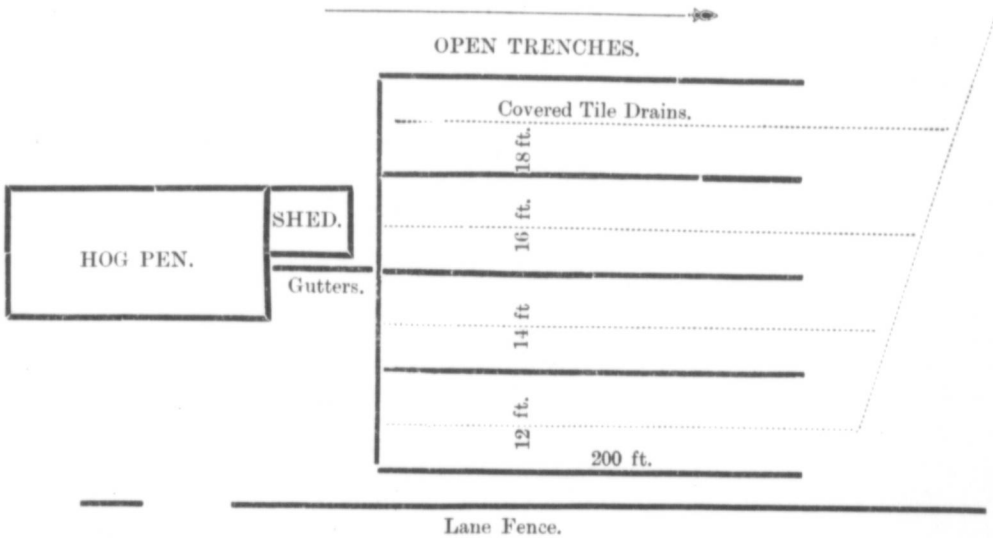
The Disposal of By-Products by Hog Feeding.

The feeding of a large number of hogs near a cheese-factory or creamery has for some time been recognized as a nuisance to those living in the vicinity; a nuisance to the health of the population, and a source of trouble to the factory operators. All this is so because

at most places no adequate provision has been made for the disposal of the refuse from the pens. A hog-pen was constructed on the Experimental Farm in June, for the purpose of testing the adaptability of a system of draining and filtrating such refuse, rather than to gauge the gallon-value of butter milk or skim milk for pork production. The site for such a building should, if possible, be chosen near a piece of land with a gentle slope. The building was so planned and erected as (1) to most conveniently meet the needs of the hogs for fattening; (2) to prevent the escape, except by the gutters, of any liquid manure; (3) to be economical in cost.

The inclination of both floors toward the centre of the building permits of the hogs lying on dry floors all the time. This is important for thrift. The cleaning out is easy of accomplishment, and the disagreeable smells are reduced to a minimum. From the gutters the liquid refuse passed into a cross head, open trench about one foot deep. From it were made five lateral trenches running down the slope. A 12 foot distance was placed between the first two, then 14 feet to the next one, 16 feet to the next, and 18 feet to the last. Between these lateral trenches, and running parallel with them were dug four drains 2 feet 6 inches deep. These were laid with 2½ inch tiles and filled up. The liquid refuse was diverted by turns into the trenches and, by a plan combining irrigation and downward filtration, passed off into the tile drains. The method worked well during the past summer. The soil between the trenches was cultivated and sown with rape, as the season was rather advanced before the drain-making was finished. The solid refuse was treated with dry earth in a shed at the end of the pens. Another year's experience may reveal some weakness or defect in the method described, but so far I am led to hope that it will prove effective in abating all objectionable and dangerous smells from cheese factory, creamery, or hog-pen refuse.

A sketch of positions may make the description more fully understood by all interested.



Fifty hogs were fed in the experiment.

III.—COLLEGE LECTURES.

Lectures on Dairying were delivered to the students of both years during the Spring term. Further instruction in practical butter-making was given to some eight students during parts of the Summer term.

A short course of lectures during the Winter term for the special benefit of practical cheese and butter makers would doubtless prove a popular and valuable provision for

those engaged in these increasingly important industries. The enterprising and energetic young men in both of these businesses would carry back into their own districts added knowledge and skill that would effectually tell for the profit of their patrons. A fortnight or three weeks would suffice, and I am confident such an opportunity would be appreciated and taken advantage of by many of our oldest as well as youngest dairymen. Discussions could be encouraged after each lecture, and much valuable information to be thus elicited could not so fully be made available in any other way.

IV.—OUTSIDE INSTRUCTION AND EXPERIMENT.

The suggestion and recommendation in the preceding Part will not be taken to imply an undervaluing of the superior uses of practical instruction and demonstration at the factories during their working season.

By request of the Dairymen's Association of Western Ontario, a number of cheese factories were visited during the summer. The cheese-makers from neighbouring factories were invited to meet at central ones. The best methods of handling the milk, etc., in all stages of the process of manufacture were illustrated in practice, and the scientific reasons for such treatments were explained.

A number of creameries were visited for a like purpose. Reports credit these visits with beneficial results.

There is need for organized Provincial supervision, including systematic instruction by competent men at the various factories, of the whole cheese factory and creamery systems of Ontario. One man's time is not at all equal to a task at which seven good workers could be fully occupied, with much benefit to the industry and gain to the country.

No experiments in cheese-making were practicable at the creamery. The only milk available was that from the twelve cows mentioned in Part II. To meet the need, the Dairymen's Association of Western Ontario voted a sum of $300 to purchase milk at a cheese factory for experimental work.

Milk was obtained at the Brussels cheese factory, and a quantity of cheese was made there. Different lines of investigation were followed in connection therewith. A careful test was made to determine the comparative merits of the various brands of Canadian and English salt for cheese-making use. The results on the whole, taking into account the qualities of the cheese at five weeks and five months old, were decidedly in favour of the Canadian salt. A full statement of the experiments and conclusions will be found in the "Report of the Proceedings of the Convention of the Dairymen's Association held at Ingersoll, January, 1887." The cheese, of course, became the property of the Association.

The want of a salt for butter-making, that would meet the needs of the creamerymen all round, both as to quality and price, was recognized. The essential points of quality have already been stated. At my request a sample of salt was prepared for this Department in the following simple way. Brine—practically pure—was evaporated rapidly. The rapid evaporation induced the formation of much thinner flakes of salt-crystals than when a less intense heat was applied. The bulk of salt from these thin crystals was dried by exposure to the air, and not by roasting. It just met the case for butter-making. It was practically pure. It dissolved easily. The grains were fairly uniform in size. It had no sharp-edged, roasted crystals that might have escaped the grinder. It was velvety to the touch. Canadian salt manufacturers are losing a valuable customer while they neglect to meet the wants of the Canadian dairyman with such a salt, put up specially for butter-making.

V.—OUR CHEESE AND BUTTER AT THE COLONIAL EXHIBITION.

The holding of Industrial Exhibitions in the different parts of the world, and their development and extension have been at least contemporaneous with marked progress in the arts and industries therein represented. The stimulus given to trade, from the prospect of the unexpected competition in all branches of commerce, which a largely patronized exhibition always reveals, must have had some influence on that progress. There is the incidental inducement to the visitors to become purchasers, then or afterward, by seeing a varied and novel collection of goods. There follows the enquiry by the private citizens from their merchant suppliers as to where and how certain goods, seen at the Exhibition, can be purchased. Thousands of permanent customers are thus obtained for all classes of goods. Then from visiting such places, the shopkeepers and merchants conclude that they may, with advantage, add some new articles or features to their business in their own towns, all of which means more customers. Besides, there is the best kind of commercial education offered to all contributors by the displays of their competitors.

The aim of those who proposed and promoted this great Colonial and Indian Exhibition in London was to bring together evidences of the resources, products, and manufactures of the several colonies and dependencies for the promotion of the commerce of the Empire. There was no intention of making the Exhibition a competitive one, by giving awards of juries as to the particular merits of any class of exhibits. The only competition that existed was a friendly rivalry between the exhibitors and colonies, as to which of them could bring forward the most conclusive evidences of their national prosperity and commercial wealth and strength. In preparing for the beforementioned object, the Royal Commission, who had charge of the arrangements, secured the use of the South Kensington buildings and grounds adjoining and attached to the Albert Hall. The builings are quite commodious and extensive, and are very well adapted for such occupation. The beautifully laid-out gardens and playing fountains were additional attractions for visitors.

The time at which the Exhibition was held was, perhaps, the most fitting that could have been chosen. The population of the whole empire, for some time before, had their attention drawn to the possibility of a closer administrative, fiscal and defensive union of its many dependencies. A full recognition by the different colonies and the mother country of each other's resources, manufactures, commerce, customs, and capabilities, would make perhaps the most substantial foundation, or basis, for any such agreement or federation. Indeed, if any such federation should ever be consummated, the credit will be largely due to the success of this Exhibition, and the facilities it afforded the people of all parts of the empire for becoming acquainted with each other in the manner just indicated. The Courts of the Exhibition may be said to have been a series of object lessons, informing the visitors what each colony could and did do, and thus making a succinct history of the agricultural, commercial, and social development of each. Those who examined them with care and thought could not but leave with a higher estimate and more just appreciation of the value to the mother country of both Canada and Australia.

It was expected that the Exhibition would continue for six months—as a matter of fact it lasted six months and ten days. The attendance during the whole of that time was surprisingly large for one of its class. The visitors numbered, in round figures, five and a-half millions, being an average of about 34,000 per day. The largest number attending upon one day was 81,000. It is reasonable to expect that many benefits will accrue to this country from having its products examined by this incessant stream of 34,000 people per day. A valuable stimulus to immigration of the right classes will doubtless result from the impressions left upon so many minds, the effects of which will probably be, with advantage, felt by Ontario for twenty-five years to come.

The Dominion Government having referred the matter of making a worthy display of Dairy Products to the Government of the Provinces, I may be allowed to rehearse the steps taken to make the Exhibition truly creditable and serviceable to all those interested in this increasingly important industry in Ontario. The Presidents of the Dairymen's Association of Eastern and Western Ontario were consulted as to the best mode of procedure.

In accordance with their recommendation, a quantity of fine fall cheese of 1885 make, were purchased and held for shipment to reach London in time for the opening in May. Through some unfortunate failure on the part of the companies employed by the Dominion Government to carry the Exhibition goods through as expeditiously as usual, these cheese did not arrive in time to be used in making an opening display. Some of them were stored in London, to be used later in the season. Further on, mention will be made of the excellent service they rendered.

During the summer of 1886, when it was possible to procure cheese of the summer make, another consultation was held with T. Ballantyne, Esq., M.P.P., representing the Dairymen's Association of Western Ontario; D. M. MacPherson, Esq., Lancaster, attending on behalf of the Dairymen's Association of Eastern Ontario; John Hannah, Esq., President of the Ontario Creamery Association, and the Professor of Dairying from the Ontario Agricultural College. To them was entrusted the task of selecting and collecting contributions from cheese factories and creameries. In the west, the local Dairy Boards of trade were invited to appoint experts to assist in the work. John Podmore, Esq., Ingersoll, and John Robertson, Esq., London, rendered excellent help. The ready response on the part of the dairymen in all the districts of the Province, enabled the committee to obtain such samples as to make the whole exhibit fairly representative of the cheese and butter made both east and west. The Provincial Government had further agreed to advance money to pay for the goods so selected. In this way the exhibit, in every sense, became Provincial, and not sectional or individual. It was recognized that all possible advantage could not be reaped from the Exhibition, unless some person should take charge of the goods upon their arrival in London, who would be competent to compare, contrast, and point out the characteristic excellencies of Ontario's cheese and butter over those from other countries, competing with ours in the British markets. It fell to my lot to try to accomplish that. The fine goods sent forward made the duty light. On the 11th September I sailed for England. The display was well commenced by 1st October. There was decided gain in reaching the Exhibition with a new feature when the other departments were comparatively old and threshed out in the press of the Metropolis and country. The public interest and attendance continued unabated. The Courts were daily thronged by enquiring crowds of sight-seers, who evidently came to be amused, and left largely instructed. The space allotted to Canada in the buildings was scant enough, and not in itself the most desirable. But it became the most attractive by reason of its varied and interesting contents, and their admirable arrangement. Just enough room was got to indicate what Canada could do, had she a full opportunity to do justice to her desire and powers.

By the courtesy and help of Mr. C. C. Chipman, the acting Commissioner for the Canadian Court, on my arrival, space in a prominent place was secured. At the side of the Canadian Agriculture trophy were placed Ontario's pyramids of butter and cheese

The total quantity received was :—

618	Boxes Canadian Cheddars (white and coloured);		
300	Canadian Truckle Cheese;		
8	Monster Canadian Cheese;		
299	Tubs Canadian Creamery Butter;		
10	Firkins	do	do
2	Tierces	do	do
480	5 lb. Tins	do	do

With these, it will be seen, it was possible to make a display even in point of magnitude worthy of the industry. Two pyramid frames with surrounding shelves were erected. The edges of these were decorated with strips of colored paper on cloth, on which were printed instructive facts relating to the exhibition, and inviting visitors to "take home a sample" from "Ontario's display of butter and cheese," etc. Then ornamental cards of varied shapes and colours were attached. These had such information as "Ontario's cheese and butter are all from pure whole milk." "Ontario makes no oleomargarin e, no butterine, no imitations." "Ontario leads the world in cheese making." "Ontario has

752 cheese factories," "Ontario has 40 creameries." "Ask your grocer for Canadian cheese and butter," etc., etc.

It was not thought that the mere display on the shelves would serve our interests as well as might be done by the distribution of samples. Hence your representative considered that some means should be taken to put samples of the best in the mouths of the visitors while they admired the general appearance of the dairy pyramids. Facilities were soon provided at four counters in different parts of the grounds. Samples of cheese to be sold at a penny and twopence each were done up in neatly printed oil paper wrappers. The call for these was very good. In less than five weeks nearly 40,000 samples were so sold, and in many cases the cheese and wrappers were carried back to mechanics' and farmers' homes. The wrappers set forth such information as this:

ASK YOUR GROCER FOR CANADIAN CHEESE.

ASK YOUR GROCER FOR CANADIAN CHEESE.

SAMPLE OF CANADIAN CHEESE

FROM THE

ONTARIO GOVERNMENT'S EXHIBIT

AT THE

COLONIAL AND INDIAN EXHIBITION.

———)o(———

The Province of Ontario, Canada, has now over 750 Cheese Factories in Operation.

———

Canadian Cheese is as fine as English Cheddar Cheese and finer than three-fourths of the English make.

———

Canadian Cheese sells for 4s. per cwt. above American Cheese.

———

The average price of farms in Ontario is $37.00 (£7.12s.) per acre.

———

The average rent value of farms in the older settlements is from $2.30 (9/5) per acre to $3.50 (14/4) per acre per annum.

———

ONTARIO HAS A SPLENDID CLIMATE FOR DAIRYING.

ASK YOUR GROCER FOR CANADIAN CHEESE.

That means of advertising the lands, etc., of the country will be of service to Canadian farmers for many years to come. It was complained by some from our own Dominion, that

the retailing of samples in this way should have been thought quite beneath the dignity of the Government of the Province of Ontario. I thought then and have continued to think since, that the smallness of the common sense and commercial sense faculty of these croakers was alone responsible for such small talk. No matter how large in the aggregate may be the value of butter and cheese exported by Ontario annually, it must be ultimately distributed in small quantities and consumed by not more than mouthfuls. To give away samples to all who would have taken them, would have involved heavy additional expenditure, while the desired end could be more advantageously attained by selling at a small price than by giving away for nothing. The exhibition throngs talked more about and tasted and tested with more interest and took home with more care what cost them only a penny than what they got free.

Enquiries directed by persons—so tasting our cheese butter—to their grocers brought me from the latter many letters, asking where and how equal qualities could be regularly obtained. Instead of seeking to supply these shop-keepers from the exhibition I referred them to wholesale firms in their own districts accustomed to handling Canadian goods. I judged that such using of already established agencies of trade was preferable to arousing the jealousy, and perhaps the opposition of importing houses by selling direct to grocers. I think he best serves the interests of the industry he represents who encourages and strengthens, as far as possible the already established and legitimate agencies in commerce.

In another part of the ground a further display of butter and cheese was made. The use of a suitable building at one side of the gardens was obtained for the storing of surplus boxes and tubs. There it was convenient to show goods to persons directly interested in the trade, by whom a closer examination and comparison of the different lots was desired than was practicable at the central pyramids.

The subjecting of the different lots of butter to much boring by the "tester," lessened the immediate market value of many of the tubs, but that loss was of little consequence in view of the after advantage to the industry from the high quality of "Canadian creamery" being well known by the trade.

I did not find the re-packing of samples of butter in small tins easily practicable nor prospectively serviceable, and hence very few packages smaller than the five pound tins which had been prepared at the Ontario Agricultural College Creamery were offered on the counters.

Good service was rendered by the cheese of the make of 1885 before mentioned, and sent over in care of Messrs. Ballantyne and Macpherson. Often prominent dairy experts would say that while our Canadian cheese was very fine when comparatively new, it lacked good keeping properties. To such I would sample these cheese over one year old. Among the well known dairy experts to whom I showed these cheese wrere Mr. H. F. Moore, of Frome, and Prof. Fream, of Downton Agricultural College. The expressed opinion of both was that these old cheese were as fine then as any cheese in the whole exhibit, and so fine that to them the cheese awarded the first prize at Frome Dairy Show would have made but an indifferent second. At Frome is held the largest cheese show in England. Mr. Moore did us the justice and service of writing an article to the London *Times* containing the same statement.

I also sent samples of the cheese of 1885 and '86 and some tubs of butter to the dairy show held at Kilmarnock in Scotland. It is by far the largest dairy show in the United Kingdom. On this occasion there were no less than 645 entries, and in the show and fair not less than 18,000 cheese of British make. The unanimous verdict of experts who carefully examined the Canadian cheese was that there was nothing on exhibition finer than the cheese of 1885 from Ontario, then over twelve months old.

The dairy display received a good deal of attention from the press of London and England, which will not fail to effect some valuable. results for dairymen. I quote parts of articles from only three of the many papers containing favourable comment.

The *Canadian Gazette* had the following and a number of other articles :—

ONTARIO DAIRY PRODUCTS IN BRITISH MARKETS.

"It has been left to the closing weeks of the exhibition to witness one of the most practical of Canadian exhibits from a directly commercial point of view. Visitors acquainted with the leading industries of the Dominion must often have been struck, when visiting the Canadian section, with the absence of any adequate representation of the cattle raising and dairying trades of Eastern Canada. This deficiency is now fully made up at least from one Province by the joint action of the Eastern Dairymen's Association of Ontario, the Western Dairymen's Association of the Province, and the Ontario Creamery Association. These three bodies have united, and together sent over 500 boxes of the finest Ontario and Stilton cheeses, contributed by some forty different factories throughout the eastern and western sections of the Province, and about 100 tubs of fancy creamery butter, to be followed by 150 further tubs this week. These goods are now being arranged on the south side of the eastern transept of the central gallery, in the form of two trophies of cheese and butter, and a side display of fancy packages of butter and small Stilton cheeses. The exhibit is in charge of Mr. James W. Robertson, of the Dairy Department of the Ontario Agricultural College, at Guelph, from whom the following information, in regard to the exhibit, was elicited in the course of a conversation with our representative :—

"'The object of our display is,' said Mr. Robertson, 'to introduce our best Canadian cheese to English consumers. Hence a good portion of the cheese will be sold in small quantities to visitors in the course of the exhibition, while the balance may be disposed of direct to retailers here, so as to allow of no mistake as to its being Canadian cheese. We feel very strongly in Ontario the imperative necessity of taking active steps to bring the good quality of our cheeses before the direct notice of the consumers here. We have not had fair play in the past. Formerly—*i.e.* eight or nine years ago—Canadian cheese was sold here as American, but the Centennial Exhibition so revealed the superiority of the Canadian product, and we have since so steadily kept the lead, that our best Canadian Cheddar is often now, on reaching this market, sold as English Cheddar, while inferior English qualities are often sold as Canadian. Hence a prejudice has not unnaturally arisen against our cheeses, though we hope yet to prove how unwarranted this prejudice is. Then in doing this we hope also to promote emigration. We are earnestly looking for the settlement on our fertile lands in Ontario of the English farmer, who has capital enough to enable him to buy land and have a surplus sufficient to stock it well, and at once enter upon dairying on a profitable scale. Nothing will appeal so much to this class of English agriculturists as the excellence of our product, and seeing that the best Ontario cheese is equal to the purest Engltsh Cheddar, and superior to three-fourths of English Cheddar, and is quoted at four shillings per cwt. above the finest United States cheese, we don't anticipate any great difficulty.'

"'How does the industry stand in Ontario ?'

"'According to the last returns for 1885 we have in the province 752 factories in operation, with an output of nearly seventy-one and one-fourth million pounds, of the value of one and one-fifth million pounds sterling. The increase in the number of factories last year is thus only one, and in the output of four and one-fourth million pounds, though the fall in prices, which affected Ontario less than English dairymen, made the value of the 1885 output less by a qnarter of a million sterling than that of 1884. Our present policy is to strengthen in every possible way by co-operation and instruction the hands of each dairyman, and past success gives reason for the expectation that we shall thus be able to keep in the front rank even in the face of keen competition. The great thing we have to fight against here is prejudice. This alone prevents Canadian cheese from selling as high as the fancy makes of English cheese. In this respect the London market seems as yet the most satisfactory, in that it regards our products with less of that unreasoning prejudice so common in many parts. English dealers need not, however, fear that we are

going to overdo the business. We are careful of that, and what development takes place will now tend in the direction of butter rather than cheese production.'

"'Ah, yes. Canadian butter might be improved with advantage, might it not?'

"'Yes, it might, and will be, for we want to introduce it fairly into this market. It is true that our butter has a bad reputation here, and perhaps deservedly so, but the Canadian Creamery butter is now made in sufficient quantities with us to be exported. We have good samples of this creamery butter in the exhibit, so as to open up a market for it."

"'What is the distinction between dairy and creamery butter?'

"'Well, dairy butter is just the butter made at a private dairy by farmers and their wives, without either of them being skilled in its manufacture. Creamery butter is the product of the butter factory, where the cream from, perhaps, one hundred dairies is collected and made into the purest butter by those skilled in every improvement. We are thus, you see, adopting with our butter the same factory system that has proved so successful with our cheese. Canadian cheese, when it used to be made at the farmhouses, was a complete failure, so far, at all events, as outside markets were concerned; but since the factory system has been introduced it has been a marked success. We have the prospect of at least twenty-five new creameries being erected in Ontario before next spring—that is, twenty-five butter-making factories. The farmers form joint-stock companies, and erect the factories in many cases for the disposal of their produce. In other cases the factories are built by private capital, and the owner of the creamery charges a commission for the manufacture. It is easy to see the great aid this system is to the best methods of manufacture, and how the market naturally discourages the home production of dairy butter and favors the product of the creameries. The difference is that, where Ontario dairy butter may be worth barely 12 cents per pound, creamery butter will be worth 20 cents per pound. The commission of the creamery owner would be, say about 4½ cents per pound, leaving an advantage of 3½ cents per pound to the farmer who makes use of the creamery rather than attempting home production. We have a creamery at the College at Guelph, and have sent over samples of butter made there. We have also something new here in the way of five pound tin packages for retail sale in the place of fifty pound or one hundred pound firkins. The experiment is, we think, worth a trial, a five pound package being of a convenient size for family use,'" etc., etc.

The *Morning Post* wrote as follows:—

"During the past two weeks there has been in the Exhibition at South Kensington a display made by the Canadian Government of the greatest importance to the British farmer. It is that of cheese and butter from Ontario, the whole having been collected from some fifty factories, and brought over to the Exhibition by Professor J. W. Robertson, who is the head of the dairy department at the Ontario Agricultural College. An examination of this extensive exhibit ought to be the aim of every cheesemaker in the country, for without an examinatiou he can have no idea of the perfection to which the Caanadian competition has been brought. The writer of these reports spent an afternoon in company with Professor Robertson and Captain Clarke (who is in charge of the Canadian agricultural exhibits), in an examination of these dairy products, the high quality of which would fairly astonish the cheese and butter makers of the country. That which was tried was two months old, and had been for ten days (and ten days of heat), in the exhibition. It was not at all salt, the natural texture was well preserved, it was well and solidly worked, and of fine meaty flavour. It was equal to our best butter, and this, it is said, can be placed on the English market at 1s. a pound. There was none better at the London Dairy Show. The Canadians are trying hard to meet the markets in this country, and this butter will be imported fresh in five pound tins, which can be obtained regularly by the householder. But it was in the cheese department that the greatest perfection has been obtained. Here there are in all some 400 cheeses, all made on the Cheddar system, and all of a uniform high quality. Out of the 1,000 cheeses shown at Frome last month it would have been impossible to have selected 50 cheeses of such a uniform quality as the 400 on exhibition at the Canadian Court, while the first prize

winners at that show would have been run very close indeed by most of the Canadian. The cheese shown vary in size, the "truckles" being about four pounds smaller than those usually made in the west of England, and the ordinary sizes weighing about fifty pound to seventy pound against the eighty pound to one hundred pound of the deep Cheddars of the west of England. The Canadian cheese is also earlier in maturing than our own Cheddars, the cheese in the exhibition being about six weeks old, and being then well matured. At that age our English cheese would be still soft and curdy. The Canadian cheese is mellow, silky, and meaty to the palate, solid in body, and of fine grain and texture, is rich and nutty in flavour, and is shapely in size, clean in appearance, and smooth and clear in the skin. It is a great pity that at the show at Frome a few lots of Canadian could not be sent for competition, for it would prove such an "object lesson" to the farmers of the West as they would not soon forget. This exhibition opens up a very great question for the English Cheesemonger, and that is how it happens that Canada has been able to produce so even and high a quality of cheese. It is not in the factory system that the answer is to be found, for the United States has factories, and its cheese is much inferior to Canadian. Cheddar cheese has really become the world's cheese, and is made not only in various parts of Great Britain, but on parts of the Continent, in Canada and the United States, and in the antipodes. In the latter place Victoria produces a higher quality than other place. The subject of Cheddar cheese in every part of the world requires to be investigated, and a more useful work could not be undertaken by the Department of Agriculture at Whitehall. A good investigation would give such a mass of practical details that could not fail to be useful."

The following extract is taken from the *Daily Telegraph*:—

"Two or three years ago Canadian butter was made at each farmstead, with every possible grade of care and negligence, science and ignorance, with the net result that a small portion was excellent, a certain quantity middling, and the bulk grading downwards to 'very inferior.' Two or three years ago co-operative dairying was started under the auspices of the Government and under the supervision of the Ontario Agricultural College. The idea of this system is that the farmers of a district possessing 500 to 1,000 cows among them send their milk to a creamery. There it is treated in a most scientific manner by skilled hands using the best machinery, the result being that butter is produced of a uniformly high quality, the farmer receives a better price and the public a better article. Professor Robertson, of the Ontario College, is now in London representing his Government at the Colonial Exhibition, and he has explained the principles on which the system is worked in his Province, which has led the way in the Dominion; and his exposition goes to show that the colonists have applied strictly scientific theory and art in the attainment of their object. They have recognized first of all that butter has a natural texture which is destroyed by mixing and too much handling; and second, that it is a material which undergoes a natural ripening or maturing process, and that this may be hastened or retarded to suit the requirements of commerce. Taking these points together, it may be said that the finest product is only possible where the butter is made from the best milk, by the most careful processes, untouched by hand, and when it is brought to market just at the time when its oxidation or mellowing by contact with the air brings about the mature or ripe flavour. In Brittany, England and Ireland, butter is usually made in shallow vessels, and at a rather warm temperature. The result is quick oxidation—soon ripe, soon spoil; and an excess of salt is used to prevent it from becoming rancid. The Canadians use, on the contrary, deeper cases, submerged in cold water, and their fresh butter will keep easily from three to five weeks; with a very slight covering of salt, and packed in suitable tins, it will keep good for a year. They can send perfectly fresh butter to the English market, and the probability is that in a few years this will be done to a large extent. In Canada the whole cost of collecting, churning, providing packages, salt and other necessaries, is 2¼d. per pound."

My own pen was not idle in the matter of commending our Dairy Products and the natural and good features of Ontario for farmers' homes. Thinking that two of these

letters may contain some information of interest to Canadian readers I take them from *The Daily News:*

BUTTER-MAKING.

To the Editor of The Daily News:

"SIR,—I read with much interest your remarks on the butter trade in your Agricultural Notes the other day. It cannot be without commercial benefit to the country that your paper evidences such a lively concern in its great agricultural interests. Very timely, indeed, is any discussion that tends to enlighten on the dairy industry, which is fast coming to the front, in the northern latitudes of the Empire, as the main and most profitable branch of farming. The town and city people need information as much as the dairymaids of the country. And the instruction of the city consumers as to the "hows," "whys," and 'wherefores' of butter-making, would quickly and forcibly tell in a prosperous propulsion to the trade wherever intelligently, tidily, and scientifically carried on. Fine butter is a table luxury which will always be cheerfully paid for by the masses, at a price profitable to the makers; and while its "fineness" of quality is eminently the characteristic which gives to it, and through it to the dairyman, superior and profitable value, the same "fineness" is that which really costs nothing extra of cream or labour to produce. When British dairymen—English, Irish, Scotch and Canadian—all learn how to add or rather conserve the natural "fineness" of flavour in their really nutritious butter, the price will come up to an abundantly profitable figure. By butter-making there is hardly any appreciable exhaustion of the fertility of the soil; by it there is provided remunerative employment for many extra workers; and out of it the producer (the farmer) realises a larger percentage of its ultimate cost to the consumer than from almost any other article he sells. That all being so, why is it that the British and Canadian farmers do not supply all the butter England and Scotland want? If British farmers would but adopt the Canadian methods of manufacture, and British consumers but become acquainted with the excellencies of Canadian creamery butter, the question would not need to be asked. Herein is a subject for the investigation and consideration of agitators for Imperial federation. The vitality of any scheme of federation will be proportionate to its power for promoting the interests of all the individual citizens concerned. The increase by it of everybody's comfort and safety, and the making of life to the people richer in its opportunities and enjoyments, will alone make federation desirable, durable, or endurable, or by it strengthen the Empire. Whatever facilitates the interchange of excellent food commodities will be the harbinger of closer union. Therefore, through your columns, I seek to speak to Canada of England's unsupplied need of fine, pure butter, and to England of Canada's power and resources to supply it; and, besides, in the supplying of this food-need, to give therewith such apt and acceptable dairy information and instruction as will direct England's and Ireland's and Scotland's farmers to do better for themselves.

"In every department of agriculture, the colonies have learned and are learning much from the mother country. But the impetus given to life, in every avenue, in a new country, impels its population to the speedy development and combination of old and merely local methods into comprehensive, adaptable and applicable systems. This is true as applied to the dairying industry and other minor things, such as newspaper making, public policies, social customs, etc. The love of the new—the changed—for its own sake, is characteristic of the mental and mechanical methods of all young countries. However in the case of a colony like Canada, heathfully fed by numerous additions of immigrants from old countries, with their tersely conservative habits, the native tendency is well corrected, and safe progress only is made. But what has that to do particularly with butter-making? Well, this. Canada can and does make as fine and finer and as uniform a quality of butter as the "Brittany mixture" so highly commended by the well known butter merchant mentioned in your article, befcre referred to. Moreover the uniformity of Canadian creamery butter is not due to the "grinding," "milling," or "mixing" of different samples into one homogeneous mass, whereby the natural texture and grain are all destroyed, and the butter left as greasy as goose gravy. Canadians have adopted the good and the good only of the "mixing" system. They mix the cream, not the butter,

from fifty to two hundred dairies at each creamery where finest butter—every package alike—is made by skilled butter-makers. Uniformity and fineness of flavour, body, and colour are thus obtained without the destruction of the keeping properties by the objectionable "milling" process. Canadian creamery butter has only to be well-known in the London market to divert the trade that now goes to a foreign country into the channels which are being more widely opened between England and her Colonies. Let but English butter dealers lend their aid by introducing Canadian creamery butter to their customers —(and here let me remark that Canada manufactures no oleomargarine, no butterine, no imitations)—and much of the desired end of increased, closer, and more profitable trade relations between the mother country and her enterprising children will be brought about. Then, as soon as Canadian creamery butter is well known, English and Irish farmers will begin to inquire about the "hows" of the system by which such results are obtained; and an early adoption of the creamery system into their own districts will soon be sought. Let the landlords, who are said to find many tenants unable to meet their rent obligations, take the lead in this matter, and the money which may be invested in factory buildings will yield 1,000 per cent. in the prosperity of the tenants and the consequent increased value of properties. The Government of the Province of Ontario, having in view the development of a butter trade with England, on a scale equal to the export cheese business of the province—now over $6,000,000 annually—are about to exhibit a large quantity of butter and cheese, contribnted from all parts of the province, at the Colonial and Indian Exhibition. Sample packages of both may be obtained by visitors. Inquiries as to the resources of the province and the nature of Canadian dairy systems, so far as the knowledge may further fore-mentioned objects, may be addressed to the undersigned at the Canadian Court, Colonial and Indian Exhibition.

Your obedient servant,

JAS. W. ROBERTSON,
Government Superintendent of Dairying for
the Province of Ontario, Canada.

Ontario Agricultural College, (Dairy Department),
London, England, Sept. 28th.

"CREAMERY" BUTTER.

The following statements are made in the form of a letter by Mr. J. W. Robertson, Government Superintendent of Dairying for Ontario, dated from the Canadian Court of the Colonial Exhibition:—

"For the moment the butter industry is exciting unusual attention and comment in the Press. Producers and consumers alike manifest lively concern for the improvement and extension of this most profitable branch of farming. Nor is the quickened interest confined to London and England. The news from Cork tells that Irish farmers and merchants are bestirring themselves, in the hope of recovering their once enriching trade, which lately foreigners have won from them. Nearly every article and letter on agricultural affairs makes more apparent the urgent need for some action. The Government might well implement their expressed intention "to investigate the capacity of Irish resources for development by public works on a remunerative scale," in connection with this business, and that, too, with unique advantage to Ireland at this particular time. By a simple calculation, founded upon the data of last week's market reports from Cork, it appears there is a difference of about £6,000 between the total value of the butter sold there during the week (about £33,300) and the sum that would have been realized (about £39,300) had it all fetched the price quoted for best quality. What a large loss every week to the producers on the butter of one market, due to the manufacture of irregular and inferior qualities. The loss indicated is not local nor peculiar to Cork, but is all too general over dairying Ireland and England, where butter is made at the farms without system. To prevent the continuance of such an enormous loss to the farmers of the country, and to protect and foster this valuable and elastic industry, surely comes within the

scope of Government duty. I am convinced that such a desirable end can be efficiently attained by the establishment of suitable creameries, after the Canadian system. By their general introduction a profitably and permanent enlargement of the trade would be immediately possible by the production within our own Empire of sufficient uniformly fine butter for our own people. Such a quality would always be in demand at remunerative rates. At the Ontario Agricultural College in Canada, the Government erected an experimental creamery some two years ago. The cream from nearly 1,000 cows is now received. The system of butter-making throughout the whole province is being rapidly changed and much increase of wealth is going into the country in consequence. The institution is educational, and free instruction in the management of creameries and the details of scientific butter-making is given to eligible young men. Why does not the Imperial Government aid English and Irish farmers in a similar way? Contrasted with the mixing, milling Brittany process, the Canadian creamery system has everything to commend it. The desirable keeping properties, which add much to the butter's worth, are by it conserved, and the natural and exquisitely delicious creamy flavour is preserved for weeks. The national importance of the subject will excuse me in encroaching further on your space to state in popular terms some interesting facts recognized by only a few experts.

1. The natural flavour of milk and its products reside mainly in their fat constituents.

2. While milk is quite new its cream or fatty portion is comparatively insipid or lacking in flavour.

3. By exposure to the action of the air (oxidation) the flavour is ripened or developed, and the colour of the cream and butter made therefrom is deepened.

4. A warm temperature facilitates and a cool temperature retards the development of flavour.

5. Thus, butter made from cream raised at the ordinary temperature of the atmosphere, in open shallow vessels (such as are commonly used in Brittany, England, and Ireland), has a much fuller and riper flavour when just made than butter manufactured from cream raised in deep cans, submerged in cold water, as by the creamery system of Canada.

6. The former butter has its best flavour within two days after it is made, while the latter, the creamery, may continue to have its best taste from three to five weeks afterwards.

7. The earlier development of flavour in that butter which is at its best just after churning proclaims it of the character defined by the fruit adage, "Quick ripe, quick rotten." For such butter, delicious while fresh, nobody claims keeping properties any more than for harvest apples the quality of keeping sound till Spring time.

8. On the other hand, the quality of creamery butter (as evidenced by the Ontario Government's display at the Colonial and Indian Exhibition free for inspection and examination by all interested) shows that it has excellent keeping properties.

9. The butter fat of milk is in the condition of minute globules. These are collected into mass by the impaction of churning.

10. Any after-working, "mixing," or milling, that destroys the natural grain or texture of butter, thereby destroys its keeping properties, just as the bruising of fruit or the breaking of egg shells renders both of these commodities subject to speedy decay.

11. As an article of diet, delicious butter is very different in its gastronomic effect from oleomargarine or any imitation compounds.

12. Fine butter—its peculiarity—aids weak digestion by instilling its own atoms between the atoms of more solid foods, thus assisting in their disintegration for assimilation.

It will be to my satisfaction, as an humble servant of my own Province and of the Greater Britain, to give any further information I can that will be helpful in promoting the prosperity of the farmers of the empire along the lines indicated."

These have since been copied into the leading British papers and journals devoted to the provision trade. Many inquiries came in consequence and the information thus given about Ontario, and Ontario's butter and cheese, may be of some help in the further development of her natural resources. Numerous letters came from English, Scotch and Irish dairymen, seeking information about how to improve the quality of their goods. Any help in that direction that can be given would leave a larger and more profitable market for Canadian products. Though this is perhaps not the place to fully discuss that proposition, it may not be amiss to point out that during the months of November and December, the consumption of some of the inferior and cheaper qualities of late-made English cheese very much weakened the demand for higher priced Canadian. The consumer is a very much longer time about consuming two pounds of inferior cheese than in disposing with satisfaction of four pounds of excellent quality. Every pound of inferior butter or cheese made anywhere shuts off the demand—by lessening the consumption—for at least twice its quantity of fine quality. The conclusion that the higher is the standard of quality of dairy products of our own and all other countries that compete with us, the more profitable will be the business for all producers, is indisputably correct. The exhibition is to be credited with doing something in that direction.

The criticism of some of the best buyers drew my attention to some of the defects that lessen the value of our average shipments of both cheese and butter. At the three dairy conventions I have pointed out these and detailed the slight changes in the process of manufacture that are needed to remedy or avoid them. I may condense the important points as lessons for cheese and butter makers.

Lessons for Cheese-Makers.

I. Uniform fineness of quality is required in *every* cheese of *every* lot.

II. A cheese with fine flavour and solid and buttery body, which will retain its richness after exposure by cutting, is wanted.

III. A smooth, bright rind, without cracks, gives additional value; also a neat finish as to shape and general appearance.

IV. Scaleboards should be put on just before boxing, and so as to stick closely to the surface of every cheese.

V. Cheese boxes should be made with stronger covers to safely stand the rough handling of transhipment. The cover bands should be $\frac{5}{16}$ of an inch thick.

Lessons for Creamery Butter-Makers.

I. An attractive, neat and clean butter package, that will be decently ornamental to a provision shop will increase the value of the butter. Besides the packages already in use, a Canadian cask with wooden hoops and holding 112 pounds would meet with favour.

II. The use of impure butter cloth leaves an objectionable taste on the top of the butter, very seriously lessening its value.

III. Such salt should be used as may be tasted but not felt by the touch of tongue or finger in the butter.

IV. Pure brine should be frequently poured on the butter while in store. A tallowy taste for an inch on the top is induced by neglect of that.

V. All butter for export shipment should be stored in suitably cold store-rooms from the time of making.

The need for attention to the last mentioned matter is so urgent that I take the liberty of stating the case at some length. In our competition with butter from Ireland, Denmark, France, Sweden, Holland, etc., we labour under difficulty in trying to put Canadian butter on the consumer's plate in the best condition to please the palate and nourish the body. In the matter of freight charges we are comparatively well off, but the circumstances presently existing of our largest production being at a time when safe

transportation is most difficult, and when the price in all consuming centres is lowest, is against us. The adoption, in a measure, of winter dairying might be recommended as a partial relief and remedy. Still this state of things exists, in that most of the June and July creamery butter is stored somewhere, either on this side the ocean or the other. Hence the providing of suitable storage that will prevent deterioration in quality, and consequent depreciation in price, is a manifest need of the business. In visiting creameries during the past summer, I generally found the storage accommodation quite inadequate and unsuitable. Large refrigerators at convenient centres would be more economical for use than the erection of small ones at every creamery. Then there would be less risk of butter "going off in flavour" when kept in buildings exclusively used for that purpose, and looked after by men engaged for the definite work of regulating its temperature and preserving its contents. Such buildings would be of Provincial and national service and benefit. Watchful attention to a continuance of suitable conditions for preserving quality, with proper selection and classification, would gain us a higher reputation and price. Any quality under fresh-flavoured, sweet, delicious-tasting butter, will be pushed out of the market by the finest brands of butterine. I am satisfied that by treatment as advised, June butter, in nine cases out of ten, would reach the consumer in better condition in November and December, or later, than by immediate and direct shipment in midsummer, followed by exposure to the humid air of English warehouses and shops. Probably the farmers would not receive their full share of the increased prices for a time, but additional wealth would be brought into the country, and the competition of commerce would soon equalize the distribution of profits. A rate of 5 cents per tub per month would amply cover all expense and allow a fair dividend on the cost of buildings. It would thus be possible to preserve the creamery butter, and put it before the consumer in England, or elsewhere, in its best state, and at the season of the year when the highest price may reasonably be expected.

The interests of the carrying companies are closely identified with those of dairymen. When the latter use only reasonably strong boxes and packages, the former should look after their safe carriage. The heated and damaged condition in which I observed some cheese to be discharged from the ships'-holds, if continued, will speedily and justly lead to the withdrawal of Canadian dairy patronage from such vessels.

With the consumers, the shop-keepers, the wholesale dealers, and the importing firms, the butter and cheese from Ontario now stand in higher repute than ever.

Of the general influence of the dairy display from an immigration-fostering standpoint, I am not prepared to report. But this I can confidently write, that the Apple, the Honey, and the Cheese and Butter exhibits, all mainly under the care of Ontario men, did more to bring a true knowledge of the resources and climate of the Dominion of Canada before the public in an acceptable way than all the other departments of the Colonial and Indian Exhibition put together.

Commemorative medals and diplomas will be issued to all who contributed cheese and butter to the exhibition.

My thanks are due and are hereby tendered to all who aided me in the endeavour to make the display of cheese and butter from Ontario a success.

VI.—THE FARMING AND DAIRY SYSTEM OF DENMARK.

A few lines may be devoted to the mentioning of some things observed while on the journey from England to Denmark, that may have educational value for farmers in Ontario.

The route taken was by way of Queensboro'; thence by boat to Flushing in Holland; thence by rail *via* Bréda, Boxtel, Goch, Wesel and Hamburg to Kiel; thence by steamer to Korsœr in Denmark and on to Copenhagen by rail. London was left on the 3rd December.

The continental railroads travelled over were well equipped. The roadbeds, in respect of their construction, were between the English and Canadian styles in point of solidity

and durability. The engines seen were mostly of English make. The passenger coaches, which were comfortably upholstered and heated by steam, were built after the English pattern, with compartments across the cars, having entrances from both sides. The freight box-cars and trucks were much smaller and lighter than those in use on the Grand Trunk and Canadian Pacific Railways. The average rate of passengers' fare is lower than in Canada. On the German State Railways there are no less than four classes of carriages. The fourth-class have no seats and are largely used by labourers travelling short distances to their work at very low rates.

A thin sprinkling of snow lay on the ground. The country of the Dutch surprises one by its generally flat aspect. The monotony of a prairie scene is absent, as canals and ditches scarify its whole surface. The fields have a rich alluvial soil of dark colour. Trees, visible from the car windows, were all of light timber and mostly scrubby-looking. After Tilburg was passed, the soil has lighter colour ; and stunted shrub beech is plentiful. What seemed to be thriftless thorn and beech hedges disfigured the landscape.

The fields were mostly ridged up with deep furrows between the lands. Large fields of turnips looked very well. The kinds were mostly yellow and soft purple tops. On meadow lands the pasture was still fresh looking, with a good roughness of top for feeding or winter protection.

Great Don Quixote wind-mills, for grinding, were here and there lazily rolling round. The farm-houses were generally built of brick of smaller size than ours, and roofed with red or dark coloured tiles. Occasional groups of three or four houses close together, with moss-covered thatch roofs, seemed to have grown out of the ground on which they stood. After crossing the German frontier, the country had very similar appearance to the undulating and fertile districts of Ontario. The woods were large in area and their trees looked as large as those in Canadian forests.

The farms appeared to be smaller and the barns were quite dwarf-like in comparison with bank barns on 100-acre farms in Canada. The peasants are rather slow-moving and sedate-looking people. The farm labourers still wear wooden clogs, kept on by the movement of the toes. Their stockings are without soles and are kept in place by a leather strap around the instep and toe. For fuel, wood, peat or turf, and coal are used.

From Hamburg to Kiel through Holstein, the country is generally flat, with blotches of turf, whence the peat is obtained for burning. The soil is very much assorted, many different colours being seen in single fields. The hedges of hazel, thorn and beech are neglected looking. The woods are about as heavy as in Ontario and mainly of elm and beech, with some light birch. At Kiel I inspected a creamery, but instead of detailing what was seen at each creamery or dairy visited, I will gather into one place a description of the best points in butter making seen at the different places.

On reaching Denmark, one is struck by the clean aud well cultivated appearance of the farms. The soil is of boulder clay or boulder sand. Geological researches have revealed the history of its timber clothing at different periods. There was first poplar, then elm, followed in turn by pine, oak, hazel and beech. The present is still the beech period there.

The average annual rainfall is from 23 to 24 inches. The mean yearly temperature is 45°.

For a small country, Denmark deserves much praise for the long and thorough attention given to agricultural investigation and education. Outside the kingdom, the impression prevails that the Government of the country has financially and otherwise borne most of the burdens inseparable from the establishment and maintenance of educational means and facilities, which have been of much national benefit and have enabled the Danes, particularly in the making and exporting of butter, to gain the foremost place in the world for quantity and quality exported per acre of kingdom area.

The Government has all along maintained a friendly and fostering attitude towards the improvement of agricultural methods and implements, and has given liberal grants towards furthering scientific investigation and the dissemination of sound knowledge relating to land and its cultivation, as well as to stock and the manufacture of their products. But the agricultural and dairy instructors of the country have not been very

liberally fed at the public crib. Their success and the really telling education which the young men and women have received, I judge [to be due to the necessity laid upon all of them, of largely helping themselves before they received Government assistance. That the Government should support agricultural and educational concerns merely for the sake of appearances does not seem to have come within the range of Danish administration.

As long ago as 1769 the Royal Agricultural Society of Denmark was established. It was originally founded for the purpose of promoting interest in and spreading useful information in relation to all rural industries. The main objects sought to be attained through its organization might be summed up as:

1. Holding of meetings for the discussion of matters having scientific and practical bearing on agricultural interests as well as the publication and distribution of books and pamphlets thereon.

2. The employment of persons competent to advise farmers on dairying, on the care of stock and on the treatment of diseases of farm animals.

3. The institution and supervision of experiments, embracing chemical analyses, etc.

4. Arranging for and superintending the placing of apprentices on farms and in dairies, and granting certificates to such as comply with the conditions of service and prove deserving.

5. Acting as a central organization for the numerous local agricultural societies in the kingdom, and joining with them for the purpose of holding one comprehensive exhibition every five years at different centres.

6. Assisting in fostering the export trade of farm produce, and submitting to the Government reports on agricultural subjects.

In 1853 its membership was only about seventy, while now it has on its roll nearly one thousand members paying an annual subscription of a little over $5 each. Up to last year it received an annual grant from the Government of rather more than $800. That is now somewhat increased. It has a funded capital of about $90,000, part of the revenue from which is devoted to the maintenance of a few deserving pupils at the Royal Agricultural College at Copenhagen.

The local agricultural societies are very numerous and keep alive an active interest in the progress of farming knowledge and methods in the remoter districts. From these clubs, delegates are sent yearly to form one agricultural society for each of the four provincial districts, into which the country is divided for that purpose.

Both these and the local societies hold exhibitions every year, and the Government contributes to the premium fund dollar for dollar provided by the societies themselves.

Before proceeding to briefly trace the part taken by the Royal Agricultural Society in the development of agricultural education, mention should be made of the Polytechnic School, established in Copenhagen in 1829, and also the Royal Agricultural College of Denmark. This first institution, which seems to cover the same and more ground, educationally, than the School of Practical Science in Toronto, is very highly esteemed for its work in preparing thoroughly competent teachers for the Royal Veterinary and Agricultural College. At this school, in 1849, Prof. Jorgensen first commenced to lecture on rural economy.

A veterinary school had been in existence at Copenhagen from 1773. In 1856 it was decided to add to it a full course of instruction in all branches of agriculture. Then it became the Royal Agricultural and Veterinary College of Denmark. It is now entirely a Government institution, the expenses being met by an annual grant from the public treasury, which, however, is supplemented to a considerable extent by revenue from legacies and gifts invested for its benefit. There are twenty-two professors and thirteen assistants, besides the inspector and other officials upon its staff. The total annual expense is about $33,000, of which the Government pays about $28,000.

Its curriculum embraces five divisions, Veterinary Science, Agriculture, Surveying, Forestry and Horticulture. Then there is a ten months' preparatory course for those

needing futher elementary instruction before taking up any special subjects. Two years' study are required to pass in either of the five divisions. A few students stay for four years and thus graduate in two departments. The fees are about $15 per annum for all lectures and the use of the laboratories and chemicals; books are extra.

The students find for themselves boarding places in the city. The cost, of course, varies with the accommodation required. The average expense for the year for fees, boarding, books, clothing, etc., was put by one of the professors at $250 per student. The plan of College boarding for the students was considered by the authorities as very undesirable and unsatisfactory.

The College buildings seem spacious for the number of students, yet an early enlargement is looked for and promised. The class-rooms are fitted up in admirable arrangement. The museums are replete with specimens of every creature and skeleton that might be found on a farm. The skeletons of cattle, horses and sheep, which, while naturally clothed with flesh and skin had once won prizes at leading shows, now serve as models from which to lecture, demonstrating the desirable points of frame and build. Samples of all kinds of seeds and farm plants are daily handled in the class-rooms; working models of implements and machinery (ancient and modern) are taken apart in the class-rooms as far as practicable, and the names, uses and manner of construction of each piece explained. So, also, with the various fertilizers of commerce.

The chemical laboratories are fitted up most completely and ample opportunity is afforded all students for practical work in analyses. The O. A. C. laboratory at Guelph is like a blacksmith shop beside a well equipped engine works when compared with that at Copenhagen.

There is also a large botanical garden adjoining the college. One feature that delighted me was the full and clear labels attached to every shrub and bush. Some twenty acres are used to illustrate agricultural operations. The students visit the plots in company with the professors to watch and note the progress, differences and likenesses between plants and grasses at their various stages of growth.

For the use of veterinary students there is a suitable dissecting room, with excellent appointments. Under the charge of the same department there is a commodious horse hospital, where the disabled and sick equines of the city are stabled and doctored. The students accompany one of the professors of veterinary science on his morning rounds and receive clinical instruction.

A branch hospital is a retreat for the sick dog-and-cat pets of the capital. At this place we received a very noisy welcome. Horse-shoeing is taught in an adjoining building. A small dispensing laboratory is attached, where students learn how to prepare and compound medicines.

For use in his lectures on Dairying, Prof. Segelcké has models of all kinds of apparatus, used in nearly every country where cows are milked and butter and cheese are made. Especial attention is given to instruction in the use of and parts of the centrifugal cream separators.

Apart from the College stands the special dairy laboratory, under the charge of Prof. Fjord, who is assisted by three chemists and a number of other helpers. A Government grant is also made for its support (about $5,000 annually), and the whole time of these enthusiastic experts is given to investigation and experiment with milk, butter and cheese, and the utensils used in their manufacture. The chief chemist, M. Storch, whose name, together with Prof. Fjord's, will be permanently engraved in the dairy literature of the century, kindly showed me over the place. The necessary limits of this report, and my unavoidably hurried visit, forbid an attempt at fully detailed description. Everything useful, seen or learned, will be communicated to the professor of chemistry at Ontario Agricultural College, who is with commendable vigour devoting much time to scientific dairy investigation. Besides the work carried on at this laboratory, many of the leading dairies of the country have appliances and conveniences for Prof. Fjord's use when he wishes to work at their places. Whatever improvement in dairy machinery is effected is made known freely to the public, and all useful discoveries are regularly published for the benefit of dairymen. Such elaborate care is exercised in all the work that the confidence reposed by the public in Prof. Fjord's conclusions is fully warranted and justified.

There have passed through the college course at the Royal Agricultural College—

455	in Veterinary Science	during	the last	25	years.
258	in Agriculture	"	"	25	"
71	in Surveying	"	"	25	"
55	in Horticulture	"	"	18	"
82	in Forestry	"	"	18	"

These graduates become teachers in the lower agricultural schools, managers of estates, or follow the special vocation for which they have been educated, on their own account. By way of incitement to diligence, the Royal Agricultural Society—formerly mentioned—awards to successful students premiums of sums of money, sufficient to enable them to visit different parts of their own or some foreign country, for further culture and acquisition of knowledge relating to their intended calling. Many instances are on record where diligent and persevering youths have risen from poverty and obscurity, to occupy foremost places of usefulness and influence.

I return to the part taken by the Royal Agricultural Society, outside of the College, for the improvement of agricultural operations. From the beginning of the present century, it has been a very important factor in developing the country's resources. It first undertook the task of apprenticing young men to the bsst farmers all over the Kingdom for training and instruction. The conditions upon which youths were received were briefly: they must be native Danes, of good health and irreproachable moral character; they must have a recommendation from a magistrate and clergyman, and express an intention to follow farming. When everything of that sort was satisfactory, the applicants were accepted for two or three years. Good farmers of approved standing were glad to take these youths as learners, paying them a small sum yearly, besides giving them board and lodging. Each apprentice was left for one year only on one farm, when he was removed to a farm in another part of the Kingdom. His third year was spent on still a different farm in one of the other districts. At the outset each apprentice received from the Society a number of books bearing on agriculture, which became his own property upon the completion of the three years. Reports were made to the Society at stated intervals by each apprentice. Then from these, and the youths' records at the places where they had spent three years, the Society judged of their progress and merits, and granted diplomas accordingly.

Such varied training gave the apprentices a wider knowledge, and more skill in regard to all farm work, than if they spent the whole period on one farm under one manager. After the Society had laid the foundations for the success of the system, the demand for apprentices, and the desire to be apprenticed, quite out-grew its capacity for oversight and management. Then the terms of the Society were accepted as the basis of engagement between youths and farmers direct. Thus the leading farms of the Kingdom have each become a centre for agricultural education. The plan whereby the young men learn the systems of farming, in all the districts of their country might be transplanted with much advantage, to the farming community of Ontario. The student apprentice's life was not by any means half work and half play. They were at work by four o'clock in the morning, and, except for meals, did not knock off till seven in the evening.

By 1873 this same Society began to recognise the value of the dairy industry and the importance of and need for instruction. It took steps to learn of the best methods in dairy husbandry, followed in their own and other countries and by means of pamphlets and lectures set out to improve the manufacture of butter. In 1860, Prof. Segelcke was engaged as dairy chemist. Then his whole time was occupied in the work of apprenticing young women to the best dairies in the country. Considerable difficulty was at first experienced by reason of the opposition of the chief dairymaids, who were secretive. This was finally overcome, and a small fee in every case, for a two or three months' course, allayed their jealousy and directed their tongues to teaching. From 1864, young men were apprenticed in the same way. They were accepted by the Society upon conditions similar to those affecting candidates for apprenticeship for general farming. The term of service, however, was usually three months, instead of three years. Each apprentice was

furnished with blank report forms, on which he was required to report to Prof. Segelckè, once a week, a record of the operations of the dairy in detail. The supervision and necessity for recording details of everything done, were very helpful in furthering the young men's education and progress.

By 1885, no less than 945 youths had passed through the course of training and received the Society's diplomas. They were required to pay their own way, but no fees were charged for the Society's help. As in the apprenticing of youths to general farming, this, also, soon outgrew the need of the Society's control. Now nearly every dairy of note has many learners, accepted and trained by private agreement and arrangement. All this has told with marked effect on the general progress and appearance of the country. No antagonism is apparent between dairymen and other branches of farming. But as more attention has been paid to this specialty, so more progress and prosperity have attended the other departments of farm labour. While the Danes have been appropriately called a "Nation of Dairy Farmers" they have not neglected the thorough cultivation of their farms for grain and root growing, nor ignored the profits to be made from stock raising and fattening cattle. From the export statistics it is learned that during the four years from 1869 to 1872, Denmark exported 69,838,730 lbs. of butter and 207,513 head of cattle; from 1870 to 1873, inclusive, Canada exported 61,976,234 lbs. of butter, and 233,402 head of cattle; from 1881 to 1884, Denmark exported 133,061,193 lbs. of butter and 445,498 head of cattle; from 1882 to 1885, Canada exported 38,674,611 lbs. of butter and 360,771 head of cattle. These figures show that the development of the dairy industry is not at all incompatible with, but rather helpful to, the profitable extension of the export cattle trade.

For sixteen years, each, the export figures are:

	Lbs. Butter.	No. of Cattle.
Denmark, 1869–1884.....	433,492,488	1,401,918
Canada, 1870–1885.....	212,593,246	914,462

Enthusiastic engagement in the dairy business has led the farmers to keep more stock, and the keeping of additional stock has made the raising of larger crops of feed a necessity. It has also made the latter an easy possibility by the consequent increased fertility of the lands.

I had the honour and pleasure of visiting the estate of Baron Tesdorpf, who wears the proud honour of being acknowledged as perhaps the leading farmer in the Kingdom. He has under his direction no less than seventy student apprentices, besides his small army of labourers. I quote two of his courses of rotation of crops, which will give a general idea of the system of farming followed;

Eight-course rotation.	Four-course rotation.
Clean fallow.	Wheat.
Wheat.	Roots.
Sugar Beets.	Barley.
Barley.	½ Clover, ½ Beans.
Peas, Beans, Turnips.	
Oats.	
Clover to cut.	
Pasture.	

The same gentleman uses a phosphate fertilizer in the shape of ground bones very liberally. He applies from 600 to 700 lbs. per acre about every fourth or fifth year. His large herd, at the home farm, of some 250 milking cows, were a lot of very fine milkers. The daily ration for stable feeding while in milk for a 1,000 lb. cow was:

3 lbs. Bran.	7 lbs. Clover Hay.
2 lbs. Cake (Oil or Cotton Seed).	30 lbs. Mangels.
5 lbs. Mixed Barley and Oats.	Straw without stint.

The mixture of chopped barley and oats for milking cows was very highly commended. For Canadian dairymen, I should recommend a mixture of barley, oats and

peas. General feeding practices that had been successful in different parts of the Kingdom I found to be very much as followed by our best feeders. A word or two of comment here will not come amiss. Bran was found to be more economical for milk production, together with grain, than the feeding of grain alone. All the richer feeds are fed with the coarse feed, both to encourage a large consumption of coarse feed and to promote the best results from digestion. The feeding of clover hay gives better results in milk than the feeding of timothy hay. A mixture of grasses will be found best in Ontario. These should be cut rather on the green side and well saved and kept. An excessive feeding of roots, even to the extent of one bushel a day, is judged to be wasteful and injurious. Straw from a grain crop cut on the green side is held to make excellent fodder. Ontario farmers may note that the practice of cutting crops rather on the green side would avoid loss of grain, leave it of brighter colour and better weight, and make the straw much more valuable for milk production.

The breed of cows now finding most favour are the Angels (*g* is pronounced hard). In appearance they resemble a cross between the Ayshires and Jerseys. It is not believed that they are descended from either of these breeds; but possessing similar powers for milk production, they reflect these in forms somewhat alike. They are of a dun-red colour, shading into black on the neck and head.

The price in Denmark of a first-rate Angel Bull, with good pedigree, would be about $165, and that of a choice picked cow about $75. I do not recommend their importation. The average annual milk yield will be about 6,700 lbs. per cow, with an average weight of under 1,000 lbs.

The stables are constructed to provide for thorough ventilation, as the cows are often stabled for eleven months continuously. Every care is taken to preserve the manure for use on the fields. Both liquids and solids are guarded from losing their fertilizing value. In some stables the manure is pitched under the cows feet, then covered with straw, and so allowed to accumulate for three months. No bad odour was detected as arising from that practice. At other farms, covered manure yards protect their contents against the washing of rains and the bleaching of the sun. At such places the liquids are conveyed to a central tank, and frequently pumped over the compost heaps.

The stable feeding has already been described. The ration mentioned is the usual one, and is divided into three feeds per day.

Water is given in the stables. Attention is paid to its purity, and it is offered freely. Cows have access to salt at all times.

On large farms, the soiling system prevails; and cows are allowed out only one month in the year. That is either June or August. Where allowed to pasture during the summer, the cows are usually tethered. Water is supplied by a watering cart driven along between the rows, and with convenience for each cow to drink.

The milking is mostly performed by women, who, generally in large dairies, milk twenty cows each, morning and evening. Attention is paid to the equal division of time between the milkings. From four to six o'clock in the morning, and from four to six o'clock in the evening, are the times taken. A superintendent sees to it that each milker washes her hands after milking every two cows. The utmost cleanliness is observed in all the handling of milk and its products.

A record is kept of the milk yield of each cow by weight once a week, and occasional tests are made of its quality. The average quantity of milk required to yield one pound of butter is about 25 lbs., by the centrifugal separator. At some creameries where deep setting was followed, the average was 31 lbs.

The heifers drop their first calves when from twenty-two to thirty months old. The season of the year when most cows calve is from early December to late January.

Cheese-making is followed, to only a very limited extent. Skim milk mostly is used in its manufacture. The product is not very palatable, though it is rather more so than the soft varieties to be found in North Germany. The taste in North Europe seems to be for a soft, a very soft cheese, when made from whole milk: and if the odour is of an indescribably vile description, no objection is taken. The sense of smell seems to be dulled into enduring, or cultivated into relishing every kind of assault.

Butter-making is followed both on the home-dairy and creamery plans. The smaller dairies frequently unite to support a creamery, while the larger dairies of from 100 cows and upwards, can afford to manufacture their own butter economically. The shallow pan, deep-setting and contrifugal systems of cream separation, have all been tried, and in different places, are all still in practice. Progressive dairymen have abandoned the shallow-pan method for the deep-seeting, during most of the season; and are now adopting the centrifugal, as an advance and improvement on the latter. It is allowed that a fuller separation of cream is effected by the mechanical than by the natural plan—that the skim milk is left in better condition for calf-feeding—and that the butter has better keeping properties. The cream is better under the control of the butter-maker for ripening, and its butter has a higher melting temperature than when milk is set in the ordinary way for cream to rise.

Care is taken to have the centrifugal machines run at a regular rate of speed. The inflow is regulated to a nicety. Then the separation can be adjusted to any per cent. desired. The usual temperature of the milk is 86° Fahr. for mechanical separation. Where deep setting is practised the milk is heated to 100° Fahr. and immediately placed in ice-water tanks, and so allowed to stand till cream separates. For the best results from shallow pans the milk is poured into them while warm, and then left in a cool room. In both of the latter cases, the skimming is performed in the well-known manner, and always while the milk is sweet. Thus the cream obtained in bulk is always sweet.

To properly ripen the cream for churning a "fermentation starter" is prepared daily in the following way: As much milk as will yield cream, equal to two per cent. by bulk of the whole cream to be churned each day is taken from the evening's milk and set in deep-setting cans in ice-water. Sometimes it is set in shallow pans. The surface in both cases is left exposed to the air. In the morning this is skimmed. About 11 o'clock in the forenoon it is warmed to 72° Fahr., and placed under cover so as to retain its heat. By the following morning it will have become sour. The sourness is merely a result of the fermentation induced by the exposure to the air and after maintenance of warmth. This is now what is called the "fermentation starter." After the bulk of the cream is separated, if by the centrifugal machine, it is heated to 72° Fahr. and then put in tin-lined cream tubs. To it is added "fermentation starter" equal to two per cent. of its bulk about 11 a.m. The whole mass is allowed to gradually cool to 58° Fahr., and by the following morning, or after the lapse of about 18 hours, is in the right condition for churning.

When the separation of cream has been effected by the natural method of setting, the bulk of the cream is heated to 59° Fahr., and then the "fermentation starter" is added, and the treatment is as above. These temperatures vary slightly with the season of the year and the length of time the most of the cows have been milking. So, also, the temperatures at which the churning is performed, the range being from 57° to 64° Fahr.

The churns in common use are the Holstein churns. The churn body is cylindrical and stands perpendicular, the bottom being wider than the top. On the inside and standing perpendicularly, are three or four blades of wood, fastened at equal distances around the inside These stand out in width from three to four inches, and are about one inch thick. The churning is performed by means of a revolving dash whose axle stands perpendicularly. The churns vary in size, holding from 150 pounds to 300 pounds of cream.

The speed of revolution varies with the diameter of the churn. The smaller in diameter the greater number of revolutions per minute. By a simple calculation, I arrived at the ratio of speed to diameter. The outside of the blades on the dash are made to travel about 700 feet per minute. Churning is completed in from 30 to 40 minutes. In the cover of the churn, provision is made for the insertion of a small stick or tube, while the churn is in motion, on which to withdraw a sample and learn the condition of the cream. As soon as the cream is churned into butter-particles about the size of clover seed, the churning is instantly stopped. This stage is watched very closely, as churning too long or stopping too soon are regarded as injurious.

The butter in the granular state is then dipped out by a hair sieve. As much as possible of the buttermilk is shaken off. The remaining buttermilk is worked out by hand

in hollow troughs. No water is used to wash the butter; the hand-pressing only is applied. The working is performed on small quantities of less than half a pound each, and each piece is folded and pressed some eight or nine times. They are then placed on an ice-box to cool for an hour.

Salt is then added. From three to four per cent. by weight is the usual quantity, though the salt is generally measured and not weighed. By measuring, instead of weighing, the moist or dry condition of the salt does not affect the salting power of the quantity added. In from one hour to three hours the salt will have fully dissolved and the second working is proceeded with. The highest temperature at which butter is worked is 60° Fahr. The firkin to be filled will have been previously prepared by soaking with cold water and then washing with hot water and rubbing with salt inside. The butter is immediately and finally packed away. Usually within four hours or less from the time when it leaves the churn, the butter is packed. In that way all disturbance of the grain of the butter by re-working after it has commenced to set is avoided. The butter has better keeping properties in consequence.

The package mostly used is the Danish cask, which is barrel-shaped, and headed in at both ends. It holds 112 pounds of butter, and is finished with wooden hoops. The butter is packed in very firm and close, and covered with a clean cloth, free from all impurity that would impart offensive flavour to its surface. A slight sprinkling of coarse salt is put both under and over the cloth.

Examination has been made by trial of the effect of cold storage on the after-keeping qualities of butter when exposed to the warm summer weather of England. It was found that the cold-stored and cold-carried butter was in every way better than butter from the same churnings that had not been so treated.

A considerable quantity of the Danish butter is packed in hermetically sealed tins in Copenhagen and shipped at very remunerative prices to markets in the East and West Indies, China, Brazil, etc.

A measure has been framed, and by this time I believe it has become law, making it a penal offence to manufacture any compound in imitation of and of the colour of butter in the Kingdom of Denmark. Having won for themselves an excellent and valuable reputation, the Danes are setting their faces against the making of all counterfeit vilenesses.

For assistance rendered to me in the making of enquiries and gleaning the foregoing information, which I trust will be useful to the Dairymen of Ontario, my hearty thanks are due to Baron Tesdorpf, Rev. M. Weber, Prof. Segelcké, and Drs. Faber, of London and Copenhagen.

VII.—GENERAL REMARKS AND CONCLUSIONS.

Looked at in its relation to other branches of farming in Ontario, dairying needs and deserves more attention from farmers and educators than it has received in the past. Everybody acknowledges that the most economical way in which to increase and maintain the fertility of farms is by thorough cultivation and the keeping of large numbers of some kind of stock to consume the coarser grains and fodders. To those who prefer horses and sheep I have no advice to offer. But to those who go in for cattle I would say that dairying offers the best profits. Good milking cows leave margins above the cost of their keep; and as good and generally better stock for economical and profitable fattening may There is an endless chain of annually increasing profit from the keeping of good cows on any farm. The more the cows kept, the more the stock reared and fed; the more the be got from such cows, and reared in conjunction with dairying than in any other way. stock, the more the barn-yard manure; the more the manure, the richer the fields; the richer the fields, the better the crops; the better the crops, the more the stock that can be fed; the more the stock, etc., etc.

In those districts where milking cows are already numerous, but where no cheese factories or creameries are in operation, the farmers cannot too soon set about establishing the one or the other. The profits to the farmers from both are, on the average of years, about equal, when counting in the value of the skim-milk for calf feeding. The loss from dairy butter-making, where a market for immediate consumption cannot be reached, is very great, as has been already pointed out.

Then the dairy industry, even where well established, needs to be conducted on more progressive and profitable lines. The average yield per cow in Ontario is still deplorably small. Too much time has been spent in trying by manipulation to get the selling prices up, to the neglect of trying the more easily accomplished task of putting the producing prices down. That can speedily be effected by suitable and economical feeding and proper stabling, watering, salting and handling, as recommended. The line of possible profit is between the two prices mentioned, and nearly every farmer can make the line for himself a good deal longer than it has been, in the way just suggested.

At the factories and creameries the men whose special work it is to handle milk and manufacture cheese and butter need to keep on improving the quality of the goods turned out. As compared with the same industry in other and competing countries, our cheese-makers cannot afford to weaken effort at further improvement by too much confidence and boasting. The need now is to have *all the cheese from the Province as fine as the "make" of the best factories.* Systematic supervision and instruction would much facilitate that work.

In butter-making our creamery men have made some advances during the past few years. It is needed that the quality of the butter from the best creameries be better in 1887 than during 1886, and that the "make" from the creameries of the whole Province be as nearly uniform as possible. Judicious superintendence and practical instruction at the creameries during their working season would further that end. All of which is respectfully submitted by

Your obedient servant,

JAS. W. ROBERTSON.

REPORT

OF THE

ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION,

FOR THE YEAR 1886.

INTRODUCTORY.

The proceedings of the Union are so fully presented by the reporter as to leave the editor but little to say. It might be mentioned, however, that great interest was taken in the discussions by those present, and several suggestions which were made, have since been put into operation by the officers of the College and Farm. In accordance with a resolution passed during the meeting, the Committee distributed seeds and fertilizers for experimental purposes in various parts of the Province, and those receiving them, very willingly undertook the assigned work. The results will be ready to come before the Union at its next meeting in February, 1887, and from all indications, we think a valuable work will be done in the future in this line by the members.

CONSTITUTION OF THE UNION.

The objects of the Association are to form a bond of union among the officers and students, past and present, of the Ontario Agricultural College and Experimental Farm, to promote their intercourse with the view to mutnal information, to discuss subjects bearing on the wide field of agriculture, with its allied sciences and arts, to hear papers and addresses delivered by competent parties, and to meet at least once annually for these purposes.

All officers and students of whatever time shall be entitled to become members of the Union on paying their subscription. The Hon. the Commissioner of Agriculture for the Province of Ontario, the presidents for the time being of the various agricultural societies of Ontario, and such parties as the Association deem it advisable to appoint, shall be honorary members of the Union.

Members shall pay the sum of fifty cents annually. They are eligible to all the offices of the Union, and shall receive gratuitously any reports of the same which may be published after the date of such payment. For any reports previous to their admission they shall pay the sum of twenty-five cents.

Every ex-officer and ex-student, who is in regular accord with the Union, shall be considered as a corresponding member thereof. Each shall be entitled to the privilege of receiving for experimental purposes at least five samples annually of such agricultural

seeds as may be on hand for distribution at the Ontario Experimental Farm. He shall report to the Union the results of such experiments, and also give his experience on such subjects as come within the scope of the Association. Ex-officers and students, who are members, shall be entitled to receive by correspondence, if necessary, such information on the work of the Union or that of the Ontario Agricultural College and Experimental Farm as may be deemed reasonable by the Executive Council.

The Union shall meet annually at the Ontario Agricultural College for one day or more, beginning two days previous to the Easter closing exercises of the institution.

The officers of the Union shall consist of a President, Vice-President, Recording Secretary, Corresponding Secretary, Treasurer, and Editor of Transactions, who shall be appointed annually by the general meeting. and hold office for the ensuing twelve months.

The President, as chief officer of the Union, shall be *ex-officio* a member of all committees or councils thereof during his term of office.

The Vice-President shall have powers similar to the President, but only in his absence.

The Recording Secretary shall keep the minutes of the general meetings of the Union.

The Corresponding Secretary shall conduct all business in connection with the Union in regard to memberships, general meetings, and all the business of the Executive Council, for which purposes he shall be *ex-officio* a member of that council.

The Treasurer shall collect all fees, and keep account of all receipts and disbursements of the Union as may be authorized by the general meeting and Executive Council.

The Editor shall receive, revise, and attend to the publication of such addresses, articles or papers, as may be authorized for publication in the Transactions of the Union.

The Executive Council shall consist of the officers of the Union for the time being. Its duties shall be to prepare a programme for annual general meetings, invite and arrange with parties for the reading of papers, to appoint reception and sectional committees, and transact such other work as has been indicated for it in this constitution, or which may be hereafter authorized by the general meetings.

The accounts of the Union shall be audited annually by the auditors appointed by the general meeting.

No part of the constitution can be altered except at an annual general meeting of the Union, and then only by giving at least three hours' notice of such intended alteration.

SEVENTH ANNUAL CONVENTION.

The Seventh Annual Convention of the Ontario Agricultural and Experimental Union opened in the lecture room of the Agricultural College on Thursday, March 11th, 1886, at 2.30 p.m.

The chair was occupied by the President, Mr. J. A. Campbell, of Simcoe, and Mr. J. P. Anderson, of Puslinch, acted as Secretary. The attendance was about equal to that of former years. Among others, the following members were present:—Messrs. J. I. Hobson, Mosboro'; Jas. Anderson, Puslinch; C. A. Keil, Chatham; L. E. Morgan, Strathroy; E. M. Zavitz, Coldstream; R. F. Holterman, Brantford; J. A. Ramsay, Eden Mills; J. B. Muir, North Bruce; John Morgan, Strathroy; J. Anderson, Jr., Puslinch; George Charlton, St. George; P. A. Carpenter, Collingwood; G. W. Westlake, New Sarum; W. Eidt, Philipsburg West; W. Thomson, Galt; A. E. Wark, Wanstead; O. T. Stamer, Paisley Block; P. Grant, Chatham; W. Robertson, Wanstead; W. Ballantyne, Stratford; A. E. Shuttleworth, Mount Albert; D. A. Black, Listowell; O. A. Chase, Sparta; George McIntosh, Paisley Block; W. Shark, Killyleigh; and W. A. McDonald, London.

After the roll had been called, and the minutes of the last annual meeting read and confirmed, the Treasurer, Mr. R. A. Ramsay, presented his report, as follows :—

TREASURER'S REPORT.

Dr.		Cr.	
Money received from A. E. Shuttleworth, Treasurer of last year	$ 3.75	Paid Mr. Galbraith for reporting	$10.00
Subscriptions received	25.50	Printing 300 Circulars	3.00
Special suscriptions from ex-students	6.00	Two hundred certificates	2.00
	$35.25	Postage and stationery	3.65
		Printing 100 programmes	2.25
		Cash balance on hand	$14.35
			$20.90

The report was adopted.

The retiring president having briefly reviewed the workings and object of the Union, the following gentlemen were appointed a Committee to nominate the officers for the ensuing year :—Messrs. Ramsay, Shuttleworth, Wark, Campbell, Holterman and J. P. Anderson, the Committee to report at 8.30 Friday morning.

A few communications were received and read, and the Chairman then announced that the next business of the Convention would be the reading of papers on the various subjects selected by the executive committee.

STUDY.

PAPER BY P. A. CARPENTER, GOLD MEDALIST OF 1884.

This is a subject of great moment to every student, and yet one which not a few know very little about. Every student is supposed to study, but is left entirely to himself to learn how to study. Every subject studied has its share of teachers and text books; but the subject of study itself can only be taught by the student to himself. Yet it is a subject separate and distinct from all other subjects, and as such, it is well worthy of every student's consideration. A student should study how to study.

Generally speaking, we have a two-fold object in study. We want to obtain a knowledge of the subject studied, and we want to develop and educate all our faculties. This latter is often a secondary consideration, but it should never be lost sight of. Indeed it is often advisable to select subjects for the first object solely with a view to their effect on the second. Educated men, and those who have charge of educational matters, generally choose subjects that are best adapted to develop and educate the mind. While the young student that studies the subject prescribed often values it only for the knowledge it contains. He considers it an end what is only a means, and if he thinks the end not worth the time spent in attaining it, he often wants to give it up on that account.

Every student has his own particular way of studying; some choose the steady, plodding, hard-working style that always tells, while others only study by fits and starts, brilliant at times, but generally wofully deficient in the long run. Still, each one must adopt a style that is best suited to him, and in order to master a subject he should do it one way if he cannot another; if the old orthodox way won't suit, you find a way that will. Take the shortest, easiest and best way of getting it up. If it takes a year to learn to judge a cow by reading text books, and a month by working about the stables, by all means save the eleven odd months. When a subject can be mastered in a practical way, it is generally easier and better to do so. Similarly in studying a description of anything, if the thing can be seen, or even pictured in the mind, it is generally much easier remembered. Some can remember views and descriptions very easily, while others might soon forget them, but retain facts and lists of names. When one has a good memory, but deficient reasoning powers, he is very apt to study altogether by memorizing. These are generally poor in mathematics, and would rather remember a rule than understand it,

on the other hand, a good reasoner always understands, and goes to the bottom of everything as he goes along, thus he makes less use of his memory, but if he forgets a thing, can generally reason it out, and a thing once learned is always available. Poor reasoners should take every chance to improve themselves by making it a point to understand everything as they go along. When hurried, and especially when studying for examinations, it is often easier to commit a thing to memory than to understand it; however, this is mere waste of time, as it is soon forgotten, and leaves no permanent good. Besides, a catch question on the subject would completely puzzle one who did not thoroughly understand it, the student who follows this plan, must acknowledge that he has spent so much time merely for the sake of standing well at an examination. The sooner a student finds that he has fortitude enough to, in a measure, overlook the examinations and study only for his permanent benefit, the sooner will he realizing the true meaning and value of education. However, while we should not substitute our memory for our reasoning powers, we must not forget the great value of cultivating the memory ; it is a faculty very easily cultivated. and, on the other hand, carelessness often makes our memory poorer. If we get in the habit of never trusting our memory, but writing everything down as it occurs, we will soon find our memory for daily events becoming poorer. Thus a business man could not tell you what he paid for a hat a week afterward, while an uneducated laborer would remember the price for a year ; still, while the memory may become poorer for some things, it may get better for others, and knowing this, I would make it a rule to memorize only those things necessary to be remembered, and never mind those things that can be found at a moment's notice. Never burden the memory with a lot of facts that can at any time be referred to, but rather make it a point to remember everything that you have to depend on yourself for. A successful student must make good use of his memory, and in order to do this, he must know what to forget, that he may have more room for that which should be treasured up.

In studying such subjects as mathematics, it is a good plan to explain difficult questions to others. In order to make a thing plain to others a person must be very clear on the subject himself, and very often in trying to explain anything you notice your own defects. Trying to explain a thing clearly is very good practice, as it accustoms one to look exactly at what is wanted. Thus we form the habit of thinking and acting right to the point. Ability to do just what is wanted, no more nor less, is attained only by a few, and gives those few a decided advantage over others ; they become possessed of that clear, practical mind that at once strikes to the root of everything, and are not apt to waste much time in getting down to work.

While we study chiefly as a means of education, we should study only that which will be of most use to us ; an active man that makes good use of what he knows, finds life far too short to spend time reading a great deal that some consider necessary to a first-class education. Indeed, I consider a book-worm that spends much of his time reading what will never be of much use to himself or anybody else, one of the worst educated men of our time. Knowledge is only valuable when we are able to make use of it ; unless it can be applied in some manner the time spent in acquiring it is as good as wasted. Of course just how much is useful, each one must decide for himself and to suit himself. What would be indispensable to one person in one walk of life, might be of little value to another ; different people require different modes of education and treatment, and a man's chief study should be to know himself, and find out just what he does want. Still, in picking out for ourselves we must not be guided by narrow or prejudiced opinions, because we don't like a subject, or because, at first, we see little of real value in it, is no reason that the study would not benefit us. Very often the very effort required to master a subject is of more value to us than the knowledge gained. Nearly all study is more or less beneficial, even if it goes in at one ear and out the other, it leaves its trace.

In beginning a course of study, the key to success is method, "Order is heaven's first law," and the farther we go from heaven's decrees, the worse for us. Have a time for every subject, and do everything in its time. When the time for one subject is up, leave it whether you know it or not and go to the next; if you find you cannot get up a subject in a certain time, you must allow more time for it. In this way one finds out exactly the time required for each subject, and, knowing the time at one's disposal, each can have its

proper share allotted to it; this will save confusion, and prevent some subjects taking nearly all the time, and others hardly any; but the chief advantage in method is, that it enables one to find out just what one can do. In order to study with any degree of success, a student must know himself; he must know what he can do, and in what way he can best do it. The more he knows about his own abilities and failings, the better is he able to accomplish his purposes. It is not always the cleverest scholar, the greatest intellect, nor the hardest worker that makes the best student, but the one that is able to make the best use of his own abilities. Method is the great secret of knowing yourself and your studies; it enables you to handle your studies, your time, and yourself to the best advantage, and will get you into the habit of thinking, planning and systematizing, so as to be able to make the best use of the means at hand. Thus we soon find that some subjects can be best studied after certain others. If we have been at one subject for some time, a change to another entirely different will rest the brain. When studying, always keep the mind concentrated on your work; allow yourself only a reasonable time to get up a lesson, and make up your mind to do it in that time, and it will not be long before determination forces concentration, and by practice the time required for a certain amount of work will gradually grow shorter. Having too much time at one's disposal is fully as bad as having too little, as one is apt to fall into careless ways of studying, while determination is pretty sure to make up for want of time. Of course one can generally study best in a quiet room, yet if a person makes up his mind to it he can study in a room full of talkers without being disturbed.

As to the best time to study much depends on the student. Some prefer the night, others the early morning. Some can study at any and every time, day or night. Odd minutes can be snatched now and then during the day for study. If a text-book is not handy, the mind can always run over and digest what is already acquired. After meals or much exercise, it is generally best to study light subjects that do not require much effort. Anything needing much reasoning is best studied when the brain is clear and calm, as in the morning. Still, here as elsewhere, each one must find for himself when he can best study certain subjects.

The foundation for vigorous brain work is a vigorous constitution. If the brain is to act clearly, it must be supported by good health. A person in poor health cannot stand nearly as much study, nor study as well as one in good condition. Hence the first requisite to a student is to keep well. Do not study hard enough to over-work the brain and always take plenty of out-door exercise. The brain needs to be rested fully as much as the body. A rest of one day in seven, enables one to do more work in six than could be done in seven continuous days, because a constant strain tends to make the brain dull, while a short rest gives it time to recover its freshness and vigour. Also a few weeks holidays after a hard term's work, have a very beneficial effect. After a good rest one can study much more in a given time, at the beginning than at the end of a term, simply because he has had a rest; hence, I am no advocate of much study in the holidays; especially about examination time should one make it a point to be in the best of health and spirits. If possible, study very little while the examinations are going on. The strain caused by writing and thinking while striving to do well, is fully as much as the brain can stand. It is very poor policy to spend a hard night's study before an examination. The mind is sure to be tired and dull, and cannot act as clearly and promptly as when backed up by a good night's sleep. Cramming for an examination is one of the worst evils of our educational system. Still, as long as examinations are conducted as they are now, just so long will most students make a business of cramming. Steady systematic work, from the beginning to the end of the term, always tells. Cramming for a few weeks before an examination is time spent in stuffing trash wholesale, only to be cleaned out and forgotten as soon as the examination is over. Besides this waste of time, it is very injurious to the health; and about examination time one feels more like taking a week's sleep than on entering a competition in which a calm, clear mind, high spirits and splendid condition are indispensible to success.

President MILLS said that the question of cramming referred to in the essay, was a very difficult matter to grapple with. In his opinion, students would always cram ; there was no such thing as putting a stop to it.

Mr. HOLTERMAN agreed with all that was said in the paper. In reference to cramming, he thought there would be many obstacles in the way of overcoming the habit. The questions asked at the examinations should be broad, and the student should concentrate his mind upon those subjects which would be most useful to him in after life.

Mr. MUIR said that the only way to meet with success was by systematic study. His term at the college was over, and he was well satisfied with the knowledge he had gained whilst attending the institution. In the first year he had studied everything, but in his second year, he fonnd by experience that it was best to confine himself to those subjects which were best suited to the walk in life which he intended to follow ; he also made a practice of memorizing.

Prof. BROWN said that a point was made in the paper in reference to the style of examinations. He thought that a great many students failed to understand the questions asked. There was a great difference in the way the questions were put.

President MILLS said a great revolution for the better had taken place in the style of questions given to the students. There was less cramming in the schools now than there was some years ago. Enough general questions should be given to help the earnest plodders and pick out the crammers. He advised the students to buy a little book called "Todd's Students' Manual," which, he said, would be of incalculable service to them.

Mr. BROOME advocated outside examiners for the institution.

Prof. BROWN said there were certain objections against outside examiners. The students would be induced to throw all their labour into the examinations and would neglect the lectures. It would be better to have associate examiners, like some of the universities. There would be no difficulty in getting them.

Mr. WARK thought there was too much study on the dry facts. More time should be allowed for reading, and the professor should tell them the best books to read. They did not get enough general knowledge.

Prof. BROWN intimated that he occasionally suggested books which contained useful information.

Mr. SHUTTLEWORTH thought that one night each week should be devoted to recreation. He appreciated fully the sciences taught in the Institution, but thought that if the three hours which were devoted to reading, every other day, were given to agricultural matters, it would be much better.

Mr. HOLTERMAN—Study agriculture at home and scientific matters here.

Prof. PANTON said that each student could study what he wished during the three hours mentioned; it was left to his own discretion. In reference to outside examiners, there was much in their favour ; but this Institution could not be compared with Toronto University, and therefore, was not prepared to introduce professional examiners. In the latter institution, a four years' course was gone through, whilst here, the majority of the students barely put in two years. "Just imagine," he said, "an outside examiner from Toronto University, asking questions to the class here on botany and the other sciences; not one-third of them would be properly answered ; he would not know what kind of a question to ask and give the student a fair chance. Associate examiners should, however, be employed, and they should be selected from among the ex-students." He thought that cramming could be partly overcome by holding monthly examinations.

Dr. GRENSIDE said that in his profession an outside examiner would be of no use. He always took great pains in explaining the subjects upon which he lectured, and made them as plain as possible. He did not think there was any cramming in the veterinary department.

PRACTICAL FORESTRY.

PAPER BY J. B. MUIR, NORTH BRUCE, ONTARIO.

It is not my intention to enter into a full and detailed history of the conserving and replanting of forest in this paper. Were I to do so, I presume we would require to go back to the time when our ancient ancestor dwelt with his fair consort on the banks of the great river Euphrates, and enjoyed himself beneath the leafy branches of those beautiful trees in the garden of Eden. And delightful it must have been to him then, as it is to us now; to walk in the primeval forests, and enjoy their health-giving atmosphere and

> "Under the shades of melancholy boughs
> Love and forget the creeping hours of time."

But I do not mean to linger on the pleasures which our forefathers enjoyed; I must pass by the ages of antiquity, loaded though they be with useful information regarding our subject, and confine my attention to the forest of the present time.

In this and other provinces of the Dominion, which were at one time covered with trees from shore to shore, we find large tracts of land, where the trees have been entirely removed, and a dreary, cheerless waste exposed to view. Those of us who have the misfortune to live in those exposed places, know and realize what a grievous mistake was made in the early settlement of this country, when they permitted the forest to be all cleared or burned away. The soil has ceased to be so productive, the little streams and rivulets have dried up, greater extremes of heat and cold are experienced, and the climate becomes more variable. Besides this, it requires more fuel to keep our homes warm during the cold winter weather, more food and shelter to maintain our stock, and all out-door work done during the winter is accomplished with greater expense and hardship both to man and beast. Again, we find it much more difficult to raise some of our principal crops. The pasture becomes bare and withered in early summer, owing largely to exposure and the hot dry winds, which sweep along unchecked and lick up the moisture from the parched soil. The raising of fall wheat and clover is not so profitable, and is attended with greater uncertainty, than where we have a due proportion of forest land preserved on each of the farms. The rain, also, as it falls, washes away the soluble constituents and natural fertility of the soil from exposed places, more quickly than in protected districts, and in a very short period of time, we have the land in a state of poverty, altogether unfit for the successful raising of crops.

From a consideration of those facts, we may readily arrive at the just estimate as to the importance of renewing a small portion of the original forest on each of our farms. And in addition, when we consider the history of the different countries in the world, we cannot find one that has made a successful agricultural record, but what has given its attention to forestry as well.

If we go to the distant prairies of the North-West, rich in the elements of fertility and decaying vegetable matter, there men of science tell us that unless the cultivation of trees is resorted to, there can be no great agricultural future in store for that vast territory. Now, if we continue wasting our forests in the future, as we have done in the past, many parts of Ontario will soon be as bare of trees, as the prairies of the North-West. But, fortunately for us, Ontario possesses many far-seeing and able men, who are alive to the importance of saving the timber on their farms, and are seeking to the best of their ability to preserve their forests in a healthy condition. Those men will one day prove to be the backbone of the agricultural wealth of this Province. We cannot find an eminent agriculturist without at the same time finding a forester. Forestry and agriculture are twin brothers; they must go hand in hand, in order that both may be successful.

To those who are living in the newer districts, where a large percentage of the natural forests are still standing, we would say, be conservative in regard to the wasting of your timber. Where it is possible and convenient to save it, do so. The time is coming when every stick of timber will be valuable, and varieties which cannot now be placed on the market but at a loss, will be increased in value, and made to yield a handsome profit.

Then in order to secure the climate amelioration which bush-lands are known to possess, it is not sufficient that here and there one farmer should be conservative and save his bush-land, while his neighbours pursue the opposite course. He must be "up and doing" as well, arguing, reasoning and prevailing with his neighbours for their own good, for their families comfort and for their countries wealth, to save a portion of the timber-land in its natural condition. Protect it from the woodman's axe, as you would the young and growing crop from the reaper's sythe, and stimulate its production, by planting new and improved varieties whenever a fit opportunity presents itself.

But then there are those who maintain that the timber thus saved will in a few years die off and be of very little use. True, we see some notable examples of this throughout the country ; but on the other hand, it is equally true that we can find many examples of reserved timber lands, flourishing in all the beauty of their own native grandeur, pushing out year after year an abundance of foliage, unsurpassed in vigour and richness by the healthiest forests of America.

But if we give the cattle permission to roam amongst the trees, eating and tramping under foot the rejuvenators of the woods, breaking with horn and hoof the rising sapling, tramping the soil from the roots of the trees, and letting in the drying winds, sooner or later our forest becomes but the dried-up remains of former greatness ; very little use as a protection, and an eye-sore to all lovers of natural beauty.

Another very destructive enemy to the conserving of forests are the annual summer fires. Thousands of dollars worth of timber are sometimes destroyed in a very few days by one of those forest fires, which sweeps across the country for miles at a stretch, burning everything before it.

To guard against this, we should keep our forests and woodlands as free from fallen and decayed timber as possible. This may be done by taking out the dead and dying trees, and making use of them either for timber or firewood. Their place should be supplied by more profitable trees, and, in time, a very inferior piece of woodland may be made to contain some excellent specimens of the best varieties of timber.

In order to secure this result at an early date, it is well to thin out the poorer qualities in the underwood, and supply their places by more profitable varieties. Care must be taken in this operation, though, not to thin too near the edge of the bush, as by so doing the wind finds an entrance, drying up the soil snd upsetting many of the larger trees.

Having thus touched briefly on the more important points to be observed in saving a piece of bush in a healthy state, let us turn our attention to another aspect of the situation, namely, replanting our roadsides and other places with trees. As has been stated in the former part of this paper, large tracts of Ontario have already been stripped too bare of their natural protection. The climate is now more liable to extremes of heat and cold than formerly, changes in temperature are more sudden, and the wind sweeps along with greater force and penetration than in the backwoods. This last remark is especially true in many of the western counties of Ontario, bordering, as they do, on the great lakes, where the wind sweeps along the vast bodies of water, and rushes with unchecked fury across our treeless fields and round our unprotected houses, piling the snow in heaps promiscuously behind the fences in the roads, lanes, outbuildings, etc. Now, if we had clusters of trees around our dwellings, and wind-breaks along the north and west sides of our farms, how different it would all be. Occasionally we meet with a farmer who is taking advantage of the natural protection which trees afford, and is planting groves for wind-breaks around his buildings. As one nears the friendly shelter on a stormy day, he feels as though he were leaving winter's icy blasts for summer's pleasant breezes, so great is the change. Here the severity of the winter's blast is moderated, the yearly consumption of fuel economized, the comfort and healthfulness of the live stock increased, and reater facilities afforded for proper attention to out-door work.

Now, if we consider that tree-planting is a necessity, as many farmers do, it is important that we should adopt some system as a guide to all our future operations. The haphazard system which characterizes the work done by many farmers is a very injurious one, and should be discarded as well as our scrub stock.

In planting we should consider what will be the most profitable size and shape to give the clump, wind-break, or other plantation. We should arrange the trees so as to afford shelter and protection to our buildings, to our fields, and to our stock. The trees should also be planted, when convenient, in rows, so that at any future time they may be used as posts for a wire fence. Again we must select trees suitable for the soil and locality, and such as will be profitable for timber when matured. Yet another consideration would be to plant the trees in such a manner so that they shall be an ornament to the place, hide unsightly objects and give a more pleasing effect to the eye, "for a thing of beauty is a joy forever."

How to make the trees grow, is a question which puzzles many of our practical men when they commence to plant their first trees. The present system of going to the woods in the spring and rooting and tearing out by main force a few fishing rods, and then planting each in a hole in the ground a few inches in diameter, is a useless one, and in nearly every case results in failure. The few trees that survive usually present a dwarfed, sickly, stunted appearance, compared with their natural condition.

Now, a simpler and much better method of obtaining trees, and one that usually proves successful, is to carefully prepare a plot of ground for a nursery. This should be a free, rich, loamy soil, carefully tilled, and kept free from weeds and grass. Great care should be experienced in keeping the fence well repaired around it, as the stock would cause a serious loss to the young trees if they should happen to break in.

Having carefully prepared the land for the reception of the young trees, go to the woods and select good, thrifty, healthy trees. It is always better to select small trees, (say from eight inches to two feet in height), as the change in their mode of living does not affect them so much. Trees of such a size will readily bear transplanting, and will soon become accustomed to their new quarters. After having carefully planted the young trees in rows in the nursery, they will require to be kept well cultivated for a few years to prevent their being smothered out with grass, and also, to keep the soil loose and moist. Planting the trees in the nursery develops a large number of fibrous roots, and this can only be done under favourable conditions, as when the soil is kept cultivated, etc. When the young trees in the nursery are ready to be removed to their permanent positions, select a mild, damp day in the spring of the year. Have the land carefully prepared for their reception, either by plowing or digging, and in no case plant deeper than the tree stood in the nursery.

And now, in concluding this paper, which is intended only to form a subject for discussion, and to awaken an interest, if possible, in this great branch of farming, let me ask: Why is it that so few of our farmers take any interest in ornamenting their places with trees? Is it because they think that only millionaires and such as are able to command their thousands are able to engage in this business? Or do they imagine that only foreign and expensive trees should be planted? To one and all I would say lay aside those foolish notions, and in the spring go to the nearest woods and select your young trees. Commence at once to beautify your homes, and save your stock from the cutting, wintry blast, and your fields from the sweeping winds. There is no need for us to turn this fair Province into the cold and barren *steppes* of Siberia, while we have plenty of material growing in our midst to prevent it. What we lack is the energy to go at the work; but let us combine our forces and turn again the treeless plains of Ontario into fields bordered on every side with shady fences, and in so doing we shall be able to make our homes more comfortable, our stock shall thrive on fat pastures, prosperity shall meet us on every side, and our land shall yield her increase.

Mr. MILLS asked Mr. Muir if he considered too much of our timber had been cleared away.

Mr. MUIR.—No; it is the unequal distribution that causes the difficulty. Many farms have no bush whatever, every stick having been cleared away. I claim that every

farmer should reserve from fifteen to twenty acres of bush to every one hundred acres of land. A farmer would realize more profit from eighty acres of land well cultivated and protected by bush, than from one hundred acres all cleared.

Mr. RAMSAY, (Eden Mills).—I think it would be wise to do more tree planting, but, at the same time, it is quite possible the thing could be overdone. Farmers should make it a point to leave some of the original bush standing and not clear all the land. Some people do not believe that taking away the forest dries up the springs, but I must say that I do. I do not approve of woodland pastures, as I have found it impossible to have bush and pasture in one. The grass will not grow in an old bush, and the cattle will not let the trees grow in a new one. Money can be made out of a bush by thinning out the old trees for sale, and planting young trees as the old ones are taken out.

Mr. MILLS.—When would you consider the best time for planting—in the spring or fall?

Mr. RAMSAY.—I always plant in the spring; it is much the better, and is more reliable.

Mr. MILLS.—Is there any damage arising from watering them in the heat of the day?

Mr. RAMSAY.—I apply water any time, and have found no bad results. The ground should also be mulched well to keep the roots moist.

Mr. FORSYTH said that in his experience watering did no harm at any time. He preferred mulching, as it retained the moisture around the roots. He was much pleased with the paper, but regretted that it said nothing about the raising of trees from seed. Anything of a loose nature would do to mulch with, such as leaves, straw, chips, saw-dust, and barnyard manure.

Prof. BROWN briefly referred to hedge rows, as compared with rows of trees, and expressed himself as much in favour of the latter. England, he said, was not realizing what she expected from her hedge rows, and we should take a lesson from her. He favoured planting trees on the sides of the farm from which the prevailing winds came.

A memorandum was here submitted by a member, in reference to the sowing of a handful of oats in the hole with the young tree, it being claimed that the people of some countries practised this custom.

Mr. MORGAN (Strathroy), considered that a farm beautifully ornamented with trees was the happiest home on earth, and besides, the trees formed wind-breaks and protected the grain fields. He was not in favour of tall, thin, fish-rod trees, but advocated the planting of soft-maples of stout proportions, with good roots.

President MILLS.—How do you protect the trees?

Mr. MORGAN.—I dig a large hole, and if the soil is not good, I procure soil that is adapted, and pack it well about the roots. I also mulch well, and advocate the driving down of stakes, and placing wire guards around the trees to keep the cattle off.

Mr. A. E. WARK (Wanstead).—I would like to hear from some one who has had experience in raising walnuts.

Mr. C. A. CAMPBELL (Simcoe)—I am now raising several hundred trees, and find that there is more difficulty in raising nut-bearing trees than any other kind. I cannot, however, give much information on the subject, as I have not had sufficient experience to speak with accuracy. I was much amused with the remark made by a member, "That a handful of oats facilitated the growth of a tree." The thing seems to me to be absurd.

A member here explained that he had seen oats sown with trees on several occasions. The oats grew and formed a turf which acted as a mulch, and therefore, was very beneficial.

Mr. RAMSAY.—There is a great difference between nut-bearing and other trees. In transplanting from the nurseries to the farm there was not much risk of losing the trees,

but in taking them from the bush, they invariably died. The oat question he considered as a relic of barbarism. He used stones as a mulch, and his trees thrived. Watering not enough was worse than no water at all.

Mr. FORSYTH.—When the tap-root is cut, the upward growth of the tree is checked, and it branches out from below without any leading shoots. He advised planting seed where the trees were wanted to grow, thereby avoiding transplanting.

Prof. BROWN.—This tap-root is an important point. To-morrow morning I will show you some trees on the farm, and you will see the difference between those which had been cultivated, and those which had not.

Mr. KEIL.—I have planted over one hundred and fifty nut trees, some of them have had the tap-roots cut, while others have not. They all thrived equally well.

Mr. FORSYTH.—I have noticed some trees planted from seed which grew up hardy, tall and straight. Transplanting and cutting the tap-root seems to check the growth, and causes side roots to shoot out.

President MILLS.—I don't believe that the sap from this one root runs separately through the tree, and would, therefore, look to other causes for the check in growth.

Mr. CAMPBELL.—Could it not be traced to the severe weather of the last few winters? The fruit trees have also suffered much lately from some cause.

Mr. JAS. ANDERSON (Puslinch).—I have not had much experience in anything but apple trees. I believe that mulching is better than watering, and that all orchards should be properly drained. I find black muck to be the best mulch.

Mr. LESLIE (Peel), had planted over one hundred trees, and they had all lived. He merely hoed around them; believed there was nothing as good as cultivation.

Mr. LICK referred to the Government grant of 25 cents per tree, and said that the farmers were not taking enough interest in the matter. There was great difficulty in getting trees from the bush to grow after transplanting. Sugar maples would not live in wet land. In planting on the roadside, trees should be placed thirty feet apart, and protected from cattle by a snake-rail fence.

Mr. RAMSAY.—Any municipality can pass a by-law, naming the size of tree to be planted, to get the Government grant of 25 cents. I know where whole lines of trees are dead, a fitting monument of the folly of men who planted for the sake of the Government grant.

Mr. MORGAN.—The law requires that the trees shall be growing for three years before the grant is paid. There is no law to compel a farmer to plant trees—merely a reward offered to those who do so.

Before the meeting adjourned, Prof. Mills invited all present to proceed to the dining-hall of the College, to partake of the matron's hospitality, after which various toasts were proposed and fittingly responded to by members of the Union.

SECOND DAY.

The Union resumed at 8.30 this morning, pursuant to adjournment of yesterday. There was a large attendance present. Mr. J. A. Campbell in the chair.

The Nominating Committee having reported, scrutineers were appointed, and the election of officers for the ensuing year proceeded with. Following is the result:—

OFFICERS FOR 1886-7.

Hon. President	Professor Brown, O. A. C.
President	A. E. Shuttleworth, Mount Albert.
Vice-President	P. A. Carpenter, Collingwood.
Treasurer	R. A. Ramsay, Eden Mills.
Recording-Secretary	R. W. Madge, O. A. C.
Corresponding-Secretary	R. F. Holtermann, Brantford.
Editor	C. A. Zavitz, O. A. C.

CREAM GATHERING *VERSUS* CENTRIFUGAL IN THE MANUFACTURE OF BUTTER.

PAPER BY A. E. WARK, OF WANSTEAD, ONTARIO.

The raising of cream by the old shallow pan system is fast going out of date, and will be substituted either by the deep-setting or centrifugal. The farmer who makes butter under the old system in the future will either have to consume it himself or trade it off in our country stores, which is little better than giving it away.

Creamery butter brings the highest price in our market; artificial butter or butterine the second, and farmers' home-spun, third or lowest.

Of the two evils, butterine and farmer's butter, it is hard to say which is the best. Statistics show, that from the 1st of May, 1885, up to date, 10,000,000 pounds of butterine were manufactured in the city of Chicago, and it is calculated that by May, 1886, there will have been 20,000,000 pounds made. Now, these are startling figures, and must influence the market to a great extent. At the Sixth Annual Convention of the National Agricultural and Dairy Association, which was held in New York last month, the President, Mr. Jos. H. Reall, contended that milch cows have depreciated $10 a head, the land 25 per cent. in value, and that a direct loss of $1,000,000,000 was entailed on the dairy industry by the manufacture of imitation butter, and by its sale as the genuine article. Now, I hope that this will be a warning to Canada.

You are all aware of the fact that Canada can stump the world in the manufacture of cheese, and taking into consideration the absence of butterine factories, and the non-market for farmers' butter, why not stump the world in the manufacture of butter also?

Creamery butter is of two kinds, namely, that made from cream raised by the centrifugal separator, and that made from cream raised on the deep-setting system.

The first prominent fact in the separation of cream from milk is, that it rises by reason of its having a less specific gravity than the milk with which it is mingled. The average specific gravity of milk is 1,030. The difference between this and 985 brings the cream to the surface. In the deep-setting system, everything being favourable, all or nearly all the cream rises in from 6 to 12 hours, while by centrifugal force it is separated in the fraction of an hour.

In criticising these two systems I will do so from an unprejudiced standpoint, and as I am neither acting as an agent for centrifugal separators, nor interested in the sale of deep-setting cans, I think I am in a position to do so.

In the first place, we will compare the cost of rigging out a factory to be run on the cream-gathering system, with one to be run on the centrifugal system.

CREAM-GATHERING.

Cost of Building	
Two 300-gallon vats	$400
One 250-gallon churn	100
One butter-worker	30
One test-churn	12
Eight gathering cans	8
One scale	70
One 6 horse-power engine and 8 horse-power boiler	5
Sundries	400
	25
Total cost	$1,050

CENTRIFUGAL SYSTEM.

Building	
Two vats	$400
One churn	100
One butter-worker	30
One scale	12
One 6 horse-power engine and 8 horse-power boiler	5
Three centrifugal separators	400
Sundries	750
Wear and tear on machines, 10 per cent	25
	75
Total cost	$1,800

We will suppose our factories in running order, the centrifugal having cost us $750 more than the cream-gathering factory. In order to meet my extra expense in starting the centrifugal factory, I must have more per pound for manufacturing.

The farmer's expense in both cases is about the same. In the one he has to furnish himself with cans to set his milk in, and in the other he has to furnish cans for the conveyance of his milk to the factory. In the one case I have the patrons complaining about the cooling of the milk, and in the other they keep growling about the skim-milk having no more nourishment than whey, and sour at that. These two points are where the shoe pinches the farmer, and which ever system can prescribe the best remedy is the one which is going to meet with success.

The trouble of cooling the milk can be easily overcome by laying in four or five loads of ice during the slack time in winter. The farmer can do this at little or no expense. He must build himself a water-tight box with a lid attached; into this set the cans of milk, and fill the box with water, which can be kept cold by throwing in a chunk of ice and closing the lid, by doing this he will greatly diminish the labour of cooling the milk.

Advocates of the centrifugal claim that they can take more cream out of the milk than can be done under the cooling system. If this is so it must certainly be done at the expense of the skim-milk, thus decreasing its value as a food. I maintain that the farmer would realize more by feeding the extra cream—which the separator takes out—to his calves.

"The skim-milk is sour."

This will invariably be the cry in the hot summer months, especially from patrons living four or five miles from the factory. This is not to be wondered at when we consider the different temperatures, etc., to which the milk is exposed. Milk comes from the cow at a temperature of 90°; it is set aside over night and cools; next morning it is

mixed with morning's milk and the milk hauler draws it, say five miles, to the factory. Here it is heated up to 90° and run through the separator at the rate of 1,000 revolutions per minute, and after all this carried home to the owner.

It is not the quantity of butter extracted from a given quantity of milk, which decides in favour of one system over another, but the quality. I fear that this one word "quality" will greatly retard the progress of centrifugal factories. We have only to look at the results of the Provincial Exhibition held in London last fall, and the Industrial held at Toronto, where butter from both systems were in competition side by side. The first prize in both cases was awarded the butter made under the cream-gathering system, the centrifugal not even getting a prize. I know of similar cases both in Canada and the States.

From these statements we must come to one of two conclusions—either that a first-class article can not be manufactured by this system, or that centrifugalists are not up to their business.

In either case my opinion is, that the cream-gathering system will be the system for some time to come.

Mr. CAMPBELL, Chairman of the Convention, called upon the farmers present to express their views on the subject. He said it should be thoroughly sifted.

Mr. MCDONALD (London), thought that the paper was much to the point. He had been making many enquiries lately in regard to the centrifugal manufacture of butter, and had come to the conclusion that at present the system was not complete enough to go into general use. He had been told in Toronto that the milk from Holstein cows was poor in solid matter, but in his opinion, the soil and grass had more to do with the quality of the milk than the breed of the animal. He would like to hear from some of the old butter-makers in attendance.

Mr. RAMSAY (Eden Mills), said that it was not worth while discussing the subject in this section of the country. The farmers here raised a good quality of stock, and would not sell the milk for centrifugal manufacture. Something should be done towards improving the butter that was now made, and means proposed to judiciously use the milk to raise young stock for export purposes. He was not in favour of the centrifugal process, although it had been said that in Denmark butter made by that system was considered the best and brought the highest market price. The Danes, he thought, were better posted in its manufacture. At all events it had never been a success in Canada. The cattle here were exactly suited for exportation, and the deep-setting is best for the milk. We should be very careful about jumping into this new-fangled system of centrifugal separators.

Prof. BROWN asked the essayist if butterine brought a higher price on the market than farmers' butter, when the buyer was made acquainted with the difference between them.

Mr. WARK replied that butterine took the precedence and highest price on the foreign markets, but not in Canada.

Mr. MORGAN (Strathroy), had not had much experience in the making of butter or cheese, or in the raising of farm stock, and was not posted on the centrifugal system. The essayist had said that Canada should lead the world in butter. This, the speaker thought, was an easy thing to propose but another thing to accomplish. Canadians could make very good butter, but other countries could make equally as good. He knew a gentleman in the county of Middlesex who had competed with the best makers in all parts and had always came out with first honours. This gentleman had attributed his remarkable success, solely to cleanliness in manufacture. Cleanliness was a very important factor and should not be lost sight of. He once knew two brothers, both extensive butter-makers and importers; one was an habitual smoker, the other did not use tobacco

in any shape or form. They both sold their butter through an agent on a foreign market, and the one who did not smoke, always received a higher price for his butter than the one who used the noxious weed. Not being able, in any other way, to find out why this distinction should be made, they at last resolved to change the labels upon the packages as an experiment, and in their next shipment, made it appear that the butter from one belonged to the other, and *vise versa*. In due time a letter was received from their agent, in which that person said. that—strange to relate—a very disagreeable taste or flavour was attached to the butter belonging to one brother, which had never been known of before, whilst the other brother's butter, which had always been marked by this peculiar flavour, was this time pure and sweet, and, therefore, worth 2½ cents more per pound on the market. This convincing test satisfied the brothers that it was the aroma of the tobacco, which had invaded the butter and detracted from its value. He, the speaker, merely cited this case as an example of the effects of cleanliness, and he could vouch for its correctness.

Mr. RAMSAY.—Who smoked ; the man or his wife ?

Prof. BROWN.—You are not in Scotland now Mr. Ramsay ; the women don't smoke in Canada.

Mr. CAMPBELL (Simcoe), said that down his way a short time ago the people were inclined to go into the creamery business. They thought there was more money in it than in cheese, and wanted to give it a trial. The cheese men made a big kick and the matter was thoroughly discussed. Prof. Barrè of the College staff attended one of the meetings held at the time, and gave the farmers some good sound advice, the result was, that after careful consideration, they resolved that it would be unsafe to start a creamery, and they accordingly stuck to the cheese factory, and seem to be well satisfied with the course they took.

Mr. RAMSAY thought the farmers should stick to the cheese factories ; it paid better than butter.

Mr. MORGAN asked what effect turnips fed to the cattle would have on the butter.

Prof. BROWN stated that anything over thirty pounds would effect the milk seriously. Some people's experience differed. One-third of a bushel would leave no marked taste—it was a good idea to mix the turnips with chopped stuff; it appeared to destroy the flavour.

Mr. RAMSAY.—Does the time of feeding make any difference—say, before or afte milking ? I have heard that the centrifugal separator got rid of this turnipy taste.

Prof. BROWN.—It is best to feed turnips just after milking. I see by the report of the New York Dairymen's Association, that butter made by the centrifugal system, is of a more greasy nature than other butter ; also, that the texture is affected and it does not keep so long. The leading chemists of the country were at sea on the matter.

Mr. MORGAN did not think it possible that a feed of turnips, given a short time before milking, could pass through the blood and taint the milk at once. He believed it was the continual feeding of turnips that did the mischief, and thought the top was worse than the root. He agreed with Prof. Brown in everything, and thought that mixing the food would be of great benefit. Up his way the farmers considered Prof. Brown's views as sufficient authority on all subjects relating to the farm.

Mr. RAMSAY said, that when turnips were properly housed, they lost a great deal of their disagreeable odor ; chilled, half frozen turnips were the worst for feed.

Prof. PANTON said the testimony of the majority was in favor of feeding the turnips immediately after milking. Experience, he said, teaches that the aroma will pass through the animal and taint the milk. Nearly everyone had a different opinion on the matter, but, taken on the whole, feeding after milking had been proven to be the best.

Prof. BROWN said that in England the cattle were fed on all kinds of roots without evil results. There was something mysterious about it, which we, in this country, had not yet learned.

OBSERVATIONS FROM A TWO YEARS' COURSE AT THE ONTARIO AGRICULTURAL COLLEGE.

Paper prepared by T. Raynor, Rose Hall, Ont.

When a young man leaves home for the purpose of gaining instruction in some particular line of operation, or to better his circumstances, he becomes instilled with hope, new desires, and determinations. This is no less true of the student, when he first sets out for a course at the Ontario Agricultural College.

Directly he is thrown upon his own resources, and the sympathies of this cold world, his views of life broaden. He realizes, it may be for the first time in his life, that he is a responsible being, and that upon his individual efforts depends to a large extent, his success in life. As to the degree of responsibility he may feel, depends largely on the training he has received at home, the habits he has formed, and his surrounding circumstances.

I have noticed with few exceptions, that every new student begins the term well, acting out his resolutions with great earnestness and seeming profit. But human nature requires company. In a week or so, the student has formed several acquaintances, the choice of whom as bosom companions soon determines, as a rule, whether or not he will carry on the good beginning he has made.

We conclude from this that great care should be taken by the student in selecting close friends, and that carefulness should be exercised by the authorities in the distribution of new comers.

The first two or three weeks of the student's life abroad seems to be a period of stock-taking, not only with regard to his surroundings and study, but also in the professors and those with whom he may have to deal generally. It is then that his likes and dislikes begin to root; and if the former are not properly nourished, and the latter by all means discouraged, the success of such a student may be considerably impaired. On the impressions made during this brief period, depends to a larger extent, the conduct of students towards their superiors than is generally admitted.

I have noticed too, that if there be any animosity existing in the minds of older students towards those who have the oversight of affairs, or with regard to any of the methods of doing things, more particularly in the outside departments, that it is very contagious, and like contagious diseases, spreads rapidly. This to a certain extent counteracts the impressions previously mentioned, but in the main, I think the assertion holds true. From the foregoing, then, I draw the following conclusions:—

1. That all the instructors, whether outside or in, should be very punctual in the dispatch of business.

2. They should seek to impress the importance of the subject or work, as the case may be, in which they are imparting instruction, laying particular stress upon its practical bearings.

3. They should insist on the work assigned being thoroughly prepared, although it may be argued that young men are old enough, when they enter such an institution, to be impressed with their own responsibility in such matters; but not always the case, as some seem to be more matured in judgment at seventeen years of age than others at the age of twenty-one, due, as before stated, largely to one's early surroundings; and

4. They should seek to know the students individually, as soon as possible, especially the more reserved characters.

The most successful instructors that I have observed are those who are the most practical in their methods of teaching, and hence the necessity of having each department supplied with plenty of the right kind of apparatus. There seems to be nothing so good as the object itself to impress the lesson home on the mind of the student, whether young or old.

In the method of studying, I have noticed particularly a great lack of system on the part of the student. Every one seems to have a system of his own, and, as in the case with respect to political economy, people, if they have not the proper principles, will make some to suit themselves, which, too often, adds but little to their own wealth or to that of the nation. It is much the same in studying. One may appear to be working hard, but some how or other very little appears to be accomplished. There seems to be about three principal methods of studying :—

1. The method of those who start in well for a few weeks, but given to too much company which seeks the gratification of pleasure, get behind, discouraged, and then "throw up the sponge," until a week or so before the examinations come off. Then relief from work, and shutting down on lectures is wanted. Note books are drawn out from beneath the *debris*, when only about half are to be found, and a general raid is made on their more provident and generous neighbours, to supply the other half. Usually this method results in the pluck and zero scale on the list.

2. That pursued by those who want to get along, but who only like certain of the subjects taught, spending nearly all their time on these, while those which are more distasteful, are studied when the eyes are on the book, but the mind is revelling in some enjoyment, or travelling in some foreign country. Here we may class those who partly understand the subjects, but have no ambition to ferret out the other part. The results of this system are more satisfactory, as it generally shows itself in the pass list.

3. Method, and the most successful, is that in which there is a system, (*a*) as to the division of time regulated by the subjects to be learned ; (*b*) regarding determination to understand the principles at all hazards ; (*c*) as to the training of the eye and mind to observe and inquire into the causes of things ; and (*d*) commencing to work at the beginning of the term, keeping, if anything, a little ahead of the work (at any rate even with it), and simply reviewing at the end of the term, instead of having to get up all new work. This kind of preparation fills in the honour list.

We conclude, then, that to study successfully it requires attention, observation, an inquiring mind, determination, application, and perseverance. To carry out these principles properly the student requires a healthy and vigorous mind, which acts best in a sound body, and which in its turn demands exercise.

There has been a tendency, on the part of many students, to find fault with the number and kind of subjects taught, owing formerly for the most part, to the limited amount of time for studying; but which, with the more extended time, I presume and hope, has entirely died out. The study of such a variety of subjects has a very refining influence upon the mind of a man, and better fits him for his calling in life. I have noted the dull, listless expression of the eye, seldom turning from the ground before it, on which the possessor was walking, turned to a sharp, searching look, which could only be changed to such a degree of brightness by the refining influence of many subjects, especially those cultivating the powers of observation. No subjects have done more to attain this end than have the different branches of science, drawing the attention to the book of nature constantly open before us, and causing the willing student to see some of its hitherto hidden pictures. I think, however, if some of the subjects taught, by way of lectures, as for instance much of the veterinary department, were printed on sheets, with a space at the bottom, or in books, with blank sheets between the pages, on which to take explanatory notes, that some of the bad effects of so much scribbling, and much of the poor spelling, too, often seen on examination papers, might be done away with to a considerable extent. This would give more time for the practical part of these branches which does the most good in after life.

The necessity of having plenty of exercise to retain a healthy body for a sound mind to work in was referred to in passing. It has been maintained that the work in the outside department is sufficient to supply the demands of exercise. It does help to a large extent; but now, with the increased time for studying and reading, I think the want of a good gymnasium must be doubly felt. And, as it was so humorously and ably

referred to by a fellow student at our last re-union, I quite agree with him, that pillow-fights, broken-down beds and hall raids with water deluges, might become a thing of the past, if a convenient and well-equipped gymnasium was at the disposal of the students. Also this might result in some permanent benefits, as the preservation of property, less cases of hauling up on the carpet, and might afford peace and quietness for the less nervous students to concentrate their minds on their work.

I have also observed that there is more disappointment of the expectations of students in the outside departments, than with the inside training. This is due, possibly, to the fact that students expect too much, in fact a great deal more than was ever intended. Many expect to be turned out first-class farmers, first-class mechanics, and expert gardeners, all in the space of two years, eight months of which time, by many, is spent at home. This may be somewhat overdrawn, but I appeal to the students if there were not some such ideas in their minds before the reality was found out. This impression, though absurd on the face of it, must originate somewhere, and would it not be well to find out the source?

Without the aid of an instructor, much can be learned from observation and enquiry, if the student be willing to apply himself. Too often, however, he waits to have everything handed to him, and thus misses much of the benefits to be obtained in the outside departments.

That students under the old system of work and study sought to kill too much time in order to appear busy, few will deny; and yet, it was quite noticeable, that those who did the least work by killing the most time, found the most fault with the pay they were getting. As a rule, students do not like to work at jobs which are distasteful to them, especially away from home. If they can avoid it they will, and in too many instances those who stand around pleading for the "fat jobs," to keep peace in the family receive them, to the discomfiture of the more willing workers. Without discussing the lack of proper equipment for a more thorough and practical training in the principles of agriculture, I wish to call attention to how the overseers might make attractive some of the more or less distasteful work. I know that it is utterly impossible to please all; yet if the overseers had more time at their disposal to spend with the students engaged at the different operations, explaining the necessity of having the work in question done at the proper time, by the best and simplest methods, and at as little cost as possible, I think greater interest would be taken in the work generally.

Under the past system of doing much of the work by making a job last a certain length of time, the student, almost unconsciously, contracts the habit of working slow and often to little advantage, which will follow him after his college days are over. The object of the overseer should be to make his department the most interesting and attractive by imparting all the information possible in connection with it.

Another fact which has attracted a great deal of attention is, that too many of the students leave the College before the two years have expired. Thus they deprive themselves of much valuable information, and lose many benefits arising from the first year work. This ought not to be, as the ground to be covered properly, should occupy three years, instead of two; but under the circumstances impossible. Why then, it has been asked, do not more stay for their second year? Is it because there is not enough to be learned in the outside departments? This has been one complaint. Another has been that in the first year a number of the subjects taught are quite useless, for instance the chemistry and zoology; of which they do not remain to see the real benefits. This again shows the necessity of the professors fully explaining their positions with respect to the subjects in their charge.

Some have complained (1) that too much stress is laid on the examinations, and the course has been styled a "systematic cram," and (2) that the students are studying more for the examinations than for general information, leaving valuable books in the library untouched, and only glancing at the general news topics, and that studying, therefore, becomes irksome and repulsive. They maintain that if they cannot pass in all their subjects during the first year, that there is no use trying the second year, basing their conclusions on some of the subjects they do not understand, as for example chemistry, one of the keys which help to unlock the great book of nature.

These views, no doubt, arise from the fact that the average education of the farmers' sons, received at our public schools, is not high enough to enable them successfully to take advantage of many of the subjects taught in the College. Hence the necessity, as has been so eloquently and convincingly argued by the President of the College, in his tours through the Province, of a change in our system of education, whereby agriculture, the most important industry of our Dominion, may receive its just dues.

Finally, let us notice briefly some of the benefits arising from a course at the Ontario Agricultural College, (1) After leaving college one takes a greater interest in his work, because he understands much better what he is doing.

(2) It fits him much better to take a social standing in life, in which his influence may be felt, and the world made better by his having lived in it.

(3) It creates a desire to know more about his occupation, by reading along that line what prominent men have to say through the press, and

(4) It enables one to read and talk much more profitably and intelligently, on all topics of general interest, and on those subjects which concern his own occupation in particular.

Now, sir, if I have succeeded in throwing out any hints, which may be of some practical benefit, I shall not consider the time used in preparing this paper spent in vain.

W. H. Owen, (student) spoke of some criticisms on the College and Farm, that had been printed in some of the papers. He admitted that there were some defects in the outside department, and thought that a proper system of outside instruction had not yet been adopted. He thought that much more instruction on practical work should be given, and suggested the appointment of an Advisory Board composed of practical farmers to assist in managing the farm.

Mr. Morgan, (farmer), asked to hear the opinions of some more of the students.

R. W. Madge, (student), said he agreed with Mr. Owen in his remarks about the outside department. As to the interior department, the students themselves are all well aware that the studies are compulsory. He was in favour of making some of the subjects optional, as a great many of the young men who came to the institution to gain a better knowledge of farming, were not prepared to take hold of all the studies imposed upon them; some in fact were not qualified to do so, and became discouraged before the first year was finished, and left the College. He did not think that it was the bad reputation attached to the Farm, which deterred farmers from sending their sons to the College, nor yet had politics much to do with it. He attributed it merely to a want of interest in scientific agriculture. The present regular course of study at the College was first-class in every respect, but the special class was a complete failure. A change should be made in it at once. He was exceedingly well pleased with the suggestions made in Mr. Raynor's paper, and felt that they would be fully appreciated by all. The Veterinary Department was well and thoroughly taught, but the lectures were not of as much practical benefit to the students as they might be; what was wanted was practical knowledge. Mr. Madge next reviewed the Horticultural Department, and suggested that the practical work in this department should run through the whole course. In conclusion, he said that it gave him great pleasure in moving the following resolution, which included all he had to say in reference to the special class.

"That it be suggested, (1) that the special class be recognised, and the course of study extended, including live stock, agriculture, agricultural chemistry, veterinary science, arboriculture and entomology; (2) that all their time be as fully occupied as in the regular class, and that in every respect the class be considered of equal importance with the regular class; (3) that the course extend over two winters, and that the members of the special class be allowed, if desiring, to join the regular class in the intervening season again."

E. STURGE (student) in rising to second the resolution, remarked that he agreed with all the former speaker had said. He thought that the resolution covered all the subjects necessary for such a class. He regretted that the winter holidays extended over such a long period. The Farm Foreman should go around the farm with them, and give practical lectures on farm implements, soil, cultivation, etc. The class should be taken around to visit some of the neighbouring stock farms. He would second the resolution.

C. A. ZAVITZ (student) said the regular course at the Institution was an excellent one, but many of the farmers' sons came here with very little education, and as a matter of fact found it next to impossible to keep up with all the subjects. Two ways existed of remedying the evil: First, by having science classes established throughout the country where young men could gain a preliminary knowledge in botany, chemistry, etc., and consequently be better prepared to properly master the work after entering the college; Secondly, the formation of the special class referred to in the resolution. He approved of having the lectures in veterinary science and those of some other subjects printed, and fly-leaves attached for taking notes. In relation to the outside work, he said that in his opinion lectures should be given in the stables, where they could be practically illustrated, with stock of various kinds. This would, if carried on systematically, no doubt result in much benefit to the students. He would like to see more lectures on the field, tools, implements, etc.

J. P. POE (student) thought there were not enough lectures on agricultural chemistry and live stock, and that a large proporation of the whole number of lectures, should be on these subjects. He also suggested that the studies on natural sciences be made optional. He thought that for an inducement for students to return for their second year, the tuition fee should be dropped, and they should receive more privileges than those in the first year. He supported the resolution.

It being 12 o'clock, the meeting adjourned.

The Union met again at 1.30, and the discussion was resumed.

A. E. SHUTTLEWORTH (Mount Albert), said he had been to the college longer, and was connected more closely with agriculture, than most of the students, and could probably enlighten them on some points. He believed in the College being a professional institution, and the Farm a model farm. He disapproved of cutting off a single subject from the list, and condemned a special course, until after the first year had been completed. No pupil should enter the College at less than eighteen years of age, and he should p in at least one year with a practical farmer, and have attended a science school before coming here. He said it was impossible to turn out a skillful farmer in two years, and another year should be added to the course. One hundred acres of the Farm should be set apart as a field for instruction with necessary implemenls, and four hundred acres as a model farm. Three teams and three instructors would be required, and a certain portion of the students could be sent out daily to receive instructions in practical farming. The second year students to manage the farm and get pay for it. The summer months could be spent in learning how to sow, plough, etc., and in the winter the time would be devoted to science and the live stock. He felt satisfied that the four hundred acre model farm would pay.

Mr. SLEIGHTHOLM (student) said that this discussion should be for the ultimate good of the College. In his opinion the course all through was a good one, but he considered that there should be a special professor of agriculture for the outside department—one who could teach us how to go about our work in a practical, systematic manner. This Institution cannot be, a model farm, agricultural college, farm of instruction and an experimental farm, all in one; each branch should be distinct of itself, and under the management of a separate professor, who would be held directly responsible to the government for his actions. He thought the winter vacation was rather long, and he did not approve of the officers of the College spending so much time in organizing farmers'

institutes throughout the country. In reference to the lectures on veterinary subjects, he thought if would be advisable to have them printed, as much of the student's time is lost in taking notes of these lectures, which would otherwise be devoted to gaining practical knowledge from the professor. He would, therefore, move the following resolution :—

"It is respectfully suggested that the lectures on veterinary science, as now given at the Ontario Agricultural College, be printed and bound in book or phamphlet form, and that one copy be supplied to each and every student. That the student pay cost-price for such book or pamphlet, and that it be printed not later than October 1st, 1886.

Rev. W. F. CLARK made some highly interesting remarks on the history of the Institution, and thought that the subjects of agriculture and live stock, should receive more attention than all the other subjects combined. He thought that the reason more farmers did not send their sons here was because they could not spare their labour from their farms, and not because they did not think well of the Institution. He favoured the printing of the lectures on veterinary subjects, thinking it would result in much advantage to the students.

President MILLS said he felt some delicacy in saying anything; he was perfectly willing to make any modifications in the class, that would be of benefit to the students. In regard to the special class, he would say the only objections he had was that Prof. Brown and Dr. Grenside had not the time to give enough lectures to keep the students engaged, and the average young man, if left to himself, usually falls into idle ways. This was the only difficulty which presented itself to him, and he was in favour of any plan, which would economise the student's time.

Prof. BROWN said that the management had not secured that system of outside instruction, which they would like to have; but unless some other system was adopted, and a farm set aside for the purpose of instruction, no great changes could be made. At the Michigan State College, after twenty-six years and with one instructor to every ten students, they have failed to turn out the young men in two years time in shape to assume the management of a farm; and these colleges were surprised to find, this College was still working on the old system and succeeding.

President MILLS: "We are far ahead of any other agricultural college in America to-day."

JOHN J. HOBSON, Mosborough, said he thought the reason more farmers did not send their sons to the College, was that they were conservative in their habits, and thought their sons could learn enough at home. This was the only reason why they did not send them to the College. The Institution, he said, wouldyet do much towards removing the stigma which was at present attached to the name of "farmer" and would raise the farmers' sons to the same prominence, as that attained by men in other professions.

Mr. HOLTERMAN remarked that the very best young men of the Province were attending the College. When the farmers first settled in Canada, he said there was very little scope for education, but that day had long since gone by. There was no reason now why the farmer's son should not be just as enlightened as men in other professions.

Mr. MORGAN thought that if the mind were trained to literary pursuits when young, it would seek literary pursuits in after years, and the same might be said in regard to improved agriculture. He expressed himself as having been very much interested in the discussion. He was proud of being a farmer, and he believed that farmers' sons should be well educated. He had come a long distance in order to be present at this union,and he considered that the information, which he had gleaned on many important subjects, much more than repaid him for the expense he had incurred. He was well pleased with the management of the Institution, with the appearance of the farm, and above all with the manner in which the students had conducted themselves during the disscussion.

Mr. MADGE's resolution with reference to the special class, and that of Mr. Sleightholm suggesting that the lectures on veterinary subjects be printed, were then voted on and carried unanimously.

BREEDING STOCK.

A Paper Read by Mr. John Morgan, Strathroy, Ont.

I regret to say how few farmers, comparatively speaking, understand the principles of breeding, and succeed in improving their stock.

Breeding is a branch of knowledge to be secured by study, also an art te be acquired by experience, and a knowledge of its principles shows us how to produce and reproduce what we want. Prof. Darwin says, not one man out of a thousand has sufficient accuracy of eye and judgment to become an eminent breeder. If a person gifted with this quality studies the subject for years, devoting all his energies to it with an indomitable will, he will and must succeed. If he does not possess the requisite qualities of making improvement, he will surely fail. A man with a natural quick eye can pick out an animal which an untrained or unexperienced man would not admire, while others cannot detect qualities in an animal by any practical skill or knowledge, but judge in a sort of hap-hazard process, which is not all commendable.

The handling of animals is by no means a particular gift or endowment, but a quality and qualification, which should not be lost sight of.

The qualification of a breeder, by far the least easy to be accomplished, is to judge the proper maturing. This is a knowledge by few men possessed and recognized with anything like fitness. There is a law of variation in nature as well as of similarity, and our highest ambition should be not to accomplish a stationary uniformity, but a steady progress towards the perfection of our stock. We must seek to discover how to turn the law of favourably variation to account and secureand perpetuate valuable characteristics, when we get them, as in life all nature is born of sexual union. There is potent sexual union to determine the progress of the race.

In selecting male animals, always fix on those of strong masculine character and with striking male characteristics ; supposing they are not high in flesh, good feeding will put that right, if you have the constitution. Still I would recommend an animal of a fleshy nature, to have a broad level top, deep and even underneath, deep heavy flank, full quarters, stately head and neck, and, by all means, of a quiet disposition. The sire to possess a masculine appearance does not follow that the female will be of a coarse quality.

Always prefer a male with a higher tone of pedigree, to those of a lower ; if animals are equal in other respects, then add judgment at all times to pedigree, as animals on paper are not always the most desirable.

You must learn to determine at a glance what to cull and what to breed from. This is one of the greatest natural gifts of a breeder's success. It is generally conceded that the male animal has the more influence in breeding, but not always ; doubtless it is the animal, whether male or female, with the strongest vitality, that stamps itself more powerfully on the offspring.

The selection of animals for maturing purposes (which evidently is now the main point) is perhaps one of the great secrets of breeding successfully. The soundest animal has the greatest vitality, and the animal with the strongest vitality is the best, soundest and surest breeder. It is the relative peculiarity of the parent that determines the nature of the offspring. In breeding you must properly mate the male and female, in order to accomplish a successful issue. In a herd, say of twenty females, you should have at least two males of different lines and of the highest order of course, in order to suit the adaptability of the females. We have seen in some cases where an inferior looking male produced on one class of females better offspring than that of a superior looking male with the same female, simply because they were properly mated. Now then, if you follow out this theory you can remedy the imperfections in your animals, (if any), and correct accordingly ; if you do not carry out this system you are as likely to aggravate the defects as to remedy them.

Docility in the male is a very essential qualification, as the more docile an animal is the more likely he is to have the fleshy qualities, which is a very important trait in the bovine race.

Every male should be tested before placed at the head of a herd of any note, then you will be breeding with safety, as one female may be the mother of one calf in twelve months while the male may be the sire of seventy, hence the necessity of having the male animal the superior, as in laying the foundation of a good herd. The breeder should have in his mind's eye what he wants to accomplish.

In selecting animals to breed from you must always choose the superior one of the herd, and as near as possible reach the ideal you want.

In order to succeed you will have to spend years of toil in culling and reculling, in selecting and reselecting, before you can attain the highest point of perfection, and when you have succeeded in that attainment, you can congratulate yourself as having accomplished as much for your country's good, as the bravest hero who has conquered nations.

As regards in-and-in breeding, I am not a very strong advocate of it, but I am aware in some cases it will prove to an advantage, if proper care is taken as to the constitution and construction of the animal, as for instance, you have a first-class male or female, (as the case may be), by breeding to blood relations, you will get more of the original blood in the cross, and the progeny of that cross, if a male, will stamp more fully in his stock the noble blood of his ancestors. This, where you want to retain more of the original blood of either, will prove a boon of success. Some breeders advocate, breed the best to the best regardless of affinity ; but always study formation and constitution ; it was this principle that brought Collins, Bates and Booth to such perfection. But now since the different lines of cattle have become so numerous, you can breed best to best of other blood with safety. The laws of nature prohibit in-and-in breeding in the superior race and why not in the inferior ?

EXPERIMENTATION WORK.

Mr. J. P. ANDERSON called the attention of the Convention to the fact that the Union had been organized for the purpose of making experiments, but of late years had gradually been drifting into a debating society. The Minister of Agriculture had granted them the sum of seventy-five dollars, and he (the speaker) would like to know what was going to be done with it. He would be very much pleased to see some experiments made during the coming season.

Mr. CAMPBELL thought that so long as members of the Union confined themselves to debates, the government would give no regular support to it. Something should be done without delay towards getting things in shape for experimenting this summer.

President MILLS thought Mr. ANDERSON's suggestions were correct, but they could not be successfully carried out unless some of the officers at the College interested themselves in the matter. There was a lot of work to be done in connection with the matter. Seed must be sent out to those who were willing to experiment ; letters should be answered promptly and a great deal of other work done to make the thing a success.

Mr. ANDERSON remarked that more progress would have been made if the Union had not been short of funds.

Professor BROWN advised the Convention not to do anything unless they could see their way clear to make it a success.

Mr. HOLTERMANN said that he was in favour of the students giving their views from year to year at the meetings. No satisfactory results had yet been attained from previous

experiments. The time of the Convention was taken up too much with debates; more papers on agriculture should be read, and less time occupied in useless debating.

Mr. ANDERSON asked what was going to be done with the seventy-five dollars granted by the Minister of Agriculture.

Mr. CAMPBELL wanted a few experiments of some kind made, even though they were on a small scale.

Professor JAMES said that each member of the Union should be an experimenter himself, and report at the meeting next year. He did not think they should want for assistance from the Government, but on the contrary, go right ahead, experimenting in the field, garden, dairy, or elsewhere, and report the result at next session of the Union. He would be only too happy to assist them all in his power.

On the suggestion of President Mills, the matter was finally settled by the formation of a Committee composed of the following gentlemen: Professor Brown, Professor. James, Professor Panton, and Messrs. Anderson, Ramsay, and Zavitz, to confer with the Minister of Agriculture, and make necessary arrangements for future experiments.

REPORT OF EXPERIMENTS CONDUCTED BY MEMBERS OF THE UNION IN 1866.

The object of the experiments was to test the effects of salt, gypsum or land-plaster and superphosphates upon wheat, oats and barley.

The plots were one-fortieth of an acre in area in each case.

The cereals sent out were twelve pounds of white fife wheat, eight and a-half pounds of barley, and seven and a-half pounds of black tartarian oats, each for four plots or one-tenth of an acre.

The fertilizers were ten pounds of salt, ten pounds of gypsum, and ten pounds of superphosphate. The analysis accompanying the superphosphate was as follows:—

Phosphoric acid, thirteen per cent.; ammonia, two per cent.; potash, one and a-quarter per cent.

Each experimenter would, therefore, have wheat, oats or barley growing on four similar plots treated as follows: One, no manure; two, salt; three, gypsum; four, superphosphate.

Grain and fertilizers were sent to twelve members of the Union, wheat to four, oats to four, and barley to four. Eight completed the experiments and replied in full; four made incomplete reports.

The experimenters were requested to observe and report upon the following points:—

1. Previous cropping and fertilizing.
2. State of soil and condition at time of sowing; date of sowing.
3. Time of appearance of grain on each plot.
4. General growth and comparative condition of grain on the four plots, from time to time.
5. Date of maturity and harvesting.
6. Weight and condition of straw and grain, separately.
7. General observations on the weather.
8. Conclusions as to the value of each of the fertilizers.

	Experimenter.	Grain.	Fertilizer.	Straw in lbs.	Grain in lbs.	Total.	Soil.
I.	J. B. Muir, Bruce Co.	Wheat	No fertilizer	46—10 lbs chaff	32	88	Clay loam to clay, with clay sub-soil.
		"	Salt	42—10 "	34	86	
		"	Gypsum	44— 9 "	33	86	
		"	Superphosphate	50— 8 "	34	92	
II.	J. G. McKay, Bruce Co.	Wheat	No fertilizer	73	21	94	Clay loam.
		"	Salt	60½	19½	80	
		"	Gypsum	73	21	94	
		"	Superphosphate	66½	16½	83	
III.	E. M. Zavitz, Middlesex Co.	Wheat	No fertilizer	57¾	23¼	81	Clay loam inclined to loam, gravel sub-soil
		"	Salt	77	36	113	
		"	Gypsum	62¾	27¼	90	
		"	Superphosphate	58	23	81	
IV.	T. Raynor, Pr. Edward Co. (See notes below.)	Barley	No fertilizer	8	12	20	Clay loam.
		"	Salt	10½	15½	25¾	
		"	Gypsum	10¾	14¾	25½	
		"	Superphosphate	9½	13¾	22¾	
V.	Geo. Charlton, Brant Co.	Barley	No fertilizer	35	35	70	Clay loam, with clay sub-soil.
		"	Salt	43	39	82	
		"	Gypsum	43	37	80	
		"	Superphosphate	43	38	81	
VI.	C. A. Keil, Chatham	Barley	No fertilizer	39	42	81	Rich alluvial soil.
		"	Salt	28	33	61	
		"	Gypsum	28	31½	59½	
		"	Superphosphate	34	35	69	
VII.	E. Lick, Ontario Co.	Oats	No fertilizer		32½	....	Poor clay loam, inclined to gravelly nature.
		"	Salt		32¾	....	
		"	Gypsum		26¼	....	
		"	Superphosphate		32	....	
VIII.	A. L. F. Lehman, Simcoe Co.	Oats	No fertilizer	23—4 chaff	31	58	Clay loam.
		"	Salt	20—4½ "	28.5	53	
		"	Gypsum	22—8½ "	21.5	52	
		"	Superphosphate	22—5 "	26	53	
		"	Farmyard manure, 20 tons per acre.	33—6 "	33	72	

Average of experiments on—	Experimenter's Nos.	Fertilizer.	Straw in lbs.	Grain in lbs.	Total in lbs.
Wheat	I., II., III.	No fertilizer	62.25	25.42	87.67
		Salt	63.17	29.83	93.00
		Gypsum	62.92	27.08	90.00
		Superphosphate	60.83	24.50	85.33
Barley	V., VI.	No fertilizer	37.00	38.50	75.50
		Salt	35.50	36.00	71.50
		Gypsum	35.50	34.25	69.75
		Superphosphate	38.50	36.50	75.00
Oats	VII., VIII.	No fertilizer	27.00	31.75	58.75
		Salt	24.50	30.50	55.00
		Gypsum	30.50	23.87	54.37
		Superphosphate	27.00	29.00	56.00
All complete reports of crops.	I. II. III. V. VI. VII. VIII.	No fertilizer	47.96	30.99	78.56
		Salt	47.50	31.78	79.17
		Gypsum	48.37	28.21	76.83
		Superphosphate	47.58	29.21	76.50

The following observations and notes were made by the experimenters :—

I.—*J. B. Muir, North Bruce.*

Previous Cropping.—Previous to 1886 no systematic course of cropping had been adopted, but corn, potatoes, millet, etc., had been grown upon it from time to time.

Previous Treatment.—For the past eight or ten years it has been plowed in autumn and generally received from ten to twelve loads of barnyard manure per acre yearly. A small quantity of wood ashes were thrown upon it from time to time every winter. In September, 1885, a light topdressing of fresh meadow muck was spread, and allowed to be exposed for the winter.

State of Soil, Etc.—Land selected was in fair state of cultivation, and not exhausted by previous cropping. The surface soil varies from a clay loam to clay, with heavy clay sub-soil, only partially drained, on gentle slope to east and south.

In spring of 1886 weather was wet and cold. Land plowed May 12th, then harrowed, rain prevented sowing till 18th.

Appearance of Grain.—First blades on gypsum plot on 23rd, on 24th large percentage up in all plots ; wheat came out quite thin.

Weather.—Severe frosts early in season, dry later on. In time the plots fertilized by salt and superphosphate became more healthy and vigorous looking than the other two, especially the plot where no fertilizer was used. During the latter part of June and early part of July, quite a percentage of this latter plot turned yellow in the leaf, and was very unhealthy looking for a time. As the season of growth advanced, the salt and superphosphate plots became more uniform and healthy-looking than their companions, and after the grain shot out, the salt plot seemed to gain on its rival, ripening a day or two earlier; had a brighter, stiffer and healthier-looking straw, and when threshed, a plumper and more uniform grain.

On 22nd August, wheat on salt plot was ripe and ready to cut, on 24th all were cut. Had the grain on the superphosphate plot filled out as well in proportion, as that from the salt, it would certainly have ranked first in point of yield, as there was a more vigorous growth of vegetable matter from this plot, than from any of the others.

Conclusions.—From the results of this experiment, I consider salt to be the most economical and beneficial fertilizer to apply to our land at the present time. It is inexpensive and convenient, may be obtained in abundance in this locality, and would certainly be used profitably, even if there was no greater return than the improved quality of the grain it would secure. Judging by the return from the superphosphate plot, it would not pay to use this fertilizer at present prices on our land. Gypsum, apparently, has no value, and is not required by the land in our locality.

II.—*J. G. McKay, Underwood P. O., Bruce Co.*

Previous Cropping.—Last crop peas ; land never manured before ; four crops taken off since broken up from sod soil.

Sowing, Weather, Etc.—Sowed wheat forenoon of May 14th, rained seven p.m. of same day. Fore part of season was very dry (June). July 7th doing fairly well. On July 15th the salt plot headed out, superphosphate plot half headed out, gypsum plot just starting. July 20th all headed out. August 13th heavy hail, which hurt the grain, shelling about one-fourth. August 16th, rain, salt plot the ripest. August 23rd, rain all day. August 30th, salt plot cut. September 1st, other plots cut ; superphosphate plot being a little riper than the gypsum. The salt plot had a little more clay in it than the others.

III.—*E. M. Zavitz, Coldstream P. O., Middlesex Co.*

Previous Cropping.—Roots up till last two years, when plots 1 and 4 were under strawberries ; only manure has been barnyard.

Growth of Grain.—Sowed on April 28th, soil moist and mellow :—

Grain on plot No.	1	appeared	May 6th.
" "	2	"	" 8th.
" "	3	"	" 7th.
" "	4	"	" 6th.

They seemed to keep even until the time of the drouth, when the salt plot appeared to hold out rather the best.

Condition of Grain and Straw.—The straw of No. 2 was a little the brightest, the rest about the same. After careful examination, we concluded that the difference in quality of grain was slight, and in the following order from best to poorest : Nos. 2, 3, 4, and 1.

Conclusions.—The exceptional drouth seemed to give the salt plot an advantage over the rest. Had it been a wet season the results might have been materially changed, even reversed in some cases. Could we foretell the nature of the season, we might choose more wisely, but under existing circumstances we must draw conclusions from the aggregate of advantages and disadvantages of each fertilizer, not only the aggregate of the dozen little experimental stations of this year, but of a number of years. We feel well repaid for having undertaken the experiments, in the insight we have gained in experimenting. We intend to act on the result obtained by sowing the wheat next spring from all the plots and fertilizing with *salt*.

IV.—*T. Raynor, Rosehall, Prince Edward Co.*

Previous Cropping.—Barley in 1885, then light coat of farm yard manure.

Soil.—Clay loam, plowed once in fall and ganged again in spring ; in fair condition, but not so fine a seed bed as is desired. Sowed May 4th, plots somewhat wet. It was harrowed over twice after the fertilizers had been applied.

Appearance of Grain.—It was all above the surface in a week, or perhaps less time. No. 4 first showed itself distinctly. The other plots seemed to come up and grow about alike.

Growth of Grain.—Notwithstanding the fact that the grain was too thick it grew quite uniformly most of the time. Plots 1 and 2 grew somewhat ranker towards close of growing season. Being so thick on the surface the straw was made finer, and the head much smaller than it otherwise would have been.

Maturity.—About August 1st plot No. 4 had matured four or five days before the others. The straw was fine, a fair color, of medium length. That from No. 2 was a little the coarsest, I think. The grain was partly coloured and partly bright—about No. 2 extra. It was plump, however ; in other ways a good sample.

The weather at time of seeding was everything could be desired. The seed sprouted quickly and grew rapidly with the refreshing showers. The weather changed, however, becoming cold and very backward for two or three weeks, and finally a drought setting in indicated a short crop. Towards harvesting time, the weather became once more favourable and with the few warm showers a good crop was harvested after all.

Conclusions.—From results obtained I must acknowledge the salt to be the best, although I think the position of one and two were a little advantageous. I do not think that salt acts directly as a manure, but indirectly, aiding in splitting up other constituents into soluble plant food. Salt has been used before in this vicinity, and with good results.

The gypsum gave even better returns than the superphosphate. However as a fertilizer I think it is much better for leguminous crops than for the cereal crops.

There is no doubt in my mind that the superphosphate is a far better manure for barley than the others. It is quick in its action and causes a more rapid growth. A rapid growth means early maturity, and on the whole I am somewhat prejudiced in favor of the phosphate for barley.

In conducting this experiment I discovered when too late that only one-quarter of the land necessary was taken. This will account for the small amount of grain and straw. If the results were multiplied by three, a fair average would be obtained.

V.—*Geo. A. Charlton, St. George P. O., Brant Co.*

Previous Cropping.—The soil the previous year was under roots and had farm-yard manure applied at the rate of twenty loads per acre. Soil is a clayey loam and at time of sowing was in the best possible condition.

Growth of Grain.—Sowed May 8th; by May 14th all plots were up equally well. No difference apparent in growth from time to time except that No. 3 had a deeper shade of green. A difference was perceptible in the time of maturing, No. 2 (salt) ripening fully three days sooner than No. 3; No. 4 maturing sooner than No. 3 but not so soon as Nos. 1 and 2. All were ripe and harvested July 20th.

Condition of Grain.—No. 1, heads short; straw had a tendency to remain green and the barley contained a considerable percentage of small grains, though of good colour.

No. 2 straw bright, and stood up well, heads well formed; grain of a good colour, plump and very few of small size.

No. 3 same as No. 1, except that the percentage of small grains was less.

No. 4 straw seemed soft, had a tendency to lodge and coloured rapidly with dews and sun; heads large and well formed; grain slightly coloured yellow but plump with few small grains.

Weather.—During the experiment the weather was warm and moist first half, but latterly dry and hot, which, I think, was the reason why the yield was not greater.

VI.—*C. A. Keil, Chatham, Ont.*

Previous Cropping.—From 1879 to 1885, potatoes (farmyard manure), barley, potatoes, fodder corn, sugar beets, flax (farmyard manure), oats. Land has been cropped for twenty-five years, no special fertilizers ever having been used. It is drained by an open creek near by, no under-drains. The soil is a clay loam with considerable percentage of humus having a clay sub-soil.

The land was plowed April 21st (rather late for us), barley was broadcasted next day and fertilizers broadcasted afterwards. The ground was not in very fine condition and the weather was very warm.

Growth.—From date of sowing till harvesting we had very little rain fall, and the barley did not stool out as it should have done. The only difference in all the plots was that the salt plot could be easily distinguished from the others by the whiteness of the straw and grain.

It was cut July 21st and threshed; November 25th; although not a heavy crop, the sample was good. Salt was number one, gypsum number two, the other two equal. I also sowed salt on our field of barley, and also fall wheat, leaving some strips unsown. I could never see any difference in the growth or maturity except that the straw was brighter where the salt was sown.

The land in this part of the country being of a rich alluvial nature, if moderately well worked and manured with farmyard manure will yield good crops for a great many years, and I think the benefits derived from special fertilizers would not compensate for their cost. Salt and gypsum would be useful in diminishing the quantity of straw and especially salt, very materially brightens the grain and straw but superphosphate would not pay. The extreme dry weather may have affected the action of the manures, but it is rather strange that the "No Manure" plot came out the best.

VII.—*Elmer Lick, Oshawa, Ont.*

Previous Crop.—Oats seeded to Alsike clover, the portion under experiment winter killed. In 1884 barley. In 1883 peas, on three year old sod. A light dressing of barn yard manure was applied in fall of 1883.

Soil.—It is a poor clay loam inclined to be gravelly. It was plowed May 14th; was very wet owing to spring rains and low situation.

Grain.—On May 17th oats and fertilizers were sown. June 23rd, a much darker and more luxuriant growth could be noticed in the superphosphate plot. Dry weather following, the salt soon gave the best appearance. After every rain a very noticeable improvement could be seen in No. 4 plot. No difference in Nos. 1 and 2. July 22nd, Nos. 1 and 2 headed out, 3 and 4 a few days behind and not looking so well as Nos. 1 and 2. Just before harvesting Nos. 2 and 4 were equal in appearance, only slightly better than No. 1. No. 3 was very inferior to the others.

August 23rd.—Ripe and harvested; no difference could be noticed in ripening, owing to rust.

The quality of the grain was best on No. 4, then No. 2, No. 1 and No. 3 in order. There appeared to be more straw on 2 and 4 than on 1, and more on 1 that on 3. No. 3 was badly rusted, No. 1 not so badly, and Nos. 2 and 4 were comparatively free from rust.

The late sowing and rust account for the low yield (under forty bushels per acre).

The dry summer gave the salt a good chance, and hindered the superphosphate from showing the effects of its application.

The land was poor, scarcely ever giving over thirty-five bushels of oats, twenty bushels of peas, or twenty of barley to the acre.

Conclusions.—From the above experiment I would conclude that gypsum was an injury to the crop; that salt would pay in dry seasons, through the straw being freer from rust; that superphosphate in dry seasons would not pay for its application. All the above applying to land similar to that under experiment.

VIII.—*A. L. F. Lehmann, Orillia, Ont.*

Previous Cropping.—Oats, preceded by peas.

Soil.—Clay loam, plowed in fall and spring.

Grain.—Sowed on May 8th, appeared on 17th and 18th May.

June 1st.—Supherphosphate and gypsum ahead, then farmyard manure, then salt and no manure. June 15th.—Farmyard manure improving. June 30th.—Salt and no manure still behind, others even. July 7th.—Farmyard manure decidedly ahead, and heading out, the others evenly advanced. July 12th.—All headed out. August 23rd.—Grain matured. August 30th.—Cut; rainy weather preceded this. September 4th.—Threshed. All grain was "dead ripe" except that of the farmyard manure, which still contained some green stalks. The season was a dry one, with the exception of seeding and harvesting time.

Conclusions.—My conclusions are, that the soil, on which I experimented, has been deficient only in nitrogen. The barnyard manure was of an inferior quality. As clay predominates I think sufficient potash was present.

As far as I know no similar experiment has been conducted in this neighbourhood.

I was much astonished to find all the special fertilizers have an injurious effect upon the soil on which I experimented, but in a previous experiment with superphosphate on potatoes on sandy soil, I found the same injurious effect.

RESOLUTION OF CONDOLENCE.

On motion made and passed, a resolution was drawn up and ordered to be forwarded to the family of the late Doctor HARE—a former member of the College staff—expressing the heartfelt sympathy of the union upon the early demise of their late friend and fellow member.