ONTARIO AGRICULTURAL COLLEGE, GUELPH.

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FOR

PRINTED BY

TENTH ANNUAL REPORT

OF THE

ONTARIO

AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

FOR THE YEAR ENDING 31ST DECEMBER,

1884.

Printed by Order of the Legislative Assembly.

Toronto:
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1885.

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REPORT OF THE PRESIDENT

OF THE

ONTARIO AGRICULTURAL COLLEGE, GUELPH,

FOR THE

YEAR COMMENCING 1st JANUARY AND ENDING 31st DECEMBER,

1884.

GUELPH, January 2, 1885.

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

SIR,—In presenting the Tenth Annual Report of the Ontario Agricultural College and Experimental Farm, I beg to state that, in compliance with your suggestion, I have referred with greater brevity than usual to the various operations of the past year, leaving each Professor to report more fully on the work done in his own department.

MANAGEMENT.

It is scarcely necessary to repeat that the management of the Institution is divided between the President and the Farm Superintendent, who are, to a large extent, independent of each other. The former has full control of the College, and the latter of the Farm. Each is expected to work for the other; but neither is responsible for the discharge of his duties to any one but the Commissioner of Agriculture.

THE FARM.

The work on the farm is divided into four departments:—

I. THE FARM DEPARTMENT.
II. THE LIVE STOCK DEPARTMENT.
III. THE MECHANICAL DEPARTMENT.
IV. THE EXPERIMENTAL DEPARTMENT.

For the revenue, expenditure, and entire management of these departments my colleague Professor Brown is alone responsible. He buys and sells as he feels disposed; hires

men, directs the foremen, and does whatever else may seem to him necessary for the accomplishment of the objects he has in view. The experimental work is varied and interesting; and the Live Stock is worthy of special notice on account of the large and valuable additions made to it during the past year.

An able and elaborate account of everything pertaining to the farm will be found in Professor Brown's report at the end of this volume.

THE HORTICULTURAL DEPARTMENT.

This is now one of the heaviest and most important departments of the Institution. It embraces the lawn, kitchen garden, orchard, raspberry plots, vineries, arboretum, greenhouses, and forest-tree clumps—all in charge of Mr. James Forsyth, the foreman of the garden department. Every one knows that a lawn requires a great deal of time and attention during the spring and summer months. When the work is once done you need to begin again and again throughout the whole season from April to November.

A statement of the past year's work and progress in this department is given in part VI. at the end of this report.

THE COLLEGE.

The work in the College is usually spoken of under three heads :—

I.—The Course of Instruction in the College.
II.—The Boarding-house and College Buildings.
III.—The Business Department.

The routine in these so-called departments varies very little from year to year. There are no experiments to describe; no new theories to discuss; nothing very interesting to tell. Hence I shall report briefly under each head, as follows :—

I.—THE COURSE OF INSTRUCTION IN THE COLLEGE.

Before proceeding to the work of 1884, I may give the sessions and terms into which the year is divided, a list of the subjects taught, and the names of the professors and lecturers, with the work allotted to each; after which I shall speak of the year's operations as a whole, and then of each term separately.

The scholastic year commences 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 31st March.

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

Terms.

Fall Term—1st October to 22nd December.
Winter Term—5th January to 31st March.
Spring Term—16th 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, Inorganic Chemistry, Organic Chemistry, Geology and Physical Geography, Structural and Physiological Botany, Physiology,

Zoology, Veterinary Anatomy, Veterinary Materia Medica, English Literature and Composition, Book-keeping, Arithmetic, and Mensuration.

Second Year.—Agriculture, Live Stock, Arboriculture, Agricultural Chemistry, Meteorology, Systematic and Economic Botany, Entomology, Horticulture, Veterinary Pathology, Veterinary Obstetrics, Veterinary Surgery and Practice, 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.

2. William Brown, C.E., P.L.S.

Agriculture, Live Stock, and Arboriculture.

3. R. B. Hare, B.A., Ph.D.

Inorganic, Organic, Agricultural, and Analytical Chemistry; Geology; Physical Geography; Meteorology.

4. J. Playfair McMurrich, M.A.

Physiology; Zoology; Structural, Physiological, Systematic, and Economic Botany; Horticulture; Lectures on English.

5. Frederick Grenside, V.S.

Veterinary Anatomy, Pathology, Materia Medica, and Obstetrics; Practical Handling and Judging of Horses.

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

Arithmetic, Mensuration, Mechanics, Levelling, Surveying, and Book-keeping; Lectures on English.

THE YEAR 1884.

The history of the College during the year 1884 is little else than a record of ordinary exercises and incidents, such as have been reported from year to year. The work in the several departments has gone on as usual, and the progress made has been no less substantial and satisfactory than in any former period.

Attendance.

The following list contains the names of those who have been in attendance during the past year, making a total of 188, and representing not only Ontario but other

Provinces of the Dominion, also Great Britain and Ireland, and two or three foreign countries as follows: from Ontario, 120; England, 26; Quebec, 14; Nova Scotia, 10; New Brunswick, 6; Scotland, 3; Ireland, 2; Prince Edward Island, 2; United States, 2; Jamaica, 1; Turkey, 1; Wales, 1.

As we admit students every six months, the total number on the roll from year to year is considerably larger than those in attendance at any particular time. Of the 188 enrolled in 1884, there are 108 in attendance at the present time.

COLLEGE ROLL.

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Alderson, A. B	Ottawa	Carleton, Ont.
Alexander, R. C	Wendigo	Middlesex, Ont.
Ashworth, H. L	London	England.
Annand, F. W. C	Halifax	Nova Scotia.
Austin, W. E	Ottawa	Carleton, Ont.
Ballie, W	Mount Olivet	Jamaica.
Baldwin, E. H	Everitt	Massachusetts, U. S.
Ballantyne, A. W	Stratford	Perth, Ont.
Baker, V.H	Parkstone, Dorset	England.
Beadle, C. D	St. Catharines	Welland, Ont.
Beament, H. J	Ottawa	Carleton, Ont.
Beer, H. H	Charlottetown	Prince Edward Island.
Begbie, E. A	London	England.
Bent, E. H	Belleville	Hastings, Ont.
Birdsall, W. G	Birdsall	Peterborough, Ont.
Black, C. C	Amherst	Nova Scotia.
Black, P. C	Windsor	Nova Scotia.
Brodie, C. J	Bethesda	York, Ont.
Brown, C. R	Norwood	Peterborough, Ont.
Brown, W. J	Fergus	Wellington, Ont.
Brownjohn, N. S	East Lydford, Somerton	England.
Broome, N. H	Henley-on-Thames	England.
Brush, G. H. R	Clifton, Bristol	England.
Buckingham, F. W	Stratford	Perth, Ont.
Burch, E. W	Toronto	York, Ont.
Burwash, H. A	Underwood	Bruce, Ont.
Butler, G. C	London	England.
Byers, W. F	Gananoque	Leeds, Ont.
Calvert, S	Manchester	England.
Campbell, C. A	Toronto	York, Ont.
Campbell, J. L	Clarksburg	Grey, Ont.
Campbell, W. W	Clarksburg	Grey, Ont.
Carlaw, C. M	Warkworth	Northumberland, Ont.
Carpenter, P. A	Collingwood	Simcoe, Ont.
Carr, G. P	Hatherley, Cheltenham	England.
Carr, L. H	Elmhurst, South Croydon	England.
Carden, J	Toronto	York, Ont.
Casswell, A. B	Ingersoll	Oxford, Ont.
Chadsey, W. E	Wellington	Prince Edward, Ont.
Chipman, S. B	Halifax	Nova Scotia.
Climie, W. J	Listowel	Perth, Ont.
Cobb, C	Fingall	Elgin, Ont.
Collins, H. J	York	England.
Corson, G. H	Hamilton	Wentworth, Ont.
Courbarron, F. H	St. Andrew's	Scotland.
Cowley, A. E	Guelph	Wellington, Ont.
Craig, H	Carsonby	Carleton, Ont.
Cross, E. L	Montreal	Quebec.
Cutting, W. A	Guelph	Wellington, Ont.
Davies, S	Toronto	York, Ont.
Dennis, J. E	London	England.
Denton, E	London	Middlesex, Ont.
Donaldson, H. W	Mobarnane, Tipperary	Ireland.
Dunn, J. G	St. John	New Brunswick.
Eby, J. R	Sebringville	Perth, Ont.

COLLEGE ROLL—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Erskine, H. R	Ottawa	Carleton, Ont.
Etherington, C. B	Cambridge	England.
Fair, J. L	South Monaghan	Northumberland, Ont.
Fee, J. J	Toronto	York, Ont.
Fortune, G. R	Muir Cambus, Colinsborough, Fyfe	Scotland.
Fraser, G	Stratford	Perth, Ont.
Fuller, S. G	Stratford	Perth, Ont.
Furner, G. H	Toronto	York, Ont.
Glass, J. M	Montreal	Quebec.
Green, C. W	Brampton	Peel, Ont.
Greenweil, H	Orange Park	Florida, U. S.
Greenwood, J. T	Peterborough	Peterborough, Ont.
Guest, J	Ballycroy	Simcoe, Ont.
Hague, J. P	Cobourg	Northumberland, Ont.
Haldimand, E. M	Montreal	Quebec.
Hall, H. B	St. John	New Brunswick.
Hannah, J	Egmondville	Huron, Ont.
Hay, D. D	Stratford	Perth, Ont.
Hay, W. H	Stratford	Perth, Ont.
Hayman, J. M	Aldingham, Ulverston	England.
Henry, J. W	Thornton	Simcoe, Ont.
Herbert, D. L	St. Andrew's	Scotland.
Hipwell, J. R	Thompsonville	Simcoe, Ont.
Holcroft, H. S	Orillia	Simcoe, Ont.
Holtby, R. M	Manchester	Ontario, Ont.
Horsman, J. V	Ingersoll	Oxford, Ont.
Hubbard, W. W	Burton	New Brunswick.
Idington, P. S	Stratford	Perth, Ont.
Jeffrey, J. S	Toronto	York, Ont.
Jamieson, W. A	Thornton	Simcoe, Ont.
Johnston F. A	Toronto	York, Ont.
Jones, T. L	Aberystwith	Wales.
Jones-Bateman, H	Stratford	Perth, Ont.
Jordan, A. W	Simonds	New Brunswick.
Keil, C. A	Chatham	Kent, Ont.
Kemmis, J. H	Dublin	Ireland.
Kennedy, J. R	Leeds	England.
Kenyon, J. D	Thedford	Lambton, Ont.
Kernighan, J. N	Benmiller	Huron, Ont.
King, J. E	Middlemarch	Elgin, Ont.
Knott, E	London	Middlesex, Ont.
Lane, H	Guelph	Wellington. Ont.
Lane, H. R	Surbiton, Surrey	England.
Langlois, R. J	Toronto	York, Ont.
Leech, L. T	Guelph	Wellington, Ont.
Ledyard, E. D	Toronto	York, Ont.
Lehmann, A	Orillia	Simcoe, Ont.
Little, W	Killyleagh	Simcoe, Ont.
Lloyd, O	Gormley	York, Ont.
Lobb, E. W. T	Hamilton	Wentworth, Ont.
Loblaw, W. T	Elm Grove	Simcoe, Ont.
Macalister, T. G	Kingston	Frontenac, Ont.
Macdonald, F. J	Montreal.	Quebec.
Macdonald, W. A	Stratford.	Perth, Ont.
Macfarlane, A. D	Wallace	Nova Scotia.
Macpherson, A	Montreal.	Quebec.
Madge, R. W	Brucefield	Huron, Ont.
Magee, F. P	St. John	New Brunswick.
Major, C. H	Lyn	Leeds, Ont.
Malcolm, G. H	Guelph.	Wellington, Ont.
Marsh, T. J	Clarksburg	Grey, Ont.
Mathewson, G	Montreal	Quebec.
Matson, J. S	Toronto	York, Ont.
Maude, F	Bournemouth.	England.
Mavor, L	Toronto	York, Ont.
McGregor, J	Colborne	Northumberland, Ont.
McIntyre, D. N	Paisley	Bruce, Ont.
McKay, J. B	Stellarton	Nova Scotia.
McKay, J. G	Underwood	Bruce, Ont.
McLean, R. M	Ottawa	Carleton, Ont

COLLEGE ROLL—*Concluded.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
McPherson, H. A.	Lancaster	Glengarry, Ont.
Meikle, G. W.	Lachute	Quebec.
Menzies, R. M.	Almonte	Lanark, Ont.
Mill, J. S.	Bay of Chaleurs	Quebec.
Miller, J. T.	Norwich	England.
Moberly, G. E.	Erith, Kent	England.
Morris, D. W.	Montreal	Quebec.
Muir, J. B.	North Bruce	Bruce, Ont.
Mytton, R. P., B.A. (Cantab.)	Guelph	Wellington, Ont.
Nairn, J.	Toronto	York, Ont.
Notman, C. R.	Toronto	York, Ont.
O'Doherty, E. J.	Ottawa	Carleton, Ont.
Owen, W. H.	Hull	England.
Page, F. E.	Amherst	Nova Scotia.
Paget, H. A.	Loughborough	England.
Patterson, J. W.	Constantinople	Turkey.
Pethick, W. H.	Charlottetown	Prince Edward Island.
Pattingill, C.	Wellington	Prince Edward, Ont.
Power, R. H.	Barrie	Simcoe, Ont.
Powys, P. C.	Fredericton	New Brunswick.
Pritchard, R. M.	Port Hope	Durham, Ont.
Quinn, E. C.	Orillia	Simcoe, Ont.
Ramsay, A. R.	Montreal	Quebec.
Raynor, T.	Rose Hall	Prince Edward, Ont.
Read, F.	Bobcaygeon	Victoria, Ont.
Reid, P.	Montreal	Quebec.
Ridings, H. L.	Colborne	Northumberland, Ont.
Robinson, B.	Wheatley	Kent, Ont.
Rose, G. M.	Toronto	York, Ont.
Ross, J. H.	New Glasgow	Nova Scotia.
Rowat, J. T.	Hillsdale	Simcoe, Ont.
Routh, P. G.	Toronto	York, Ont.
Saxton, E. A.	Nantwich	England.
Schroeder, R.	Toronto	York, Ont.
Sharp, W.	Killyleagh	Simcoe, Ont.
Sharman, H. B.	Stratford	Perth, Ont.
Sharman, G. C.	Stratford	Perth, Ont.
Skaife, F. W.	Montreal	Quebec.
Slater, H.	Taunton	England.
Smith, A. H.	Simcoe	Norfolk, Ont.
Smith, E. P.	Port Hope	Durham, Ont.
Smith, J.	Guelph	Wellington, Ont.
Spalding, F. J.	Perth	Lanark, Ont.
Stamer, O. F.	Hubbard's Cove	Nova Scotia.
Steers, O.	Ottawa	Carleton, Ont.
Sturge, E.	Ilfracombe	Muskoka, Ont.
Thompson, H.	Cheltenham	England.
Thompson, W. D.	Guelph	Wellington, Ont.
Tucker, H. V.	Toronto	York, Ont.
Vivian, K.	Mohawk	Brant, Ont.
Walsh, E. F.	Luton, Bedford	England.
Walter, J. R.	Barrie	Simcoe, Ont.
Wark, A. E.	Wanstead	Lambton, Ont.
Watts, W. G.	London	England.
Weatherston, D.	Toronto	York, Ont.
Whitehead, E. A.	Montreal	Quebec.
Wiggins, G. C.	Windsor	Nova Scotia.
Williams, M. L.	Leaskdale	Ontario, Ont.
Wilson, T. G.	Hawkstone	Simcoe, Ont.
Wilson, C. J.	Dunkeron	Simcoe, Ont.
Workman, J. R.	Guelph	Wellington, Ont.
Wroughton, T. A.	Montreal	Quebec.
Zavitz, C. A.	Coldstream	Middlesex, Ont.

ANALYSIS OF PRECEDING LIST.

Counties, etc.	Students.	Counties, etc.	Students.
Brant	1	Northumberland	5
Bruce	4	Nova Scotia	10
Carleton (including Ottawa)	8	Ontario	2
Durham	2	Oxford	2
Elgin	2	Peel	1
England	26	Perth	13
Frontenac	1	Peterborough	3
Glengarry	1	Prince Edward County	3
Grey	3	Prince Edward Island	2
Hastings	1	Quebec (Province)	14
Huron	3	Scotland	3
Ireland	2	Simcoe	16
Jamaica	1	Turkey	1
Kent	2	United States	2
Lambton	2	Victoria	1
Lanark	2	Wales	1
Leeds	2	Welland	1
Middlesex	4	Wellington	10
Muskoka	1	Wentworth	2
New Brunswick	6	York (including Toronto)	21
Norfolk	1		
		Total	188

Ontario Students	120
Non-residents	68
Ontario Counties represented	30

For the last three years the County of Simcoe has sent us the largest number of Students. In 1884 it had a representation of 16, which is larger than that of any other county, except York, which includes the city of Toronto. Perth sent 13; Wellington, 10; Carleton (including Ottawa), 8; Northumberland, 5; Bruce, 4; Middlesex, 4; and each of the twenty-two other counties, a smaller number.

Religious Denominations.

Under this head, it may be observed that the College is patronized by members or adherents of nearly all the religious organizations in the Dominion. Last year there were ten denominations represented in our class-lists, as follows:—

Episcopalians	83	Unitarians	2
Presbyterians	49	Friends	1
Methodists	31	Lutherans	1
Baptists	9	Plymouth Brethren	1
Congregationalists	6		
Roman Catholics	5	Total	188

Lectures.

Lectures commenced on the 1st October and continued throughout the first three terms of the scholastic year 1883–84—from the 1st October to the 30th June; during which time all our regular students were engaged in class-room work and manual labour alternately—three hours a day having been spent at the former, and from three and a half to five at the latter. To this were added five hours in two weeks for set-up drill and

gymnastics, under Adjutant Clarke, the very efficient drill instructor of the Ontario and Wellington Field Batteries; so that the daily routine of every student in the regular course, for nine months of the year, was—

Lectures in the College, three hours a day (excepting Saturdays).
Manual Labour, outside, three and a half to five hours a day, according to the season of the year.
Study in room, two hours a day.
Drill and gymnastics, one hour a day (for five days of every alternate week).

While the first year students were at lectures in the College, the second year students were employed outside. Those who went out to work in the forenoon, came in for lectures in the afternoon, and *vice versa*. Thus the theoretical work inside and the practical work outside went on simultaneously during the Fall, Winter and Spring Terms. The Summer Term (1st July to 31st August) was devoted entirely to work in the outside departments—the farm, the live stock, the garden, the carpenter-shop and the experimental department.

In order to place systematically and clearly before the readers of this report an outline of the literary work done in the Institution, I beg to submit the following syllabus of lectures delivered by the professors in the several departments and sub-departments of study during the scholastic year, commencing on the 1st October, 1883, and ending on the 31st August, 1884 :—

Outline of Class-room Work.

Scholastic Year 1883–84.

(*1st October to 30th June.*)

FIRST YEAR.

Fall Term—1st October to 22nd December.

Department 1.—Agriculture.

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

Reclamation of Land.—Clearing, stumping, stoning, fallowing, etc.

Soils.—Origin and distribution of soil; natural conditions of soil and plant; examination and classification of soils; physical and chemical properties of each kind.

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

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

Implements and Machinery.—Principles in construction of implements and machinery; points to be aimed at; classification, examination, and description of the same.

Miscellaneous.—Roads, lanes, fences, wells, etc.

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, pyrometers, specific and latent heat; sources, nature and laws of light; spectrum analysis.

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 ; 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.

Human Physiology.—Evidences of life ; elementary tissues, connective tissues, adipoise tissue, cartilage, bone ; alimentary system, teeth, salivary glands, stomach (structure and functions of), intestines, liver and pancreas ; foods, digestion of an ordinary meal, dietting ; respiratory system ; ventilation ; excretory system ; functions and structure of the kidneys and skin ; clothing ; bathing ; nervous system, general working of the system, structure and working of the brain, eye, ear and other sense organs ; locomotory system, structure and physiology of the muscles ; walking ; running ; exercise ; hygiene—draining ; thirty-seven motive diseases, contamination of water, etc.

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 Washinton Irving's "Sketch Book."

Department 5.—Mathematics.

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

Mental Arithmetic.—Calculations in simple rules.

FIRST YEAR—(*Continued*).

Winter Term—5th January to 31st March.

Department 1.—Agriculture.

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

Horses.—Different breeds of horses, and leading characteristics of each ; type of horse required for farm work ; breeding, feeding and general management.

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

Sheep.—Breeds of sheep generally considered ; long-woolled sheep ; medium-woolled sheep ; short-woolled sheep ; crosses between different breeds compared ; texture ; quality, quantity, and uses of different kinds of wool.

Swine.—Characteristics of various breeds ; management of sows ; stores ; bacon-curing, etc.

Department 2.—Natural Science.

Inorganic Chemistry.—Subject continued from Fall Term.

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.—Definition of terms morphology, physiology, embryology, etc.; distinctions between animate and inanimate objects; life distinctions between plants and animals; definition of general terms; development; basis of classification; characters of the various classes, with a more detailed and special account of the porifera and sponges; actinozoa, including the formation of coral islands; trematoda, including the "liver-fluke"; cestoda, with a description of the life-history of the common tape-worm, and of the form causing "staggers" in sheep; nematoda, including thread worms, trichina, wheat anguillula, cause of gapes in chickens, etc.; acanthocephala; oligochæta—formation of mould by earth-worms; hirudinea lamellibranchiata, including edible molluscs and pearl fisheries; gasteropoda; cephalopoda; arthropoda, with special attention to structure and habits of the arachnida, acarina and insecta; general structure of the vertebrata; distinctions between vertebrata and invertebrata; pisces; amphibia; reptilia—treating especially of the snakes and turtles; aves—habits and appearance of the more important insectivorous birds; mammalia, with special attention to the orders containing useful and domestic animals; anthropomorpha; man.

Lectures illustrated by specimens, diagrams, and drawings on the blackboard.

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, tugumental system.

Department 4.—English.

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

English Classics—Committing to memory and critical study of Scott's "Lady of the Lake," Cantos V. & VI.

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—16th April to 30th June.

Department 1.—Agriculture.

Preparation of Soil.—Modes of preparation for different crops, as wheat, barley, oats, rye, pease, maize; modes suited to various kinds of soil.

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

Improvement of Lands.—Ordinary cultivation ; subsoiling in some cases ; fallowing ; draining ; manuring. Farm-yard manure and management of the same ; the properties, application and uses of artificial manures—lime, plaster, salt, bone-dust, superphosphates, etc.

Roots.—Cultivation of roots and tubers—turnips, mangolds, carrots, potatoes ; effects of each kind on soil.

Green Fodders.—Tares, lucerne, sanfoin, prickley comfrey, clovers, grasses ; the cultivation and management most appropriate for each.

Management of pastures ; harvesting and preparing crops for markets 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, inferences from their presence in rocks ; geological periods and the characteristics of each. Geology of Canada, with special reference to the nature and economic value of the rock deposits ; glacial period and its influence in the formation of soil. Lectures illustrated by numerous diagrams and specimens.

Physical Geography.—Scope of the subject—earth's place in space, external and internal conditions, atmosphere, ocean, land ; superficial configuration of Ontario ; theory of springs ; classification of lakes ; zones of animal and vegetable life.

Botany.—Derivation and definition of word ; definition of morphology ; vegetable physiology ; botanical geography ; palæophytology ; history of the growth of the science ; structure of plant-cells as individuals, cells aggregated into tissues ; fibro vasculas bundles ; roots—structure and physiology—stems ; structure in exogens and endogens, growth of stem, branching, varieties of stem ; leaves—structure, chlorophyll, stomata, hairs, shape, venation, compound leaves, phyllotaxis ; flower—arrangement, structure, colyx, corolla, stamens, pistils, foliar nature of parts, fertilization, natural provisions for cross-fertilization, development ; fruit—classification of fruits ; germination of seeds. Physiology—proximate principles of plants ; nutrition ; metastasis ; insectivorous plants ; respiration ; motion ; heliotropism and geotropism ; irritability ; influence of temperature.

Lectures illustrated by specimens, diagrams and drawings on the blackboard.

Department 3.—Veterinary Science.

Materia Medica.—The preparation, doses, action, and uses 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 wheat, oats, barley, peas, grasses, clovers, roots, etc. ; liability to disease ; effects of various manures on different crops ; growth of plants, etc.

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

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

Department 2.—Natural Science.

Agricultural Chemistry.—Connection between chemistry and agriculture; the various compounds which enter into the composition of the bodies of animals: the chemical changes which food undergoes during digestion; chemical changes which occur during the decomposition of the bodies of animals at death; the functions of animals and plants contrasted; food of plants, and whence derived; origin and nature of soils; classification of soils; causes of unproductiveness in soil and how detected; composition of different plants in relation to the soils upon which they grow; rotation of crops; preservation, development, and renovation of soils; manures classified, the chemical action of manures on different soils; chemical theories in reference to the action of superphosphates; the action of lime in the decomposition of double silicates; feeding of animals; classification of foods; chemical results in the use of different foods; points necessary to be considered in order to obtain the full value of artificial and natural foods.

Meteorology.—Relation of meteorology to agriculture; composition and movements of the atmosphere; nature and manipulation of the barometer, its importance in forecasting the weather; temperature, description of the various instruments used in its measurement and how to use them; solar and terrestrial radiation; the influence of forests on climate; mists, fogs, clouds, rain, hail, and snow; description of instruments used in measuring rain and snow-fall; velocity and direction of wind; causes affecting climate; influence of climate on vegetation.

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 bog-spavin, curb, and other diseases of the joints.

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

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—5th January to 31st March.

Department 1.—Agriculture.

Laws affecting agriculture; capital required in farming; laying out of farm; general management and economy; measuring, levelling, and draining; permanent pastures; inventory and valuation; cost of production; buying, selling, and marketing; field experiments.

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 sheep, etc., etc.

Arboriculture.—Planting and attendance of forest trees, shade trees, etc.

Department 2.—Natural Science.

Agricultural Chemistry.—Subject continued from Fall Term.

Entomology.—Importance of the study to agriculturists; natural checks to insect ravages; system of nomenclature; anatomy of insects—appendages, respiration, nutritive and nervous systems; metamorphosis; classification; beneficial and injurious insects—their habits and the best means of checking the ravages of the latter—lectures illustrated by specimens.

Department 3.—Veterinary Science.

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

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

Respiratory System.—Nature, causes, symptoms, and treatment of catarrh, nasal-gleet, roaring, bronchitis; pleurisy, 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.

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

Book-keeping.—Review of previous work.

Spring Term.—16th April to 30th June.

Department 1.—Agriculture.

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

Department 2.—Natural Science.

Practical and 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.

Quantitative analysis of soils, mannres and farm produce.

Systematic and Economic Botany.—Definition of the terms; importance of classification; requisites of good classification; classification of plants, character of the more important orders; description of source and preparation of the various economic products obtained from plants. The course was illustrated by a large collection of plants and also by practical field-work, in which various plants were examined, dissected, and classified by the students.

Horticulture.—Ontario as a fruit-growing country; influence of climate, soil, topography; source of our commoner fruits; improvement by selection; Van Mon's theory; cross fertilization—physiology, extent to which it can be carried; duration of cultivated varieties; grafting and budding—objects of operations, methods, extent to which operations can be carried; influence of graft on stocks; layering; propagation by suckers; propagation by pieces of root; pruning—objects of operation, physiology, root-pruning, other methods of producing fruitfulness; training—objects of operation, methods; transplanting—physiology, time of year to be practised, operation, mulching, manuring, laying in by the heels; winter care of plants; diseases of plants—produced by changes in the external conditions of plants, poisonous gases in the atmosphere or soil; growth of parasitic plants; injuries from insects; points to be considered in the selection of trees.

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.

Having thus briefly outlined the work of the year as a whole, I may proceed to report more at length on the work of each term separately.

The scholastic year began on the 1st October, 1883, and ended on the 31st August, 1884. The first term of the year, *i.e.*, the Fall Term, having been treated of in our report of 1883, I shall begin with the

Winter Term, 1884.

5th January to 31st March.

The students in attendance were those who had entered at the beginning of the Fall Term in October, 1882, or previous to that date—109 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 two days long, exclusive of the time spent on the Easter Examinations; and the lectures delivered were as follows:—

First Year.—30 lectures, one hour each, on Agriculture and Live Stock.
32 " " " Chemistry.
21 " " " Zoology.
21 " " " Veterinary Anatomy.
20 " " " English Literature.
10 " " " English Composition.
29 " " " Arithmetic and Book-keeping.
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Second Year.—15 lectures, one hour each, on Agriculture and Live Stock.
5 " " " Arboriculture.
31 " " " Agricultural Chemistry.
11 " " " Entomology.
21 " " " Political Economy.
11 " " " English Literature.
9 " " " English Composition.
21 " " " Veterinary Pathology.
21 " " " Statics, Hydrostatics, and Book-keeping.
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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, pigs, and horses, while the second year men spent six hours on general agriculture, five 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, and 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 weak 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, Aberdeen Polls, Devons, Galloways, Ayrshires, and Jerseys—breed with breed in regard

to shape of frame, quality of flesh, feeding, beefing, milking, hardiness, and other properties. Much the same course is pursued with the different breeds of sheep. Cotswolds, Leicesters, 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 1884, 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 full course of lectures from Dr. Hare 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 McMurrich'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 Biology, on the marks, habits, and depredations of the various insects that infest our crops and fruits, seeking especially to learn the best means of checking and preventing their ravages.

A detailed account of the work in the sub-department of Chemistry, including both class-room and experimental work, will be found in Dr. Hare's report in part II. of this volume.

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 thoroughly practical, 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.

The work of the year in this department embraced not merely the lectures in the College, but also the medical treatment of all the stock kept on the farm. This, of course, gave the Professor of Veterinary Science a good deal of extra work; but it afforded him an opportunity of observing carefully the action of one or two diseases to which stock in this country is more or less liable.

See Dr. Grenside's report in part III.

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 and refining influences 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 not got by confining the attention to any single subject, but by reading, writing, and conversation, with the sharpening and refining influence of many studies. At the same time, I think there is nothing else which contributes so much to 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 that kind.

During the Winter Term of 1884, the first year students spent one hour a week on exercises in composition, and two hours in the critical study of the fifth and sixth Cantos of Scott's "Lady of the Lake." The second year men read Shakespeare's "Julius Cæsar," and a part of "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, lock-outs, etc.

Department 5.—Mathematics and Book-keeping.

The work under this head, as I said once before, presents certain difficulties which are likely to remain for some time to come. First of all, we cannot devote much time to the department; and in the next place our students generally have a very imperfect knowledge of the elementary principles of Mathematics when they come to us. Consequently, we have not as yet undertaken anything beyond Arithmetic, Mensuration, elementary Mechanics, and the less difficult operations in Levelling and Surveying. Even in these few branches, we find it necessary to 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.

The work of last winter differed very little from that of the winter before; hence I shall not spend time in describing it, but simply refer to the Examination papers on Arithmetic, Statics, and Book-keeping in Appendix 2, and to the Class-Lists in Appendix 3.

Special Live Stock and Veterinary Class.

In the fall of 1883, as in 1882, we organized a Special Class for the benefit of young men who did not wish to take the regular course, but were anxious to devote a few months to the study of Live Stock and Veterinary Science.

The members of this class were to spend the half of each day in handling and looking after cattle, sheep, pigs, and horses, and the remainder of the time in studying lectures and books which treat of these animals in health and disease.

The difficulty in the way of carrying out this proposal was the fact that the specials, by spending all their time with the live stock, were in danger of interfering with the practice of the regular students in that department, and, for that reason, it was arranged that the regular students should have the same privileges in the live stock department as if there were no specials; and that the work of the specials, being for their own benefit rather than for the performance of remunerative labour, should not be paid for by the Institution.

In the fall of 1883, sixteen applied for admission to the class and fifteen were accepted. They did much better work than the previous class, and made a fair record at the Easter Examinations. Seven were gazetted as having passed in all the subjects, and one, Mr. H. B. Sharman of Stratford, was ranked first class in every branch.

Easter Examinations.

The Easter Examinations were, as usual, on the class-room work of the Winter Session (1st October to 31st March). They commenced on the 17th and ended on the 27th March. 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 workers a fair 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., Mossboro', (Wellington) ..... Stock-Breeding.
Charles Drury, M.P.P., Crown Hill, (Simcoe) ..... The Feeding of Animals.
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.

Granted on the Results of the Easter Examinations, 1884.

First Year.

Agriculture and Live Stock—

1. McKay, J. B ..... Stellarton, Nova Scotia.
2. Raynor, T ..... Rose Hall (Prince Edward), Ont.
3. Muir, J. B ..... North Bruce (Bruce), Ont.

Natural Science—

1. McKay, J. B ..... Stellarton, Nova Scotia.
2. Raynor, T ..... Rose Hall (Prince Edward), Ont.
3. Ridings, H. L ..... Grafton (Northumberland), Ont.
4. { Macpherson, A ..... Montreal.
   { Muir, J. B ..... North Bruce (Bruce), Ont.
6. Butler, G. C ..... London, England.

Veterinary Science—

1. McKay, J. B ..... Stellarton, Nova Scotia.
2. Muir, J. B ..... North Bruce, Ont.
3. Ridings, H. L ..... Grafton, Ont.
4. Raynor, T ..... Rose Hall, Ont.
5. Butler, G. C ..... London, England.

English Literature and Composition—

1. Raynor, T ..... Rose Hall, Ont.
2. Ridings, H. L ..... Grafton, Ont.
3. Kemmis, J ..... Dublin, Ireland.
4. Butler, G. C ..... London, England.
5. McKay, J. B ..... Stellarton, N. S.
6. Muir, J. B ..... North Bruce, Ont.

Mathematics and Book-keeping—

1. Raynor, T ..... Rose Hall, Ont.
2. Ridings, H. L ..... Grafton, Ont.
3. McKay, J. B ..... Stellarton, N. S.

Second Year.

Agriculture and Live Stock—

1. Ballantyne, A. W ..... Stratford (Perth), Ont.
2. Carpenter, P. A ..... Collingwood (Simcoe), Ont.

Natural Science—

1. Carpenter, P. A ..... Collingwood, Ont.
2. Slater, H ..... Taunton, England.
3. Wark, A. E ..... Wanstead (Lambton), Ont.
4. Powys, P. C ..... Fredericton, N. B.
5. Ballantyne, A. W ..... Stratford, Ont.
6. Lehmann, A ..... Orillia, Ont.

Veterinary Science—

1. Carpenter, P. A ..... Collingwood, Ont.
2. { Ballantyne, A. W ..... Stratford, Ont.
   { Lehmann, A ..... Orillia, Ont.
4. Slater, H ..... Taunton, England.
5. Powys, P. C ..... Fredericton, N. B.

English Literature and Political Economy—

1. Carpenter, P. A ..... Collingwood, Ont.
2. Powys, P. C ..... Fredericton, N. B.
3. Tucker, H. V ..... Toronto, Ont.

Mathematics and Book-keeping—

1. Lehmann, A ..... Orillia, Ont.
1. Carpenter, P. A ..... Collingwood, Ont.

SPECIAL CLASS.

First-Class Men—

1. H. B. Sharman ..... Stratford, Ont.
2. W. W. Hubbard ..... Burton, N. B.

Spring Term.

(16th April to 30th June.)

All specialists and generally some others leave at Easter. Hence we have been accustomed to hold two entrance examinations in the year—one on the 1st of October, and the other on the 16th of April. The number admitted in April of last year was 26. They were examined on the 17th and 18th; and lectures commenced on Monday, the 21st.

Work in Outside Departments.

As the Spring Term affords special opportunities for practise in the outside departments, the class-room work did not receive quite so much attention as during the Winter Term. Every one had to attend lectures three hours a day as usual; but a little less time was occupied in study than during the winter months. From four and a half to five hours a day were devoted to practical work outside, a part of which was spent with the instructor, and the balance with the foremen of the several departments. By the instructor, I mean one of our men who spends most of his time in teaching the students how to perform such operations as they require to understand before taking charge of farms on their own responsibility; such as harnessing and driving horses, ploughing, sowing, harrowing, rolling, mowing with the scythe, driving a mower, and such like. The young men are sent to him in rotation, according to our knowledge of what they require; and while under his instruction they get no wages. Hence they are generally anxious to learn as quickly as possible, so that they may be in a position to claim the promised pay for their work.

Class-room Work.

While particular prominence was given to practical work outside, the theoretical work inside was by no means neglected. In the department of Agriculture the cultivation of the various crops was taken up; seeds were examined and judged; the different modes of sowing discussed and exemplified; the principles underlying rotation, and the rotations suitable to different soils, climates, and circumstances were explained; also the improvement of land by ordinary cultivation, subsoiling, fallowing, manuring, and laying down to grass. At the same time, under the head of Practical and Analytical Chemistry, the second year men were employed from three to four hours a week in the laboratory, examining and testing waters, soils, foods, manures, etc., so far as our limited appliances would allow. In that way they were led to see the practical value of what they had already learned in Inorganic, Organic, and Agricultural Chemistry. They had opportunities for putting their knowledge to a practical test. Hence most of them entered cheerfully and heartily into the work. In systematic and Economic Botany they received lectures on the general classification of plants, and studied more particularly those orders which contain the most important agricultural and economic plants—cereals, grasses, roots, and plants used in the manufacture of fabrics, oils, medicines, and other articles of commerce. At the same time the first year students were attending lectures on Geology and Botany. In the former they learned something of the formation, composition, and character of the soils found in the country; in the latter they studied the plant in relation to the soil and the atmosphere—its form, food, functions, and diseases, giving special attention to hybridization, the different modes of propagation, and such diseases as smut, rust, mildew, etc. The lectures of the class-room were illustrated and applied to some extent by the gardener while the students were at work with him in the greenhouses, gardens, and lawns. In the departments of Veterinary Science, English, and Mathematics, the work was carried on as during the Winter Term.

The first-year students had twenty-three lectures on the preparation, action, and doses of about fifty kinds of medicine commonly used in veterinary practice; read Wordsworth's "Excursion," Bk. I.; wrote impromptu compositions; and gave some time to th study of Mensuration. During the same period, the second-year men had lectures on veterinary science, including twenty-five or thirty important medicines and the therapeutics of the veterinary art; read critically and committed to memory Milton's "L'Allegro," and "Il Penseroso;" gave some attention to road-making; and went twice a week into the fields with a master to apply, as far as possible, what had previously been taught them under the heads of levelling, draining, and elementary surveying.

Midsummer Examinations.

The midsummer examinations on the work of the Spring Term (16th April to 30th June) began on the 19th and ended on the 21st June; and immediately thereafter a number of the students went into

Camp at Guelph,

And remained in charge of Lieutenant-Colonel Macdonald, Commander of the First Provisional Brigade of Field Artillery, for ten days, at the end of which time they returned for the

Closing Exercises of the College,

The Granting of Diplomas and Presentation of Medals and Prizes.

These exercises took place on the 3rd July, and were attended by the Hon. A. M. Ross, Commissioner of Agriculture, James Innes, M.P., James Laidlaw, M.P.P., and a number of other visitors from Guelph and elsewhere, who came to witness the presentation of the diplomas, medals, and prizes that had been granted or awarded on the results of the year's work.

Eleven young men, having completed the regular course of study and apprenticeship, were presented by the President of the College for diplomas, which were granted by the Hon. A. M. Ross, Commissioner of Agriculture.

Medals and Medallists.

Three medals are granted annually to the graduating students who stand respectively first, second and third in general proficiency, provided they reach a fixed standard in both the theoretical and the practical work.

Last year the competition was keen; and the results, as regards the first four on the list, may be stated as follows:—

(1) Written Examinations at Easter.	(2) Written Examinations at Mid-summer.	(3) Practical Examinations at Mid-summer.
1. Carpenter, P. A.	1. Carpenter.	1. Wark.
2. Slater, H.	2. Slater.	2. Lehmann. / Carpenter.
3. Lehmann, A.	3. Lehmann.	4. Slater.
4. Wark, A. E.	4. Wark.	

General Proficiency.

1. Carpenter, P. A. (Gold Medallist)..... Collingwood, Simcoe, Ont.
2. Slater, H. (First Silver Medallist)..... Taunton, England,
3. Lehmann, A. (Second Silver Medallist)..... Orillia, Simcoe, Ont.
4. Wark, A. E. ..... Wanstead, Lambton, Ont.

The gold medal was presented by the Honourable 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 other honours and prizes were distributed as follows:—

Honour Certificates.

Midsummer Examinations, 1884.

First Year.

Agriculture and Live Stock—

1. Raynor, T. .....Rose Hall, Ont.
2. Muir, J. B. .....North Bruce, Ont.
3. Ridings, H. L. .....Grafton, Ont.
4. McIntyre, D. N. .....Paisley, Ont.

Natural Science—

1. Raynor, T. ..... Rose Hall, Ont.
2. McPherson, A. ..... Montreal.
3. Muir, J. B. ..... North Bruce, Ont.
4. Ridings, H. L ..... Grafton, Ont.
5. McIntyre, D. M. ..... Paisley, Ont.
6. Owen, W. H. ..... England.

English Literature and Composition—

1. Raynor, T. ..... Rose Hall, Ont.

Veterinary Science—

1. Raynor, T. ..... Rose Hall, Ont.
2. Muir, J. B. ..... North Bruce, Ont.
3. Ridings, H. L ..... Grafton, Ont.
4. Alexander, R. C. ..... Wendigo, Ont.

Mathematics—

1. Raynor, T. ..... Rose Hall, Ont.
2. Ridings, H. L. ..... Grafton, Ont.
3. Muir, J. B. ..... North Bruce, Ont.

Second Year.

Agriculture (Theoretical and Practical)—

1. Wark, A. E. ..... Wanstead, Ont.
2. Carpenter, P. A. ..... Collingwood, Ont.
3. McKay, J. B. ..... Stellarton, N. S.

Horticulture—

1. Carpenter, P. A. ..... Collingwood, Ont.
2. Slater, H ..... Taunton, England.
3. Lehmann, A. ..... Orillia, Ont.
4. Powys, P. C ..... Fredericton, N. B.

Natural Science—

1. Slater, H ..... Taunton, England.
2. Carpenter, P. A. ..... Collingwood, Ont.
3. Lehmann, A ..... Orillia, Ont.

Veterinary Science—

1. Carpenter, P. A. ..... Collingwood, Ont.
2. Slater, H ..... Taunton, England.
3. Wark, A. E. ..... Wanstead, Ont.
4. McKay, J. B. ..... Stellarton, N. S.
5. Lehmann, A ..... Orillia, Ont.

English Literature—

1. Carpenter, P. A. ..... Collingwood, Ont.
2. Slater, H ..... Taunton, England.
3. Powys, P. C. ..... Fredericton, N. B.
4. Butler, G. C ..... London, England.

Mathematics—

1. Carpenter, P. A. ..... Collingwood, Ont.
2. { Lehmann, A. ..... Orillia, Ont.
   { Powys, P. C ..... Fredericton, N. B.
4. Slater, H. ..... Taunton, England.
5. Wark, A. E ..... Wanstead, Ont.

Prizes Awarded on the Results of the Easter Examinations.

Regular Course.

First Year.

Agriculture and Live Stock—
1st. J. B. McKay.
2nd. T. Raynor.

Natural Science—
1st. J. B. McKay.
2nd. T. Raynor.

Veterinary Science—
1st. J. B. McKay.
2nd. J. B. Muir.

English Literature and Composition—
1st. T. Raynor.
2nd. H. L. Ridings.

Mathematics and Book-keeping—
1st. T. Raynor.
2nd. H. L. Ridings.

General Proficiency—
1st. T. Raynor.
2nd. J. B. McKay.
3rd. H. L. Ridings.

Second Year.

Agriculture and Live Stock—
1st. A. W. Ballantyne.
2nd. P. A. Carpenter.

Natural Science—
1st. P. A. Carpenter.
2nd. H. Slater.

Veterinary Science—
1st. P. A. Carpenter.
2nd. { A. W. Ballantyne. / A. Lehmann.

Eng. Lit. and Political Economy—
1st. { P. A. Carpenter. / P. C. Powys.
2nd. H. V. Tucker.

Mathematics and Book-keeping—
1st. A. Lehmann.
2nd. P. C. Carpenter.

General Proficiency—
1st. P. A. Carpenter.
2nd. H. Slater.
3rd. A. Lehmann.

Special Class.

First Year Students—
1st. C. Carlaw.
2nd. G. C. Sharman.

Second Year Students—
1st. H. B. Sharman.
2nd. W. W. Hubbard.

Associates of the College.

1881.

Ballantyne, W. W.....Stratford, Ont.
Dickinson, C. S.....England.
Grindley, A. W.....Montreal.
Motherwell, W. R.....County of Lanark.
Phin, R. J. (Governor-General's Medallist)..Hespeler, County of Waterloo.
Phin W. E..... " "
Pope, Herbert .....County of Grey, Ont.
Ross, James G.....Montreal.
Robins, W. P..... "

1882.

Blanchard, M. G.....Windsor, Nova Scotia.
Charlton, G. H.....St. George (Brant), Ont.

Chase, Oscar ..... Cornwallis, Nova Scotia.
Dawson, J. J ..... South Zorra (Oxford), Ont.
Dennis, James..... Weston (York), Ont.
Elworthy, R. H ..... Jamaica.
Fotheringham, James..... St. Marys (Perth), Ont.
Hallesy, Frederick..... Merthyr Tydvil, Wales.
Horne, W. H..... North Keppel (Grey), Ont.
Howitt, Wm..... Guelph, (Wellington), Ont.
Landsborough, John..... Clinton (Huron), Ont.
Mahoney, E. C..... Hamilton (Wentworth), Ont.
Nicol, George..... Cataraqui (Frontenac), Ont.
Ramsay, R. A. (Second Silver Medallist).. Eden Mills (Halton), Ont.
Shuttleworth, Arthur (First Silver Medallist) Mt. Albert (York), Ont.
Silverthorne, Newman ..... Sommerville (Peel), Ont.
Stover, J. W..... Norwich, (Oxford), Ont.
Wettlaufer, Frederick (Gold Medallist)... Tavistock (Oxford), Ont.
White, C. D ..... Hereford, England.

1883.

Fotheringham, W (Second Silver Medallist) St. Marys (Perth), Ont.
Garland, C. S ..... Montreal.
Jeffs, H. B ..... Bond Head (Simcoe), Ont.
McPherson, D..... Glanworth (Middlesex), Ont.
Perry, D. E ..... Ottawa (Carleton), Ont.
Robertson, W. (Gold Medallist)..... Wanstead (Lambton), Ont.
Schwartz, J. A. ..... Quebec.
Torrance, W. J..... Ottawa (Carleton), Ont.
Willis, W. B. (First Silver Medallist)..... Whitby (Ontario), Ont.

1884.

Black. P. C. ..... Windsor, Nova Scotia.
Carpenter, P. A. (Gold Medallist) ..... Collingwood (Simcoe), Ont.
Lehmann, A. (Second Silver Medallist).... Orillia (Simcoe), Ont.
Major, C. H ..... Croydon, England.
Powys, P. C ..... Fredericton, N. B.
Saxton, E. A ..... Nantwich, England.
Slater, H. (First Silver Medallist)..... Taunton, England.
Steers, O. ..... Ottawa, Ont.
Tucker, H. V. ..... Toronto, Ont.
Wark, A. E..... Wanstead (Lambton) Ont.
Wroughton, T. A ..... Bangalore, India.

Live Stock Certificates.

Nine members of the special Live Stock and Veterinary Class having done the work and passed the prescribed examinations, received special certificates as follows :—

First Year—
Carlaw, C. M. ..... Warkworth, Northumberland, Ont.
Sharman, G C ..... Stratford, Perth, Ont.
Skaife, F. W..... Montreal.

Second Year—
Cowley, E. A..... Windsor, England.
Holcroft, H. S..... Orillia, Simcoe, Ont.

Hubbard, W. W.....Burton, N. B.
Keil, C. A.....Chatham, Kent, Ont.
McGregor, J.....Colborne, Northumberland, Ont.
Sharman, H. B. (winner of Special Medal)....Stratford, Perth, Ont.

Results and Conclusions.

On looking over these prize and honour lists, I must confess to a feeling of regret that the number of those who gained a first-class rank is so small, when compared with the total number of candidates. In a class of nearly seventy first-year students, seven carried off all the first-class departmental honours at Easter; and out of twenty-five second-year men, only seven were gazetted as first-class, and these in nearly all the departments. The record at the midsummer examinations was similar; but we would like to have seen it different. There should have been a wider distribution of the honours. The several classes should not have allowed a few men in each to carry off all the prizes and honours in every department.

One or two other facts regarding our honours, medals, and diplomas seem to merit a passing notice; and I make no apology for calling attention to them, although in doing so I may appear to express my disapproval of the very prevalent and, I think, injurious habit of smoking among young men. Many of our students, I regret to say, like those at other colleges, are confirmed smokers; but it is a noteworthy fact that hitherto our best students have been nearly all non-smokers. Of the twenty-eight who got departmental honour certificates at Easter and midsummer, twenty-two were non-smokers; of the eleven who received diplomas last year, eight were non-smokers and non-drinkers; and of the eleven to whom our college medals have been awarded, ten were non-smokers and non-drinkers.

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 farmer's 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-six 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 gardens, and the shop. They spent a portion of their time in a special class for the purpose of learning how to dig, plough, harrow, sow, shear sheep, mow, cradle, drive a reaper, bind, shock, etc.; 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 managemeht of a large vegetable garden, flower garden, orchard and lawn.

Fall Term.

Commencement of a New Scholastic Year—1st October, 1884.

Fifty old students returned at the beginning of the Fall Term and fifty-eight new ones were admitted, making a total of 108. Their names, post-office address, and other information regarding them having been given in the college roll and analysis on a previous page, I need not trouble you with a repetition at this point. I shall simply refer to one or two particulars and pass on.

Ages of Students.

The ages of our students during the Fall Term, which ended on the 22nd December, ranged from 16 to 34, as follows :—

19	at the age of	16	years.	7	at the age of	22	years.
16	"	17	"	2	"	23	"
18	"	18	"	3	"	25	"
18	"	19	"	1	"	27	"
11	"	20	"	1	"	28	"
11	"	21	"	1	"	34	"

Average age a little over 19 years.

Class-room Work.

The time table in Appendix I. indicates the subjects which are taken up in the Fall Term, and the number of hours allotted to each. Lectures commenced on Friday, the 3rd of October, and continued without interruption till 19th December.

Regular Students.

The first-year students received three lectures a week on the characteristic points and peculiarities of the different breeds of cattle; had a full 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 Gray's "Elegy," wrote compositions, 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 one lecture a week on Meteorology, 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 three acts of Shakespeare's "Richard II.," and devoted some time to the study of dydamics and drainage.

Special Students.

Twenty-six students, who wished to confine their attention exclusively to Live Stock and Veterinary Science, chose the work of the Special Class described on a previous page. They attended the same lectures as the regular students with Professor Brown and Dr. Grenside, and had four additional lectures a week on the same subjects. The balance of their time they spent in reading text-books and in looking after cattle, sheep, and pigs in the pens, sheds, and stables.

In addition to this, they got a course of practical lectures on stock from P. J. Woods, our Farm Foreman—some in the class-room, but the greater part in the stables and yards with the cattle.

Fat Stock Show.

On the 17th and 18th December, the Council of the Agricultural and Arts Association held a Fat Stock Show in the City of Guelph, and kindly arranged matters so that all our students were afforded special opportunities for examining, comparing, and judging

the animals on exhibition. Every one had to take notes on the show as a whole, and on the best animals in each class, and write out a special report for Professor Brown. The work was heartily entered into and very much enjoyed by all.

Terminal Examinations.

The examinations on the work of the Fall Term took place on the 19th and 20th December. The subjects were as follows :—

First Year—

Live Stock,
Inorganic Chemistry,
Veterinary Anatomy,
English Literature,
English Composition,
Arithmetic,
Bookkeeping,

Second Year—

Agriculture,
Live Stock,
Agricultural Chemistry,
Veterinary Pathology,
English Literature,
Mechanics,
Draining.

The questions were not difficult, because they were intended only to show who were making a right use of their time, and to prepare the candidates for a severer test on the same and some additional work at Easter.

BOARDING HOUSE AND COLLEGE BUILDINGS.

For the information of those who have not seen the College Buildings, I take the liberty of quoting, with slight alterations, a paragraph from my last report, as follows :—

College Buildings.

The College building, as shown on frontispiece, is a plain substantial structure, without much claim to architectural beauty. Like the Institution itself, it was built little by little without any very definite idea of the shape it might ultimately assume. When the Government first bought land and determined to establish an agricultural college, the Architect drew plans for a building which would have suited the purpose very well, but the cost seemed too great and the country was not prepared for it ; consequently it was decided nine years ago to commence work with a few students in Mr. Stone's farmhouse. Additions and alterations were made from time to time as the number of students increased, till the result is a large and peculiarly arranged building altogether different from what was originally intended—not what we would like—but affording considerable accommodation and serving the purpose fairly well.

In the building, as it now stands, there are one hundred and twenty-two rooms—three class-rooms, a reading-room, a library, a room to be fitted up for a museum, a laboratory, three offices, a public recep'ion-room, sixty-two students' dormitories, a large dining-hall, a servants' dining-room, a storeroom, pantery, kitchen, scullery, laundry, drying-room, eight bathrooms, nine bedrooms for servants, the messenger's-room, a parlour and bedroom for the Matron, a sitting-room and bedroom for the Assistant Resident Master, nine rooms in the left wing occupied as a dwelling-house by the President and his family, two rooms in the centre occupied by the Matron, an officer's dining-room, a spare room, three washrooms, an engine-room and a coal house.

Repairs and Alterations.

During the months of August and September last, some alterations and much needed repairs in the College buildings were made under the direction of the Public Works Department. A new and commodious stairway was constructed from the ground floor to the museum in the south end of the main building, the worn-out pine floors in the principal halls were replaced by well-seasoned beech and maple, and the dilapidated stairs leading from the washrooms up to the College halls were replaced by much more substantial ones—all promptly and in a very satisfactory manner.

Boarding House.

In the Boarding-house nothing special has occurred during the past year. Things have moved along as usual. Our supplies are provided by contract; and, generally speaking, the quality of the articles furnished has been satisfactory. The Matron has superintended the work in the culinary department, and the Assistant Resident Master has taken charge of the students at meals and assisted me in looking after them in the halls and dormitories.

Daily Routine.

In regard to the surroundings of our students in the College, and the duties required of them, I may say that their bedrooms are furnished with beds, bedding, bureaus, mirrors, washstands, study-tables, and chairs. They sleep separately, two in a room, and in a few instances three. The daily routine during the Fall, Winter and Spring Terms, is as follows:—

All are required to rise at six to make their beds and put their rooms in order. At half-past six they go to breakfast; and at seven, or half-past seven, according to the season of the year, the students of one division are sent to work outside, and those of the other employ their time as they feel disposed, till eight o'clock. From eight to nine the latter are at drill or gymnastics, and from nine to twelve at lectures in the classroom. Both divisions return to the boarding-house and prepare for dinner at half-past twelve. The bell rings at half-past one, and the division that was in at lectures in the forenoon goes out to work in the afternoon. The other division is free till two o'clock. From two till five it attends lectures; and at five both divisions return again to the boarding-house to prepare for tea at half-past five. From tea time to seven o'clock, and in spring to eight o'clock, they generally rest or take exercise. From seven to nine in fall and winter, and from eight to half-past nine in spring, they study in their rooms under the supervision of a master. At nine or half-past nine, according to the season of the year, they proceed to roll-call and evening prayers; lights are put out at ten, and doors closed at half-past ten. Every student who is not under ban for some misdemeanour, is allowed out one evening in the week till half-past ten. To some parents, perhaps this will appear late; but as it takes not less than thirty minutes to come from the city to the College, any earlier hour would scarcely give sufficient time. When going out each student leaves his name with the master in charge, and is required to report himself on his return, that we may know whether all are in or not before the doors are closed for the night.

Such is the routine in the boarding-house, and such are the duties required of the students therein, during nine months of the year. As the months of July and August are devoted entirely to work in the outside departments, the duties inside differ but little from those of an ordinary boarding-house on a large scale.

Discipline.

In the early part of last winter, a few restless spirits began to show signs of mischief and insubordination, such as manifest themselves now and then in every large boarding-house. I did what I could to bring them into line without the exercise of undue severity; but my efforts were unsuccessful. Moral suasion and the ordinary means of College discipline were only laughed at by the young men to whom I allude. They had evidently made up their minds to set authority at defiance and create an unseemly disturbance,

if possible. So they set themselves to annoy and insult one of the masters; but soon found to their sorrow that the way of transgressors, even at College, is hard. Six of them were summarily dismissed on the 31st January, and sent to seek quarters where such conduct can pass with impunity. The immediate effect was wholesome. Everything went on very quietly to the end of the year; and during the term just ended we have had better order and more satisfactory work than at any previous period in the last five years.

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.

Most of the correspondence falls to the lot of the President, and consists chiefly in sending out circulars, distributing reports, and answering inquiries about terms of admission, course of study, duties of students, cost of board and tuition, books used, books recommended, etc. Last year I distributed 1,700 copies of our last Annual Report, sent out over 8,000 circulars, and wrote, on an average, from five to six letters a day. Reports were sent to the leading Agricultural Colléges in Britain and the United States, to the subordinate Granges in Ontario, and to all farmers and others who applied for copies.

Books and Accounts.

Our Bursar, Mr. A. McCallum, as financial agent of the Institution, is responsible for the work under this head. It is his duty to examine all accounts against the College and the Farm, to check them by invoices and requisitions, to charge each item under the proper heading, and to make out separate statements for the College and the Farm once a month, submitting the former to the President and the latter to the Farm Superintendent for approval, and then to forward both to the Treasury for payment. He receives and accounts for all moneys from the College, the Farm, and the Treasury Department, and pays all accounts that have been approved of by the President or the Farm Superintendent, and passed by the Auditor. He also keeps three set of books:—

No. 1, showing the monthly expenditure under each head of the appropriation for the College and boarding-house.

No. 2, giving in detail the revenue and expenditure of the outside departments under the Farm Superintendent.

No. 3, showing 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. One hundred and eighty-eight such accounts were made out last year.

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 1884 amounted to $8,817.71, and was made up of the following items :—

(1) Tuition fees	$4,709 00
(2) Balances paid for board, after deducting allowances for work in outside departments	3,984 21
(3) Paid for breakage	11 00
(4) Paid for supplemental examinations	10 50
(5) Paid for library book lost	3 00
Total revenue in 1884	$8,717 71

Expenditure.

No. 1.—*College maintenance*—

The total sum voted for College maintenance last year, as per Provincial Estimates, page 30, was $25,490 ; and from this was deducted the sum of $9,000, which the Legislature estimated as the probable College revenue for the year. So the net sum voted under this head was $16,490. (See Estimates of 1884, page 30.)

The total expenditure for College maintenance during the twelve months has been $24,759.02 ; and from this we have deducted the sum of $8,717.71, which is the actual College revenue for the year. So the net expenditure under this head for 1884 has been $16,041.31.

Stated briefly as follows :—

Net sum voted for College maintenance in 1884	$16,490 00
Net expenditure for College maintenance in 1884	16,041 31
Balance unexpended under this head	$448 69

No. 2.—*Maintenance and repairs of Government buildings*—furniture and furnishings, repairs and alterations, fuel, light, and water—

The sum voted under this head was $6,450, and the expenditure exceeded that amount by $40.82, as follows (see Estimates for 1884, page 33) :—

Sum voted for maintenance and repairs of buildings in 1884	$6,450 00
Expenditure for " " in 1884	6,490 82
Over-expenditure under this head	$40 82

Summary.

Total sum voted, less estimated revenue, under both the above heads for 1884	$22,940 00
Total sum expended, less actual revenue, under both the above heads in 1884	22,532 13
Net balance unexpended	$407 87

The following table indicates briefly the amounts expended under the different heads which make up the totals just mentioned :—

No. 1.—College Maintenance.

I.—*Salaries and Wages*	$11,400 88

II.—*Food*—		
Meat, fish and fowl	4,157 67	
Bread and biscuits	997 24	
Groceries, butter and fruit	3,981 85	
III.—*Household Expenses*—		
Laundry, soap and cleaning	157 49	
Women servants' wages	1,753 34	
IV.—*Business Department*—		
Advertising, printing, postage and stationery	782 26	
V.—*Miscellaneous*—		
Chemicals and apparatus for Laboratory	156 33	
Library (books, papers and periodicals)	305 38	
Travelling expenses (Farmers' Institutes)	300 00	
Unenumerated	766 58	
Less Revenue		$24,759 02
		8,717 71
Net expenditure for College Maintenance		$16,041 31

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

(1) Furniture and furnishings	$568 58	
(2) Repairs and alterations	803 68	
(3) Fuel	3,398 44	
(4) Light	1,170 12	
(5) Water for both College and Farm (rent paid City water-works)	550 00	
		$6,490 82
Total net expenditure in 1884		$22,532 13

Of the above $22,532.13, expenditure for the year, $4,234.98 was for student labour on the Farm and Garden at rates fixed by the Farm Superintendent and his foremen; but, as an offset to this, we received from the Farm and Garden flour, milk, vegetables, and fruit valued at $1,463.41—Farm, $860.02, and Garden, $603.39. From which it will be seen that there is a balance of $2,771.57 to the credit of the College, which being deducted from the 22,532.13, leaves a net expenditure of $19,760.56 for the year.

For the items making up the $866.02 credited to the farm, see Appendix 4; and for the Garden, turn to Mr. Forsyth's report in part VI., at the end of this volume.

MISCELLANEOUS ITEMS.

Library.

A very important factor in the education given at the College, is our Library, which numbers 4,220 volumes, to which we are adding from time to time as circumstances permit and the work of the several departments demands. We have not only a good representation of the best books which treat of the several branches taught in the Institution, but also a large number of volumes on history, biography, travels, poetry, and general literature, as well as the latest and best dictionaries and encyclopædias.

Reading-Room.

In our Reading-Room, which may be described as large, commodious and well-lighted, we have had forty-six papers and magazines on file during the past year—twelve sent free by the publishers and thirty-two furnished by the College.

Papers and Magazines.

(a) Sent Free by the Publishers.

Journal of Commerce, Montreal.
Journal of Agriculture, Montreal.
Weekly Herald, Stratford.
Advertiser, Elmira.
Christian Guardian, Toronto.
Canadian Lumberman, Peterboro'.
Dominion Mechanical and Milling News, Toronto.
Monthly Weather Review, Toronto.
Canadian Horticulturist, St. Catherines.
Canadian Entomologist, London.
St. John Telegraph, St. John, N. B.
Weekly Witness, Montreal.

(b) Furnished by the College.

Daily Globe.
Daily Mail.
Weekly Globe.
Weekly Mail.
Guelph Mercury.
Guelph Herald.
Canadian Farmer.
Farmers' Advocate.
Rural Canadian.
Canadian Breeder.
Canadian Dairyman.
Grip.
The Week.
Canadian Stock Raisers' Journal.
North British Agriculturist, Edinburgh.
Farmers' Gazette, Dublin, Ireland.
Mark Lane Express, London, England.
Live Stock Journal and Fancier's Gazette, England.
Popular Science News and Boston Journal of Chemistry.
Scientific American.
Scientific American Supplement.
Science.
Cultivator and Country Gentleman.
Rural New-Yorker, U.S.
Country Gentleman's Magazine.
Gardener's Monthly.
Veterinarian.
Veterinary Journal.
Aberdeen Free Press.
Good Words.
Sunday Magazine.
Quiver.

☞ I wish here to acknowledge the kindness and generosity of the publishers who have sent us free of all charge the twelve papers placed at the head of this list.

Museum.

We have also a room set apart for a museum in the south end of the main building, not so large as we could wish, but fairly well adapted to the purpose. If the roof were raised, a gallery constructed, additional windows put in the east end, and the whole room re-floored, and refitted, we could soon make a very interesting and useful display of grain, seeds, and specimens in natural history, entomology, geology, meteorology, etc.

Under several of these heads we have already a very fair collection; and a portion of it has been arranged and classified by the Professor of Biology, who acts as Curator of the Museum.

Literary Society.

The Literary Society in connection with the College never was more active, vigorous, and useful than at the present time. The members of this society meet every Friday evening in one of the class-rooms, to practise reading, debating, and declamation. The discussions are often quite spirited; and the work done is, undoubtedly, a very valuable addition to the educational appliances of the Institution. In the performance of such work, the young men have an opportunity of testing their ability before they assume the responsibilities of life on the broader scale. 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. Last year the funds of the society were spent in the purchase of prizes for reading, essay-writing, and public speaking.

Changes in Staff.

The only change in the staff of instruction during the year was in the department of Biology and Horticulture. J. Playfair McMurrich, M.A., who was the Professor in that department for the last three years, resigned his position on the 1st October, to engage in more congenial work at John Hopkins University, Baltimore, U.S.; and the vacancy has been filled by the appointment of H. Hoyes Panton, M.A., who was our Professor of Chemistry and Natural History for some time prior to his voluntary resignation in the winter of 1882. Professor Panton will undertake the work which was allotted to Professor McMurrich, and also the subjects of Geology and Meteorology, which have hitherto been taught by the Professor of Chemistry.

Professor McMurrich is one of the rising biologists of this continent. He is fast gaining a favorable reputation for original work, not only here, but in Europe; and I predict for him a brilliant career in the new field which he has just entered.

There has also been a change in the bursarship of the institution. Mr. A. McCallum, formerly of Brighton, Ont., was appointed in July last to fill the position which Mr. A. T. Deacon had occupied for two years and a half previous to that date.

Recommendations.

Although much has already been done to provide suitable buildings and equipment for the College, there is still need of many things to meet the growing requirements of the Institution. I shall not alarm you, Sir, or the Legislature, by pressing for too much at once, but simply enumerate a few of the additions and alterations which should be made without delay, and leave the question of details to be settled with the Department of Public Works. A few moments' consideration would convince any one that the following are among the most urgent wants of the Institution, and should receive early attention from those who are responsible for its growth, development, and usefulness:—

(1) The removal of our old barns and stables and the erection of suitable farm buildings at a respectable distance from the College, on the site selected by Mr. Miller of Philadelphia.

(2) A good laboratory for practical work in the department of Chemistry.

(3) Two cottages for professors on the College grounds—one for the Professor of Chemistry, and the other for the Professor of Geology and Natural History.

(4) The construction of three or four contiguous water-closets in the College building and some alterations in one of the washrooms for the accommodation of students.

(5) An addition to our coal-house, and a new hot water boiler in the engine-room.

To those who have visited us, it is quite unnecessary to say that our barn, stables, and especially our yards, are not such as farmers and students expect to find at an institution of this kind. The stables are dark, inconvenient and poorly ventilated; and the barn-yard, in its present condition, is admirably adapted to illustrate how good manure may be wasted by plenty of rain and a suitable outlet for the soluble salts of ammonia and potash. These yards and stables are behind the times, and ought not to be found at an institution which is supposed to teach not only by precept, but by example also.

I have pleaded so often and so strongly for a good chemical laboratory, that it seems a useless repetition to argue the question any further. Every one who knows anything about the science of agriculture or the requirements of an agricultural college, will admit that a chemical laboratory is an absolute necessity and should be provided before almost anything else at such an institution. An expenditure for the erection and equipment of such a building was one of the first incurred by every college worthy of the name on this continent, except our own. Men everywhere have recognized the fact that chemistry lies

at the very foundation of all enlightened progress in agricultural science and practice; but in this Province of Ontario, which founded an Agricultural College ten years ago, we seem to attach but little importance to the science without which the German and American institutions think they can make no real progress. We teach Chemistry in a room set apart for the purpose; but we have no chemical laboratory. I asked for one in 1879, and have repeated the request every year since—but all in vain. May I, then, in the year of grace 1885, once more repeat my request to the Government and Legislature of Ontario for a well equipped chemical laboratory at the Ontario Agricultural College? $12,000 will give us what we require.

I have the honour to be, Sir,

Your obedient servant,

JAMES MILLS,
President.

APPENDIX 1.

TIME TABLES FOR FALL TERM (1st October to 22nd December), 1884.

Tables No. 1 and 2 indicate the work of the regular students for the term ending the 22nd December, 1884. No. 1 is the same as No. 2, except the order of the lectures, which change from forenoon to afternoon, and *vice versa* at the beginning of each week, to suit the arrangements for practical work in the outside departments.

TIME TABLE No. 1.

2nd Year.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-12	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departm's.
Afternoon.	2-3	English Literature.	Statics.	English Literature.	English Literature.	Levelling and Drainage.	Half Holiday.
	3-4	Agricultural Chemistry.	Agricultural Chemistry.	Practical Live Stock.	Meteorology.	Agricultural Chemistry.	
	4-5	Veterinary Pathology.	Agriculture.	English Composition.	Veterinary Pathology.	Practical Horse.	

1st Year.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-12	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departm's.
Afternoon.	2-3	Arithmetic.	English Composition.	Agriculture.	2. Arithmetic. 2.40 Book-keeping. 3.20 Human Physiology and Sanitary Science.	Agriculture.	Half Holiday.
	3-4	Agriculture.	Human Physiology and Sanitary Science.	English Literature.		English Literature.	
	4-5	Inorganic Chemistry.	Veterinary Anatomy.	Inorganic Chemistry.	Inorganic Chemistry.	Veterinary Anatomy.	

TIME TABLE No. 2.

2ND YEAR.

	Hours	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-8	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Half Holiday.
	8-9	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	
	9-10	English Literature.	Statics.	English Literature.	English Literature.	Levelling or Drainage.	
	10-11	Agricultural Chemistry.	Agricultural Chemistry.	Practical Live Stock.	Meteorology.	Agricultural Chemistry.	
	11-12	Veterinary Pathology.	Agriculture.	English Composition.	Veterinary Pathology.	Practical Horse.	
Afternoon.	1.30-5	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departm'ts.

1ST YEAR.

	Hours	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-8	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Half Holiday.
	8-9	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	
	9-10	Arithmetic.	English Composition.	Agriculture.	9. Arithmetic. 9.40. Book-keeping.	Agriculture.	
	10-11	Agriculture.	Human Physiology and Sanitary Science.	English Literature.	10.20. Human Physiology and Sanitary Science.	English Literature.	
	11-12	Inorganic Chemistry.	Veterinary Anatomy.	Inorganic Chemistry.	Inorganic Chemistry.	Veterinary Anatomy.	
Afternoon.	1.30-5	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside de

APPENDIX 2.

ONTARIO AGRICULTURAL COLLEGE.

EXAMINATION PAPERS.

I. PAPERS SET AT THE MATRICULATION EXAMINATIONS, EASTER, 1884.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1884.

III. PAPERS SET AT THE SESSIONAL EXAMINATIONS, MIDSUMMER, 1884.

I. PAPERS SET AT THE MATRICULATION EXAMINATIONS, EASTER, 1884.

ARITHMETIC.

Examiner: E. L. HUNT.

1. A hires with a farmer for $10 a month; his expenses are $4 a month. In what time will he save enough to buy 25 acres of land at $30 an acre?

2. A buys from B, general merchant, $4\frac{1}{4}$ lbs. tea at 60 cts. a lb., 24 lbs. sugar at 9 cts. a lb., and 22 yards cloth at $1.25 a yard, and gives in payment 8 dozen eggs at 12 cts. a dozen, and butter at 20 cts. a lb. How many lbs. butter does A give B?

3. Find (*a*) the H C F of 1908 and 2736.
(*b*) The L C M of 15, 26, 39, 65, and 180.

4. If 280 bushels of oats last 24 horses 120 days, in how many days will 9 horses consume 63 bushels?

5. Add together 12.346; .0045; 1.12 and .3, and convert the sum into an equivalent vulgar fraction.

6. Simplify $\frac{3}{5}$ of $\frac{4}{9} \div \frac{5}{6} + (\frac{1}{3} + \frac{3}{4}) - \frac{4}{9} \times \frac{27}{32} + \frac{1}{4}$

7. A, B and C engage to cut a pile of wood 66 ft. long, 8 ft. high, and 4 ft. wide. A can cut as much in three days as B can in $3\frac{3}{4}$ days, and as C in $4\frac{1}{2}$ days, and C can cut $\frac{3}{4}$ cord in one day. A, B and C work together $2\frac{1}{2}$ days, when A leaves. How long will it take B and C to finish?

ENGLISH GRAMMAR.

Examiner: JAMES MILLS, M.A.

1. Define the terms *person*, *case*, *voice*, and *syntax*.

2. Write out the feminine forms corresponding to *friar*, *abbot*, *hart*, *marquis* and *executor*; and give the plural of *grotto*, *lady*, *flagstaff*, *scarf*, *commander-in-chief*, and *phenomenon*.

EASTER EXAMINATIONS, 1883—Continued.

3. Compare, *ill*, *near*, *happy*, and *beautiful*.

4. Decline *it*, *her*, *and whom*.

5. State and illustrate the different uses of the word *that*.

6. Correct the following sentences, giving reasons :—

(1) Please keep room 17 for McIntyre and I.

(2) I dislike those sort of questions.

(3) Every one will please attend to their own work.

(4) Can I go to the city ?

7. Analyse the following passage, and parse all the words in it :

"All that we possess is God's, and we are under obligation to use it all as He wills."

GEOGRAPHY.

Examiner : J. PLAYFAIR MCMURRICH, M.A.

1. Define the following terms used in Geography :—*Equator*, *latitude*, *peninsula*, *gulf*, *channel*, *delta*. Give examples of each of the four last.

2. State the boundaries of Austria, and name five of its principal towns.

3. Describe the position of the following islands, stating in the case of each the country to which it belongs :—*Cuba*, *Malta*, *Ascension*, *Mauritius*, *Hebrides*.

4. Draw an outline map of the Province of Ontario, indicating the position of *Ottawa*, *Kingston*, *Toronto*, *Guelph* and *Sarnia*.

5. Draw an outline map of the North-West Territories, marking off upon it the principal towns and rivers, and the course of the Canada Pacific Railway from Winnipeg to the Rocky Mountains.

6. What and where are the following :—*Quebec*, *Natal*, *Malacca*, *Ural*, *Vancouver*, *Khartoum*, *Crimea*, *Cincinnati*, *Cabul*, *Alleghany*.

COMPOSITION.

Examiner : R. B. HARE, PH. D.

Write a composition on one of the following subjects :—

(*a*) A description of your home and its surroundings.

(*b*) The advantages of country life over city life.

(*c*) A letter to a friend describing how you spent last summer.

DICTATION AND READING.

Examiner : R. B. HARE, PH. D.

DICTATION.—Fourth Book, p. 77—"I now plodded.....air tremble."

READING.—Fourth Book, p. 76, 77—"At last.....Anticosti."

EASTER EXAMINATIONS, 1883—Continued.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1884.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Give the rotation of cropping called the "Seven Shift," and discuss its importance.
2. Judge the accompanying sample of wheat.
3. Sketch the best management of farm-yard manure.
4. What are special manures, and their position in farm practice?
5. What are green fodders, their time, usual quantity, and relative values?

FIRST YEAR.

CATTLE AND SHEEP.

Examiner: WM. BROWN, ESQ.

1. Give some reasons why pedigree animals are desirable, and what is meant by having "the pedigree on their backs?"

2. Distinguish between the two standard types of cattle, and name a breed most applicable to each.

3. What is meant by constitution, impressive power, foraging, and disposition, among cattle and sheep?

4. Compare the characteristics of the Hereford and Aberdeen-Angus Poll breeds.

5. Place, in order of merit, by quality of milk, the nine breeds of cattle we studied.

6. Classify the nine breeds of sheep we have studied, and make comparative notes on them: (1) Early maturing, (2) Weight of fleece, (3) Weight of carcass, and (4) Hardiness.

7. What is implied when we say, that to know all breeds of sheep it is only necessary to know the Leicester and South Down?

8. When we desire the wool of the Merino, the carcass of the Leicester, and the constitution of the South Down, what breed meets the bill best?

9. Criticise the two samples of wool herewith, and indicate to what breed or grade they belong respectively.

10. Describe the points of cattle and sheep that agree when we desire to obtain rapid production of flesh.

FIRST YEAR.

INORGANIC CHEMISTRY.

Examiner: R. B. HARE, PH. D.

1. Define "atom," "molecule," "atomic weight," "molecular weight," "acid," "acid forming oxide," "basic oxide," and "salt."

2. What is meant by combination in definite, equivalent, and multiple proportions

EASTER EXAMINATIONS, 1883—Continued.

3. Write in symbols the following compounds :—Sodium hyponitrite, bismuth nitrate, calcium carbonate, ferrous chloride, ferric sulphate, hypochorous acid, sodium chlorite, zinc chloride, pottassium perchlorate, hypobromous acid, calcium fluoride, thiosulphuric acid, hyposulphurous acid, hydrofluosilicic acid, sodium metaphosphate, calcium phosphate, potassium hypophosphite, Scheele's green, Glauber's salts, bleaching powder, and Epsom salts.

4. Draw a diagram of the apparatus you would use in preparing chlorine, ammonia, silicon, tetrafluoride, phosphuretted hydrogen, and sulphur dioxide.

5. (*i*) What compounds can be formed by the combustion of the following substances in a limited and in an excessive quantity of air? And what are their respective formulæ? Sulphur, phosphorus, hydrogen, carbon, and arsenic.

(*ii*) How would you show that air is necessary for the maintenance of ordinary combustion?

(*iii*) Supposing the air to contain 23 per cent. of hydrogen by weight, how many grains of it must be supplied to order to burn completely—

(*a*) 10 grams of carbon.

(*b*) 10 grams of sulphur.

(*c*) 10 grams of phosphorus?

(*iiii*) Explain the structure of the flame, and describe how you would support your explanation by experiment.

6. Six bottles containing oxygen, hydrogen, nitrogen, chlorine, nitrous oxide, and sulphur dioxide respectively, are given to you, with the request *to determine the nature of the gas* in each bottle. How would you distinguish each of these gases from the others?

7. Formulate the decompositions occurring in the preparation of chlorine, phosphorus, nitric acid, sulphuric acid, and phosphuretted hydrogen.

8. How many cubit centimetres of ammonia measured at 20°, and under a pressure of 790 mm., can be obtained from 100 grams of ammonium chloride?

9. (*i*) Give with the name and formulæ of the oxides of nitrogen, their per centage composition.

(*ii*) Why is the atmosphere supposed to be a mechanical mixture and not a chemical compound?

(*iii*) What is meant by the term "hardness" as applied to water?

10. Describe any experiments you have made or seen made.

FIRST YEAR.

ORGANIC CHEMISTRY.

Examiner: R. B. HARE, PH. D.

1. Describe briefly the process adopted for the estimation of the carbon and hydrogen contained in organic compounds.

2. Give the names and formulæ of the best known members of the paraffine and olefine series.

3. Show the relation in composition existing between monatomic, diatomic, and triatomic alcohols.

4. Name the properties and mode of preparation of ethyl alcohol and acetic acid. What is the action of sulphuric acid upon ethyl alcohol?

EASTER EXAMINATIONS, 1884—Continued.

5. Give the formulæ of hydrocyanic acid, formamide, acetamide, chloroform, ethyl nitrite, melisyl alcohol, methylamine, cacodyl, tri-ethyl bismuthine, acetyl aldehyde, chloral, acetone, malic acid, citric acid, urea, carbolic acid, salicylic acid, morphine, and strychnine.

6. (*i*) What is the composition of the natural oils and fats?

(*ii*) Illustrate by formulæ the chemical action occurring in soap making.

(*iii*) Show the relation in composition existing between (1) the lactic series, (2) the oxalic series, and the glycols.

7. (*i*) Describe briefly the composition, occurrence, and properties of the sucroses, glucoses, and amyloses.

(*ii*) What are the principal phenomena of fermentation?

8. (*i*) Show that the constitution of the saturated compound benzine is different from that of the alcohol group of bodies.

(*ii*) What is the general composition of essential oils? Of albuminoids?

9. (*i*) Describe the properties and mode of preparation of nitro-glycerine and dynamite.

(*ii*) Formulate the chemical action occurring in the preparation of tartar emetic.

FIRST YEAR.

PHYSIOLOGY AND ZOOLOGY.

Examiner: J. PLAYFAIR McMURRICH, M. A.

1. Describe the arrangement of the valves of the heart, and show their use.

2. Hay contains albuminous, fatty, amyloid, woody and mineral constituents. Describe the digestion of hay by a ruminant.

3. Describe the mechanism of respiration.

4. What is meant by the expression "adaptation of organs?" Give an example.

5. State the general characters of the *Foraminifera*. Indicate their importance in rock-formation.

6. Describe the structure and life-history of a tape-worm What form occurs in lambs, and whence do they probably obtain it?

7. *Syngamus trachealis* and *Echinorhynchus gigas*. To what orders do these belong and what animals do they infest?

8. State the characters of the order *Insecta* which distinguish it from the other orders of air-breathing *Arthropoda*.

9. Describe the general modifications of the spinal column in the *Vertebrata*. What other characters distinguish vertebrates from invertebrates?

FIRST YEAR.

VETERINARY ANATOMY.

Examiner: F. C. GREENSIDE.

1. Name the different processes of digestion, and state by what organ or organs each is affected.

EASTER EXAMINATIONS, 1884—Continued.

2. Give the number and kinds of teeth possessed by an adult horse.

3. Mention the structures entering into the formation of teeth, and describe the arrangement of the Incisors of ruminants.

4. Account for a horse not being able to breathe through his mouth.

5. Describe how rumination is believed to be effected.

6. Why is it that a catheter cannot be passed in a bull? and what precaution is necessary to pass one in a cow?

7. Describe the course of the circulation of the blood.

8. Describe the valves of the heart, and their function.

9. Describe the situations of the urinary organs of the male.

10. What is the function of the Lymphatic, or Absorbent system.

FIRST YEAR.

ENGLISH LITERATURE.

Examiner: J. PLAYFAIR MCMURRICH, M. A.

1. Give the dates of Irving and Scott. Were they personally acquainted, and if so, how did the acquaintance arise, and what resulted from it?

2. "He loved to tell long stories about the *stark* old warriors whose portraits looked grimly down from the walls around, and he found no listeners equal to those who fed at his expense. He was much given to the marvellous, and a firm believer in all those *supernatural* tales with which every mountain and valley in Germany abounds. The faith of his guests exceeded even that of his own. They listened to every tale of wonder with open eyes and mouth, even though repeated for the hundredth time. Thus lived the Baron von Landshort, the *oracle* of his table, the absolute monarch of his little territory, and happy, above all things, in the persuasion that he was the wisest man of the age.

(*a*) Give the origin and meaning of the words in italics.

(*b*) "Supernatural tales, etc." Give the outline of one.

(*c*) Absolute monarch. What other kind of monarchy is there? Distinguish between them, and give examples of each from the kingdoms of to-day.

(*d*) Point out and define any figures of speech in the extract.

3. "This flagitious attack on the dignity of the knight so incensed him, that he applied to a lawyer at Warwick to put the severity of the laws in force against the rhyming deer-stalker. Shakespeare did not wait to brave the united puissance of a knight of the shire and a country attorney."

(*a*) Define "flagitious" and "puissance."

(*b*) "This flagitious attack." What was it, and how was it brought about?

(*c*) Give a brief outline of Shakespeare's life after this occurrence.

4. Name the hero and heroine of the "Lady of the Lake," giving a brief account of the former's life up to the time of the poem.

5.

1 And thus an airy point he won,
2 Where gleaming with the setting sun,
3 One burnished sheet of living gold.
4 Loch Katrine lay beneath him rolled,
5 In all her length far winding lay,
6 With promontory, creek, and bay,

EASTER EXAMINATIONS, 1884—Continued.

7 And islands that, empurpled bright,
8 Floated amid the livelier night,
9 And mountains that like giants stand,
10 To sentinel enchanted land.
11 High on the south, huge Benvenue
12 Down on the lake in masses threw
13 Crags, knolls, and mounds, confusedly hurled,
14 The fragments of an earlier world."

(*a*) *burnished* (l. 3), *empurpled* (l. 7), *livelier* (l. 8). Give meaning of these words.

(*b*) *Loch Katrine.* Where is it? Draw a map showing its position and the features of the surrounding country.

(*c*) In what metre are the above lines? Scan ll. 13-14. Explain the metre of l. 13.

6. Name Scott's principal works. Under what circumstances were his later works written.

FIRST YEAR.

COMPOSITION.

Examiner: JAMES MILLS, M.A.

1. Quote rules for punctuating:

(1.) Co-ordinate words and phrases.
(2.) Participial phrases.
(3.) Adverbial phrases.
(4.) Complex sentences.

2. Punctuate the following sentences, giving rules:—

(*a*) "In carrying a barometer from the level of the Thames to the top of St. Paul's Church in London the mercury falls about half an inch marking an ascent of about five hundred feet.

(*b*) "Though deep yet clear though gentle yet not dull
Strong without rage without o'erflowing full.

3. Give directions for the arrangement of—

(*a*) Modifying phrases in a simple sentence.
(*b*) The subordinate elements in complex sentences.

What is to be aimed at in each case?

4. Combine the following statements—(*a*) into a simple sentence, (*b*) into a complex sentence; and punctuate carefully:—

(*a*) Bruce sent two commanders.
The war between the English and Scotch still lasted.
He sent the good Lord James Douglas.
He also sent Thomas Randolph, Earl of Moray.
These men were great commanders.
They were to lay waste the counties of Northumberland and Durham.
They were to distress the English.

EASTER EXAMINATIONS, 1884—Continued.

(*b*) Augustus held a Council in order to try certain prisoners.
This was while he was at Samos.
This was after the famous battle of Actium.
This battle made him master of the world.
The prisoners tried were those who were engaged in Antony's party.

5. Write a description of the City of Guelph, paying special attention to choice of words, arrangement, spelling, and punctuation.

FIRST YEAR.

ARITHMETIC.

Examiner: E. L. HUNT.

1. A merchant failed and his goods were worth $7,770. Out of this he can pay his creditors 37 cents on the dollar. He owed one creditor $2,100. Find the merchant's indebtedness and what the one creditor got as his share.

2. A farmer sells 2 tons, 450 lbs. of hay at 12\frac{1}{4}$ a ton. Out of this he pays a labourer for cutting 18$\frac{3}{4}$ cords wood at 90 cents a cord. How much has he left?

3. A. deposits $300 in the Bank at the end of each year. What amount will he have in the bank at the end of 5 years? Interest at 5 per cent.

4. Distinguish True and Bank Discount. A farmer gave for a horse a bill of $272, due in two months, and sold him at once for a bill of $316, due in five months. Find his gain or loss; true discount being reckoned at 4$\frac{1}{2}$ per cent.

5. A. bought from B. 25 acres of land at $55 an acre; gave $500 cash, and his note for the balance drawn March 10th, at 9 months. If B. has this note discounted at the Bank November 12th, at 6 per cent., what amount will he receive for the note?

6. Define Insurance, Premium, Policy. Find the premium of Insurance on property valued at $2,460, at $\frac{1}{6}$ per cent.

7. A's property is assessed at $8,450, and the rate of taxation is 7$\frac{1}{4}$ mills on the dollar. A. appeals, and has his property valued at $7,600. Find the difference in the amount of his taxes.

8. (*a*) Why are duties imposed on imported goods?
(*b*) Distinguish *ad valorem* and specific duties.
(*c*) Find the duty on 2,300 lbs. sugar worth 7 cents a pound, duty being 25 per cent.
(*d*) If a merchant pays 7$\frac{1}{2}$ cents a lb. for sugar in the United States, $\frac{3}{4}$ cent a lb. for freight—a duty of 30 per cent., and sells it for 12 per cent. advance on cost, find the retail price.

9. A. owned $3,500 Montreal Bank Stock. He sells at 191$\frac{1}{4}$, and invests in Bank of Commerce at 126. The dividends beiug respectively at 10 and 6 per cent., and the brokerage $\frac{1}{4}$ per cent., find—

(*a*) The amount of Stock purchased.
(*b*) The alteration in the income.
(*c*) The brokerage on the transactions.

10. A merchant consigns a quantity of flour to an agent in Montreal, who charges 2$\frac{1}{2}$ per cent. commission for selling, and 3$\frac{1}{2}$ per cent. for buying, with instructions to invest the proceeds (after deducting his commission for both transactions), in certain goods; the agent sells the flour at $6.25 a bbl., and invests as directed, his entire commission being $432; how many bbls. flour were consigned?

EASTER EXAMINATIONS, 1884—Continued.

FIRST YEAR.

BOOK-KEEPING.

Examiner: E. L. HUNT.

1. What is the object of Book-keeping? State the principal books usually employed. Would you use all these in keeping farm accounts? Why, or why not?

2. Enumerate the ledger accounts requisite on an ordinary farm of 100 acres.

3. State fully how yon would close the following accounts:—

   (*a*) Cash.

   (*b*) Loss and Gain.

   (*c*) Balance.

4. Make out, and close, an account with a wheat field of 10 acres.

5. Explain what is meant by (*a*) Note negotiable by endorsement; (*b*) a Draft. Write out a form of each; also of note negotiable without endorsement.

6. Make out an inventory of the Live Stock for a farm of 100 acres.

7. Enter each of the following in the accounts affected:—

   Sept. 7, paid cash for repairing plough, $1.30. Sept. 20, shoeing horses, $1.20; gave in payment 6 lbs. butter. Oct 1st, paid $9.00 for threshing oats. Oct. 12, sold 40 bush. oats at 40 cts. a bushel. Oct. 20, fed 12 bush. oats to horses. Oct. 21, travelling expenses to Niagara Falls, $8.50. Oct. 30, bought pair boots, $7.00; rubbers, 60 cts.; got boots repaired, 70 cts.; gave in payment 12 bush. oats and $3.50 cash for remainder.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Sketch in order of occurrence the management of a flock of ewes from 1st Sept. to following August, as applicable to Ontario.

2. Discuss, briefly, the position of Ontario farming as regards the use of special fertilizers, in association with systematic cropping, and the best management of farm-yard manure.

3. What is the result of your study of the Experiments in feeding cattle with grain during the past winter?

SECOND YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. Give reasons for, and against, the practise of clipping lambs, and of clipping all other sheep twice a year, in Ontario.

2. What have been the lessons in the purchase, feeding and finishing of the st er called "The White Duke"?

EASTER EXAMINATIONS, 1884—Continued.

3. In the proposed importation of nine breeds of cattle and nine of sheep for the Ontario Experimental Farm this year, show the relative importance of each to the province by a diagram—the longest line, or most important, equalling 100.

4. On 1st December last the average animal of the three grades of steers at present in contest here stood thus:

Hereford, 468 days, weighed 1,054 lbs.
Aberdeen-Angus Poll, 470 days, weighed 1,155 lbs.
Shorthorn, 666 days, weighed 1,237 lbs.

What is likely to be their weight and financial standing on 1st December next?

5. An average grade cow weighs 1,000 lbs.; what (1) quantity and (2) cost of food will she consume in twelve months; how (3) long will she continue in Milk, what (4) quantity of milk in pounds per day; how (5) much cream from the milk; how much (6) butter from cream, and (7) how much cheese is usually got from the milk?

SECOND YEAR.

ARBORICULTURE.

Examiner: WM. BROWN, ESQ.

1. What are the principal objects of conserving trees, and replanting certain parts of a country?

2. What special results would likely follow from the proper application of the science and practice in Canada?

3. What kinds of trees are specially adapted to (1) road side shade, (2) small clumps or belts, and (3) large plantations?

4. Sketch the general management of trees for a plantation, from the seed bed up to fifty years old.

5. Give a brief statement of the probable expense and revenue of a hundred acre plantation, up to fifty years old.

SECOND YEAR.

PRACTICAL HORTICULTURE.

Examiner: JAMES FORSYTH, ESQ.

1. Describe the usual methods of heating greenhouses. State the respective uses of the Propagating House, the Greenhouse, and the conservatory. Give the minimum and maximum temperature suitable for each, also the usual means of regulating the temperatures.

2. Describe fully the process of propagating by cuttings, the materials required, and necessary conditions; also enumerate all the different modes that you know of increasing a stock of plants.

3. In the collection of plants before you, name—

(*a*) The monœcious plants.

(*b*) Those with endogenous stems.

(*c*) Those with perfect flowers.

EASTER EXAMINATIONS, 1884—Continued.

4. Make a selection of 10 half-hardy or bedding plants, giving the natural orders to which they belong; also a selection of 10 plants suitable for window culture, giving the technical and the common name of each.

5. What is understood by Annual, Biennial and Perennial plants? Give an example of each, with the common and the scientific name.

6. Describe the process of hybridizing. How it takes place in nature; how it may be accomplished artificially; for what purpose is it done; and how varieties are perpetuated.

7. Give the generic name of a plant illustrative of each of the following natural orders:—*Acanthaceæ*, *Brassicaceæ*, *Crassulaceæ*, *Fabaceæ*, *Malvaceæ*. *Polypodiaceæ* and *Scrophulariaceæ*.

8. Give the natural orders of the following genera:—*Labonia*, *Hoya*, *Gnaphalium*, *Eulalia*, *Dracæna*, *Cupressus* and *Solanum*.

9. Name what insects you know that attack inside plants, and describe the usual or best means of destroying them.

10. Identify the plants before you, giving the generic and common names of each.

(*a*) Name the orders to which they belong.

(*b*) Describe fully plants 4 and 9.

SECOND YEAR.

AGRICULTURAL CHEMISTRY.

Examiner: R. B. HARE, PH. D.

1. Name the *ultimate* elements of the volatile and of the fixed part of plants, distinguishing those that are indispensable from those that are supplementary.

2. Explain the origin of the inorganic and organic constituents of soils.

(*i*) Classify the inorganic constituents, noticing briefly their composition, and the part each plays in forming soil-texture.

(*ii*) What relation does the mechanical texture of a soil bear to its fertility? To its absorbent and retentive power?

(*iii*) State briefly the objects, process, results, expense and profit of land drainage.

(*iiii*) When may the mixing, claying, liming, marling, chalking, paring, and burning of soils be used with advantage?

3. Explain the composition of farm-yard manure.

(*i*) What are the conditions that affect its composition and quality?

(*ii*) How, in your estimation, is farm-yard manure best managed and applied?

(*iii*) Why is *another* kind of natural manure, weight for weight, almost as good as farm-yard manure?

4. Describe the forms in which nitrogen, phosphorus, potassium and calcium are present in artificial manures.

(*i*) By what system of field experiments may the effects of fertilizers and the feeding capacities of plants be best studied?

(*ii*) Explain the form and source of the nitrogen that is conveyed from the atmosphere to the soil by rain.

EASTER EXAMINATIONS, 1884—Continued.

(*iii*) State briefly the conditions that favour nitrification and those that are adverse to it.

(*iiii*) Compare the results of bare fallow with those of green-manuring.

5. Describe briefly the characteristic composition and mode of feeding of cereal legumenous, and root crops.

(*i*) By what system of rotation and of manuring would you expect most economically to secure the best returns?

(*ii*) How does the nutrition of turnips, mangolds, and potatoes differ?

(*iii*) By the application of what manure may the quality, as well as the quantity of permanent pasture be advanced?

(*iiii*) How does *high manuring* influence the composition of all vegetable foods?

(*iiiii*) Name the foods richest and poorest in phosphoric acid, lime, and potash.

6. How have German investigators determined the digestibility of foods?

(*i*) Is the digestibility of food influenced by the age, daily ration, and labour of the animal, or by the maturity of the fodder crop at time of cutting.

(*ii*) Why should the addition of one food to a ration of wasteful digestion check the waste, and the addition of another to a ration of good digestion turn it into a wasteful one?

(*iii*) From the recent experiments of Wolff, draw a comparison between the digestive powers of horses and sheep.

(*iiii*) In comparing the nutritative value of foods, how would

(1) The proportion of water they contain,

(2) Their capacity of producing heat and work,

(3) Their proportion of albuminoids to non-albuminoids, influence your judgment?

(*iiiii*) Name the diet most suitable for maintenance, labour, fattening, and the production of wool and milk.

7. Clover, barley, straw, mangolds, linseed, bean meal, and unbolted rye are given you to fatten an ox.

COMPOSITION OF FODDER.

	Clover.	Barley Straw.	Mangolds.	Linseed.	Bean Meal.	Rye.
Water	16.0	14.3	88.0	11.5	14.5	14.3
Ash	5.3	4.1	0.8	7.9	3.1	1.8
Albuminoids	12.3	4.0	1.1	28.3	25.5	11.0
Crude fibre	26.0	40.0	0.9	11.0	9.4	3.5
Carbolydrates	38.2	36.2	9.1	37.3	45.9	67.4
Fat	2.2	1.4	0.1	10.0	1.6	2.0

Give, per 100 lbs. live weight, the daily ration of each constituent of the fodder you would use.

☞ The student can exercise a choice between questions 4 and 5.

EASTER EXAMINATIONS, 1884—Continued.

SECOND YEAR.

METEOROLOGY.

Examiner: R. B. HARE, PH. D.

1. Explain the difference in structure between Fortin's and Adie's barometer.
   (*i*) How is the correction for capacity avoided in each?
   (*ii*) Give the correction for gravity depending on latitude and altitude.
2. Describe structure, mode of suspension, and mode of setting of the self-registering minimum thermometer in use at Canadian Stations.
3. How is the height of a mercurial column accurately measured.
4. Explain mode of reading Foster's anemometer.
5. Define and briefly describe each cloud in Luke Howard's classification of clouds.
6. Summarize the following observations:—

	Bar.	Max. T. Degrees.	Min. T. Degrees.	Ther. Degrees.	Rain.	Snow.
1	7 a.m.—28.245	....	....	44.6	2.05	5.6
	2 p.m.—29.143	....	....	23.4	.....	.....
	9 p.m.—29.378	45.3	7.6	17.8	.....	.....
2	7 a.m.—39.016	....	....	—5.8	.....	3.1
	2 p.m.—29.451	....	....	26.3	.....	.....
	9 p.m.—28.861	26.5	—8.4	—7.4	.....	.....
3	7 a.m.—28.005	....	....	11	1.5	.....
	2 p.m.—28.026	....	....	26	.....	.....
	9 p.m.—28.136	27.6	10.6	20	.....	.....
4	7 a.m.—28.799	....	....	24.0	.....	4.7
	2 p.m.—29.114	....	....	14.6	.....	
	8 p.m.—29.578	24.3	—9.7	—9.3	.....	

7. Read the instruments before you.

SECOND YEAR.

ENTOMOLOGY.

Examiner: J. PLAYFAIR MCMURRICH, M.A.

1. Describe the modifications of the wing in Insects. Name some wingless forms.
2. What is Pathenogensis? Mention any form exhibiting phenomenon and give its life-history.

EASTER EXAMINATIONS, 1884—Continued.

3. Gall-flies. Name the families and orders which include these forms. Describe their habits.

4. Describe the Hessin fly. Give a full account of its life-history.

5. Name the characters of the *Curculionidæ*, and give the life-history and remedies for *Conotrachelus nenuphar*.

6. Name the order to which each of the following forms belongs, state whether it is beneficial or injurious, and if injurious what plant it affects:—*Leucani, unipuncta, Aphiaius, Clytus speciosus, Coccinella, Coreus tristis.*

7. Describe the habits of, and remedies for, *Agrotis Cochrani.*

8. *Orgyia leucostigma,* Describe the larva and its habits.

9. Describe the larva before you, giving also a description of its imago, its habits and the remedies to be applied for its destruction.

SECOND YEAR.

EQUINE AND BOVINE PATHOLOGY.

Examiner: F. C. GREENSIDE.

1. Mention the diseases of the feet of the horse, and give treatment for Corns and Thrush.

2. Mention the diseases of the hock of the horse, and give the symptoms of bone-spavin.

3. Give the nature, causes, symptoms and treatment of Foul-in-the-foot of Cattle and Foot-rot in sheep.

4. Mention the four indications in the treatment of wounds, and how each is to be carried out.

5. Give the nature, causes, symptoms, and *post-mortem* appearance of Bovine Tuberculosis.

6. Give the abnormal conditions of the teeth usually found, and symptoms of imperfect mastication.

7. Mention the diseases of the eye, and give symptoms and treatment of "Simple Ophthalmia."

8. Give the symptoms of Tympanitis and Impaction of the Rumen in Cattle.

9. Give the causes and treatment of Poll-Evil and Fistulous Withers.

10. Give the differential symptoms of Spasmodic Colic and Enteritis.

PRACTICAL HORSE.

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

1. For what purpose are horses shod? Describe the most rational kinds of shoes, and the principles that ought to be observed in the application of them.

2. Describe how to put a horse in slings, and state the objects to be effected by slinging.

3. Describe minutely how to perform Rumenotomy.

4, Describe how to perform Neurotomy, and state when the operation is indicated.

5. Describe the different means of restraining a horse for an operation, also those for a cow.

EASTER EXAMINATIONS, 1884—Continued.

SECOND YEAR.

JULIUS CÆSAR.

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

1. Wherefore rejoice? What conquest brings he home?
What tributaries follow him to Rome
To grace in captive bonds his chariot wheels?
You blocks, you stones, you *worse* than senseless things,
O, you hard hearts, you cruel men of Rome,
Knew you not Pompey? Many a time and oft
Have you climbed up to walls and battlements.
To towers and windows, *yea*, to chimney-tops,
Your *infants* in your arms, and there have sat
The live-long day, with patient expectation,
To see great Pompey *pass* the streets of Rome:
And when you saw his chariot *but* appear,
Have you not made an universal shout,
That Tiber trembled underneath her banks,
To hear the replication of your sounds
Made in her concave shores?
And do you now put on your best attire?
And do you now cull out a holiday?
And do you now strew flowers in his way
That comes in triumph over Pompey's blood?
Be gone.

(*a*) Parse the words italicized.

(*b*) Compare the use of the past tense and the present-perfect tense in this extract.

(*c*) Indicate the pronunciation of *live-long* and *long-lived.*

(*d*) *To grace*, &c. Explain the allusion.

(*e*) *An universal.* Distinguish, as to their use, the forms *an* and *a.* Explain their origin.

(*f*) *And do you now.* Name the figure of rhetoric here employed. Remark upon the effect.

2. Explain the connection in which the following extracts occur:—

(*a*) I rather tell thee what is to be feared
Than what I fear, for always I am Cæsar.

(*b*) For if thou put thy native semblance on
Not Erebus itself were dim enough
To hide thee from prevention.

(*c*) * * * Live a thousand years
I shall not find myself so apt to die.

3. Give briefly in your own words the story of the play of Julius Cæsar.

4. From what source did Shakespeare obtain the materials for his Richard II.?

5. Myself I throw, dread sovereign, at thy foot:
My life thou shalt command, but not my shame:
The one my duty owes; but my fair name,
(Despite of death, that lives upon my grave),

EASTER EXAMINATIONS, 1884—Continued.

To dark dishonour's use, thou shalt not have.
I am disgraced, impeached, and baffled here;
Pierced to the soul with slander's venom'd spear;
The which no balm can cure, but his heart-blood
Which breathed this poison.

(*a*) Point out and explain any figures in this extract.

(*b*) By whom is this passage spoken, and under what circumstances?

(*c*) Give a scale of the metre.

6. Name the "unities," and show to what extent they are observed by Shakespeare.

7. Discuss briefly the characters of Brutus, Anthony, and Richard II., as drawn by Shakespeare, illustrating your statements by references and short quotations.

(*a*) Give in order a list of the Plantagenets proper, stating in a word what the reign of each was noted for.

8. Mention any theory which has been advanced in opposition to the generally accepted one as to the authorship of the Shakesperian plays.

9. Complete the following quotations:—

(1.) "Let me have men about me that are fat
* * * to be moved to smile at anything."

(2.) "'Tis meet
* * * * * * be seduced."

(3.) "Lowliness is young ambition's ladder,
* * * * by which he did ascend."

(4.) "O, conspiracy, &c.

(5.) "I am no orator, as Brutus is
* * * You yourselves do know."

(6.) "His life was gentle, &c.,
* * * 'This was a man.'"

(7.) "This royal throne of kings * *
* * * * a pelting farm."

SECOND YEAR.

POLITICAL ECONOMY.

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

1. Name the four divisions of this subject.

2. To which of these subdivisions do the following facts belong?
Labour is a source of wealth.
Rent is the landlord's share of the product.
Scarcity raises the price.
There is an increasing tendency to division of labour.
Producers endeavour to locate their industries in the most suitable locations.

3. Water. (1) Under what circumstances has it no exchange value, and (2) under what circumstances has it exchange value? (3) Are the people of a community richer when water has exchange value, or are they poorer?

4. Value depends on three conditions. What are they?

(*a*) State relation between value and quantity. Give illustration.

EASTER EXAMINATIONS, 1884—Continued.

5. To make labour most productive, the three methods are: apply labour at the best time, in the best place, in the best manner.

(*a*) Will people observe these methods spontaneously, or must the law of the land enforce their observance with penalties?

(*b*) Name any law of any country that interferes with these methods.

(*c*) Name also any rule of Trades' Unions that interferes with these methods.

6. Division of Labour:—

(*a*) What causes lead to division of labour?

(*b*) Division of labour leads to exchange of commodities. What means are adopted to facilitate these exchanges?

(*c*) What laws in any country try to stop exchanges?

(*d*) In division of labour, what disadvantages are to be guarded against?

7. Distribution of wealth:-

(*a*) Name the four parts in the distribution.

(*b*) Which part tends to increase continually, and which to diminish?

(*c*) Distinguish the common meaning of "rent" from the limited meaning in Political Economy.

(*d*) Distinguish nominal and real wages.

8. Name some common fallacies in Economics.

9. By what methods can the condition of labourers be improved?

10. In the employment of machinery, resorting to the best locations, working at the best time and in the best manner, what is the object aimed at?

11. Mention any principles in Political Economy that may be illustrated by the following examples:—

A postman.
A cook.
A locomotive.
Two or three men lifting a weight.
A printing press.
A town clock.
A joint stock company.

12. Name any laws Canada that interfere with the distribution of wealth.

SECOND YEAR.

MECHANICS.

Examiner: E. L. HUNT.

1. Define acceleration; what is meant by saying with reference to gravity "g" = 32? Why does a ball of lead fall to the ground more quickly than a feather?

A balloon is moving horizontally through the air at the rate of 30 miles an hour, and a stone projected vertically downwards from it with a velocity of 10 feet a second, reaches the ground in four seconds.

(*i*) What is the height of the balloon?

(*ii*) How far has it travelled during the passage of the ball?

EASTER EXAMINATIONS, 1884—Continued.

(*iii*) Through what distance has the ball passed?

(*iiii*) How far has the ball travelled during each second?

2. Define force, and show that forces may be properly represented by straight lines. State Newton's Second Law of Motion, and show clearly how you deduce from it the principle of the parallelogram of forces.

3. One body whose mass is 20 lbs. and velocity 40 feet a second, overtakes another whose mass is 18 lbs. and velocity 35 feet a second. Find the velocity of the two moving together after impact. (*b*) Find the velocity if the bodies meet.

4. Define work. Explain how work done is measured, and hence show that a great weight may be lifted by the application of a very small power; illustrate by a reference to any three of the simple machines.

5. Distinguish the three kinds of levers and give an example of each; explain why in some cases it is desirable to place the weight in a wheelbarrow nearer the handles and in other cases nearer the wheel. Which has an easier draught, a large diametered or small diametered field roller of equal weight? Why? A scaffold-pole 60 feet long balances on a log put under it 35 feet from one end, and it also balances on a log put under its centre, when a boy weighing 90 lbs. is sitting on it at one end and a man weighing 160 lbs. at the other. Find in round numbers the weight of the pole.

6. Describe the screw. If the distance between the threads of a screw be $\frac{1}{8}$ inch, and a force of 10 lbs. be applied at the end of an arm two feet long, fixed to the centre of the circumference of the screw, what pressure can be produced?

7. (*a*) A heavy body is supported on a smooth inclined plane by a force acting parallel to the base of the plane; show clearly what forces act on the body to keep it at rest.

(*b*) A body weighing 200 lbs. is supported on a smooth plane, inclined at an angle of 30° to the horizontal, by a power acting parallel to the base of the plane. Find the magnitude of the power.

(*c*) If a power of 100 lbs., acting parallel with the base of the plane, is required to support the weight when the plane is inclined at an angle of 45°, what power will be required when the plane is inclined at an angle of 30°.

(*d*) With the conditions given in (*c*) find, by the resolution of forces, the magnitude of the power if it acts parallel with the plane.

8. Two cylindrical communicating vessels contain water; the diameter of the one is two feet and of the other one inch. If the larger is fitted with a piston, what weight may be supported on this if the water in the smaller is two feet higher than in the larger?

9. Explain by diagrams the working of the suction pump, forcing pump and siphon.

SECOND YEAR.

DRAINING.

Examiner: E. L. HUNT.

1. Three things are essential for the germination of the seed: air, heat and moisture. Explain fully how soils in a proper condition supply these requisites, and why underdraining is in many cases necessary to place the soil in such condition.

2. Write fully on the following:—

(*a*) "Drained lands will stand drought better than undrained."

(*b*) "Underdraining pulverizes the soil."

EASTER EXAMINATIONS, 1884—Continued.

3. (*a*) Describe the movement of water in the soil from the time it falls on the ground till it enters the tiles. (*b*) Are we hence furnished with any data to determine the relative depth and distance apart the drains should be placed? (*c*) At what general depth would you lay your drains? State a few circumstances that might make it necessary to depart from the general rule.

4. Write briefly on (*a*) the fall required in tile drains; (*b*) the size of tile to be used in mains and laterals.

5. Given, there are 4,840 square yards in an acre, and that each tile is one foot long. Estimate the number of tiles needed to drain a 10 acre field. State the distance between the drains on which you base your calculation.

SECOND YEAR.

BOOK-KEEPING.

Examiner: E. L. HUNT.

1. What is meant by a trial balance?
2. Explain how you would close the ledger.
3. Make out, and close, an account with a wheat field of 10 acres.
4. What accounts would be affected and how by the following entries:—
   (*a*) Paid J. Cook and R. Beatty $9.00 each for one week's labour in harvesting.
   (*b*) Lost my pocket-book containing $160.
   (*c*) The pocket-book was returned to me a few days after, when I gave the finder $10.00.
   (*d*) Gave $8.00 to relief fund for neighbour.
   (*e*) Buggy horse killed by accident,—valued in inventory at $125.00.
   (*f*) Bought another horse for $160, giving two tons hay and the balance cash $138.00.
   (*g*) Bought a lamp to replace a broken one, $2.00.
   (*h*) Bought 20 acres of land adjoining my farm at $45.09 an acre, giving $300.00 cash, and my note at 7 months for remainder.

SPECIAL LIVE STOCK AND VETERINARY CLASS.

CATTLE.

Examiner: WM. BROWN, ESQ.

1. What is wanted to complete the following pedigree; to what breed and particular "blood" does it refer; and what is its value comparatively?

LOUAN OF GUELPH.

Red, bred at O. E. Farm; calved 4th May, 1877.

Got by 3rd Duke of Springwood [3087], 16926.
Louan of Brant 5th " Knight of St. George (26544)..... Mr. Carr, England.
Louan of Brant 2nd " Crown Prince of Athelstane (1507),
" 5487 ..... J. Douglas, Scotland.

EASTER EXAMINATIONS, 1884—Continued.

Louan 17th	Got by	Duke of Airdrie	Major J. Duncan.
Louan 3rd	"	John O'Gaunt (11621)	Mr. J. S. Tanqueray.
Louan 1st	"	Otley (4632)	Mr. Fawkes.
Cambria	"	Bertram 2nd (3144)	Col. Powell.
Virginia 2nd	"	Bertram (1716)	Mr. Whitaker.
Lucilla 2nd	"	Memnon (1223)	Mr. Whitaker.
Virginia	"	General (272)	General Simpson.
Rosemary	"	Flash (261)	Mr. Gibson.
Redrose	"	Petrarch (488)	Mr. C. Collings.
Brighteye	"	Alexander (22)	Mr. C. Collings.

2. The Hereford and Dutch breeds take an equal value by our scale; name five of the principal points for and against each that go to establish such a position.

8. In what do the Aberdeen Angus-Poll and Galloway differ as stall feeders and graziers, and to what extent does their general value differ?

4. In the full study of milking breeds wherein do the Ayrshire and Jersey present little or no difference?

5. Whercin does the general stamp of a beefer and of a milker agree and differ?

6. What is likely to be the financial standing of a steer that weighed 1,000 lbs. when tied up on 1st October last, and promised to be fit for shipping on 1st June next? Give full particulars.

7. In our experimental feeding of cattle with grain during the past winter what have been the principal indications?

SPECIAL LIVE STOCK AND VETERINARY CLASS.

SHEEP.

Examiner: WM. BROWN.

1. Sketch the history of the Leicester and South Down breeds.

2. Give a full account of the breeding, the particular build and characteristics of the Oxford Down.

3. Classify wool, and give your opinion of the two samples herewith, indicating to what breed or grade they belong.

4. Discuss briefly the relative merits of the Shrops and South Down for Ontario conditions.

5. What is the best management of a flock of ewes from 1st of February until grass?

6. What are the objects of dipping sheep?

SPECIAL LIVE STOCK AND VETERINARY CLASS.

LIVE STOCK.

Examiner: P. J. WOODS.

1. Give number of ewes rams should serve at following ages:—One, two, and three years old.

2. Describe the signs of lambing in ewes, giving the necessary treatment at this important time. At what age should castration and docking take place? Explain the method.

EASTER EXAMINATIONS, 1884—Continued.

3. Give the essential points in a well-bred Berkshire pig. What breeds of pigs have a tendency to early maturity? What are the advantages derived from such breeds?

4. How should a pen be prepared for a sow about to pig? Give treatment of sow and her pigs to time of weaning.

5. Give the methods of feeding calves for the following purposes:—(1) A calf for the butcher to be sold at six weeks old. (2) A steer to be sold at thirty months old; give time of castration. (3) A calf to be raised for breeding purposes.

SPECIAL LIVE STOCK AND VETERINARY CLASS.

STOCK BREEDING (MILES).

Examiner: JOHN HOBSON, ESQ.

1. What was the system which Bakewell practised as a breeder, and what has been the aim of the most successful breeders since his time?

2. State in what way the method which he followed differed from that of the breeders before his time.

3. What is the most important consideration in estimating the value of animals?

4. Upon what does the relative value of animals depend?

5. On what is the modern art of breeding founded?

6. State what is meant by the "law of heredity."

7. Name some of the diseases that illustrate the laws of hereditary transmission.

8. State what is meant by "Atavism," and illustrate its leading features.

9. In what way have the distinguishing characteristics of the various breeds of animals been mainly produced?

10. What are the principal causes of "animal variation?"

11. How has the great development in fattening quality and in early maturity, that characterizes the modern meat-producing breeds of cattle and sheep, been secured?

12. How is the greater fecundity of domesticated varieties of birds and other animals, as compared with that of wild species, accounted for?

13. For what purpose have the most eminent breeders of modern times practised close breeding?

14. In the improvement of a breed, what does in-and-in breeding tend to produce?

15. Explain what is meant by the term "prepotent" as applied to the breeding of animals.

16. What is one of the most valuable characteristics which a male can possess?

17. Is in-and-in breeding necessarily associated with a delicacy of constitution? Discuss this question.

18. What is meant by "cross-breeding"? Illustrate.

19. State some of the advantages of "cross-breeding," and also what you consider of the greatest importance when breeding in this way.

20. Supposing both parents to be equally well bred, is there a preponderance of influence on account of sex? Explain.

21. What is a "pedigree"?

EASTER EXAMINATIONS, 1884—Continued.

22. What are the characteristics of special importance which are always fonnd in animals belonging to the best developed meat-producing breeds?

23. In the improvement of grade stock, what rules will be found the safest guides in practice?

SPECIAL LIVE STOCK AND VETERINARY CLASS.

"FEEDING OF ANIMALS" (STEWART).

Examiner: CHAS. DRURY, M.P.P.

1. Define the terms *nutrient* and *ration.*

2. Write a short article on the composition, properties, and uses of the *nitrogenous* and *non-nitrogenous* constituents of fodders and roots.

(1.) Write short notes on the *nature and digestibility of cellulose, inorganic nutrients,* and *respiratory food.*

(2.) "It becomes evident that the health of animals cannot be sustained without mixed diet." Name the classes of substances which a proper diet should contain, and state what is the special use of each class.

3. From experiments made at the Michigan Agricultural College and at Rothamsted, England, on cattle feeding, state—(1) the age at which animals can be most profitably fed, giving reasons; (2) the composition of the food that produces the best results.

4. What is meant by the term *nutritive ratio*?

(1.) On what basis does Dr. Wolff estimate the money value of feeding stuffs in Germany?

(2.) Institute a comparison between the nutritive values of the following waste products of manufacturing establishments: corn starch feed; brewers' grains; malt sprouts; and fish scrap.

5. Give a synopsis of the economic advantages of the soiling system.

(1.) From the reports of the English and American feeders, state briefly the effects of soiling on the production of milk and of meat.

(2.) How would you answer the objection as to the labour involved in soiling?

6. Make for calves three rations about as nutritious as new milk,—(1) from *skim milk,* (2) from *whey,* (3) from *hay tea.*

7. State the leading facts established by the experiments at the Chicago Fat Stock Shows on the *rapidity* and *cost* of growth and the quality of the beef grown, with animals of different ages.

8. Give the nutritive ratio to be observed in feeding:—

(1.) Oxen at rest in stall.
(2.) Oxen heavily worked.
(3.) Fattening oxen.
(4.) Cows giving milk.
(5.) Young cattle.

9. Write short notes on the size, food, and management of dairy cows.

10. State briefly the author's views on:—

(1.) Early maturity in sheep.
(2.) Selection of sheep for breeding.
(3.) Food, feeding, and management of ewes in winter.
(4.) Feeding and management of young lambs.

EASTER EXAMINATIONS, 1884—Continued.

SPECIAL LIVE STOCK AND VETERINARY CLASS.

VETERINARY OBSTETRICS.

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

1. Describe the fœtal envelopes and fluids, and give their functions.
2. Give the origin and course which the spermatozoa and ova have to travel before they can come in contact.
3. Give the periods which elapse between heat in the mare, cow, ewe, sow and bitch, and give the periods of the gestation in these animals.
4. Give the causes of sterility.
5. Give the signs of pregnancy.
6. Describe the uses of cords and the repeller, and the best method of applying traction in parturition.
7. State how to discriminate between the hind and fore-legs *in utero*, and describe the normal presentation.
8. Describe the *modus operandi* for removing the fore-limb and viscera of fœtus.
9. Give indications for delivery in the following cases: hock presentation, fore-legs bent at knees, and deviation of head towards the shoulder.
10. Give treatment for retention of fœtal envelopes.

SPECIAL LIVE STOCK AND VETERINARY CLASS.

LAW'S VETERINARY ADVISER.

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

1. Give the different names that are applied to "Sturdy" in lambs, also the cause of the condition; and how the cause is brought into operation. Give the symptoms of the disease.
2. What causes Measles in swine, and what would result from the consumption of meat from animals so affected, by human beings?
3. During or after what kind of weather would attacks of Ergotism be expected, and give the symptoms of the Gangrenous form?
4. What does the condition termed Goitre consist in, and how does it differ in appearance in Solipeds from other animals? Give treatment.
5. Give the causes and treatment of Purpura Hœmorrhagica.

III. PAPERS SET AT THE MIDSUMMER EXAMINATIONS, 1884.

FIRST YEAR.

AGRICULTURE.

Examiner: JOHN MCMILLAN, ESQ.

1. Give a detailed description of the best methods of preparing land for crops of fal wheat, spring wheat, barley, oats and peas respectively.

MIDSUMMER EXAMINATIONS, 1884—Continued.

2. Why is a rotation of crops necessary? Give a statement of the principal advantages which result from a good rotation

(*a*) Is a fixed rotation possible or desirable in this Province? Give reasons for your answer.

3. What are the special advantages which result from fall cultivation, and how do you account for them?

4. Enumerate the advantages which result from summer-fallowing and describe briefly what you consider the best method of managing a fallow so as to secure the best results.

5. State fully and account for the beneficial results of thorough underdraining.

7. Write notes on the breeds of dairy cattle which are best adapted—
(1) For cheese-making.
(2) For butter-making.
(3) For mixed farming.

FIRST YEAR.

GEOLOGY.

Examiner: R. B. HARE, PH. D.

1. Distinguish between practical, theoretical, and applied Geology.

2. Give crystallographic form and chemical composition of the minerals Dolomite, Gypsum, Rock Salt, Fluorite, Pyrite, Mica, Oligoclase, Hematite, Apatite, and Quartz.

3. Briefly describe the following mineral varieties, naming the mineral to which each belongs:

Amethyst, Sahlite, Cat's Eye, Actinolite, Aventurine, Tremolite,
Meershaum, Chalcedony, Satin Spar, Agate, Selenite,
Flint, Asbestus, and Jasper.

4. The minerals Hornblende, Pyroxene, Calcite, Gypsum, Magnetite, Hematite, and Limonite are placed before you, how would you proceed to determine each of them?

5. Give the mineralogical and chemical composition of Doleritic Lava, Trachytic Lava, Felsite, Gneiss, Mica Schist, and Marble. How do metamorphic rocks differ from aqueous?

6. Define layer, stratum, formation, seam, joints and slatly cleavage, dip, strike, outcrop, anticline, syncline, fault, unconformability and denudation.

7. Name the Systems into which the Palæozoic Period has been divided, briefly outlining the Series that occur in Ontario. In which series is the "Oil District" situated?

8. In what respect does the Coal of the Eastern Provinces differ from the Lignite of the Western Territories? What is the coloring matter of rocks?

9. Briefly describe the more important geological facts which the practical examination of the rocks about Guelph gave you.

10. Name and briefly describe the minerals, rocks, and fossils before you.

FIRST YEAR.

STRUCTURAL AND PHYSIOLOGICAL BOTANY.

Examiner: J. PLAYFAIR MCMURRICH, M.A., F.R.M.S.

1. Name and describe the formation of the principal non-nitrogenous organic substance found in vegetable cells.

MIDSUMMER EXAMINATIONS, 1884—Continued.

2. Describe and state the use of stomata.
3. How do plants grow in thickness and in height?
4. Describe the structure of an ovule, and the process of fertilization of it.
5. What changes result from the fertilization of the ovule?
6. Define the following terms, giving examples:—(*a*) drupe, (*b*) dimorphous, (*c*) palmate, (*d*) raceme, (*e*) rhizome.
7. Describe accurately the processes by which sap is formed.
8. What is meant by the respiration of plants? What does it effect?
9. Describe the action of light on plants.

FIRST YEAR.

VETERINARY MATERIA MEDICA.

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

1. Under what four heads are the general actions of medicines considered?
2. Mention the circumstances which modify the actions of medicines.
3. Define the following terms,—disinfectant, caustic, tonic, ecbolic, and give an example of each.
4. Give the name by which aconite is known, and its actions, and doses for the horse.
5. When is aloes contra-indicated.
6. Write out a good febrifuge mixture.
7. What is the dose of aniseed for horses and cattle, and mention some other agents that resemble it in its actions?
8. Describe a means of getting rid of tape-worms from dogs.
9. What is the chief use of cantharides, and how is it prepared for application?
10. What is carbolic acid prepared from, and how much water does it take to dissolve it?

FIRST YEAR.

ENGLISH LITERATURE.

WORDSWORTH'S EXCURSION.—BOOK I.

Examiner: E. L. HUNT.

(*a*) 1. * * Or he at my request would sing
2. Old songs, the *product* of his native hill;
3. A skilful *distribution* of sweet sounds,
4. Feeding the soul, and eagerly *imbibed*
5. As cool refreshing *water*, by the care
6. Of the industrious husbandman, diffused
7. Through a parch'd meadow-ground, in time of drought.
8. Still deeper *welcome found* his pure discourse:
9. How precious when in riper days I learned
10. To weigh with care his words!

MIDSUMMER EXAMINATIONS, 1884—Continued.

(*b*) 1. * * * * *From* his intellect
2. And from the stillness of abstracted thought
3. He asked repose : and, failing oft to win
4. The peace required, he scanned the laws of light
5. Amid the roar of torrents, where they send
6. From hollow clefts up to the clearer air
7. A cloud of mist, *that smitten* by the sun
8. Varies its rainbow hues. But *vainly* thus.
9. And vainly by all other means, he strove
10. To mitigate the fever of his heart.

1. To whom does each of the above passages refer ?

2. (*a*) Parse all the words in italics.

(*b*) Give the derivation of the following words:—*Repaired* ("repaired to a school"), *repair* meaning to mend ; *prospects, pensive, sequestration, pedlar, bounties, gait, appendage, humour, enormous.*

3. Point out all the figures of speech in (*a*).

4. Write a paraphrase of (*b*) so as to bring out clearly the meaning of the passage.

5. What was the cause of "the fever of his heart ?"

6. Scan lines 2, 4 and 6 in (*a*), and 8 and 9 in (*b*). Name the metre, and point out any peculiarities.

7. Sketch the life and character of the Wanderer, as given in this poem. (*b*). What were the three elements of his education ?

8. What are the defects of the story, related in the first book of the Excursion ?

9. "Had Wordsworth d splayed the same comprehensiveness in dealing with man as with nature, his genius would not have been so long ignored." Discuss this statement.

How did he deal with nature, and how with man ?

Illustrate by quotations from any of his poems. Was Wordsworth a pantheist ? How would you explain those passages which seem to indicate that he was ? Explain the meaning of the term "Pathetic Fallacy."

10. Mention some of the leading contemporaries of Wordsworth, also any historical events of importance that occurred during his life.

FIRST YEAR.

COMPOSITION.

Examiner : JAMES MILLS, M.A.

1. Give the rules for punctuating—

(1) Adverbial phrases.
(2) Participial phrases.
(3) Adjective clauses.
(4) Compound sentences.

2. Combine the following statements—(*a*) into a simple sentence and (*b*) into a compound sentence ; and punctuate each carefully :

(*a*) Bruce sent two commanders.
The war between the English and Scotch still lasted.
He sent the good Lord James Douglas.

MIDSUMMER EXAMINATIONS, 1884—Continued.

He also sent Thomas Randolph, Earl of Moray.
These men were great commanders.
They were to lay waste the Counties of Northumberland and Durham.
They were to distress the English.

(*b*) On the scaffold his behaviour was calm.
On the scaffold his countenance was unaltered.
He spent some time in devotion.
Afterwards he suffered death.
He died with intrepidity.
This intrepidity became the name of Douglas.

3. Write a short composition on "my native place," or "my schools and schoolmasters," paying special attention to punctuation and the use of capitals.

FIRST YEAR.

MENSURATION.

Examiner: E. L. HUNT.

1 (*a*) How many boards, each 10 feet long, are required to enclose a field of 10 acres, if it be 100 yards wide?

(*b*) How many are required if the field be square?

2 How many miles will a team walk in ploughing 12 acres, the width of the furrow being 8 inches?

3 A barn is 60 feet long and 30 wide; find the cost to cover the roof (common pitch) with slates which cost $4.00 a hundred, and each of which has an exposed furface of 12 inches by 9 inches.

4 In question 9, if each cylinder is 25 inches high and has a diameter of $12\frac{1}{2}$ inches, how many gallons will it hold?—(a gallon contains 277,274 cubic inches.)

5 (*a*) If ditches be dug on both sides of a road, each 6 feet 6 inches wide at the top, and 1 foot wide at the bottom, and if the excavation be put on the road to the width of 20 feet, how high will the road-bed be raised, allowing that the earth will shrink 1-9th of its bulk in embankment?

(*b*) Find the cost of gravelling $1\frac{1}{2}$ miles of road to the depth of 10 inches and width of 15 feet, if 5 men and 2 teams are employed, each man to receive $1.10, and each team $1.50 a day, and if each team hauls 9 loads per day, the waggon being 12 feet long, 3 feet broad, and 10 inches high.

6. A stick of timber 49 feet long is in the form of a frustum of a cone, the circumference of the ends being 22 feet and $17\frac{1}{2}$ feet respectively. Find the number of feet it contains.

(*a*) By the exact rule.
(*b*) By the approximate rule.
(*c*) Find, by the exact rule, the size of the largest squared stick of timber that may be cut from it.

7. Explain clearly how the height of an object or the breadth of a stream may be found if the base, but not the top, of the object is accessible, and only one bank of the stream.

8 (*a*) The area of the Yorkshire coal field is $937\frac{1}{2}$ square miles, and the average thickness of the coal is 70 feet. If a cubic yard of coal weigh a ton, and the annual

consumption of coal in England be 70,000,000 tons, find the number of years for which this coal field alone would supply Great Britain with coal at the present rate of consumption.

(*b*) Suppose the coal consumed in one month in England were formed into a square pyramid on a base equal to that of the great pyramid of Egypt (base is 764 feet in length); find the height of the pyramid which would be thus formed.

9. The rain gauge in the experimental field has an area of $\frac{1}{1000}$ of an acre; the rain is collected below into 3 cylinders connected with each other by tubes at the top. If each cylinder is 25 inches high, and the area of its base 125.4528 square inches.

(*a*) Determine the amonnt of rain-fall required to fill the 3 cylinders.

(*b*) If there be a rain-fall of $\frac{3}{4}$ of an inch, how will the water show in the gauge cylinders?

(*c*) On May 16th, the water stood 9 inches high in the first cylinder. Determine the amount of rain-fall.

(*d*) On June 10th, there was a rain-fall of 0.082 inches. How high was the water in the cylinder?

SECOND YEAR.

AGRICULTURE.

Examiner: JOHN MCMILLAN.

1. What breed of heavy-draught horses is best suited for crossing with our Canadian mares? Give a full statement of the reasons for your answer.

2. Show which is the most profitable to raise—horses or steers, both to be sold when three years old.

3. Describe the treatment of a colt from the time it is foaled till it is one year old.

4. What breed of cattle is best adapted to general mixed farming in this Province, and why?

5. Describe systematically and fully the best methods of preparing land for *fall wheat, spring wheat, barley, oats, peas, potatoes, and turnips*, respectively.

6. *When, in what condition*, and *how* would you apply farm-yard manure (1) *to stiff clay*, (2) *to sand soil*, and (3) *to loam.*

(*a*) Enumerate the most common causes of loss in the management of farm-yard manure, and state how such losses may be avoided.

7. Explain how it is that drained land is warmer and mellower than undrained land.

SECOND YEAR.

HORTICULTURE.

Examiner: JOHN PLAYFAIR MCMURRICH, M.A., F.R.M.S.

1. Describe the fruit-branches of the Apple and Currant.

2. Propagation by cuttings. Give a complete account of the process, describing any variations of it indicating the requisites for a successful operation.

3. State the objects to be obtained by Grafting. Explain, physiologically, the operation and its results.

MIDSUMMER EXAMINATIONS, 1884—Continued.

4. What are the physiological causes of fruiting? How may they be made to act?

5. Mention the points to be attended to in pruning a tree to promote equal vigour in all its branches.

6. What is "mulching?" What are its uses?

7. Draw up a list of apples suitable for cultivation in the neighbourhood of Guelph, briefly describing each variety named.

SECOND YEAR.

ANALYTICAL CHEMISTRY.

Examiner: R. B. HARE, PH. D.

I. PART.—Lecture Room: Time, two hours.

1. Explain the terms:—Evaporation, precipitation, decantation, filtration, reagent, and reaction.

2. Separate and test the members of Group III. Formulate each reaction.

3. How would you separate—

(*i*) Ag from Hg, in solutions of nitrates.
(*ii*) Ca from Mg, in solutions of chlorides.
(*iii*) K from Na, in solutions of carbonates

4. Formulate the chemical action that occurs when—

(*i*) Alkali hydrates are added to solutions of zinc salts.
(*ii*) Solube carbonates to solutions of alum and of zinc.
(*iii*) Hydrochloric acid and ammonium hydrate to solution of mercurous compound.
(*iiii*) Ferrous sulphate and sulphuric acid to solutions of a nitrate.
(*iiiii*) Potassium ferroyanide to solution of a ferric compound.
(*iiiiii*) Sulphide of arsenic is treated with ammonium sulphide.
(*iiiiiii*) Potassium chromate with hydrochloric acid and sulphuretted hydrogen.
(*iiiiiiii*) Soluble arsenites with copper acetate.
(*iiiiiiiii*) Chromic hydrate is fused on platinum foil with sodium carbonate and potassium nitrate.

5. Explain the chemistry of Marsh's test for *Arsenic.*

II. PART.—Laboratory: Time, two hours.

Determine the metals and acids present in solution—

No. I., No. II., and No. III.

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

Examiner: J. PLAYFAIR MCMURRICH,, M.A., F.R.M.S.

1. Give an account of the life history of the Black Knot fungus (*sphæria morbus*).

2. Describe the mode of reproduction in Ferns.

MIDSUMMER EXAMINATIONS, 1884—Continued.

3. From what plant is sugar principally obtained? State the mode of preparation of sugar, and the distribution of the plant.

4. Name our principal trees which will yield valuable wood, stating the order to which each belongs, and the general character of its wood.

5. Name the principal plants belonging to the order *Solanaceæ*, stating the use of each.

6. Describe the preparation and manner of occurrence of Tea, Coffee, and Cocoa.

7. State the characters of the order *Umbelliferæ*, naming some of the more important plants belonging to it.

8. State the characters of the order *Rosaceæ*, naming and briefly describing some of the important plants belonging to it.

9. Name the native species of *Vitis*, stating the principal cultivated varieties derived from each.

SECOND YEAR.

VETERINARY MATERIA MEDICA.

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

1. Give the preparation and properties of chloroform, also the dose for the horse when given by the mouth, and its veterinary uses.

2. Give the dose of cinchona, quinine, and cinchonine for the horse, and state how the two latter differ from the former in action.

3. Mention the different names by which sulphate of copper is known, and give its action on carnivora.

4. Mention the diseases of the feet in which sulphate of copper is useful, and describe the different modes of applying it.

5. Give three formulæ for purgative doses for the ox.

6. Describe a means of expelling tape-worms from lambs.

7. Describe a process of medication for diarrhœa.

8. What is conine the active principal of, and how does it act in poisonous doses?

9. What is the best medicinal agent for the cure of goitre?

10. Which is the most effective diaphoretic for horses?

SECOND YEAR.

VETERINARY OBSTETRICS.

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

1. Describe the arrangement of the umbilical cord and umbilical vesicle, and mention their functions.

2. Mention the changes that take place in both sexes on the arrival of puberty.

3. What is the greatest length of time that heat lasts in any of the domesticated females, and in which species does it last the longest, and which the shortest?

4. Mention the known causes of sterility.

5. What are the causes of parturition?

6. What are the forces that expel the fœtus?

MIDSUMMER EXAMINATIONS, 1884—Continued.

7. How long does parturition usually occupy in the mare and cow, and how long may the usual terms be extended, and still a living fœtus be produced?

8. Describe the proper manner of applying traction in difficult parturition.

9. Compare the relative difficulty of giving aid in the delivery of a calf and foal, and the reasons for the same.

10. Give the indications for delivery when one fore-leg is completely retained, and when the hocks are presented.

SECOND YEAR.

ENGLISH LITERATURE.

MILTON'S *L'Allegro* AND *Il Penseroso.*

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

1. Compare these two poems.

2. "Milton is not a man of the fields, but of books. * * He does look at nature, but he sees her through books." Discuss this statement, and illustrate by references to these poems.

3. Straight mine eye hath caught new pleasures
Whilst the landscape round it measures?
Russet lawns, and fallows gray,
Where the nibbling flocks do stray,
Mountains on whose barren breast
The labouring clouds do often rest;
Meadows trim with daisies pied,
Shallow brooks, and rivers wide.
Towers, and battlements it sees
Bosom'd high in tufted trees,
Where perhaps some beauty lies,
The cynosure of neighbouring eyes.

(*a*) Scan the 1st, 5th, 6th and 12th verses of this extract and name the metre.
(*b*) *Mine eye.* Distinguish between the use of *mine* and *my.*
(*c*) Parse *round, whose, pied, brooks, bosom'd, cynosure.*
(*d*) *Do stray.* Write a note upon the use of *do* as an auxiliary.
(*e*) *Bosom'd high in tufted trees.* Explain the meaning.
(*f*) *The labouring clouds do often rest.* Point out and explain the figure.

4. Quote from L'allegro the passage beginning "Towered cities please us then," * * * and from Il Penseroso the passage beginning "Sweet bird that shunn'st the noise of folly." * * *

5. Sometime let gorgeous Tragedy
In scepter'd pall come sweeping by,
Presenting Thebes, or Pelops' line,
Or the tale of Troy divine.
Explain the allusions in this extract.

6. Give the derivation of *debonair, secure, demure, monumental.*

7. "The diction of these poems is flowing and melodious, the imagery is rich and picturesque, and the epithets are each a picture in itself."
Illustrate each of these characteristics by references, quotations, and comments.

8. Give a brief account of Milton's life.

MIDSUMMER EXAMINATIONS, 1884—Continued.

SECOND YEAR.

ROAD MAKING, LEVELLING, AND SURVEYING.

Examiner: E. L. HUNT.

I.—1. Enumerate some of the advantages resulting from the improvement of the roads of a country.

2. Distinguish Macadam and Telford roads, and fully describe the construction of either.

3. Calculate the power required to draw a wheel with diameter of 4 feet 6 inches over a stone 5 inches high, the line of draught being parallel with the road. Hence show that the power required varies (i) with the size of the stone, and (ii) with the diameter of the wheel.

4. How would you determine the steepest allowable slope for a road (*a*) considered as a descent, (*b*) considered as an ascent? (*c*) Show that this varies with the condition of the road. (*d*) Why are steep slopes more objectionable on a good road than on one in poorer condition?

5. (*a*) What is the best shape to give a road in order to make it crown?

(*b*) Why should the lateral slopes of a road exceed the longitudinal slope?

II.—(*a*) Complete the following field book, and determine the distance of A from F, and the height of one point above the other:—

Station.	Distance.	Back-sight.	Fore-sight.	Rise.	Fall.
A					
B	80	2.26	5.00		
C	65	1.45	5.58		
D	90	4.00	3.36		
E	40	3.34	1.00		
F	35	6.00	3.35		

(*b*) Between what two stations is the grade sloped.

III.—(1) Explain the use of the cross-staff and how you would make one.

(2) Describe minutely how to survey a field with the chain and cross-staff, and find its area.

APPENDIX 3.

CLASS LISTS.

I.—EASTER EXAMINATIONS, 1884.
II.—MIDSUMMER EXAMINATIONS, 1884.

I.—EASTER EXAMINATIONS, 1884.

FIRST YEAR.

Classes.	Agriculture.	Live Stock.	Handling and Judging Cattle. (Oral Exam.)	Handling and Judging Sheep. (Oral Exam.)	Inorganic Chemistry.
Honours. I.	1 McKay, J. B. 2 Raynor, T.	1 McKay 2 Muir 3 Raynor 4 Kemmis 5 Butler, Henry	1 Raynor 2 Henry	....	1 McKay 2 Raynor 3 Brodie 4 Ridings 5 Muir 6 Macpherson, A.
Honours. II.	1 Muir, J. B. / Butler, G. C. 3 McIntyre, D. N. 4 McPherson, A. / Ridings, H. L. 6 Reid, P. 7 Robinson, B. / Henry, J. W. 9 Jordan, J. W. / Jones, T. L. 11 Smith, E. P. 12 Kemmis, J. H. W. 13 Denton, E. / Malcolm, G. H. 15 Spalding, F. J. 16 Alexander, R. C. / Brodie, C. J. 18 Fair, J. L. / Thompson, W. D	1 Alexander / McIntyre 3 Jones 4 Skaife 5 McPherson, A. / Ridings 7 Campbell, J. L. 8 Robinson 9 Malcolm 10 Rowat 11 Casswell / Lane 13 Jordan / Spalding	1 Muir 2 Thompson 3 Robertson / Mackay / Pethick / McIntyre 7 Alexander / Beer 9 Denton / McPherson, A 11 Rowat 12 Ridings 13 Brodie / Malcolm	1 Muir 2 Denton / McKay / Stamer / Brown / Butler 7 Fair / McIntyre / Quinn / Ridings 11 Raynor 12 Brodie / Thompson / Robinson	1 Kemmis 2 Butler 3 McIntyre 4 Reid / Bent ....

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	LIVE STOCK.	HANDLING AND JUDGING CATTLE. (Oral Exam.)	HANDLING AND JUDGING SHEEP. (Oral Exam.)	INORGANIC CHEMISTRY.
PASS. III.	1 Buckingham, F. W 2 Campbell, J. L. Brown, W. J. 4 Bent, E. H. 5 Lane, H. R. Macalister, T. G. Corsan, G. H. 8 Morris, W. D. 9 Nairn, J. Quinn, E. C. Pethick, W. H. 12 Rowat, J. T. 13 Greenwood, J. G.	1 Reid Quinn 3 Buckingham 4 Baldwin 5 Greenwood 6 Brodie 7 Denton 8 Nairn Corsan Thompson Fair Campbell, W. W 13 Brown Morris 15 Matson Pethick 17 Beer Smith 19 McPherson, H. 20 Stamer Macalister 22 Bent 23 Knott	1 Buckingham Campbell, J. L 3 Fair Jordan Nairn 6 Butler 7 Jones Casswell Corsan 10 Brown Quinn Reid 13 Macalister Spalding 15 Matson 16 McPherson, H.	1 Buckingham Campbell, W. W Reid McPherson, A. 5 Bent Pethick. Spalding McPherson, H Kemmis 10 Henry Matson 12 Jordan Lane Macalister 13 Malcolm Rowat Smith Campbell, J. L 19 Morris 20 Alexander	1 Smith, E. P. 2 Macalister 3 Nairn 4 Jones 5 Thompson 6 Alexander 7 Henry 8 Corsan Rowat Spalding.
	Knott, E. Matson, J. S. H. McPherson, H. A. Stamer, O. P. Campbell, W. W. Lobb, E. W. T. Casswell, A. B. Baldwin, E. H. Beer, H. H. Campbell, C. A.	Campbell, C. Lobb	Kemmis Campbell Smith Baldwin Stamer Bent Morris Campbell, C. A Lane Knott Greenwood Lobb	Corsan Lobb Nairn Jones Knott Greenwood Campbell, C. A Casswell Baldwin Beer	Casswell Quinn Buckingham McPherson, H. A Lobb Campbell, J. L Beer Lane Fair Greenwood Campbell, W. W. Stamer Morris Malcolm Brown Robinson Knott Jordan Matson Pethick Campbell, C. A. Baldwin Denton.

☞ 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, 50 per cent. ; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	ORGANIC CHEMISTRY.	PHYSIOLOGY AND ZOOLOGY.	VETERINARY ANATOMY.	ENGLISH LITERATURE.	ENGLISH COMPOSITION.
HONOURS. I.	1 McKay. 2 Raynor. 3 Butler. 4 Macpherson, A. 5 Muir. 6 Ridings.	1 Macpherson, A. 2 Raynor. Muir. 4 McKay. 5 McIntyre. 6 Ridings. 7 Kemmis. Butler.	1 McKay. 2 Muir. 3 Ridings. 4 Raynor. 5 Butler.	1 Kemnis. 2 Raynor. 3 Ridings. 4 Macpherson, A. 5 Muir. 6 Butler.	1 McKay. 2 Ridings. ....
HONOURS. II.	1 Jones. 2 Reid. 3 Kemmis.	1 Jones. 2 Beni. 3 Alexander. 4 Spalding. Reid. 6 Macalister.	1 Rowat. Kemmis. 3 Skaife. King. Macpherson, A. Brodie. 7 Davies. Spalding. 9 Bent. 10 Carlaw. 11 Alexander. 12 Quinn. 13 McIntyre. 14 Reid. 15 Jones. 16 Sharman, G. C. Henry. 17 Thompson.	1 Bent. 2 McKay. 3 Reid. 4 Jones. 5 McIntyre. Brodie. 7 Alexander. 8 Macalister.	1 Butler. 2 Raynor. 3 Reid. 4 Muir. 5 McIntyre. 6 Macpherson, A. 7 Jones. 8 Kemmis. ....

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	ORGANIC CHEMISTRY.	PHYSIOLOGY AND ZOOLOGY.	VETERINARY ANATOMY.	ENGLISH LITERATURE.	ENGLISH COMPOSITION.
PASS. III.	1 Brodie.	1 Thompson.	1 Nairn.	1 Lane.	1 Thompson.
	2 Smith.	2 Brodie.	2 Jordan.	2 Rowat.	2 Smith.
	3 McIntyre.	3 Henry.	3 Fair.	3 Spalding.	3 Spalding.
	4 Alexander.	4 Jordan.	4 Macalister.	3 Quinn.	4 Buckingham.
	5 Nairn.	5 Smith.	5 Smith.	5 Nairn.	5 Alexander.
	6 Macalister.	6 Lane.	5 Lane.	5 Thompson.	6 Henry.
	6 Thompson.	7 Rowat.	7 Horridge.	7 Smith.	7 Bent.
	6 Bent.	Quinn.	7 Brown.	8 Malcolm.	8 Quinn.
	6 Buckingham.	Fair.	7 Buckingham.	9 Campbell, J. L.	9 Brodie.
	Spalding.	Nairn.	7 Lobb.	10 Buckingham.	10 Casswell.
	Henry.	Malcolm.	Baldwin.	10 Henry.	11 Macalister.
	Rowat.	Casswell.	Casswell.	Jordan.	12 Nairn.
	Stamer.	Lobb.	Beer.	Fair.	13 Rowat.
	Knott.	Buckingham.	Malcolm.	Morris.	14 Lane.
	Fair.	Beer.	Knott.	Lobb.	14 Jordan.
	McPherson, H.	Baldwin.	Stamer.	Pethick.	16 Fair.
	Morris.	Stamer.	Corsan.	Campbell, W. W	17 Campbell, W. W.
	Robinson.	Knott.	Macphrs'n, H. A	Stamer.	Campbell, J. L.
	Lobb.	Brown.	Robinson.	Campbell, C. A.	Malcolm.
	Corsan.	Campbell, J. L.	Greenwood.	Macpherson, H.	Baldwin.
	Campbell, W. W	Robinson.	Campbell, J. L.	Knott.	Macpherson.
	Jordan.	Macpherson, H.	Matson.	Greenwood.	Robinson.
	Malcolm.	Morris.	Pethick.	Robinson.	Lobb.
	Lane.	Campbell, W. W	Annand.	Corsan.	Greenwood.
	Quinn.	Pethick.	Morris.	Brown.	Stamer.
	Brown.	Corsan.	Campbell, C. A	Denton.	Morris.
	Campbell, J. L.	Greenwood.	Campbell, W. W	Matson.	Knott.
	Matson.	Watson.	Denton (Sick).	Casswell.	Denton.
	Pethick.	Campbell, C. A.	.....	Beer.	Beer.
	Greenwood.	.....	.....	Baldwin.	Brown.
	Casswell.	.....	.....	.....	Pethick.
	Beer.	.....	.....	.....	Matson.
	Denton.	.....	.....	.....	Corsan.
	Baldwin.	.....	.....	.....	Campbell, C. A.
	Campbell, C. A.	.....	.....	.....	.....

☞ Names numbered are those of Students who failed to pass in the subject.

The minimum for first-class honours is 75 per cent.; for second honours, 50 per cent.; for pass 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

Class.	Arithmetic.	Book-Keeping.	General Proficiency.	Department.		First-class men in the department.
HONOURS. I.	1 Raynor. 2 Ridings.	1 Raynor. 2 Reid. 3 Ridings. 4 Muir. 5 McKay. 6 Nairn.	1 Raynor 2 McKay. 3 Ridings 4 Muir 5 Butler 6 McPherson	I.	Agriculture and Live Stock.	1 McKay. 2 Raynor.
HONOURS. II.	1 Brodie. 2 Nairn. 3 Jones. 4 Spalding. 5 Macpherson, A. 6 Henry. 7 Alexander. 8 Butler. 9 Muir. 10 McIntyre. 11 Baldwin.	1 Macpherson, A. 2 Fair. 3 Brodie. / Butler. 5 Kemmis. 6 Henry. 7 Thompson. 8 Alexander.	1 Kemmis 2 Brodie. 3 McIntyre 4 Alexander	II.	Natural Science.	1 McKay. 2 Raynor. 3 Ridings. 4 Macpherson, A. / Muir. 6 Butler.
PASS. III.	1 Lane. 2 Nairn. 3 Morris. 4 Buckingham. 5 Campbell, C. A. 6 Kemmis. / Rowat. 8 Campbell, J. L. 9 Robinson. Quinn. Corsan. Thompson. Fair. Malcolm. Reid. Brown. Macalister. Jordan. Smith. Bent. Casswell. Beer. Campbell, W. W. Lobb. Greenwood. Macpherson, H. Denton. Pethick. Knott. Stamer. Matson.	1 Morris. 2 Jones. 3 Buckingham. 4 Macalister. 5 Smith. 6 Rowat. 7 Brown. 8 Jordan. 9 Spalding. 10 McIntyre. / Robinson. 12 Quinn. Bent. Malcolm. Lane. Campbell, W. W. Lobb. Knott. Campbell, C. A. Pethick. Campbell, J. L. Greenwood. Stamer. Matson. Corsan. Macperson, H. Baldwin. Beer. Casswell. Denton.		III.	Veterinary Science.	1 McKay. 2 Muir. 3 Ridings. 4 Raynor. 5 Butler.
				IV.	English Literature and Composition.	1 Raynor. 2 Ridings. 3 Kemmis. 4 Butler. 5 McKay. 6 Muir.
				V.	Mathematics and Book-keeping.	1 Raynor. 2 Ridings. 3 McKay.

☞ Names unnumbered are those of Students who failed to pass in the subject.
Only those who passed in every subject are ranked in proficiency.
First-class men in general proficiency must attain at least 67 per cent. of the total number of marks; second class men at least 50 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.	ARBORICULTURE.	LIVE STOCK. (Written Exam.)	HANDLING AND JUDGING CATTLE. (Oral Exam.)	HANDLING AND JUDGING SHEEP. (Oral Exam.)
HONOURS.	I.	1 Slater, H. 2 Ballantyne, A.W. 3 Carpenter, P. A. 4 Wark, A. E. Powys, P.	1 Slater. Powys. 3 Ballantyne. 4 Carpenter.	1 Ballantyne. 2 Slater. 3 Carpenter. 4 Courbarron. 5 Lehmann. Wark.	1 Ballantyne. 2 Carpenter. Rose. 4 Saxton.	1 Ballantyne. 2 Lehmann. ....
	II.	1 Lehmann, A. 2 Tucker, H. V. 3 Saxton, E. A. Wroughton, T. Courbarton, F.H 6 Black, P. C. 7 Austin, W. E. Major, C. H. 9 Hannah, J. 10 Mathewson, G. Rose, G. M.	1 Wark. 2 Austin. Wroughton. 4 Tucker. 5 Courbarron. 6 Lehmann. 7 Saxton. 8 Black.	1 Tucker. Wroughton. 3 Saxton. 4 Powys. 5 Mathewson. Austin. 7 Hannah. 8 Major. Rose. Black. 11 Steers.	1 Lehmann. 2 Major. 3 Wark. 4 Powys. 5 Black. 6 Wroughton. 7 Slater. Hannah. 9 Tucker.	1 Wark. Carpenter. 3 Saxton. Black. 5 Major. Austin. 7 Wroughton. Rose. Powys. 10 Mathewson. 11 Slater. Steers. 13 Hannah. .....
PASS.	III.	1 Steers, O.	1 Rose. 2 Mathewson. 3 Hannah. 4 Major. 5 Steers.	....	1 Austin. 2 Courbarron. 3 Mathewson.	1 Courbarron. Tucker. ....

☞ 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, 50 per cent.; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURAL CHEMISTRY.	METEOROLOGY.	ENTOMOLOGY.	HORTICULTURE.	VETERINARY PATHOLOGY.
HONOURS. I.	1 Slater. 2 Carpenter. 3 Wark. 4 Powys. 5 Ballantyne. 6 Lehmann.	1 Carpenter. 2 Wroughton. 3 Slater. 4 Ballantyne. 5 Wark. Powys. 7 Lehmann. 8 Tucker. 9 Saxton. 10 Major.	1 Lehmann. 2 Carpenter. 3 Slater.		1 Sharman. 2 Slater. 3 Hubbard. 4 Powys. 5 Ballantyne. 6 Lehmann. 7 Carpenter.
HONOURS. II.	1 Black. 2 Tucker. 3 Wroughton. 4 Saxton. 5 Rose. 6 Major. 7 Steers.	1 Austin. 2 Steers. 3 Rose. 4 Black. 5 Mathewson. Courbarron. Hannah.	1 Wark. 2 Wroughton. Black. 4 Tucker. 5 Saxton. 6 Ballantyne. 7 Austin.	1 Carpenter. 2 Wroughton. 3 Slater. 4 Ballantyne. Tucker. 6 Powys. 7 Lehmann. 8 Austin.	2 Saxton. Austin. 3 Holcroft. Wark. 5 Wroughto 6 Black. 7 Rose. 8 Courbarron. 9 McGregor. 10 Major.
PASS. III.	1 Courbarron. 2 Austin. 3 Hannah. 4 Mathewson.		1 Powys. 2 Major. 3 Rose. 4 Courbarron. Steers. Mathewson. Hannah.	1 Black. 2 Major. 3 Wark. Saxton. 5 Hannah. Courbarron. Mathewson. Rose. Steers.	1 Keil. 2 Tucker. 3 Hannah. 4 Mathewson. 5 Cowley. Steers. Fuller.

☞ 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, 50 per cent., for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.		HANDLING AND JUDGING HORSES. (Oral Exam.)	ENGLISH LITERATURE.	POLITICAL ECONOMY.	MECHANICS.	DRAINING.
HONOURS.	I.	1 Sharman. 2 Carpenter. 3 Hubbard. 4 Lehmann. 5 Ballantyne.	1 Slater. 2 Carpenter. 3 Tucker.	1 Powys. 2 Lehmann. 3 Carpenter. 4 Major. 5 Tucker.	1 Lehmann. 2 Carpenter.	1 Slater. 2 Powys. 3 Carpenter. 4 Ballantyne.
	II.	1 Major. 2 Saxton. 3 Slater. Black. 5 Powys. Holcroft. 7 Wroughton. Wark. Hannah. 10 Rose. 11 Tucker. 12 Austin. McGregor. Courbarron.	1 Powys. 2 Wroughton. 3 Wark. 4 Courbarron. 5 Black.	1 Wroughton. 2 Mathewson. 3 Ballantyne. 4 Austin. 5 Black. 6 Saxton. 7 Slater. 8 Wark. 9 Hannah. 10 Courbarron. 11 Rose.	1 Wark. 2 Wroughton. 3 Slater. 4 Ballantyne. Powys. 6 Saxton.	1 Austin. 2 Lehmann. Courbarron. 4 Saxton. 5 Wark. 6 Wroughton.
PASS.	III.	1 Mathewson. 2 Cowley. 3 Steers. 4 Keil.	1 Mathewson. 2 Saxton. 3 Ballantyne. 4 Austin. 5 Lehmann. 6 Major. 7 Steers. Rose. Hannah.	1 Steers.	1 Rose. 2 Austin. 3 Black. 4 Tucker. 5 Hannah. 6 Major. 7 Steers. Mathewson. Courbarron.	1 Black. 2 Hannah. 3 Rose. 4 Major. 5 Tucker. 6 Mathewson. 7 Steers.

☞ 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, 50 per cent.; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Book-Keeping.	General Proficiency.
Honours.	I.	1 Ballantyne. 2 { Slater. { Lehmann. 4 Carpenter.	1 Carpenter. 2 Slater. 3 Lehmann. 4 Ballantyne. 5 Powys. 6 Wark.
	II.	1 { Wark. { Black. 3 Powys. 4 Rose. 5 Mathewson. 6 Austin.	1 Wroughton. 2 Saxton. 3 Tucker. 4 Black. 5 Austin. 6 Major. 7 Rose.
Pass.	III.	1 Wroughton. 2 Saxton. 3 Steers. 4 Major. 5 Tucker. Courbarron. Hannah.	....

Departments.		First-class men in the departments.
	Agriculture and Live Stock.	1 Ballantyne, A. W. 2 Carpenter, P. A.
II.	Natural Science.	1 Carpenter, P. A. 2 Slater, H. 3 Wark, A. E. 4 Powys, P. C. 5 Ballantyne, A. W. 6 Lehmann, A.
III.	Veterinary Science.	1 Carpenter, P. A. 2 { Ballantyne, A. W. { Lehmann, A. 4 Slater, H. 5 Powys, P. C.
IV.	English Literature and Political Economy.	1 { Carpenter, P. A. { Powys, P. C. 3 Tucker, H. V.
V.	Mathematics and Book-keeping.	1 Lehmann, A. 2 Carpenter, P. A.

☞ 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 67 per cent. of the total number of marks; second-class men, at least 50 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.*

SPECIAL LIVE STOCK AND VETERINARY CLASS.

Classes.		Cattle, (Written Examination.)	Sheep, (Written Examination.)	Pigs and Sheep, (Written Examination.)	Handling and Judging Cattle, (Oral Examination.)	Handling and Judging Sheep, (Oral Examination.)	Veterinary Anatomy.*
Honours.	I.	1 Hubbard, W. W. 2 Sharman, H. B. 3 { Davies, S. 3 { McGregor, J.	1 Hubbard. 2 Sharman, H. B. 3 McGregor. 4 Skaife. 5 Holcroft.	1 Hubbard. 2 Sharman, H. B. 3 Holcroft. 4 McGregor.	1 { Hubbard. 1 { McGregor. 3 Holcroft. 4 Sharman, H. B.	1 Hubbard. 2 { Parker. 2 { Sharman, H. B. 4 McGregor. 5 Holcroft. 6 Carlaw. 7 Skaife. 8 Sharman, G. C.	
	II.	1 Holcroft, H. S. 2 Skaife, H. W. 3 Parker, T. R. 4 Carlaw, C. M. 5 Keil, C. A. 6 Horridge, J. 7 Sharman, G. C.	1 { Davies. 1 { Carlaw. 3 Annand. 4 { Parker. 4 { Fuller. 6 Cowley. 7 Keil. 8 Sharman, G. C.	1 Carlaw. 2 Parker. 3 Sharman, G. C. 4 Cowley. 5 Skaife. 6 Keil. 7 Fuller. 8 Annand. 9 King.	1 { Carlaw. 1 { Parker. 3 { Annand. 3 { Sharman, G. C. 5 Keil. 6 { Skaife. 6 { Davies. 8 Cowley. 9 King. 10 Fuller.	1 Davies. 2 { Keil. 2 { King. 4 { Fuller. 4 { Cowley. 6 Annand.	1 { Skaife. 1 { King. 3 Davies. 4 Carlaw. 5 Sharman, G. C.
Pass.	III	1 Cowley, E. A. 2 Annand, F. W. C. King, J. E. Fuller, G.	1 { King. 1 { Horridge.				I Horridge. Annand. Parker, (abs.)

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

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The minimum for first-class honours is 75 per cent., for second class honours, 50 per cent.; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SPECIAL LIVE STOCK AND VETERINARY CLASS.

Classes.	Veterinary Pathology.	Handling and Judging Horses, (Oral Examination.)	Veterinary Obstetrics.	Law's Veterinary Adviser.	Stock-Breeding, (Miles.)	Feeding of Animals, (Stewart.)
Honours. I.	1 Sharman, H. B. 2 Hubbard.	1 Sharman, H. B. 2 Hubbard.	1 Sharman, H. B. 2 Hubbard. 3 McGregor.	1 Hubbard.	1 Sharman, H. B. 2 McGregor. 3 Hubbard.	1 Sharman, H. B.
Honours. II.	1 Holcroft. 2 McGregor.	1 Holcroft. 2 McGregor.	1 Sharman, G. C. 2 King. 3 Davies. 4 Holcroft. 5 Parker. 6 Keil.	1 Sharmon, H. B. 2 McGregor. 3 Holcroft. 4 Skaife. 5 King.	1 Holcroft. 2 Carlaw. 3 Davies. Parker. 5 Horridge.	1 Hubbard. 2 McGregor.
Pass. III.	1 Keil. 2 Cowley. Fuller.	1 Cowley. 2 Keil. Fuller.	1 Cowley. 2 Carlaw. 3 Horridge. Fuller.	1 Keil. Sharman, G. C. 3 Cowley. 4 Carlaw. Fuller. Annand.	1 Keil. 2 Sharman, G. C. Skaife. Cowley. King. Fuller.	1 Skaife. 2 Parker. 3 Keil. 4 Carlaw. 5 Davies. 6 Holcroft. 7 Sharman, G. C. Horridge. Cowley. King. Annand. Fuller.

☞ 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, 50 per cent.; for pass, 33 per cent.

CLASS LISTS.

II.—MIDSUMMER EXAMINATIONS, 1884.

FIRST YEAR.

CLASS.		AGRICULTURE.	GEOLOGY.	BOTANY.	VETERINARY MATERIA MEDICA.	ENGLISH LITERATURE.
HONOURS.	I.	1 Raynor, T. 2 Muir, J. B. 3 Ridings, H. L. 4 McIntyre, D. N.	1 Raynor. 2 Macpherson. 3 Muir. 4 Owen. 5 McIntyre. 6 Ridings. 7 Broome. 8 Reid. 9 Kemmis.	1 Raynor. 2 Macpherson. 3 { Muir.* / Ridings.	1 Raynor. 2 Muir. 3 Ridings. 4 Alexander.	1 Raynor. 2 Macpherson. ....
	II.	1 Casswell, A. B. 2 Macpherson, A. 3 Alexander, R. C. 4 Thompson, W D 5 Kemmis, J. H. W 6 Jones, T. L. 7 Hall, H. B. 8 Carlaw, C. M. 9 Fortune, G. R. 10 McKay, J. G.	1 Thompson. 2 Carlaw. 3 Alexander. 4 Maude. 5 Thompson. 6 Hall. 7 Moberly. 8 McKay. 9 Bent. 10 Casswell.	1 Kemmis. 2 McIntyre. 3 Reid. 4 Owen. 5 Alexander.	1 Owen. 2 Macpherson. 3 Jones. 4 Quinn. 5 { McIntyre. / Reid. 7 Bent. 8 Donaldson. 9 Johnston. 10 { Carlaw. / Kemmis. 12 Moberly. 13 Casswell. 14 Broome. 15 Watts. 16 Patterson.	1 Ridings. 2 { Moberly. / Muir. 4 Owen. 5 Kemmis. ....

☞ Names unnumbered are the names of Students who failed to pass in the subject.

The minimum for first-class honours is 75 per cent.; for second-class honours, 50 per cent.; for pass, 33 per cent.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASS.	AGRICULTURE.	GEOLOGY.	BOTANY.	VETERINARY MATERIA MEDICA.	ENGLISH LITERATURE.
PASS. III.	1 Watts, W. J. 2 Carr, G. P. 3 Rowat, J. T. 4 Reid, P. 5 Denton, E. Dunn, J. G. Owen, W. H. Donaldson, H. W. W. Bent, E. H. Quinn, E. C. Maude, F. S. A. Power, R. H. Macfarlane, A. D Fraser, T. Brownjohn, N. S. L. Broome, A. H. S. Moberly, G. E. Johnston, F. A. Patterson, J. W. Carden, J. Baker, V. H. Lobb, E. W. T. Notman. Burch, E. W. Thompson, W. Hayman, J. N. Greenwell, H.	1 Fortune. 2 Watts. 3 Patterson. 4 Johnston. 5 Rowat. 6 Donaldson. 7 Denton. 8 Carr. Power. Jones. 11 Hayman. Byers, W. F. Macpharlane. Quinn. Lobb. Burch. Dunn. Carden. Fraser. Greenwell. Brownjohn. Baker. Notman. Greenwood.	1 Bent. 2 Thompson, W.D 3 McKay, J. G. 4 Lobb. Carlaw. 6 Power. 7 Quinn. Casswell. Hall. Jones. Johnston. Rowat. Donaldson. Denton. Watts. Hayman. Moberly. Baker. Broome. Brownjohn. Macfarlane. Dunn. Fraser. Patterson. Byers. Carr. Fortune. Thompson, H. Carden. Greenwell. Burch.	1 Carr. 2 Macpherson. Fortune. 4 McKay, J. G. 5 Rowat. Thompson, W. D. 7 Lobb. 8 Maude. Hall. Hayman. Power. Thompson, H. Carden. Brownjohn. Baker. Denton. Notman. Greenwell. Fraser.	1 Reid. 2 Broome. 3 Watts. 4 McIntyre. 5 Donaldson. 6 McKay. 7 Jones. 8 Bent. 9 Brownjohn. 10 Alexander. 11 Fortune. 12 Hayman. 13 Johnston. Carden. Rowat. Maude. Power. Casswell. Macpharlan Hare. Thompson, W D Baker. Denton. Quinn. Dunn. Byers. Notman. Fraser. Carr. Greenwell. Lobb. Burch. Thompson, H. Carlaw (sick).

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

The minimum for first-class honours is 75 per cent.; for second-class honours, 50 per cent.; for pass, 33 per cent.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

FIRST YEAR.

Classes.		Composition.	Mensuration.	General Proficiency.
Honours.	I.	1 Raynor.	1 Raynor.	1 Raynor.
		2 Muir.	2 Ridings.	2 Muir.
		3 Ridings.	3 Muir.	3 Ridings.
		4 Jones.		4 Macpherson.
	II.	1 Moberly.	1 McKay, J. G.	1 McIntyre.
		2 Reid.	2 Jones.	2 Alexander.
		3 Macpherson.	3 McIntyre.	3 Kemmis.
		4 Alexander.	4 Moberly.	4 Reid.
		5 Kemmis.	5 Alexander.	
		6 Fortune.	6 Macpherson.	
		7 McIntyre.		
		8 Bent.		
		9 Maude.		
		10 Patterson.		
		11 Watts.		
Pass.	III.	1 Casswell.	1 Casswell.	1 McKay.
		2 Broome.	2 Owen	
		3 Thompson, W.D.	3 Maude.	
		4 { McKay, J. G.	4 Dunn.	
		{ Owen.	5 Reid.	
		6 Carlaw.	6 Broome.	
		7 Lobb.	7 Rowat.	
		8 Brownjohn.	8 Johnston.	
		9 { Baker.	9 Power.	
		{ Donaldson.	10 Thompson, W. D.	
		11 Hall.	11 Quinn.	
		12 Carden.	12 Bent.	
		13 Quinn.	13 Kemmis.	
		14 Rowat.	14 Carlaw.	
		15 Johnston.	Hall.	
		16 Macpharlane.	Brownjohn.	
		Denton.	Byers.	
		Dunn.	Notman.	
		Carr.	Watts.	
		Notman.	Macpharlane.	
		Power.	Hayman.	
		Burch.	Carr.	
		Byers.	Donaldson.	
		Fraser.	Fraser.	
		Thompson, H.	Patterson.	
		Greenwell.	Burch.	
		Hayman.	Thompson, H.	
		Greenwood.	Baker.	
			Greenwell.	
			Denton.	
			Fortune.	
			Lobb.	

Departments.		First-Class Men in the Departments.
I.	Agriculture and Live Stock.	1 Raynor, T., Rose Hall, Ont. 2 Muir, J.B., North Bruce, Ont. 3 Ridings, H. L., Grafton, Ont. 4 McIntyre, D.N., Paisley, Ont.
II.	Natural Science.	1 Raynor, T., Rose Hall, Ont. 2 Macpherson, A., Montreal. 3 Muir, J. B., North Bruce, Ont. 4 Ridings, H. L., Grafton, Ont. 5 McIntyre, D. M., Paisley, Ont. 6 Owen, W. H., England.
III.	Veterinary Science.	1 Raynor, T., Rose Hall, Ont. 2 Muir, J.B., North Bruce, Ont. 3 Ridings, H. L., Grafton, Ont. 4 Alexander, R. C., Wedigo, Ont.
IV.	English Composition and Literature.	1 Raynor, T., Rose Hall, Ont.
V.	Mathematics.	1 Raynor, T., Rose Hall, Ont. 2 Ridings, H. L., Grafton, Ont. 3 Muir, J.B., North Bruce, Ont.

☞ 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 67 per cent. of the total number of marks; second class men at least 50 per cent. of the total number of marks. First-class men in any department must obtain at least 75 per cent. of the marks allotted to the subjects in that Department.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Agriculture.	Handling and Judging Cattle and Sheep.	Horticulture.	Analytical Chemistry.
Honours.	I.	1 Carpenter, P. A. 2 Slater, H. 3 Wark, A. E. 4 McKay, J. B.	1 Lehmann.	1 Carpenter. 2 Slater. 2 Powys. 4 Lehmann.	1 Slater. 2 Carpenter. 3 Lehmann. 4 Mackay, J. B.
	II.	1 Powys, P. C. 2 Lehmann, A. 3 Wroughton, T. A. 4 Butler, G. A.	1 Mackay. 2 Carpenter. 3 Wroughton. 4 Powys. 4 Slater. 6 Wark. 7 Major. 7 Steers.	1 Wark. 2 Major. 3 Mackay, J. B. 4 Wroughton. 4 Butler.	1 Wark. 2 Butler. 3 Wroughton.
Pass.	III.	1 Major, P. H. F. 2 Black, P. C. 3 Macalister, T. G. 4 Steers, O. Smith, E. P. Lane, H. B.	1 Macalister. 1 Smith. 3 Black. 3 Butler. 5 Lane.	1 Steers. 2 Black. Smith. Macalister. Lane.	1 Powys. 2 Black. Steers. Major. Macalister. Smith. Lane.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.		Systematic and Economic Botany.	Veterinary Materia Medica.	Veterinary Obstetrics.	English Literature.
Honours.	I.	1 Slater. 2 Carpenter. 3 Powys. 4 Lehmann.	1 Wark. 2 Carpenter. 3 Slater. 4 Wroughton. 5 Lehmann. 6 Mackay, J. B.	1 Slater. 2 Carpenter. 3 Mackay, J. B. 4 Wark. 5 Lehmann. 6 Black.	1 Carpenter. 2 Slater. 3 Powys. 4 Butler.
	II.	1 Mackay, J. B. 2 Butler. 3 Wark. 4 Wroughton. 5 Major.	1 Steers. 2 Powys. 3 Black. 4 Butler. 5 Major.	1 Powys. 2 Wroughton. 3 Butler. 4 Major. 5 Steers.	1 Mackay, J. B. 2 Black. 3 Wark. 3 Wroughton. 5 Major.
Pass.	III.	1 Black. 1 Steers. 3 Lane. Macalister. Smith.	1 Lane. 1 Macalister. Smith.	1 Macalister. 2 Lane. Smith.	1 Lehmann. 2 Lane. 3 Steers. Macalister. Smith.

☞ 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, 50 per cent.; for pass, 33 per cent.

Class Lists (Midsummer, 1884)—*Continued.*

SECOND YEAR—*Continued.*

Class.	Road-Making, Levelling and Surveying.	General Proficiency.	Departments.		First-class men in the Departments.
Honours. I.	1 Carpenter. 2 { Lehman. { Powys. 4 Slater. 5 Wark.	1 Carpenter. 2 Slater. 3 Lehman. 4 Mackay. 5 Wark. 6 Powys.	I.	Agriculture, Theorical and Practical.	1 Wark, A. E., Wanstead, Ont. 2 Carpenter, P. A., Collingwood, Ont. 3 Mackay, J. B., Stellarton, Ont.
Honours. II.	1 Mackay. 2 Wroughton. 3 Butler.	1 Wroughton. 2 Butler. 3 Black. 4 Major.	II.	Horticulture.	1 Carpenter, P. A., Collingwood, Ont. 2 Slater, H., Taunton, England. 3 Lehmann, A., Orillia, Ont. 4 Powys, P. C., Fredericton, N.B.
Pass. III.	1 Black. 2 Major. 3 Macalister. 4 Smith. 5 Steers. Lane.	1 Steers.	III.	Natural Science.	1 Slater, H., Taunton, England. 2 Carpenter, P. A,, Collingwood, Ont. 3. Lehmann, A., Orillia, Ont.
			IV.	Veterinary Science.	1 Carpenter, P. A., Collingwood, Ont. 2 Slater, H., Taunton, England. 3 Wark, A. E., Wanstead, Ont. 4 Mackay, J. B., Stellarton, N.S. 5 Lehmann, A., Orillia, Ont.
			V.	English Literature.	1 Carpenter, P. A., Collingwood, Ont. 2 Slater, H., Taunton, England. 3 Powys, P. C., Fredericton, N.B. 4 Butler, G. C., London, England.
			VI.	Mathematics.	1 Carpenter, P. A., Collingwood, Ont. 2 { Lehmann, A., Orillia, Ont. { Powys, P. C., Fredericton, N.B. 4 Slater, H., Taunton, England. 5 Wark, A. E., Wanstead, Ont.

☞ Names unnumbered are those of the 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 67 per cent. of the total number of marks; second class men, at least 50 per cent. of the total number of marks. First-class men in any department must obtain at least 75 per cent. of the marks alloted to the subjects in that department.

APPENDIX 4.

THE COLLEGE IN ACCOUNT WITH THE FARM AND THE GARDEN.

(a) WITH FARM. *Dr.*

To 327 bags potatoes, @ 50c.	$163 50
" 3,469 gals. milk, @ 12c	416 28
" 21 barrels flour, @ $4.25	89 25
" 53 bushels carrots @ 25c	13 25
" 18¼ turnips @ 15c	2 74
" Cartage for College	25 00
" Feed of College horse (without attendance)	75 00
" Feed of Matron's horse (without attendance)	75 00
	$860 02

(b) WITH GARDEN.

To fruit and vegetables (for items see Mr. Forsyth's report in part VI.)	603 39
	1,463 41

Cr.

By amount paid for students' labor on Farm and Garden	4,234 98
By balance	$2,771 57

PART II.

REPORT.

OF THE

PROFESSOR OF CHEMISTRY.

AGRICULTURAL COLLEGE, January, 1885.

To the President of the Ontario Agricultural College:

DEAR SIR,—We are pleased with the increased efficiency which the addition of two hundred and fifty dollars to the chemical allowance has given to the Chemical Laboratory of the college. As a consequence, the practical illustration of chemical principle is now easy and pleasant.

Professor Brown has liberally furnished the Laboratory of the experimental field, so that work in quantitative analysis can be now conveniently and accurately done.

The customary brief review of the agricultural work of Rothamstead, England, and of some of the leading stations of Germany and of the United States, we shall not seek to give in this Report, reserving them if time permits, for a separate publication farther on.

I. EXPERIMENTAL DEPARTMENT.

1. FIELD EXPERIMENTS.

On Ranges II. and III. of the Experimental Field, has been continued during the present year, the system of "Co-operative Experimenting" which Prof. O. W. Atwater submitted to the Department of Agriculture, Washington, March 27th, 1882. To enable the reader to compare the results of last year with those of this year, we have given the returns of 1883 a place beside those of 1884. Before we proceed to give the results of this year's experiments, we shall briefly review the conditions under which the fertilizers have been used.

Nitrogen was used in three distinct forms:—

First, in the form of nitric acid—nitrate of soda.
Second, in the form of ammonia—sulphate of ammonia.
Third, in the form of organic nitrogen—steam-dried blood.

Three rations were used, full, two-thirds, and one-third.

	RATION.		
	FULL. lbs. per acre.	TWO-THIRDS. lbs per acre.	ONE-THIRD. lbs. per acre.
1. Nitrate of soda	450	300	150
2. Sulphate of ammonia	343	228	114
3. Dried blood	660	440	220

There was also used a "nitrogen mixture," consisting of equal parts of nitrate of soda, sulphate of ammonia, and dried blood, and containing the same percentage of nitrogen as nitrate of soda, and hence the same rations.

Phosphoric acid was likewise employed in three different forms of combination—soluble, precipitated or reverted, and insoluble. There was used for the soluble phosphoric acid, dissolved bone black with sixteen per cent. $P_2 O_5$; for the *precipitated*, a high grade superphosphate with equal weight of chalk, making a precipitated phosphate with sixteen per cent. $P_2 O_5$; for the *insoluble*, fine bone dust with 25 per cent. $P_2 O_5$.

	RATION.		
	FULL. lbs. per acre.	TWO-THIRDS. lbs. per acre.	ONE-THIRD. lbs. per acre.
1. Soluble phosphate	600	400	200
2. Precipitated phosphate	600	400	200
3. Insoluble phosphate	400	267	133

Potash was used in the form of muriate of potash, the full ration being 200 pounds to the acre, two-thirds ration, 133 pounds, and one-third ration sixty-seven pounds.

In applying these fertilizers separately and two by two, two-third rations were used; in applying them altogether, two-third rations of two of them were added to the several rations of the third. We hoped in this way to discover the heightened effect on the one fertilizer by the addition of the other fertilizers. The sulphate of lime group has been suggested in order to ascertain if the effect of the super-phosphate be due in part to the sulphate of lime always present in it.

In the following table the number of the plots, the fertilizers, and the quantities per $\frac{1}{10}$ acre, are given :—

FIRST TWO ACRE SET—Nitrogen and Potash.

Number of Plot.	Fertilizers.	Quantities per One-Tenth Acre Plots.
	I.—Preliminary Group.	Pounds.
40	Nitrate of soda, two-thirds ration	30·0
39	Superphosphate " "	40·0
38	Muriate of potash " "	13·3
37	Nitrate of soda, Superphosphate, } mixed minerals	30·0 40·0
36	Nitrate of soda, Muriate of potash } "	30·0 13·3
35	Superphosphate, Muriate of potash } "	40·0 13·3
	II.—Nitrate of Soda Group.	
34	Mixed minerals as No. 35	53·3
	Nitrate of soda, one-third ration	15·0
33	Mixed minerals as No. 35	53·3
	Nitrate of soda, two-thirds ration	30·0
32	Mixed minerals as No. 35	53·3
	Nitrate of soda, full ration	45·0
	III.—Sulphate of Ammonia Group.	
31	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, one-third ration	11·4
30	No manure	
29	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, two-thirds ration	22·8
28	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, full ration	34·3
	IV.—Dried Blood Group.	
27	Mixed minerals as No. 35	53·3
	Dried blood, one-third ration	22·0
26	Mixed minerals as No. 35	53·3
	Dried blood, two-thirds ration	44·0
25	Farm-yard manure	15 tons per acre.
24	Mixed minerals as No. 35	53·3
	Dried blood, full ration	66·0
	V.—Muriate of Potash Group.	
23	Mixed minerals as No. 37	70·0
	Muriate of potash, one-third ration	6·7
22	Mixed minerals as No. 37	70·0
	Muriate of potash, two-thirds ration	13·3
21	Mixed minerals as No. 37	70·0
	Muriate of potash, full ration	20·0

SECOND TWO ACRE SET—Phosphoric Acid and Sulphate of Lime.

Number of Plot.	FERTILIZERS.	Quantities per One-Tenth Acre Plots.
	I.—Preliminary Group.	Pounds
41	"Nitrogen mixture," two-thirds ration	30·0
42	Superphosphate, " "	40·0
43	Muriate of potash, " "	13·3
44	Nitrogen mixture, " "	30·0
	Superphosphate, " "	40·0
45	No manure	
46	Muriate of potash, two-thirds ration	13·3
	Superphosphate, " "	40·0
47	Nitrogen mixture, Muriate of potash, } Basal mixture.	30·0
		13·3
	II.—Soluble Phosphoric Acid Group.	
48	Basal mixture as No. 47	43·3
	Superphosphate, one-third ration	20·0
49	Basal mixture as No. 47	43·3
	Superphosphate, two-thirds ration	40·0
50	Farm-yard manure	
51	Basal mixture as No. 47	43·3
	Superphosphate, full ration	60·0
	III.—Precipitated Phosphoric Acid Group.	
52	Basal mixture as No. 47	43·3
	Precipated Phosphate, one-third ration	20·0
53	Basal mixture as No. 47	43·3
	Precipated Phosphate, two-thirds ration	40·0
54	Basal mixture as No. 47	43·3
	Precipated Phosphate, full ration	60·0
	IV.—Insoluble Phosphoric Acid Group.	
55	Basal mixture as No. 47	43·3
	Bone dust, one-third ration	13·3
56	Basal mixture as No. 47	43·3
	Bone dust, two-thirds ration	26·7
57	Basal mixture as No. 47	43·3
	Bone dust, full ration	40·0
	V.—Sulphate of Lime Group.	
58	Basal mixture as No. 47	43·3
	Sulphate of Lime, one-third ration	7·5
59	Basal mixture as No. 47	43·3
	Sulphate of Lime, two-thirds ration	15·0
60	Basal mixture as No. 47	43·3
	Sulphate of Lime, full ration	22·5

The soil though not rich is by no means poor; not much farm-yard manure has ever been applied to it. It was broken from sod in the fall of 1881, and was summer fallowed the following summer. The treatment of this year resembles that of last. By April 24th and 25th, the soil had become dry; it was then cultivated with a two-horse cultivator followed by heavy iron harrows. On April 26th "White Russian Spring Wheat" was sown, all the special fertilizers applied, except nitrate of soda, and the plots drilled. The seed was bought of Scott Joseph, of Rock Island, Quebec, was plump and well matured. Although the weather remained dark and chilly from April 26th to May 18th, the blades appeared well above ground, on May 10th; on May 27th, the nitrate of soda was sown as a top dressing, the crop being at that date far enough advanced to draw nourishment from the soil. We are safe in saying that little or no loss of fertilizers occurred this year from rains. On May 4th, frost occurred, doing damage to crops growing on the darker soil of these Ranges—Plots 47, 48, 49, 50, 51, 52, 53, 54, and 55—the crops on the above plots assuming a distinct yellowish tinge.

The dark soil of these Ranges lies upon a blue clay subsoil. When the roots of the plants over this subsoil have reached a certain depth, the blades of the plants become yellowish in colour and delicate in appearance. It is this portion of the crop that suffers most from wet and cold. The dryness that occurred this season during the month of July, injured the crops over this blue clay the most.

The crop has been almost completely destroyed by rust. It became visible early in July at the time the grain was heading out, and increased until the time of ripening, August 1st. Barberry bushes have had a place at one corner of the field. We have noticed this last summer, that the wheat and oats nearest to these bushes, have been completely destroyed by rust.

In the following table, prepared by Mr. Shuttleworth, foreman of the Experimental Department, under the direction of Professor Brown, the results obtained from the different plots are given:—

FIELD EXPERIMENTS.

EXPERIMENTAL FIELD. RANGE II. 20 PLOTS. ONE-TENTH ACRE EACH.

Nitrogen and Potash on Spring Wheat in 1884.

DATE.		GRAIN PER ONE-TENTH ACRE.			GRAIN PER ACRE.			TOTAL CROP PER ACRE.						Bushels per Acre.	TOTAL CROP PER ACRE.		PER CENT. OF CROP GRAIN.		Weight per Measured Bushel.	Appearance of Crop when Standing.	Amount of Rust.	Length of Straw.	Plot.
								Grain.			Straw.												
Month.	Day.	Market Grain.	Small Grain.	Total.	Market Grain.	Small Grain.	Total.	1883.	1884.	Average.	1883.	1884.	Average.		1883.	1884.	1883.	1884.					
								Bush.	Bush.	Bush.	Tons.	Tons.	Tons.		lbs.	lbs.							
August.	12th	114.5	19	133.5	1145	190	1335	23.2	19	21.1	2.6	2.5	2.5	19.0	6710	6400	20.8	20.8	55.3	85	70	80	21
"	12th	84.5	23.5	108	845	235	1080	16.8	14	15.4	2.3	2.4	2.3	14.0	5790	6000	19.2	18.0	50.3	85	70	80	22
"	12th	110.5	19	129.5	1105	190	1295	17.7	18.4	18	2.1	2.4	2.2	18.4	5430	6200	19.6	20.8	52.2	85	70	80	23
"	13th	145	13.5	158.5	1450	135	1585	16.1	24.1	20.1	2.1	2.1	2.1	22.8	5395	5950	19.2	26.1	55.2	85	70	80	24
"	13th	148.5	18	166.5	1485	180	1665	16.7	24.7	20.7	2.3	2.0	2.1	24.1	5690	5700	17.1	27.8	56.1	85	68	82	25
"	13th	142.5	15	157.5	1425	150	1575	16.7	23.7	20.2	2.1	2.0	2.0	24.7	5310	5700	19.0	29.2	56.5	85	65	80	26
"	13th	125	18.5	143.5	1250	185	1435	15.3	20.8	18	2	1.8	1.9	23.7	5010	5300	20.1	29.7	56.2	75	70	75	27
"	12th	108.5	22.5	131	1085	225	1310	15.1	18	16.5	1.4	2.1	1.7	20.8	4910	5800	18.8	24.7	52.2	83	70	80	28
"	13th	41.5	18	59.5	415	180	595	8.2	6.9	7.5	1.7	1.8	1.7	18.0	4440	5100	20.5	25.6	50.3	85	70	80	29
"	12th	52.5	23	75.5	525	230	755	11.1	8.7	9.9	1.2	1.1	2.1	6.9	2950	2800	16.7	21.2	37.5	60	70	55	30
.....	.....	.....	.....	.....	.....	.....	.....	1.5	1.4	1.4	1.5	1.4	1.4	8.7	3690	3600	18.1	20.9	50.8	25	75	53	31
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*32
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*33
"	12th	50	14.5	64.5	500	145	645	8.5	10.7	9.6	1.1	1.4	1.2	10.7	2750	.....	18.7	18.3	49.5	55	75	60	*34
"	13th	75	15	88	730	150	880	15.5	14.6	15	1.6	1.5	1.5	14.6	4310	.....	21.7	22.5	50.2	75	65	80	35
"	13th	86	15	101.5	860	150	1010	12.6	16.5	14.7	1.5	1.6	1.5	16.9	3940	.....	19.3	23.6	51.5	75	70	75	36
"	13th	52	11	63	520	110	630	11.3	10.5	10.9	1.4	1.6	1.5	10.9	3550	.....	19.2	21.0	52.2	55	70	70	37
"	12th	65	14.5	79.5	650	145	795	10.9	13.2	12	1.3	1.5	1.4	13.2	3420	.....	19.3	20.3	48.5	78	65	73	38
"	13th	50.5	12.5	63	505	125	630	9.2	10.5	9.8	1.2	1.2	1.2	10.5	4070	.....	18.2	20.7	48.2	65	70	65	39
																							40

* In the above table plots, 32, 33, 34 are not reckoned. The crops of these plots were not worth the seed.

FIELD EXPERIMENTS—(*Continued*).

Experimental Field. Range III. 20 Plots. One-tenth Acre Each.

Phosphoric Acid and Sulphate of Lime on Spring Wheat in 1885.

Date.		Grain per One-tenth Acre.			Grain per Acre.		Total Crop per Acre.					Total Crop per Acre.		Per Cent. of Crop Grain.		Grain Weight per Measured Bushel.	Appearance of Crop when Standing.	Amount of Rust.	Length of Straw.	Plot.
							Grain—bushels.			Straw—tons.										
Month.	Day.	Market Grain.	Small Grain.	Total.	Market Grain.	Small Grain.	1883.	1884.	Average.	1883.	1884.	Average.	—	1883.	1884.	1883.	1884.			
														lbs.	lbs.					
August.	13th	40.5	13	53.5	405	130	18.4	8.9	15.6	2.0	1.9	1.9	.....	5190	4480	21.3	11.9	45.5	85	73	82	41
"	12th	65	15.5	80.5	650	155	19.3	13.4	16.3	1.8	2	1.9	.....	4950	4990	23.5	16.3	43.1	82	65	80	42
"	12th	54	20	74.1	540	200	18	12.3	15.1	2.0	1.7	1.8	.....	5090	4110	21.3	17.8	47.7	78	65	76	43
"	12th	49	26.5	75.5	490	265	16.2	12.5	14.3	1.8	2	1.9	.....	4670	4860	20.8	15.5	47	83	65	65	44
"	12th	35	26	61	350	260	15.1	10.1	12.6	1.7	1.6	1.6	.....	4330	3840	21	15.8	46.5	60	70	70	45
"	12th	100.5	27	127.5	1005	270	22.4	21.2	21.8	2.3	2.2	2.2	.....	6130	5840	21.9	21.8	52.5	85	68	80	46
"	12th	48.5	18	66.5	485	180	19.7	11	15.3	2.1	1.7	1.9	.....	5532	4200	21.4	15.8	49.1	83	70	80	47
"	13th	97	25	122	970	250	17.2	20.3	18.7	2.0	2.1	2.0	.....	5110	5560	20.3	21.9	51.2	85	70	80	48
"	13th	108	35	143	1080	350	20.5	23.8	22.1	1.9	2	1.9	.....	5160	5520	23.9	25.9	53	85	68	80	49
"	13th	103	26	129	1030	260	21.8	21.5	21.6	2.0	2.4	2.2	.....	5340	6180	23.6	20.8	54.8	88	70	85	50
"	13th	97	15	122	970	150	17.5	18.6	18.1	1.6	2	1.8	.....	4320	5160	24.5	21.7	53	85	65	85	51
"	13th	101	17	118	1010	170	17.4	19.6	18.1	1.7	1.6	1.6	.....	4570	4440	23	26.5	53.3	80	70	80	52
"	13th	90	54	144	900	540	18.9	24	21.4	1.7	1.8	1.7	.....	4640	5180	24.6	27.7	53.3	85	70	85	53
"	13th	114	18	132	1140	180	24.9	22	23.4	2.0	2.4	2.2	.....	5900	6240	25.4	21.1	51.6	85	70	86	54
"	13th	71	16	87	710	160	19.2	14.5	16.8	1.7	1.4	1.5	.....	4650	3860	24.9	22.5	52.3	75	70	80	55
"	13th	785	13	91.5	785	130	17	15.2	16.1	1.6	1.3	1.4	.....	4380	3560	23.3	25.7	54.1	60	70	75	56
"	13th	79	12.5	91.5	790	125	15.2	15.2	15.2	1.5	1.2	1.3	.....	4060	3320	22.6	27.5	54.5	60	70	75	57
"	13th	45.5	8.5	54	455	85	17.1	9	13	1.5	.9	1.2	.....	4210	2400	24.3	22.5	53	50	70	70	58
"	13th	49.5	10	59.5	495	100	16.6	9.9	13.2	1.5	1.1	1.3	.....	4170	2860	24	20.8	50.8	55	70	75	59
"	13th	61.5	9.5	71	615	95	17.5	11.8	14.6	1.6	1.1	1.3	.....	4350	2970	24.2	23.9	52	60	70	75	60

In briefly reviewing these results of the field experiments we shall examine—
First, the plots which received no manure;
Secondly, the plots which received farm-yard manure;
Thirdly, the plots which received one artificial fertilizer;
Fourthly, the plots which received two artificial fertilizers;
Fifthly, the plots which received all three artificial fertilizers;

1st. The plots which received no manure are—No. 30 of Range II. and No. 45 of Range III. Per acre, the bushels of market grain from plot 30 were, 6.9; from plot 45, 10.1. The average of the two plots is 8.5, three bushels of wheat per acre less than the average of last year.

2nd. The results obtained from the plots treated with farm-yard manure—plot 25, Range II. and plot 50, Range III.—are nearly uniform. Per acre, the bushels of market grain from plot 25 were, 24.1; from plot 50, 21.5. The average of the two plots, expressed in bushels of wheat per acre is 22.9, being four bushels more than last year's average per acre.

3rd. The plots which received one artificial fertilizer are Nos. 40, 39, and 38, of Range II.; and Nos. 41, 42, and 43, of Range III.

Per acre, the yield of plot 40—nitrate of soda, two thirds ration—was, 10.5 bushels; the yield of plot 39—superphosphate, two-thirds ration—was, 13.2 bushels; and the yield of plot 39—muriate of potash, two thirds ration—was 10.5 bushels.

Turning to the plots of Range III. we notice little difference in the results. Per acre, plot 41—nitrogen mixture, two-thirds ration—yielded 8.9 bushels; plot 42—Superphosphate, two-thirds ration—13.4 bushels; and plot 43—muriate of potash, two-thirds ration—12.3 bushels.

The difference between the returns of the three last mentioned plots this year and last, is really remarkable. The average of the returns from two-thirds ration of simple fertilizers was last year, equal to the average obtained from heavy dressings of farm-yard manure; this year it is only 11.5 bushels per acre.

4th. The plots which received two artificial fertilizers are Nos. 37, 36, and 35, of Range II.; and Nos. 44, 46, and 47, of Range III. The average this year from each of the two sets is 14 bushels per acre; last year the average from one set was, 19.4 bushels per acre, and the average from the other only 12.2 bushels per acre. The highest yield was obtained both years from plot 46, two-thirds ration, muriate of potash and superphosphate, last year the yield being 22.4 bushels per acre, this year 21.2 bushels per acre.

5th. The plots which received all three artificial fertilizers will be best considered in groups.

1. Nitrogen Group.

(*a*) Nitrate of Soda Set.
(*b*) Ammonium Sulphate Set.
(*c*) Organic Nitrogen—Dried Blood Set.

In these three sets of the Nitrogen Group there were used two-thirds rations of superphosphate of lime and muriate of potash, with one-third, two-thirds, and full rations of the nitrogen in each form.

(*a*) *Nitrate of Soda Set*—Plots 34, 33, and 32, Range II. Like last year, no account can be given of them. They occupy a low part of the field and are to all appearance barren. We purpose studying the physical and chemical properties of the soil in order if possible to discover the cause of the failure.

(*b*) *Ammonium Sulphate Set*—Plots 31, 29, and 28, Range II.

Per acre, the yield of 31—one-third ration—was 8.7 bushels; the yield of 29—two-thirds ration—was 18 bushels; the yield of 28—full ration—was, 20.8 bushels. The difference last year between the lowest and highest yield, was 4½ bushels; this year the difference between the lowest and highest yield is 12 bushels.

(*c*) *Dried Blood Set*—Plots 27, 26, and 24, Range II. Per acre, the yield from plot 27—one-third ration—was 23.7 bushels; that from plot 26—two-thirds ration—was, 26.7 bushels; and that from plot 24—full ration—was, 22.8 bushels. This year, the average

from the three plots is 23.7 bushels per acre; last year it was only 16.8 bushels per acre. The average return from the plots treated with farm-yard is one bushel per acre less than the average from the plots treated with dried blood.

2. Muriate of Potash Group.

In the one set of this gronp, there were two-thirds rations of superphosphate of lime and nitrate of soda used with one-third, two-thirds, and full rations of muriate of potash. The plots are 23, 22, and 21, Range II.

Per acre, the yield from plot 23—one-third ration—was, 18.4 bushels; that from plot 22—two-thirds ration—was, 14 bushels; and that from plot 21—full ration—was, 19 bushels. The average per acre from these plots is two bushels less this year than last.

3. Phosphoric Acid Group.

(*a*) Soluble Phosphoric Acid Set.
(*b*) Precipitated Phosphoric Acid Set.
(*c*) Insoluble Phosphoric Acid Set.

In these three sets of the phosphoric acid group, there were two-thirds rations of nitrogen mixture and muriate of potash used with one-third, two-thirds, and full rations of phosphoric acid in each form.

(*a*) *Soluble Phosphoric Acid Set*—Plots 48, 49, and 51, Range III. Per acre, the yield of plot 48—one-third ration—was, 20.3 bushels; that of plot 49—two-thirds ration—was, 23.8 bushels; and that of plot 51—full ration—was, 18.6 bushels. The same peculiarity that occurred last year in these plots occurs this year, viz. a greater yield is obtained from the two-thirds ration than from the full. The average from the three plots last year was 18.5 bushels per acre; the average this year is 20.9 bushels per acre.

(*b*) *Precipitated Phosphoric Acid Set*—Plots 52, 53, and 54, Range III. Per acre, the yield from plot 52—one-third ration—was, 19½ bushels; that from plot 53—two-thirds ration—was 24 bushels; and that from plot 54—full ration—was 22 bushels. The highest return, last year, of all the plots came from plot 54 of this set. This year plot 53 of the set stands nearly two bushels per acre over the average of the farm-yard manure plots.

(*c*) *Insoluble Phosphoric Acid Set*—Plots 55, 56, and 57, Range III. Per acre, the yield from plot 55—one-third ration—was 14.5 bushels; that from plot 56—two-thirds ration—was 15.2 bushels; and that from plot 57—full ration—was 15.2 bushels. The average of the three plots is nearly three bushels less than that of last year.

4. *Sulphate of Lime Group*—Plots 58, 59, and 60, Range III. The average last year from the three plots of this group was 17 bushels per acre; this year it is only 14.9 bushels per acre.

Taking the average of the different sets of plots as indicative of the comparative worth of the manures applied, the following series is not without interest.

(1) No manure—average of 2 plots—8.5 bushels per acre.
(2) Artificial fertilizers used singly—average of 6 plots—11.4 bushels per acre.
(3) Two artificial fertilizers used on each plot—average of 6 plots—14 bushels per acre.
(4) Complete fertilizers.
(*a*) Phosphoric acid and potash with *different rations of nitrate of soda, nothing.*
(*b*) Nitrogen mixture and potash with different rations of *insoluble phosphoric acid*—average of three plots—14.9 bushels per acre.
(*c*) Nitrogen mixture and potash with different rations of *sulphate of lime*—average of 3 plots—14.9 bushels per acre.
(*d*) Sodium Nitrate and Superphosphate of lime with different rations of *muriate of potash*—average of three plots—17.1 bushels per acre.
(*e*) Superphosphate of lime and muriate of potash with different rations of *ammonium sulphate*—average of three plots—19.4 bushels per acre.
(*f*) Nitrogen mixture and muriate of potash with different rations of *soluble phosphoric acid*—average of three plots—20.9 bushels per acre,

(*g*) Nitrogen mixture and muriate of potash with different rations of *precipitated phosphoric acid*—average of three plots—21.9 bushels per acre.

(*h*) *Farm-yard manure*—fifteen tons per acre—average of two plots—22.9 bushels per acre.

(*i*) Muriate of lime and superphosphate of lime with different rations of *dried blood*—average of three plots—23.7 bushels per acre.

The remarks made on the results of these plots last year, cannot be given this year, Professor Brown having most liberally drained the field. The brilliant prospects of early summer were, this year, destroyed by rust.

2. Amount and composition of rain water collected from the large rain gauge of experimental field.

Through the active co-operation of Professor Brown, the laboratory of the experimental field was in structure and furnishings complete at the end of July. Since the first of October, the educational work of the College has kept me actively engaged; in consequence, there has been little time for practical work.

Since the first of June an account has been kept of the amount of the rain water, and of the nitrogen, in the form of ammonia and nitric acid, which the rain water held.

The amount of chlorine has been in most cases so small we have given it no place in this year's return.

To determine the sulphuric acid, rain water in which all the rains were represented, was taken.

By enlarging the work we have already done, we hope, at the end of 1885, to be able to give the full composition of the rain water that falls upon Guelph.

In the following table, the date of the rain fall, its depth in inches, the nitrogen as free ammonia and as nitric acid, and the sulphuric acid which it contains, are given in parts per million; there is also given the direction the wind blew on the rainy days.

AMOUNT AND COMPOSITION of Rain-Water from June 1st to end of year 1884.

RATE OF RAINFALL.		DEPTH IN INCHES.	NITROGEN AS FREE AMMONIA.	NITROGEN AS NITRIC ACID.	SULPHURIC ACID.	Direction of Wind.
Month.	Day.		Per million of Rain.	Per million of Rain.	Per million of Rain.	
June	2nd	0.014	1.300	0.24		W. S.W. W.
"	3rd	0.006	1.800			W. N.W. N.
"	8th	0.520	0.182	0.069		S.W.
"	10th	0.082	0.250	0.10		E. N.E. N.
"	21st	0.632	0.750	0.12		E. W. N.W.
"	23rd	0.006	2.700	0.096		S.E. S.W.
"	24th	0.246	0.135	0.17		S.W. W.
"	25th	0.566	1.470	0.12		N.E.
July	4th	0.382	0.900	0.26		E. S.E. S.
"	5th	0.222	0.422	0.25		S.W.
"	12th	0.416	0.140	0.053		S.W.
"	18th	0.006	2.800	0.178		N.W. W. S.W.
"	23rd	0.018	2.000	0.14		W.
"	24th	0.098	0.396	0.117		W.
"	27th	0.294	0.376	0.047		W.
"	31st	0.719	0.149	0.096		S. N.W. N.
August	4th	0.688	0.168	0.14		S.W. W. N.W.
"	5th	0.239	0.418	0.062		N.W. S.W. S.W.
"	12th	0.072	2.700	0.053		S.W. S.E. S.E.
"	26th	0.044	0.254	0.085		W. N.W.
"	28th	0.738	0.240	0.102		S.W. S.E.
"	31st	0.060	0.566	0.099		W. N.W.
September	6th	0.084	0.798	0.151		W.
"	7th	0.312	0.921	0.103		W.
"	10th	0.118	1.220	0.150		S.W. S.
"	15th	0.014	1.804	0.120	The rain-water	S. S.W.
"	16th	0.016	3.875	0.130	in which all the	S.W.
"	19th	0.156	1.344	0.060	rains were re-	N.W.
"	21st	0.156	0.611	0.060	presented, gave	N.W. S.W.
"	22nd	0.616	0.712	0.080	0.270.	W. E.
"	23rd	0.210	0.712	0.155		N.E. E.
"	24th	0.620	0.306	0.040		S. S.W.
"	26th	0.786	0.081	0.060		N.W. S.W.
"	27th	0.258	0.093	0.040		S.W.
"	28th	0.067	0.435	0.050		S.W.
"	30th	0.031	0.632	0.040		S.E. S.
October	1st	0.213	0.083	0.050		W. N. N.E.
"	2nd	0.241	0.076	0.050		N.E. E.
"	4th	0.081	0.464	0.070		N.E.
"	5th	0.053				N.E.
"	8th	0.248	0.547	0.080		N.E.
"	11th	0.624	0.365	0.045		S.W.
"	15th	0.020	1.190	0.070		N. S.W.
"	17th	0.074	0.408	0.080		N.W.
"	19th	0.015	0.680	0.070		S.W.
"	21st	0.888	0.260	0.076		S.E. S.W.
"	22nd	0.070	0.431	0.030		W.
"	23rd	0.050	0.461	0.090		W.
"	24th	0.098				W. S.W.
"	26th	0.130	0.451	0.030		E.
"	27th	0.032	0.203	0.080		S.W.
"	31st	0.254	0.491	0.060		E.S. S.W.
November	1st	0.330	0.909	0.104		W. S.W. N.W.
"	4th	0.750	0.175	0.085		E. S.W
December	7th	0.540	0.413	0.094		S.W. W.

3. Amount and composition of the drainage-water from the six drain gauges of the experimental field.

The structure of these drain-gauges or lysimeters was given in last year's report. Lysimeters Nos. I., II., and III. were filled with soil of one of the experimental field plots; a characteristic loam was placed in No. IV.; a stiff clay in No. V.; and a light sandy soil in No. VI.

Upon lysimeter No. I., a permanent pasture sod was placed. It received, June 21st, a dressing of 2.8 lbs, of farm-yard manure.

Lysimeter No. II. was treated as a bare fallow. June 9th, the first plowing took place; June 21st, 2.8 lbs. of farm-yard manure were plowed under and the soil harrowed.

Upon lysimeter No. III. a crop was grown. May 14th, 2.8 lbs. of farm-yard manure were plowed under, and Russian Spring Wheat sown.

Lysimeter Nos. IV., V. and VI., containing the loam clay and sand, have been treated in like manner. The manures used for these plots were of like quality and of equal weight. June 16th, the three soils were sown with Swedish turnips. The plants appeared above ground on the loam, June 21st; on the sand, June 23rd; and on the clay, the plant growth was so slow at the beginning, some feared no growth would take place. July 9th, the plants were hoed and thinned, the roots of the seed of No. V. appearing very small.

We have only received drainage water from two of the lysimeters, Nos. II. and V. The first drainage water came from the clay, the first drops falling the first week in May. May and June, the drainage water from the clay amounted to 2010 c.c.; July and August, 1939 c.c.; September and October, 8145 c.c.; and November, 12600 c.c.

From No. II., the lysimeter treated as a bare fallow, the first drainage water became visible July 9th; it was not, however, until the end of October that sufficient water for full analysis was forthcoming. The drainage water from the fallow at the end of October was, 4860 c.c.; at the end of November it amounted to, 7842 c.c.

We shall now indicate the composition of the drainage water by the use of two columns of figures—the solid matter lost by a lysimeter forming the first, and the loss per acre the second.

LYSIMETER NO. V.—CLAY.

I.—May and June.

1. *Lysimeter Loss.* 2. *Loss per Acre.*

	Grammes.	Grammes.
1. Silica		
2. Alumina and Ferric Oxide	0.0048	48.0
3. Lime	.....	. ...
4. Magnesia	0.2072	2072.0
5. Sulphuric Acid	0.0044	44.0
6. Phosphoric Acid	0.0052	52.0
7. Alkalies in form of Chlorides	0.0056	56.0
	0.0427	427.0

Per million of drainage water,

1. Nitrogen as free Ammonia	
2. Nitrogen as Nitric Acid	0.201
	0.177

II.—July and August.

1. *Lysimeter Loss.* 2. *Loss per Acre.*

	Grammes.	Grammes.
1. Silica	0.0192	192.0
2. Alumina and Ferric Oxide	.....	.....
3. Lime	0.1908	1908.0
4. Magnesia	0.0016	16.0
5. Sulphuric Acid	0.0049	49.0
6. Phosphoric Acid	0.0040	40.0
7. Alkalies in form of Chlorides	0.0356	356.0

Per million of Drainage water,

1. Nitrogen as free Ammonia	0.211
2. Nitrogen as Nitric Acid	0.187

II.—September and October.

1. *Lysimeter Loss.* 2. *Loss per Acre.*

	Grammes.	Grammes.
1. Silica	0.1800	1800.0
2. Alumina and Ferric Oxide	.....	.....
3. Lime	0.8878	8878.0
4. Magnesia	0.0904	904.0
5. Sulphuric Acid	0.0179	179.0
6. Phosphoric Acid	0.0236	236.0
7. Alkalies in form of Chlorides	0.1050	1050.0

Per million of drainage water,

1. Nitrogen as free Ammonia	0.213
2. Nitrogen as Nitric Acid	0.125

IV.—November.

1. *Lysimeter Loss.* 2. *Loss per Acre.*

	Grammes.	Grammes.
1. Silica	0.0680	680.0
2. Alumina and Ferric Oxide	0.0340	340.0
3. Lime	1.4099	14099.0
4. Magnesia	0.1247	1247.0
5. Sulphuric Acid	0.0932	937.0
6. Phosphoric Acid	0.0315	315.0
7. Alkalies in form of Chlorides	0.5644	5644.0

Per million of drainage water,

1. Nitrogen as free Ammonia	0.162
2. Nitrogen as Nitric Acid	0.156

LYSIMETER NO. II.—BARE FALLOW.

I.—September and October.

	1. *Lysimeter Loss.* Grammes.	2. *Loss per Acre.* Grammes.
1. Silica	0.0247	247.0
2. Alumina and Ferric Oxide	.....	.....
3. Lime	0.3781	3781.0
4. Magnesia	0.2148	2148.0
5. Sulphuric Acid	0.0233	233.0
6. Phosphoric Acid	0.0106	106.0
7. Alkalies in form of Chlorides	0.1817	1817.0

Per million of drainage water,

1. Nitrogen as free Ammonia	0.236
2. Nitrogen as Nitric Acid	0.201

II.—November.

	1. *Lysimeter Loss.* Grammes.	2. *Loss per Acre.* Grammes.
1. Silica	0.0235	235.0
2. Alumina and Ferric Oxide	0.0196	196.0
3. Lime	0.8414	8414.0
4. Magnesia	0.2917	2917.0
5. Sulphuric Acid	0.0823	823.0
6. Phosphoric Acid	0.0164	164.0
7. Alkalies in form of Chlorides	0.3544	3544.0

Per million of drainage water,

1. Nitrogen as free Ammonia	0.174
2. Nitrogen as Nitric Acid	0.219

3. Soil Temperature.

The "series of experiments for the purpose of ascertaining some facts in reference to the temperature of different soils exposed to similar conditions," promised by Professor Panton in the report of 1881, and by the writer in the report of 1882, were commenced in the spring of this year. The soil thermometers were purchased from J. and H. T. Green, 757 Broadway, New York, and were inserted in the soil, first, one inch; second, three inches; third, six inches; fourth, nine inches; fifth, twelve inches; sixth, twenty-four inches; seventh, thirty-six inches; and eighth, forty-eight inches. Between the first of May and the first of November, the variations in soil temperature, at these different depths, were closely followed. Three readings were taken daily, 7 a.m., 2 p.m., and 9 p.m. The maximum, minimum, and mean of these readings are given in the following table:

May.

1. Thermometer, No. 1; depth in soil, 1 inch.
   Maximum temperature, 25th, 2 p.m., 78.3°.
   Minimum " 3rd, 7 a.m., 36.5°.
   Mean " of month, 53.3°.

2. Thermometer, No. 2; depth in soil, 3 inches.
Maximum temperature, 25th, 2 p.m., 77.3°.
Minimum " 3rd, 7 a.m., 37°.
Mean " of month, 42.2°.

3. Thermometer, No. 3; depth in soil, 6 inches.
Maximum temperature, 25th, 2 p.m., 72°.
Minimum " 16th, 17th, 7 a.m., 40.5°.
Mean " of month, 52.6°.

4. Thermometer, No. 4; depth in soil, 9 inches.
Maximum temperature, 25th, 2 p.m., 63.5°.
Minimum " 11th, 16th, 7 a.m., 42.°.
Mean " of month, 50.9°.

5. Thermometer, No. 5; depth in soil, 12 inches.
Maximum temperature, 25th, 9 p.m., 59.5°.
Minimum " 11th, 7 a.m.; 15th, 9 p.m.; 16th, 7 a.m., 44°.
Mean " of month, 49.4°.

6. Thermometer, No. 6; depth in soil, 24 inches.
Maximum temperature, 26th, 2 p.m., 56°.
Minimum " 4th, 2 p.m., 7 a.m., 44°.
Mean " of month, 52.4°.

7. Thermometer, No. 7; depth in soil, 36 inches.
Maximum temperature, 28th, 2 p.m., 50.5°.
Minimum " 1st, 7 a.m., 42°.
Mean " of month, 45.8°.

8. Thermometer, No. 8; depth in soil, 48 inches.
Maximum temperature, 27th, 29th, 30th, 31st, *steady*, 48°.
Minimum " 1st, 2nd, 3rd, *steady*, 41°.
Mean " of month, 44.4°.

June.

1. Thermometer, No. 1; depth in soil, 1 inch.
Maximum temperature, 17th, 2 p.m., 99.5°.
Minimum " 14th, 9 p.m., 48°.
Mean " of month, 70.8°.

2. Thermometer, No. 2; depth in soil, 3 inches.
Maximum temperature, 30th, 2 p.m., 98°.
Minimum " 13th, 9 p.m., 51°.
Mean " of month, 70.4°.

3. Thermometer, No. 3; depth in soil, 6 inches.
Maximum temperature, 30th, 2 p.m., 86.5°.
Minimum " 15th, 26th, 7 a.m., 54°.
Mean " of month, 68.8°.

4. Thermometer, No. 4; depth in soil, 9 inches.
Maximum temperature, 20th, 22nd, 23rd, 30th., 2 p.m., 77°.
Minimum " 15th, 26th, 27th, 7 a.m., 56°.
Mean " of month, 66.5°.

5. Thermometer, No. 5 ; depth in soil, 12 inches.
Maximum temperature, 22nd, 9 p.m., 71.7°.
Minimum " 7th, 9th p.m., 55.5°.
Mean " of month, 63.2°.

6. Thermometer, No. 6 ; depth in soil, 24 inches.
Maximum temperature, 25th, 7 a.m., 65°.
Minimum " 1st, 7 a.m. and 2 p.m., 52°.
Mean " of month, 58.7°.

7. Thermometer, No. 7 ; depth in soil, 36 inches.
Maximum temperature, 26th, 7 a.m., 60.7°.
Minimum " 1st, 7 a.m., 2 p.m., 49°.
Mean " of month, 55.8°.

8. Thermometer, No. 8 ; depth in soil, 48 inches.
Maximum temperature, 26th, 27th, steady, 30th, 57.4°.
Minimum " 1st, 2nd, steady, 48°.
Mean " of month, 52.9°.

July.

1. Thermometer, No. 1 ; depth in soil, 1 inch.
Maximum temperature, 29th, 2 p.m., 99°.
Minimum " 14th, 9 p.m., 50°.
Mean " of month, 69.6°.

2. Thermometer, No. 2 ; depth in soil, 3 inches.
Maximum temperature, 1st, 3rd, 2 p.m., 95.5°.
Minimum " 15th, 7 a.m., 50.5°.
Mean " of month, 68°.

3. Thermometer, No. 3 ; depth in soil, 6 inches.
Maximum temperature, 27th, 2 p.m., 92°.
Minimum " 15th, 7 a.m., 51°.
Mean " of month, 67.6°.

4. Thermometer, No. 4 ; depth in soil, 9 inches.
Maximum temperature, 1st, 2 p.m., 78.5°.
Minimum " 15th, 7 a.m., 54°.
Mean " of month, 67.3°.

5. Thermometer, No. 5 ; depth in soil, 12 inches.
Maximum temperature, 1st, 9 p.m., 72.2°.
Minimum " 13th, 2 p.m., 53°.
Mean " of month, 64°.

6. Thermometer, No. 6 ; depth in soil, 24 inches.
Maximum temperature, 1st, 9 p.m., 74.5°.
Minimum " 13th, 2 p.m., 52°.
Mean " of month, 62°.

7. Thermometer, No. 7 ; depth in soil, 36 inches.
Maximum temperature, 31st, 2 p.m., 9 p.m., 61.5°.
Minimum " steady, 16th, 17th, 18th, 19th, 20th, 21st, 58.5°.
Mean " of month, 60.1°.

8. Thermometer, No. 8 ; depth in soil, 48 inches.
Maximum temperature, 31st, 9 p.m., 59.5°.
Minimum " 19th, 22nd and 23rd, 57.2°.
Mean " of month, 57.7°.

August.

1. Thermometer, No. 1 ; depth in soil, 1 inch.
Maximum temperature, 19th, 20th, 2 p.m., 99°.
Minimum " 23rd, 9 p.m., 50°.
Mean " of month, 69.3°.

2. Thermometer, No. 2 ; depth in soil, 3 inches.
Maximum temperature, 20th, 2 p.m., 98.5°.
Minimum " 28th, 31st, 51°.
Mean " of month, 68.8°.

3. Thermometer, No. 3 ; depth in soil, 6 inches.
Maximum temperature, 20th, 2 p.m., 85°.
Minimum " 28th, 7 a.m., 50°.
Mean " of month, 67.1°.

4. Thermometer, No. 4 ; depth in soil, 9 inches.
Maximum temperature, 20th, 2 p.m., 77°.
Minimum " 31st, 9 p.m., 51°.
Mean " of month, 68.5°.

5. Thermometer, No. 5 ; depth in soil, 12 inches.
Maximum temperature, 21st, 9 p.m., 73°.
Minimum " 10th, 7 a.m., 60°.
Mean " of month, 65.1°.

6. Thermometer, No. 6 ; depth in soil, 24 inches.
Maximum temperature, 15th, 9 p.m., 21st, 2 p.m., 69°.
Minimum " 10th, 7 a.m., 61°.
Mean " of month, 63.9°.

7. Thermometer, No. 7 ; depth in soil, 36 inches.
Maximum temperature, 21st, 22nd, *steady*, 64°.
Minimum " 12th, 13th, *steady*, 60.5°.
Mean " of month, 61.9°.

8. Thermometer, No. 8 ; depth in soil, 48 inches.
Maximum temperature, 23rd, 24th, *steady*, 62°.
Minimum " 1st, 9 p.m., 59.1°.
Mean " of month, 60.5°.

September.

1. Thermometer, No. 1 ; depth in soil, 1 inch.
Maximum temperature, 5th, 10th, 2 p.m., 95°.
Minimum " 2nd, 9 p.m., 43°.
Mean " of month, 64.3°.

2. Thermometer, No. 2 ; depth in soil, 3 inches.
Maximum temperature, 5th, 10th, 2 p.m., 92°.

Minimum temperature, 20th, 9 p.m., 45°.
Mean " of month, 64.5°.

3. Thermometer No. 3; depth in soil, 6 inches.
Maximum temperature, 10th, 2 p.m., 83°.
Minimum " 26th, 7 a.m., 48°.
Mean " of month, 63.4°.

4. Thermometer, No. 4; depth in soil, 9 inches.
Maximum temperature, 10th, 2 p.m., 75.5°.
Minimum " 9th, 7 a.m., 47.8°.
Mean " of month, 62.8°.

5. Thermometer, No. 5; depth in soil, 12 inches.
Maximum temperature, 11th, 9 p.m., 71°.
Minimum " 23rd, 7 a.m., 2 p.m., 55°.
Mean " of month, 62°.

6. Thermometer, No. 6; depth in soil, 24 inches.
Maximum temperature, 10th, 18th, *steady*, 66.5°.
Minimum " 24th, *whole day*, 57.5°.
Mean " of month, 60.4°.

7. Thermometer, No. 7; depth in soil, 36 inches.
Maximum temperature, 11th, *whole day*, 63.5°.
Minimum " 25th, 7 a.m., 2 p.m., 58°.
Mean " of month, 60.6°.

8. Thermometer, No. 8; depth in soil, 48 inches.
Maximum temperature, 13th, 7 a.m., 2 p.m., 61.8°.
Minimum " 25th, 2 p.m., 58°.
Mean " of month, 59.9°.

October.

1. Thermometer No. 1; depth in soil 1 inch.
Maximum temperature, 5th, 2 p.m., 78°.
Minimum " 23rd, 9 p.m., 29°.
Mean " of month, 48°.

2. Thermometer, No. 2; depth in soil, 3 inches.
Maximum temperature, 5th, 2 p.m., 77°.
Minimum " 9th, 14th, 7 a.m., 32.5°.
Mean " of month, 48.3°.

3. Thermometer, No. 3; depth in soil 6 inches.
Maximum temperature, 4th, 2 p.m., 69.5°.
Minimum " 14th, 7 a.m., 34°.
Mean " of month, 50.2°.

4. Thermometer, No. 4; depth in soil, 9 inches.
Maximum temperature, 4th, 5th, 66°.
Minimum " 26th, 29th, 37°.
Mean " of month, 51°.

5. Thermometer, No. 5; depth in soil, 12 inches.
Maximum temperature, 4th, 2 p.m. 61.5°.
Minimum " 29th, 7 a.m., 39°.
Mean " of month, 51.7°.

6. Thermometer, No. 6; depth in soil, 24 inches.
Maximum temperature, 2nd, 2 p.m., 9 p.m., 61°.
Minimum " 30th, 7 a.m., 46.5°.
Mean " of month, 53.8°.

7. Thermometer No. 7; depth in soil, 36 inches.
Maximum temperature, 2nd, *whole day*, 59.5°.
Minimum " 30th, 31st, *whole days*, 49°.
Mean " of month, 54.9°.

8. Thermometer, No. 8; depth in soil, 48 inches.
Maximum temperature, 1st, 2nd, 3rd, 4th, *steady*, 58.5°.
Minimum " 31st, *whole day*, 50.5°.
Mean " of month 55.4°.

Summary of Observations with Soil Thermometers.

MONTH.	No. 1. 1 Inch.			No. 2. 3 Inches.			No. 3. 6 Inches.			No. 4. 9 Inches.			No. 5. 12 Inches.			No. 6. 24 Inches.			No. 7. 36 Inches.			No. 8. 48 Inches.		
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
May	78.3	36.5	53.3	77.3	37	42.2	72	41*	52.6	63.5	*42	50.9	59.5	*44	49.4	56	*44	57.4	50.5	42	45.8	*48	*41	44.4
June	99.5	48	70.8	98	51	70.4	86.5	54	68.8	*77	*56	66.5	71.7	55.5	63.2	65	*52	58.7	60.7	49	55.8	*57.4	*48	52.9
July	99	50	69.6	*95.5	50.5	68	92	51	67.6	78.5	54	67.3	72.2	53	64	74.5	52	62	*61.5	*58.5	60.1	59.5	*59.2	57.7
August	99*	50	69.3	98.5	51*	68.8	85	50	67.1	77	51	68.5	73	60	65.1	*69	61	63.9	*64	*60.5	61.9	*62	*59.3	60.5
September	92*	43	64.3	*92	45	64.5	83	48	63.4	75.5	47.8	62.8	71	*55	62	*66.5	*57.5	60.4	*63.5	*58	60.6	*61.8	*58.2	59.9
October	78	29	48	77	32.5	48.3	69.5	34	50.2	*66	*37	51	61.5	39	51.7	61	46.5	53.8	*59.5	*49	54.9	*58.5	*50.5	55.4

*Occurrence more than once.

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	MAY. 1	2	3	4	5	6	7	8	9	10
No. 1.	1 inch.	7 a.m.	61	61.8	59.5	59.5	67	66	71.8	73	71.2	50.5
		2 p.m.	84	85	84.2	88.3	86.6	81	82.5	78	76	59
		9 p.m.	81	62	61.5	64.3	68	64.3	64.5	66	52.5	56.5
No. 2.	3 inches	7 a.m.	57	58.5	59.2	56.6	62.2	63.5	66.5	68	67.8	51.7
		2 p.m.	79	81.8	81.7	84.5	83.3	81	82.5	79	78	59
		9 p.m.	61	64	63.5	66.3	69	66.3	67	67	55	56.5
No. 3.	6 inches	7 a.m,	57	56.5	58.5	56	58.8	61.5	60	64	62.8	55
		2 p.m.	78	72.5	72.8	75.2	75.9	74.5	76.2	78	76	58
		9 p.m.	68	67	67.2	69.5	71	69.5	69	71	60	56
No. 4.	9 inches	7 a.m.	57	56	58.2	57.3	59.2	62	60.5	65	63	57.5
		2 p.m.	65	64.8	65.2	66.7	67.8	68.5	70	75	70.3	58
		9 p.m,	63	66	66.2	68.3	69	68.3	69	70	64.5	56.5
No. 5.	12 inches	7 a.m.	56	55.8	58	58.2	60	61.5	61	64	63	60
		2 p.m.	59	57.2	58.2	59.5	61	62.2	62	66	63.7	58.5
		9 p.m.	56	60.5	61.7	63	64	63	55.5	66	64.5	57.5
No. 6.	24 inches	7 a.m.	52	52.5	54	55	56.2	57	58	59	59	59
		2 p.m.	52	53	54.7	55.5	56.3	57	57.8	60	59	58.5
		9 p.m.	52.5	53	54.7	55.5	56.5	55.3	58	58.5	59	57
No. 7.,	36 inches	7 a.m.	49	49.3	50	51	52	52.5	53.5	54	54.6	55
		2 p.m.	49	50	50.7	51.5	52.5	53	53.7	54	54.7	55
		9 p.m.	49.3	50	50.7	51.5	52.5	51.5	54	54.2	55	54.8
No. 8.	48 inches	7 a.m.	48	48	49.2	48.7	49.2	50	50.5	51	51.4	5.17
		2 p.m.	48	48	48.7	49	49.5	50	50.1	51	51.7	52
		9 p.m.	48	48.2	48.7	49	49.7	50	51	51.2	51.7	52

of the Experimental

AY.

	6	7	8	9	10
	66	71.8	73	71.2	50.5
	81	82.5	78	76	59
	64.3	64.5	66	52.5	56.5
	63.5	66.5	68	67.8	51.7
	81	82.5	79	78	59
	66.3	67	67	55	56.5
	61.5	60	64	62.8	55
	74.5	76.2	78	76	58
	69.5	69	71	60	56
	2	60.5	65	63	57.5
	8.5	70	75	70.3	58
	8.3	69	70	64.5	56.5
	1.5	61	64	63	60
	2.2	62	66	63.7	58.5
	3	55.5	66	64.5	57.5
		58	59	59	59
		57.8	60	59	58.5
	.3	58	58.5	59	57
	.5	53.5	54	54.6	55
		53.7	54	54.7	55
	.5	54	54.2	55	54.8
		50.5	51	51.4	5.17
		50.1	51	51.7	52
		51	51.2	51.7	52

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, MAY, 1884.

Thermometer

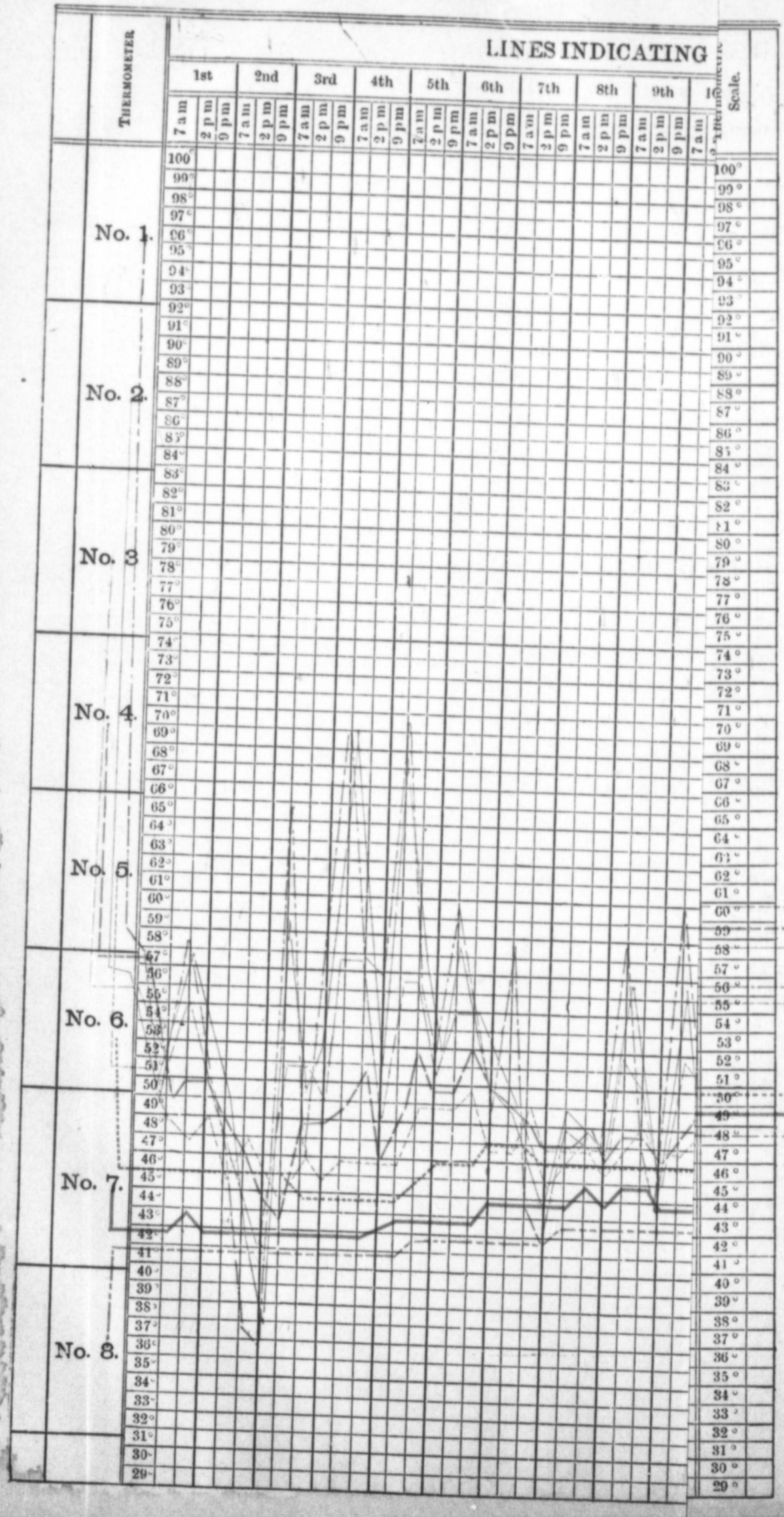
No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m · 2 p m · 9 p m

Thermometric Scale.

100° 99° 98° 97° 96° 95° 94° 93° 92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76° 75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°



Field at De

11	12	13
56.5	63	56.5
67	83	62.5
61.7	60.5	51
56.5	62.5	56
66.6	82.3	74.8
62.2	62.8	51
56.5	60.8	56.8
59.6	76	69.5
61.3	68.5	62
57.5	59.8	58.8
57.5	68.5	64.2
59	68.2	63
57.5	59	60.5
59	gl	60.2
58.7	64.2	64
57	57	58
57	57	58
56.5	67.5	58
54.8	54.5	54.5
54.8	54.5	54.7
54.6	54.5	54.8
52	52.2	52.3
52.2	52.3	52.3
52.2	52.3	52.3

Field at Depths varying from 1 to 48 inches.

MAY.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
56.5	63	56.5	53.5	62	65.8	72.5	77	69.5	74	69	79.5	74	73.5	57.5	58	65	66.8	67.8	65.8	....
67	83	62.5	77	85.8	95.8	99.5	91.8	91.3	96	93	91	75.8	84	57.5	74.3	94.8	94	97.5	99	....
61.7	60.5	51	48	64	67	69	71	74	75	66	73.5	71	70.5	49.5	54	57	64	66.4	67	....
56.5	62.5	56	53.6	59	61.2	70	73.5	89	70	69	75.5	72	72	60.5	55.5	61.5	62.8	64	63	....
66.6	82.3	74.8	76.7	85	93.5	96	89.8	87.3	92	88	90	76.2	82.5	58.8	73.8	94	93	96	98	....
62.2	62.8	51	53	69	70	72.5	73	67.2	76	67	74.5	72	71.5	52	55.5	57	67.5	70	72	....
56.5	60.8	56.8	55	54	56	62.3	65.8	79.5	66	69	67.5	65	68	65.8	54	55.4	67	60.5	61.8	....
59.6	76	69.5	69	74.2	80.2	83.2	81.8	79.8	83.3	79	84.5	78.5	79	61.3	68.5	83	81	84.8	86.5	....
61.3	68.5	62	61	71	73.5	76.5	75.4	73	77.5	70.5	76.8	74	73.8	59	63	71	74	75.5	74	....
57.5	59.8	58.8	56.8	56	57.2	62.2	65	66.8	66.4	69	66.5	64	68.5	68	56	56	68.4	62	64	....
57.5	68.5	64.2	63.5	66.5	70.3	73.8	75.2	73.5	77	74	77	77	69.5	63.5	64.8	73	72	75.7	77	....
59	68.2	63	62.5	71	72.2	74.8	74	73	75.8	71.5	75.8	72	70.8	62	64.8	65	73.5	75.7	76	....
57.5	59	60.5	59	59	59.5	62.6	64.8	66	66.5	68	67.5	69	61.5	68	60.5	60	61.5	65	66.5	....
59	g1	60.2	59.2	59.5	61.2	64.5	66.5	66.8	68.5	68	68.8	71	68.5	65.8	61.8	64	72	66	67.8	....
58.7	64.2	64	62	65	66	68.5	69	69	70.5	69.5	71.7	70	70.8	64	63.8	62	69	70.5	61	....
57	57	58	58	57.5	58	59.1	60.5	61.5	62.5	63	64	63	64.5	65	62.7	91.5	61.5	62.5	63.5	....
57	57	58	58	57.5	58	59.3	60.5	61.5	62.5	63	64	63.5	64.5	64.5	60.2	61.5	60	62.4	63.5	....
56.5	67.5	58	57.5	58	58.2	59.5	61	62	62.5	63.5	64.3	64	64.5	64	61.6	61	61.8	62.5	60	....
54.8	54.5	54.5	54.8	55	55	55.3	56	56.7	57.5	58.2	59.4	59	59.8	60	60.7	59.5	60	59	59.5	....
54.8	54.5	54.7	55	55	55.2	55.5	56.3	57	58	58.5	59.5	59	60	60.4	60.4	59.5	60	59.5	60	....
54.6	54.5	54.8	55	55	55.2	55.5	56.3	57.5	58	58.5	59.6	59	60.2	60.4	60	59.5	59	59.5	60	....
52	52.2	52.3	52.3	52.6	52.8	53	53.5	53.8	54.4	55	55.2	55	56.5	57	57	57.4	57	57	57	....
52.2	52.3	52.3	52.5	52.8	53	53.2	53.5	54	54.6	55.3	56.3	55.1	56.8	57	57.4	57.2	57	57	57.4	....
52.2	52.3	52.3	52.2	52.8	53	53.3	53.7	54.4	54.8	55.3	56.3	55.1	56.8	57	57.2	57	57	57	57.4	....

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	JUNE. 1	2	3	4	5	6	7	8	9	10
No. 1	1 inch	7 a.m.	66.5	66.5	66	64.5	65	62	58.3	60.5	59.7	62.5
		2 p.m.	97.5	89	98	66.5	78.1	77	78.5	85.8	85	86.5
		9 p.m.	71.5	65	68	65.5	57.8	56	55	56.5	59	59.5
No. 2	3 inches	7 a.m.	73.5	64.5	63.5	65.5	65.5	64	57	57.8	58.5	60
		2 p.m.	95.5	87	95.5	67.5	76	77	76.5	83	82	82
		9 p.m.	73.5	67.5	70	66	59	58	58	60	62	63
No. 3	6 inches	7 a.m.	66	65	61.5	66	65.2	63	56.5	55	55.5	59
		2 p.m.	87	81	85.5	67.5	72.3	72	71	75	77	75
		9 p.m.	78	73	75	68	65	61	64.8	67	67.5	68.5
No. 4	9 inches	7 a.m.	67	67	64	67	65	61	57.8	57.2	58	60.5
		2 p.m.	78.5	75	77	67.5	69	67	65.5	68.5	70.5	69.5
		9 p.m.	77	73.5	75	68	67.5	62	66	68	67.5	69
No. 5	12 inches	7 a.m.	68	68.5	66.8	67.7	65.3	60	60.3	61	61.8	62.5
		2 p.m.	69	69	68	67	65.8	61	61	62	62	64
		9 p.m.	72.2	70.3	71	67	67	62	64.2	65.5	65.5	66.5
No. 6	24 inches	7 a.m.	64.5	65	65	64.8	64	61	61.9	61.5	61.7	62
		2 p.m.	64.5	65	65	64.6	63.8	63	61.3	61.2	61.5	61.8
		9 p.m.	74.5	65	65.5	64.1	63.5	63	61.4	61.4	61.5	61.5
No. 7	36 inches	7 a.m.	60	60.5	61	61	61	60.5	60.5	60	59.5	59.5
		2 p.m.	60.4	61	61.2	61	61	60	60.2	60	59.8	59.8
		9 p.m.	60.5	61	61	61	61	60	60.1	59.7	59.8	59.8
No. 8	48 inches	7 a.m.	57.4	57.8	58	58.2	58.5	58.5	58.5	58.2	58	58
		2 p.m.	57.8	58	58.3	58.1	58.5	58.5	58.3	58.3	58	58
		9 p.m.	57.8	58	58.3	58.3	58.5	58.5	58.3	58	58	58

e Experimental

7	8	9	10
.3	60.5	59.7	62.5
.5	85.8	85	86.5
	56.5	59	59.5
	57.8	58.5	60
.5	83	82	82
	60	62	63
.5	55	55.5	59
	75	77	75
.8	67	67.5	68.5
.8	57.2	58	60.5
.5	68.5	70.5	69.5
	68	67.5	69
3	61	61.8	62.5
	62	62	64
2	65.5	65.5	66.5
9	61.5	61.7	62
3	61.2	61.5	61.8
4	61.4	61.5	61.5
5	60	59.5	59.5
2	60	59.8	59.8
1	59.7	59.8	59.8
5	58.2	58	58
3	58.3	58	58
3	58	58	58

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, JUNE, 1884,

Thermometer

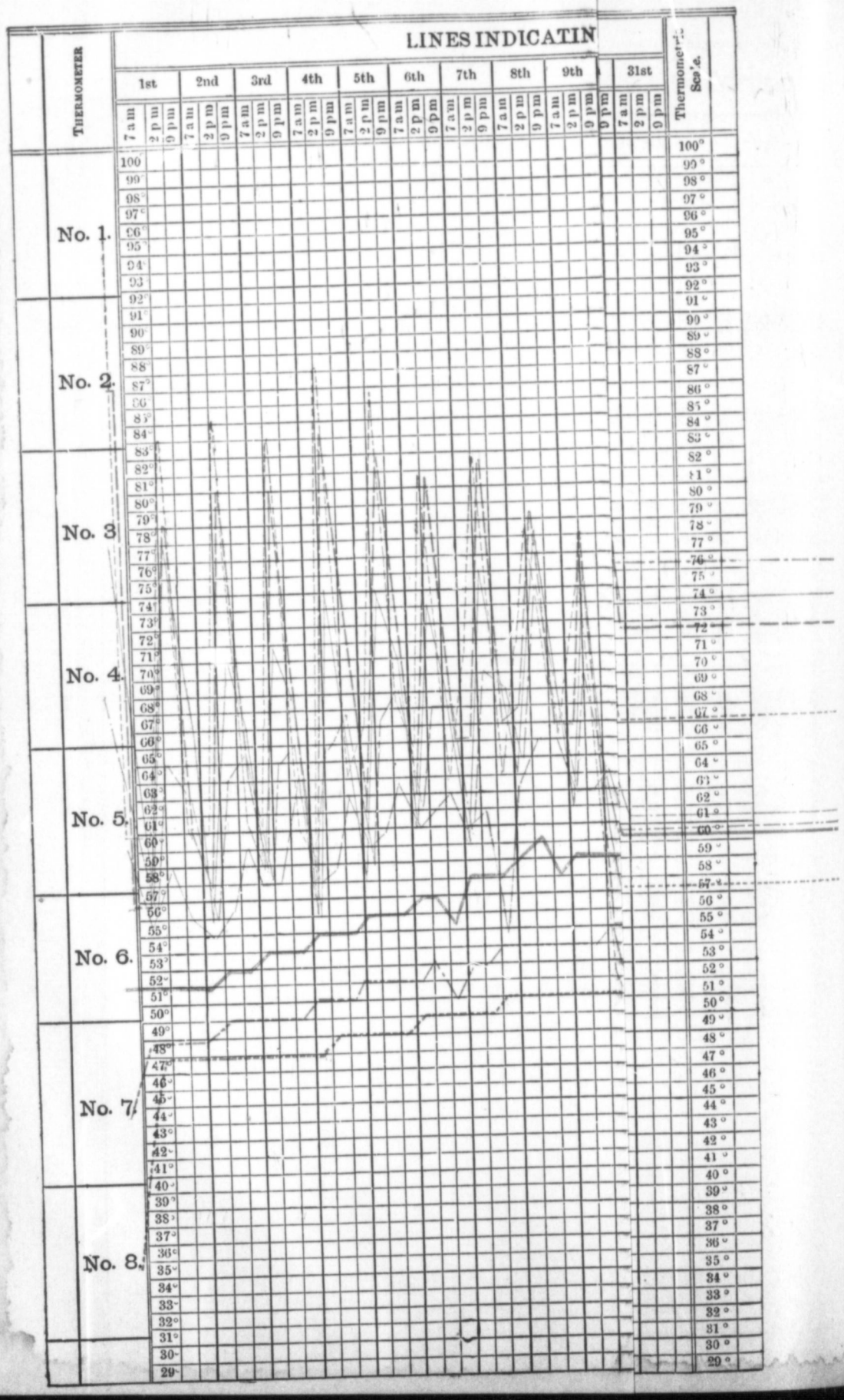
No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m | 2 p m | 9 p m

Thermometric Scale.

100° 99° 98° 97° 96° 95° 94° 93° 92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76° 75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°


LINES INDICATIN
THERMOMETER
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
31st
7 a m
2 p m
9 p m
Thermometer Scale.
No. 1.
No. 2.
No. 3
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

Field at Depths varying from 1 to 48 inches.

JUNE.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
63	61	69	54	51	59	60	62	61	61	59.5	55.5	66	70.5	67	66	74	66	65	69	64
91	90	57	67.7	72	67	84	81	78.5	78	83	86.5	82	84	86.5	92.5	98	96	99	89	73
64.5	61	52	50	53	57	59	58	59	57.5	59	67	65	67	58	62	65	67.5	67	66	57
59.5	62	65	53.5	50.5	56.5	59	60	60.5	76.8	57	55.5	65.3	66.5	81.5	63	75	62.5	63.5	65	64
86.8	84	55	66.5	69	65	80	80	76.5	79	80	85	79	78	86	90.5	94	92.5	95	89	72
67	62	54	53	55	58	61.5	57	61	60	61.5	68	67	67	62.5	65	68	69	70	68	59
57.5	63.5	59.5	54	51	54.5	57.5	75	60	62	55	57	64.1	61.8	62.8	59	75	59	63	62.5	65
78	72	55	64.8	65.8	61	70	78	68	70	70.8	72	69.5	69	78.5	79	92	80	82	80	69
71	66	60	60	61.5	61	65	67	66	65.5	66.5	71	70.5	72	70	72	74	73	74.5	72	64
60	64	59.5	56	54	56	58	58	61	60	57	59	64.1	63	64	61.5	70.5	61	64.5	64.5	67
70	65	54.5	62	65.5	57	65	69	65	60.5	66.5	66	66.9	67	72.5	71	74	71.5	74	74	66
70	67	62	62	65.5	61	66	69	66	65.5	66.5	69.1	69.5	69	71	72	71	72.5	74	72	66
63	64.7	62	59.5	58	58.5	59	60	61.5	61	60.5	61	63.8	63.8	64.5	64	65.5	63.5	65.5	66.5	66.5
64	65	53	60	59	58.5	60	62	61.5	61.5	61	61.2	64	65	65	65	67	65	67	67	66.5
67	65.5	62.8	62	61.5	60	62.5	64	64	64	64	65	66	66	68	68.5	62	68.5	70	69	66.5
62	63.5	62	61	60	59.5	59.5	60	60.5	60.5	60.5	61	61	62.8	62.1	63	63	63	64	64	64.5
62	63	52	60.5	59.8	59.5	59	60	60.5	60.5	60.5	60.3	61	60	62.5	63	63	63	63.5	64	64.5
62	62	61.3	60.5	59	59.5	59.5	60.5	60.5	60.5	60	60.1	61	62	63	63	63	62.5	64	64	64.5
59.5	59.7	59.7	59.7	59	58.5	58.5	58.5	58.5	58.5	58.5	58.9	58.8	59	59.2	60	60.2	60.5	60.5	61	61
59.9	59.7	58.7	59.5	59	58.5	58.5	58.5	58.5	58.5	58.9	58.8	59	59.2	59.9	60.2	60.2	60.5	60.8	61	61.5
59.5	59.7	59.7	59.5	59	58.5	58.5	58.5	58.5	58.5	58.9	58.5	59	59.2	60	60.2	60.2	60.5	60.8	61	61.5
58	58	58	58	58	57.5	57.5	57.5	57.3	57.3	57.5	57.5	57.2	57.5	57.8	58	58.2	58.5	58.5	59	59
58	58	58	58	58	57.5	57.5	57.5	57.2	57.5	57.5	57.3	57.5	57.5	58	58.2	58.5	58.5	59	59	53
58	58	58	58	58	57.5	57.5	57.5	57.2	57.5	57.5	57.2	57.5	57.8	58	58.2	58.5	58.5	59	59	59.5

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	JULY. 1	2	3	4	5	6	7	8	9	10
No. 1.	1 inch	7 a.m	59	59	60	67.8	63	61	57.5	58	56	58
		2 p.m	80	83	83	84	63.5	75	75.5	70	79.5	82
		9 p.m	54.5	60	68.5	60	54	62	57.1	54	54.6	56
No. 2	3 inches	7 a.m	56.8	56	62.1	66.2	62	57.5	59	57	55	56
		2 p.m.	76	81	82.5	81	65	74.5	75.8	70	77.5	79
		9 p.m.	57	65.5	69.5	61	57	62.5	59.1	57	58	59
No. 3	6 inches	7 a.m	56	55	57	65.5	61	55.5	61.5	57.5	54.5	55
		2 p.m.	71	72	77	73	68	70	71	68	69	71
		9 p.m.	64	69.5	71	65	62	65.5	64.8	63	65	68
No. 4	9 inches	7 a.m	58.5	58	59	65.9	62.5	58	62.5	60	57.5	64
		2 p.m.	67	70	71.5	70	67.5	66	66.5	65	65	65
		9 p.m.	65.8	69	70.5	68	64	66	66.1	66	66	65.5
No. 5	12 inches	7 a.m	62.5	62	65.5	65.9	64	62	63.5	62.5	61	60
		2 p.m.	63	64	65.5	66.5	64.5	62.5	63.8	62.8	61.8	61.5
		9 p.m.	65.3	65.5	67.5	67	64.5	65	65.1	64.2	64.5	63
No. 6	24 inches	7 a.m	63.5	63	63	63.3	64	62.5	62.6	62.5	62.5	61
		2 p.m.	63	63	62.5	83.5	63.5	62.5	62.5	62.5	62	61.8
		9 p.m.	63	63	63	64	63.5	62.5	62.5	62.5	62	61.8
No.	36 inches	7 a.m	61.5	61.5	61	60.9	61	61	61	61	61	60.8
		2 p.m.	61.5	61.5	61	61	61.3	61	61	61	61	60.8
		9 p.m.	61	61.5	61	61	61.5	61	61	61	61	60.8
No. 8	48 inches	7 a.m	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5
		2 p.m.	59.5	59.5	59.3	59.5	59.5	59.5	59.5	59.5	59.5	59.5
		9 p.m.	59.1	59.5	59.3	59.5	59.5	59.5	59.5	59.5	59.5	59.5

the Experimental

.

6	7	8	9	10
	57.5	58	56	58
	75.5	70	79.5	82
	57.1	54	54.6	56
.5	59	57	55	56
.5	75.8	70	77.5	79
.5	59.1	57	58	59
.5	61.5	57.5	54.5	55
	71	68	69	71
.5	64.8	63	65	68
	62.5	60	57.5	64
	66.5	65	65	65
	66.1	66	66	65.5
	63.5	62.5	61	60
5	63.8	62.8	61.8	61.5
	65.1	64.2	64.5	63
5	62.6	62.5	62.5	61
5	62.5	62.5	62	61.8
5	62.5	62.5	62	61.8
	61	61	61	60.8
	61	61	61	60.8
	61	61	61	60.8
5	59.5	59.5	59.5	59.5
5	59.5	59.5	59.5	59.5
5	59.5	59.5	59.5	59.5

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, JULY, 1884.

THERMOMETER

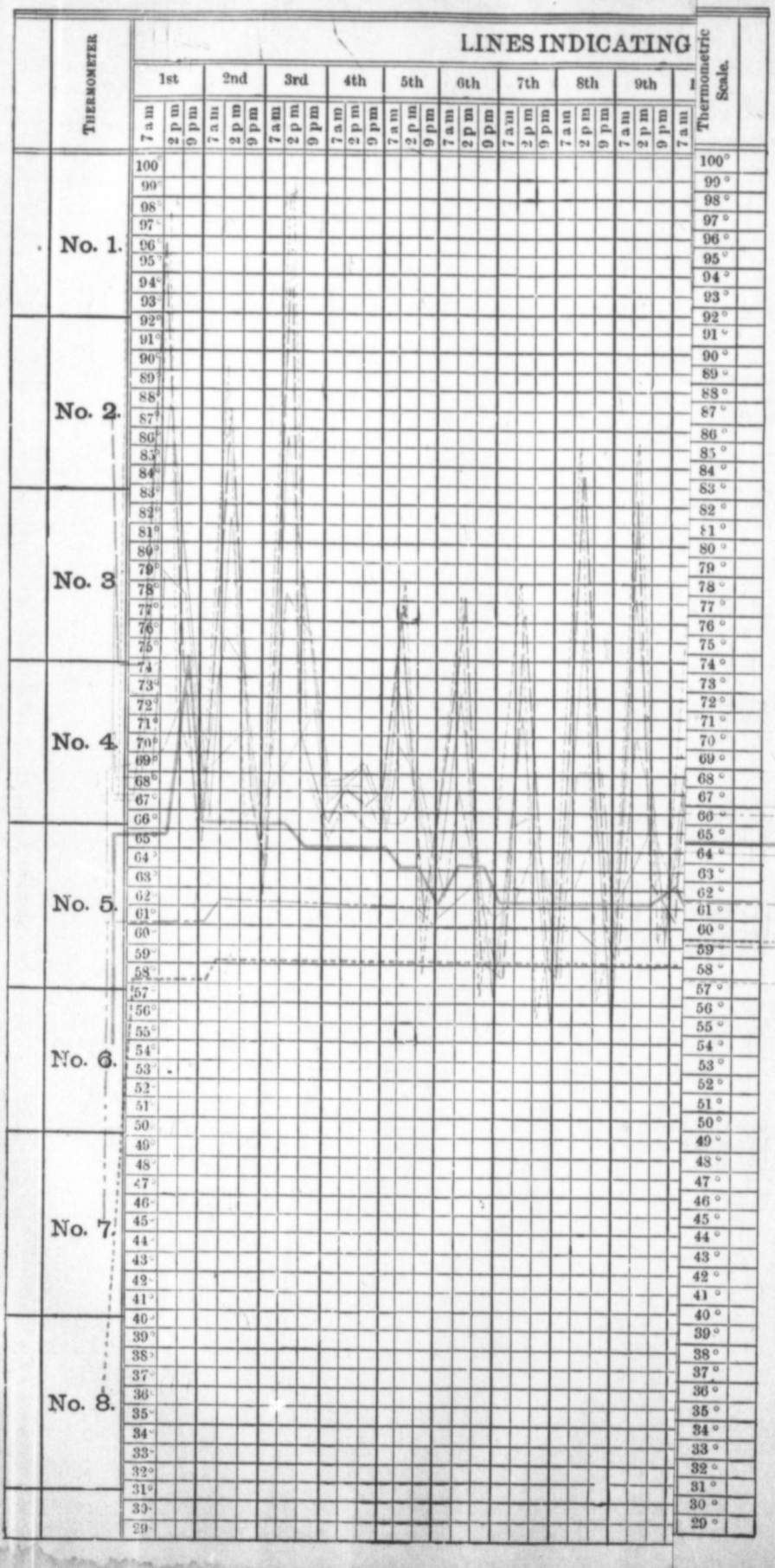
1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m | 2 p m | 9 p m

Thermometric Scale.

No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

100° 99° 98° 97° 96° 95° 94° 93° 92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76° 75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°


LINES INDICATING
Thermometer
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
7 a m
2 p m
9 p m
Thermometric Scale.
No. 1.
No. 2.
No. 3
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

Field at Depths varying from 1 to 48 inches.

JULY.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
60	62	64	64	71.5	72	73	71	73	77	77	59	56	69	54	66	53	52	63	61	60
76.5	86.5	87	88.5	95	95	95	98	99	99	89	77	74	78	64	86	86.5	79.5	67	69.5	66
63.5	63.5	67	67	69.5	69	70.5	70.5	72	72.5	71	69	50	54	63	70	71	61	55	54	52
57	62	61.5	63	67	68.5	70	67.5	69.5	74.5	73	60	58	77	54	62	54	51	63	61	65
72	84	86	86.5	90	93	92	94	98	98.5	88	77	73	78	63	78	85	77	66.5	69	65
65	65.5	69	69	71	72	73.5	72	73	73.5	69	62	58	56	62	71	72	61.5	59.5	55	51
59	61	60.5	63	63.5	65	64	65.5	67	70	69	63.5	60	70	56	59.5	53.5	50	63	61	61
66.5	75.5	77	76	75.5	82	82	82	84	85	74	72	69	72	62	69.5	74	70	65	68	65
67.5	70.5	73	73	74	76	76	76	75.3	76.5	71	70	65	61	62.5	65	70	65	67.5	57	54
61.5	64	62.5	64.8	65	66.5	71	67	68	70	69.5	66	65	66	59	61	57	53	63	61	61
62	69.5	70	70.5	70	74.5	75	75	76	77	76	69.5	66	67	61.5	66	67	65.5	64.5	68	63.5
67	70	72	72	73	75	75	75	74	75.5	74	70	66.8	67	62.5	64	66	65.5	69.3	57	51
62	63	63.5	65.5	66	67	70	68	68.5	69.5	70	68.5	62	64.5	64	62.5	61.5	62	63	62.5	61
62	64	65	65.7	61	68	68.5	68.5	68.5	69.5	71	67.5	65	67	63.5	63	62.5	63	64	63	61.5
67	67	68	68.5	70	70	71	71	71	72.5	73	70	66.5	67	63.5	62	63	65	60	63	61.5
62	62	62.5	63.5	64	65	65	66	66.5	66.5	67	67	66.5	64.5	62.8	63	63	62.8	63	62.5	62
62	62	62.5	63.7	67	65	65.5	66	66	66.5	69	67	66	65	63	63	63	62.8	63.5	62.5	62
68	62.5	63	63.5	69	65	65.8	66	66	66.8	68	67	65	65	63	63	63	62.8	66.3	62.5	62
60.5	61	60.5	60.8	61.2	62	62.5	62.5	63	63.2	63.5	64	64	63.5	62.8	62.5	62	61.8	61.8	61.5	61.2
60.5	60.5	60.5	61	62	62	62.5	63	63	63.2	63.5	64	64	63.5	63	62.5	62	61.8	61.8	61.5	61.2
62	60.5	60.8	61	62	62	62.5	63	63	63.5	63.5	64	64	63.5	63	62.5	62	61.8	61.9	61.5	61.2
59.5	59.5	59.5	59.5	59.5	60	60.5	60.5	61	61.2	61.5	61.8	62	62	61.5	61.5	61	61	61	61	60.8
59.5	59.5	59.5	59.5	59.8	60.2	60.5	61	61	61.2	61.5	61.8	62	62	61.5	61.5	61	61	61	61	60.8
59.5	59.5	59.5	59.5	60	60.2	60.5	61	61	61.3	61.8	62	62	62	61.5	61.5	61	61	61	61	60.8

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	AUGUST. 1	2	3	4	5	6	7	8	9	10
No. 1.	1 inch	7 a.m.	51	56.5	64	65.8	64.5	64.5	61	68	67	68
		2 p.m.	71	74	89	89.5	94	95	88	81	89	95
		9 p.m.	57.5	63	65	66	70	71	69	69	74	68
No. 2.	3 inches	7 a.m.	51	56.5	63.5	65	63.8	64.5	60	68	67.5	68
		2 p.m.	71	72	88	88	92	91	85	79	88	92
		9 p.m.	58	63.5	66	67	74	75	70	69	74	71.3
No. 3.	6 inches	7 a.m.	50.5	55.5	59	61	62.8	63.5	59	68	67	67.5
		2 p.m.	66.5	69	78	78	80.5	81	78	75.5	81	83
		9 p.m.	62	65	70	70	72	71	71	71	75.5	72
No. 4.	9 inches	7 a.m.	54.5	57	60	62.5	64.8	64.5	64	68	67.8	68.5
		2 p.m.	62.5	66	69.7	71	73	73	73.5	72	74.5	75.5
		9 p.m.	63	65	70	69	71	70	71.5	71.3	74.5	70.5
No. 5.	12 inches	7 a.m.	58.5	59.5	61.5	63.8	65.5	65.5	66	67.5	67.8	69
		2 p.m.	59.5	61	63	65	66	66	68	68	69	69.5
		9 p.m.	61.5	63.3	66.5	67	67	66	68.5	69.1	70.8	66.2
No. 6.	24 inches	7 a.m.	61.5	61	61.5	62.5	63.5	63.5	64.5	65	65.5	66.5
		2 p.m.	61	61	62	63	64	64	65	65	65.5	65.5
		9 p.m.	61	61.2	62	63	64	64	65	65	65.8	66
No. 7.	36 inches	7 a.m.	68.8	60.5	60.2	60.5	61	61	62	62.5	63	63
		2 p.m.	61	60.5	60.5	61	61.5	61.5	62	62.5	63	63
		9 p.m.	60.8	60.5	60.5	61	61.5	61.5	62	62.5	62	63
No. 8.	48 inches	7 a.m.	60	60	59.8	60	60	60	60.8	61	61	61.2
		2 p.m.	60.2	60	60	60*	60.5	60.5	60.8	61	61.2	61.2
		9 p.m.	60	60	60	60	60.5	60.5	60.8	61	61	61.2

r.

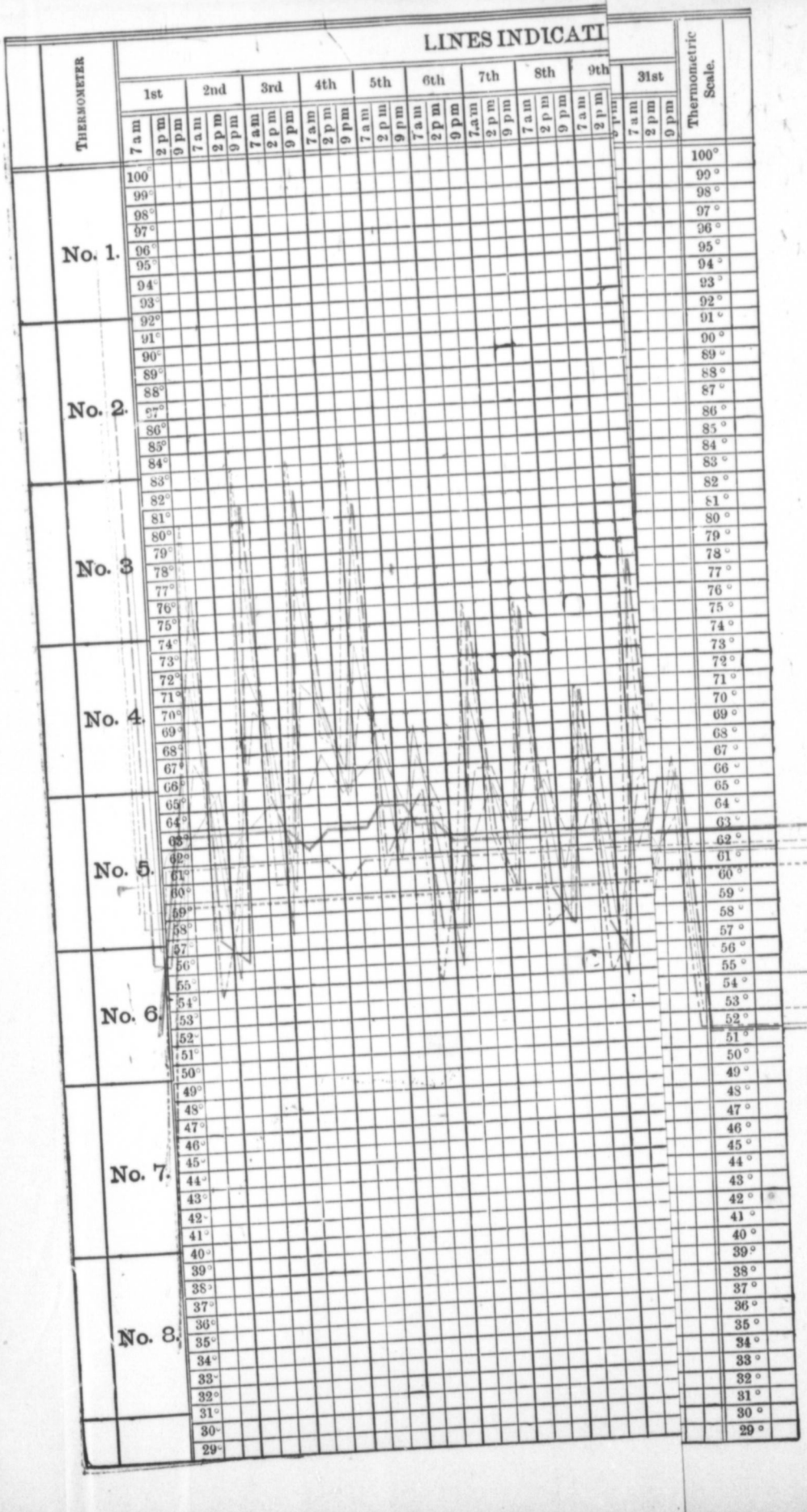
	7	8	9	10
61	68	67	68	
88	81	89	95	
69	69	74	68	
60	68	67.5	68	
85	79	88	92	
70	69	74	71.3	
59	68	67	67.5	
78	75.5	81	83	
71	71	75.5	72	
64	68	67.8	68.5	
73.5	72	74.5	75.5	
71.5	71.3	74.5	70.5	
66	67.5	67.8	69	
68	68	69	69.5	
68.5	69.1	70.8	66.2	
64.5	65	65.5	66.5	
65	65	65.5	66.5	
65	65	65.8	66	
62	62.5	63	63	
62	62.5	63	63	
62	62.5	62	63	
60.8	61	61	61.2	
60.8	61	61.2	61.2	
60.8	61	61	61.2	

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, AUG., 1884.

Thermometer	Thermometric Scale.
No. 1.	100° 99° 98° 97° 96° 95° 94° 93°
No. 2.	92° 91° 90° 89° 88° 87° 86° 85°
No. 3	84° 83° 82° 81° 80° 79° 78° 77°
No. 4.	76° 75° 74° 73° 72° 71° 70° 69°
No. 5.	68° 67° 66° 65° 64° 63° 62° 61°
No. 6.	60° 59° 58° 57° 56° 55° 54° 53°
No. 7.	52° 51° 50° 49° 48° 47° 46° 45°
No. 8.	44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°

1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m | 2 p m | 9 p m



Field at

11	12	
68	52	5
92	77.5	7
65	53.5	4
68	51.5	5
91	75.5	7
66	56	4
67.8	54	5
81	68.5	6
73	63	5
68	58	5
75	65.1	6
71	65	6
68	63.5	6
70	63	6
71	64.8	6
66.5	65.8	6
66.5	64.5	6
66.5	64	6
63.5	63.5	6
63.5	63.3	6
63.3	63	6
61.5	61.8	6
61.5	62	6
61.5	61.5	6

Field at Depths varying from 1 to 48 inches.

AUGUST.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
68	52	51	52	55.2	46.5	58	57.5	55	54	52	52	48.5	61.5	53.5	46.5	62	61	59.5	59	....
92	77.5	70	71	77	78	76	72	70.5	66	54	52.5	57.5	61.5	71	70	69.5	68	73	66.5	....
65	53.5	45	59	62.3	61	57.5	43.5	54	43	56	50	53	68	50	51	65	64	55	63	....
68	51.5	51	53	54	65	57	52	54	54	53	53	49	60	53.5	46.5	61	63	59	59	....
91	75.5	72	70	75	76	74	70	70	66	54	53	57	67	70	69	69	69.5	72	66.5	....
66	56	49	61	62	61.3	58.3	48	59	45	56.1	50.5	54	67.5	51.5	51.5	65	65	56.5	63.5	....
67.8	54	52.5	52	52.5	62	57	55	54	54.5	53	54	51.5	57	55	48	52.5	63	60	58	....
81	68.5	66.8	67	68	67	68	63	68	61.5	54	54.5	56	65	61	64	64	65.5	68	64.5	....
73	63	58.6	62	63	44.5	62	57	60	53.5	57.5	53.5	54.5	66	57	56	64	64	60	64	....
68	58	56.5	59	56	61.5	58.8	58	59	56	55	55.5	53	57	57.5	52	57.8	61	61	58.5	....
75	65.1	63.5	63	63.5	65	64	59	59	59.5	55	55	55	62	62	59.8	61.5	63.5	65	63	....
71	65	62	61	63.5	65	63.5	60	59.5	57	58.5	55	55	62	60	57.5	63	63	63.5	63	....
68	63.5	61	62	59.8	61.5	61	60.5	60	58	58	57	55	56.5	58.5	56.5	57.8	60	61	59.5	....
70	63	61	62	60	62	61	61	57	58.5	58	56.5	55	58	59	57	58.5	61	62	60.2	....
71	64.8	63	61	62.2	63.5	63	61	60.5	59	58	56	56	58	60	59	61	61	63.5	62	....
66.5	65.8	64	63	62	61.8	62	61.5	60	60	59	58.8	58	57.5	58.5	58.8	58.5	59	60	60.5	....
66.5	64.5	64	63	62	61.5	62	61.5	60.5	60	58.5	58.5	58	57.5	58.5	58.8	58.5	59.5	60	60.5	....
66.5	64	63	62	61.5	61.8	62	61	60.5	59.5	58.2	58.5	58	57.5	59.5	58.8	59	59.5	60	61	....
63.5	63.5	63	62	61.5	61.3	61	61	60.5	60	59.5	59	59	58.5	58	58.5	58.5	58.5	58.5	59	....
63.5	63.3	63	62	61.5	61.3	61	61	60.5	60	59.5	59	59	58.5	58	58.5	58.5	58.5	58.5	59	....
63.3	63	62.5	62	61.5	61.3	61	61	60.5	60	59.5	59	59	58.5	58	58.5	58.5	58.5	59	60	....
61.5	61.8	61	61	61	61	60.5	60.2	60	59.1	59.1	59	59	58.8	58.5	58.5	58.5	58.5	58.5	58.5	....
61.5	62	61.8	61	61	61	60.6	60.5	60.2	60	59.1	59	59	58.5	58	58.5	58.5	58.5	58.5	58.2	....
61.5	61.5	61.5	61	61	61	60.1	60	60.2	59.5	59.1	59	59	59	58.8	58.5	68.5	58.5	58.5	58.5	....

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	SEPTEMBER. 1	2	3	4	5	6	7	8	9	10
No. 1.	1 inch.	7 a.m.	62	51	51	64.5	63	60.5	48	56	31	37
		2 p.m.	68	52	74	75.5	78	66.5	68	52	72	64
		9 p.m.	54	49	66	65	58	51.5	51.5	38.5	39.5	45
No. 2.	3 inches	7 a.m.	62	52	52	64	62	59.5	48	56	32.5	37
		2 p.m.	63	51	73	67.5	77	66	67.8	53.5	74	63
		9 p.m.	55	49	65	65.5	59	53.5	52	40.5	41	46.5
No. 3.	6 inches	7 a.m.	60	54	53	61.5	61	59	50	56.5	40	41
		2 p.m.	62.5	53	62.5	69.5	69	64.5	63.9	57	68	58
		9 p.m.	58	51	64	65.5	65	57.5	56.3	48	48	51.5
No. 4.	9 inches	7 a.m.	60	55.8	54	60.5	60	59.5	53	57	45	45.5
		2 p.m.	62	51	59	66	65	63	60	58	60	57
		9 p.m.	60	52	63	66	66	59.5	58.3	52.5	57.5	53.5
No. 5.	12 inches	7 a.m.	60.5	58	56	69.8	60	60	57.5	58	56	51
		2 p.m.	61	57	56.5	61.5	60	60.5	57.5	58	57	52
		9 p.m.	61	58	60	63	60	61	59	56.5	54	54
No. 6.	24 inches	7 a.m.	60.5	60	58.5	58.8	60	60	60	59	58	56.5
		2 p.m.	60	61	58.5	59	60	60	59	59	59	55.8
		9 p.m.	60	61	58.5	60	60	60	59	58.5	56.8	55.5
No. 7.	36 inches	7 a.m.	59	59.5	59	58.5	58	58.8	59	59	58.5	58
		2 p.m.	59	59.5	59	58.5	58	58.8	58.8	59	58.5	57.3
		9 p.m.	59	59.5	59	58	58.5	59	58.5	58.5	58	57
No. 8.	48 inches	7 a.m.	58.5	58.5	58.5	58.5	58	58.2	58	58	58	58
		2 p.m.	58.5	58.5	58.5	58.5	58	58.2	58	58.5	58	57.5
		9 p.m.	58.5	58.5	58.5	58.5	58	58	58	58.5	58	57.5

perimental

8	9	10
	31	37
	72	64
5	39.5	45
	32.5	37
5	74	63
5	41	46.5
5	40	41
	68	58
	48	51.5
	45	45.5
	60	57
	57.5	53.5
	56	51
	57	52
	54	54
	58	56.5
	59	55.8
	56.8	55.5
	58.5	58
	58.5	57.3
	58	57
	58	58
	58	57.5
	58	57.5

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, SEPT., 1884.

Thermometer

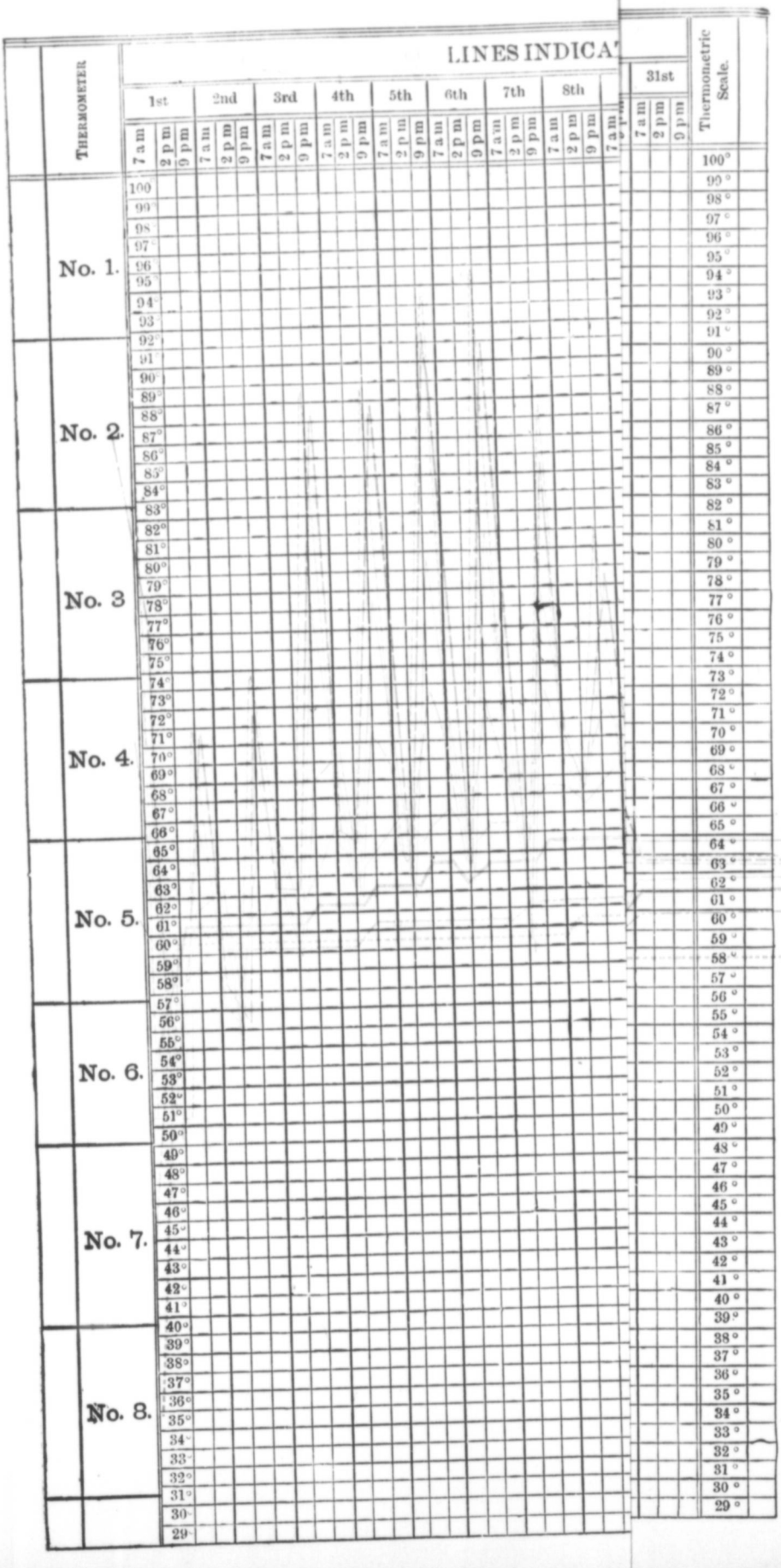
No. 1.
No. 2.
No. 3
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m | 2 p m | 9 p m

Thermometric Scale.

100° 99° 98° 97° 96° 95° 94° 93° 92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76° 75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°



Field at D

11	12	13
43	50	51
68	69	59.
66	52	38
42	51	51
66	68	58
66	53	40
44	55.5	52.
58	67	57
62	54	47.
47.5	57	54.
56	64	56.
59	60	51.
52	58	56
52.5	60	55.
53	60	55
56	57	56.
55.5	59	56.
55.5	59	56.
56.8	56.5	56.
56.8	56.5	56.
56.8	56.5	56.
57.2	57	57
57.2	57	57
57.2	57	56.

Field at Depths varying from 1 to 48 inches.

SEPTEMBER.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
43	50	51	30	32.5	48.5	41	37.5	40	48.5	48	49.5	35	33	33	32	45	38	32	35.5	40.5
68	69	59.5	40.5	55.5	57	50.5	41.5	64	68	67	47	39	36	43	42	49	38	55	52	45
66	52	38	54	45.5	55	39	33.5	56	50.5	60	38.8	29	32.5	33	39	38	38	37.5	45.5	43
42	51	51	32.5	35	48.5	42	38	38	47.8	47	51	36	33.5	34	33	45	39	33	36	41
66	68	58	39	55	56.5	50	58.5	63	65	66	48	39	37	43.5	41	49	39	56	51	45
66	53	40	52.5	45	54.5	41	33.5	57	51	59	40.5	30	33	34	39	39	38.5	38.5	46	45
44	55.5	52.5	34	42	48.5	45.5	41	41	47.3	47.5	54	39	37.5	37.5	36	43	41	35	38	42
58	67	57	41	52	54	50.5	50.8	61	58.3	59	45	44	39	43	42	46.5	41	54	48.5	45
62	54	47.5	51.5	48	53.5	46	35.5	59	53.5	57.5	46	44	35	39.8	43	41	41	41	47	46
47.5	57	54.5	39	48.8	49	48	44.5	42	48	48	55	44	41	39.5	37	43	43	37	39.5	43.
56	64	56.5	45	48.8	52.2	50.2	49.5	59	54	55.5	49	46	42	42.5	43	44.8	43	56	45	44.
59	60	51.5	50.5	49	53	48.3	42.5	50	54	56	49.2	47	39	42	43	43	42.5	42	46	45
52	58	56	45	48.8	50.5	51.5	48.8	46	49.8	50	55	49	45	44	44	43.5	45.5	39	42.5	45
52.5	60	55.5	51	48.8	51.5	51	48	48	50.8	52	55	48	45	43.4	43	44.5	45	45	43.5	45
53	60	55	51	50	52.5	51	46	49	52.8	54	52.3	49	45	44	43	45.5	44.5	43	44	45
56	57	56.8	54	54	53.5	54	53	52	51.8	52.8	54	53	51	50	50	47.8	48	47	46.5	47
55.5	59	56.5	57	54	53.5	54	52.5	52	51.8	53	54	53	51	49	49	47.5	48	47	47	47
55.5	59	56.3	55.5	53.5	53.5	53	52	52	52	53	53.8	53	51	49	47	48	48	47	47	47
56.8	56.5	56.5	55.5	56.8	55.5	54.8	54.5	54	53	53.2	53.5	53.5	53	52	52	50.5	50	49.5	49	49
56.8	56.5	56.2	56.5	56.8	55	54.5	55	54	53.1	53.5	53.5	53.5	53	52	52	50	50	49.5	49	49
56.8	56.5	56.2	56.5	55.5	54.8	54.5	54	54	53.1	53	53.5	53.5	53	52	52	50	50	49.5	49	49
57.2	57	57	56.5	56.3	56	55.8	55	55	54.5	54	54	54	54	53.5	53.5	52	51.5	51.5	51	50.5
57.2	57	57	56.5	56.3	56	55	55	55	54.3	54	54	54	54	53.5	53	52	51.5	51.5	51	50.5
57.2	57	56.1	56.5	56	55.8	55	55	55	54	54	54	54	54	53.5	53	52	51.5	51.5	51	50.5

THE TEMPERATURE OF THE SOIL of the Experimental

THERMOMETER.	DEPTH IN SOIL.	TIME OF READING.	OCTOBER. 1	2	3	4	5	6	7	8	9	10
No. 1	1 inch	7 a.m.	57	54	36.5	55	56	52	49	42.8	47.5	44.5
		2 p.m.	49	46.5	63.5	69	70	60.5	58	48.8	58	60
		9 p.m.	58.5	37.5	47	57	56	55.2	44	47	47	46.8
No. 2	3 inches	7 a.m.	56	54	37	52	51.7	52	50.8	44.8	47	45
		2 p.m.	50	49	57.5	69	68.5	58.5	49	49	56.5	56
		9 p.m.	57	42.5	50	58	57	55.5	46	48	50	49
No. 3	6 inches	7 a.m.	55	52.5	41	49	48.5	51.5	51	45.8	47	45.2
		2 p.m.	51	49.5	51	57	56.5	54.5	49.5	47.8	52	52
		9 p.m.	54	46	51	57	56.5	54.5	47.8	48.5	50	50
No. 4	9 inches	7 a.m.	56	50	44.5	48	46.7	50.5	50.8	47	47	47
		2 p.m.	49	48	45.5	49	49.5	50.8	49.5	47	48	48
		9 p.m.	50	47.5	48	51	52	52	48.8	48	48.5	49
No. 5	12 inches	7 a.m.	50	48	45.5	45	46	49	47	47.5	46.5	47
		2 p.m.	48	45	44.5	46	46.8	49	47	47	47	47
		9 p.m.	47.5	47	46	46	49	50	49	47.5	48	48
No. 6	24 inches	7 a.m.	45	45	45	44	44.5	46	47	46.8	46	46
		2 p.m.	45	45	45	44	44.8	46	47	46.5	46	46.2
		9 p.m.	45	45	44.5	44.5	45	46.5	47	47	46	46
No. 7	36 inches	7 a.m.	42	42.5	42.5	42.7	42.8	43	44	44.5	44.5	44.5
		2 p.m.	42.5	42.5	42.7	42.8	43	43.2	44	44.5	45	45.5
		9 p.m.	43	42.5	42.7	42.8	43	43.2	44	45	45	44.5
No. 8	48 inches	7 a.m.	41	41	41	41.5	41.5	42	42.2	42.8	43	43.5
		2 p.m.	41	41	41	41.5	41.8	42	42.8	43	43.5	43.5
		9 p.m.	41	41	41.5	41.5	42	42	42.8	43	43.5	43.5

xperimental

8	9	10
42.8	47.5	44.5
48.8	58	60
47	47	46.8
44.8	47	45
49	56.5	56
48	50	49
45.8	47	45.2
47.8	52	52
48.5	50	50
47	47	47
47	48	48
48	48.5	49
47.5	46.5	47
47	47	47
47.5	48	48
46.8	46	46
46.5	46	46.2
47	46	46
44.5	44.5	44.5
44.5	45	45.5
45	45	44.5
42.8	43	43.5
43	43.5	43.5
43	43.5	43.5

LINES INDICATING THE DAILY VARIATIONS OF THE SOIL IN TEMPERATURE, OCT., 1884.

Thermometer

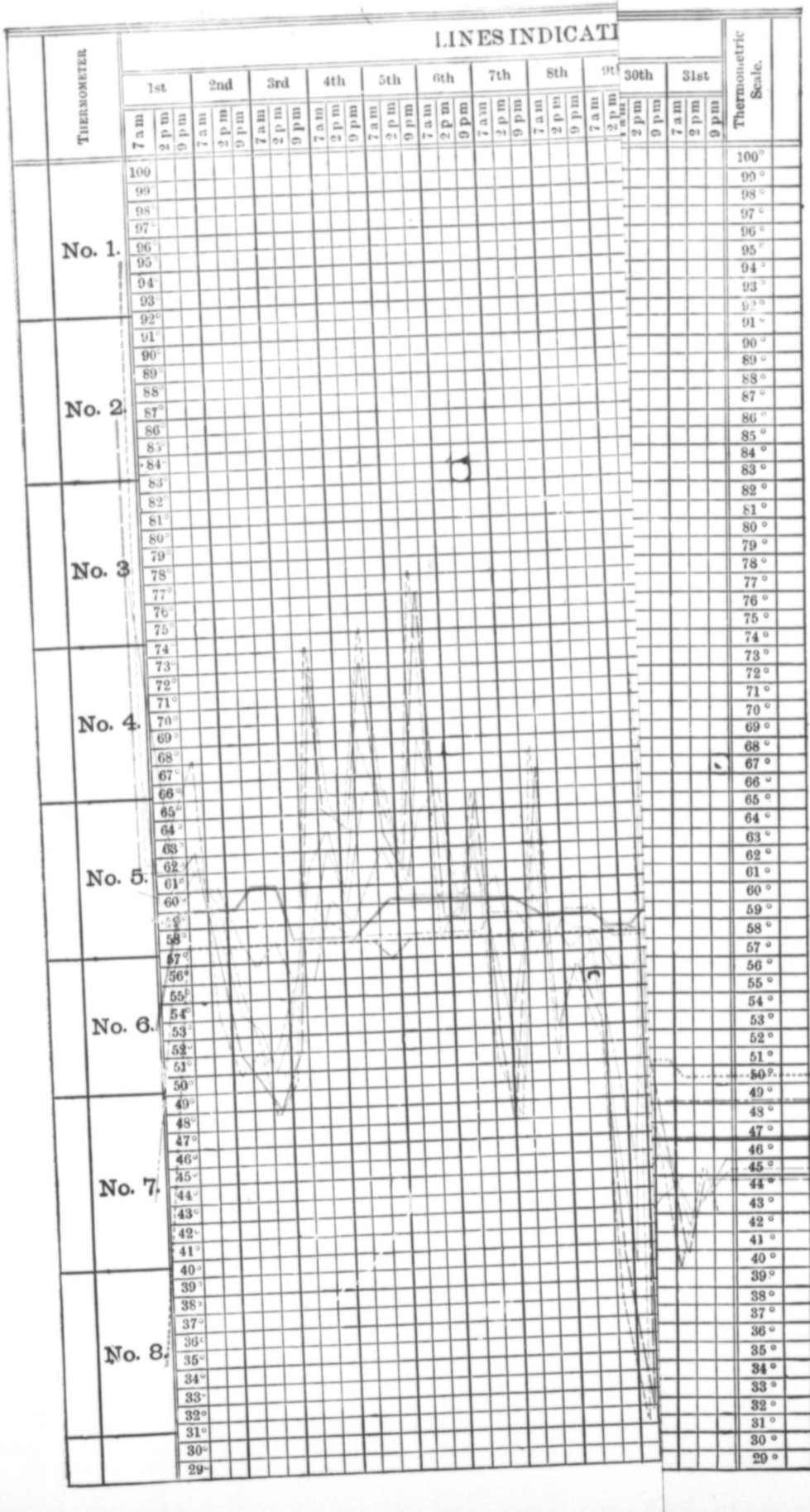
No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.

1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st

7 a m · 2 p m · 9 p m

Thermometric Scale.

100° 99° 98° 97° 96° 95° 94° 93° 92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76° 75° 74° 73° 72° 71° 70° 69° 68° 67° 66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34° 33° 32° 31° 30° 29°



Field at

11	12	
41	43.5	4
61	65.1	4
48	47	4
40	45.1	4
59	62	4
56	51	4
41	42	4
55	55.5	4
52	53	4
42	45	4
47	48.5	4
49	50.8	4
44	46.2	4
45	46.2	4
47	48.5	4
45	46.2	4
46	46	4
46	46	4
44.5	44.5	4
44.5	44.8	4
44.5	44.8	4
43.5	43.5	4
43.5	43.8	4
43.5	43.8	4

Field at Depths varying from 1 to 48 inches.

OCTOBER.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
41	43.5	45.5	43	28.5	44.5	45.5	52	51.5	49.5	54	57.6	66.5	59	62.8	59	57.2	41.5	44.5	40.5	51
61	65.1	47.5	53.5	52.5	55.5	63.8	72	71	53.8	75.5	58.7	64.2	63	78.3	70	65	61.3	60.2	51.7	75.5
48	47	44	43.5	42	41	48.8	57	56.5	48.5	56	52	62	61.5	56.5	49	48.5	39.5	39	45.5	56
40	45.1	46.2	43.5	39.5	42.5	43	49	50.5	51	50.5	56.3	63	58	58.8	57	55	41.2	42	41.5	49.5
59	62	48.5	53	52	56	62.8	69	70	58.5	73.8	56.5	64	62.5	77.3	71	67	64	62	51.5	72.5
56	51	45	46	43	41.8	47.5	46	56.8	49	57	55	63	61	58	62	50.8	42	42	46.8	58
41	42	46.5	44	41.5	40.5	40.5	40.3	49.3	52.5	46	52.5	57	57.5	53.2	54	53.5	44.5	42.2	44	48.5
55	55.5	48	50.2	49	51.5	57.5	59	52	51	65	57	64	60.7	72	67	66.5	60.2	57.8	57.5	64.5
52	53	46.5	49	47	46.8	53.2	53	56	52	59	52	61	59	63.2	59	58	51	50	50	60.8
42	45	47.8	45.6	44.5	42	42.5	43	49.3	52	47	51.7	54	57.3	53	59	57	49	45	47	48.5
47	48.5	47.5	47	46	46.8	48.8	49	51	51	55.5	54.2	62.5	57.8	63.5	62	61.2	55.8	53.2	50.5	57.5
49	50.8	47	4.85	47	47.5	52	49	54	52	57.5	51	61	54	63	60	59.5	54.6	53	51.3	59.1
44	46.2	47.8	46.2	46	44	44.5	50	49.5	51	48.5	52	52.5	56.2	54.5	58	56	53.3	49.5	50	49.8
45	46.2	47.2	46	45.8	45	45.8	57	58	50.5	50.5	52	58	55.8	56.2	59	56.5	53	50.8	50	51.5
47	48.5	47	47	44	46.8	49	49	51	51	54	51	57	54	59.5	57	58	55	53	51	55
45	46.2	46.5	46.5	46	45	45.5	46	47.5	48	48.3	49.5	50	51.8	52.8	55	53.5	53.5	52.3	51	50.5
46	46	46.7	46.2	46	45.5	45.8	46	49	48	48.5	49.5	51	52	52.5	56	53.5	53	51.5	50.7	50.5
46	46	46.5	46	46	45.5	45.8	46.5	47.8	48.5	50	51.8	52.8	53	51	53	53.7	53	51.5	51.5	50.5
44.5	44.5	44.5	45	44.8	44.8	44.5	45	45	455.	46	46.5	47	47.8	49.2	49.5	49.7	50	50	49.7	49.5
44.5	44.8	44.8	45	44.8	44.8	44.8	45	45	458.	46.5	46.8	7.8	48	49.5	49.6	50	50.5	50	49.7	49.5
44.5	44.8	45	45	44.8	44.8	44.8	45	45.2	45	46.5	47	47.8	49.2	49.5	49.7	50	50	50	49.5	49.5
43.5	43.5	43.8	43.8	44	44	44	44	44	44.5	44.5	45	45.5	46	47	47.2	47.5	47.7	48	48	48
43.5	43.8	43.8	44	44	44	44	44	44	34.5	45	45	46	46	47	47.5	47.5	48	48	48	48
43.5	43.8	43.8	44	44	44	44	44	44	44.5	45	45.5	46	47	47.2	47.5	48	48	48	48	48

II.—METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College During 1884.

During the past year some additions have been made to the instruments of the Meteorological Department of our College.

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. Each morning a form, as seen below, is filled out and given for publication to the daily papers in Guelph. At the close of each month a summary of the month's observations is also given 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 examinations the same practical method is used.

Form of Record Published Daily in the Guelph Papers.

WEATHER RECORD

Ontario Agricultural College.

.....1883.

Normal height of barometer at Guelph (1,100 feet above sea level and 740 above [sea level and 740 above] Lake Ontario), 28.86 inches. Average temperature for.....

Barometer ..... { Height.....inches / Change.....

Hygrometer.....Moisture.....

Anemometer .... { Direction of wind..... / Miles travelled during previous twenty-four hours.....

Minimum temperature during preceding twenty-four hours.....

Maximum " " " " .....

Pluviameter—Rainfall.....inches.

Form of Monthly Summary.

Meteorology.

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

Barometer—
- Highest barometer.
- Lowest "
- Highest mean barometer
- Lowest " "
- Monthly " "
- Monthly range.

Thermometer—
- Highest thermometer.
- Lowest "
- Highest mean thermometer.
- Lowest " "
- Monthly " "
- Monthly range.

Hygrometer—
- Day of greatest humidity.
- Day of least "
- Mean "

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.
- " velocity per hour.
- Mean velocity per month.

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

The following is a summary of the observation taken during the year 1884.

January.

Barometer.

Highest barometer, 26th, 9 p.m.	29.466	inches.
Lowest barometer, 9th, 2 p.m.	28.132	"
Highest mean barometer, 26th	29.384	"
Lowest mean barometer, 2nd	28.174	"
Monthly mean barometer	28.775	"
Monthly range	1.334	"

Thermometer.

Highest temperature, 30th, 31st	41°
Lowest temperature 25th	–35°
Highest mean temperature, 30th	36.8°
Lowest mean temperature 25th	–9.6°
Monthly mean temperature	13.07°
Monthly range	76°

Pluviameter.

Days rain fell, 1	13 inches.
Greatest rainfall, 30th	13 "
Days snow fell, 11	35.5 "
Greatest snowfall, 8th, 9th	18.0 "
Total precipitation	3.68 "

Anemometer.

Direction of wind:

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
6	3	7	4	4	8	6	8

Greatest number of miles travelled in 24 hours, 3rd	1,038 miles.
Greatest velocity per hour, 3rd	68 "
Mean velocity for the month	16.6 "

Clouds.

Cloudy days	24
Clear days	7
Mean cloudiness for the month	6.5

Remarks.

This month was characterized by cold and by frequent snow storms.

On the morning of the 1st, the pressure was high and the weather cold and damp; by the evening an area of atmospheric depression moving northward reached Guelph, a moderate gale blowing from the east and north east with snow towards midnight. It snowed all day on the 2nd; during the night, the wind shifted to the north-west, bringing colder weather. The strong winds which occurred in this district on the 3rd, were accompanied by a low temperature that continued until the 6th. A snow storm with strong winds and gales from the east occurred on the 8th; on the 10th and 12th it was milder, snow falling and the wind blowing from the S. W. A high pressure passed over the district on the 15th, the temperature falling considerably below zero. This pressure soon decreased and during the three following days, indications of a thaw were visible.

The weather was clear and cold during the period of high pressure which spread over the continent on the 23rd. The extreme cold of the 24th, reached 35° below zero on the morning of the 25th, being 19° lower than the coldest day of last year. The depression of the 28th brought milder weather and local falls of snow. A thaw commenced on the 29th, and continued through the next day; it was followed on the 31st by renewed cold and snow.

FEBRUARY.

Barometer.

Highest barometer, 10th, 9 p.m.	29.290 inches.
Lowest barometer, 19th, 9 p.m	28.184 "
Highest mean barometer, 15th	29.222 "
Lowest mean barometer, 28th	28.323 "
Monthly mean barometer	28.789 "
Monthly range	1.106 "

Thermometer.

Highest temperature, 13th	47.°
Lowest temperature, 29th	–10.5°
Highest mean temperature, 19th	38.5°
Lowest mean temperature, 29th	–3.5°
Monthly mean temperature	20.7°
Monthly range	57.5°

Pluviameter.

Days rain fell, 3	1.60 inches.
Greatest rainfall, 19th	0.75 "
Days snow fell, 7	8.0 "
Greatest snowfall, 22nd	2.0 "
Total precipitation	2.4 "

Anemometer.

Direction of the wind :

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
5	4	6	9	4	4	9	7

Greatest number of miles travelled in 24 hours, 20th	901 miles.
Greatest velocity per hour, 20th, 7 a.m	45.6 "
Mean velocity for the month	14.3 "

Clouds.

Cloudy days	23
Clear days	4
Mean cloudiness for the month	6.4

Remarks.

The weather during the 1st and 2nd of the month, was clear and cold. On the 3rd and 4th, the atmospheric pressure was high, local flurries of snow occurring at times. On the 5th, a thaw followed, a cloudiness continuing for a few days accompanied by higher temperature.

The depression which moved over the Lakes eastward on the 9th, produced a light fall of snow at Guelph. Another depression with rain, occurred on the 12th; after the 12th, the weather remained fine for a few days.

The area of depression which moved slowly from the Pacific Coast on the 17th, passed Guelph on the night of the 19th, and produced furious westerly gales.

On the 21st and 22nd, warm, winds blew from the South-west with snow. Two days of clear, cold weather followed.

The depression which set in over Ontario on the 26th, produced cold wet weather at Guelph.

On the 28th and 29th, cold winds blew from the North and North-west, producing the lowest temperature of the month.

March.

Barometer.

Highest barometer, 4th, 2 p.m	29.402 inches.
Lowest barometer, 26th, 7 a.m	28.232 "
Highest mean barometer, 18th	29.135 "
Lowest mean barometer, 26th	28.303 "
Monthly mean barometer	28.808 "
Monthly range	1.170 "

Thermometer.

Highest temperature, 25th, 27th	50°
Lowest temperature, 1st	–20°
Highest mean temperature, 27th	40°
Lowest mean temperature, 1st	–3°
Monthly mean temperature	26.2
Monthly range	70°

Pluviameter.

Days rain fell, 3	0.77 inches.
Greatest rainfall, 12th	0.3 "
Days snow fell, 1	
Greatest snowfall, 7th	4 "
Total precipitation	1.17 "

Anemometer.

Direction of the wind :

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
7	17	10	15	9	9	5	11

Greatest number of miles travelled in 24 hours, 12th	826 miles.
Greatest velocity per hour	42.5 "
Mean velocity for the month	12.2 "

Clouds.

Cloudy days	13
Clear days	18
Mean cloudiness for the month	4.3

Remarks.

The weather from the 1st to the 6th was clear and cold temperature reaching 20 degrees below zero, and wind blowing from the North and North-west. On the 5th, the wind changed to the S. W.; by the evening of the 6th, the wind changed to the N. E., snow falling during the night. On the 8th, a strong wind blew from the East, producing huge snow drifts.

A light fall of snow occurred on the 9th, followed by an increase of temperature. A steady rain occurred on the 11th, wind blowing from the East.

With the exception of one or two days towards the end of the month, the weather of the rest of the month, was mild. On the 17th and 19th rain fell, the 19th being cold.

The temperature increased from the 21st to the 28th, and much snow melted. The temperature became lower on the 29th and 30th.

APRIL.

Barometer.

Highest barometer, 21st, 2 p.m.	29.176 inches.
Lowest barometer, 2nd, 7 a.m.	28.072 "
Highest mean barometer, 21st	29.154 "
Lowest mean barometer, 2nd	28.192 "
Monthly mean barometer	28.726 "
Monthly range	1.104 "

Thermometer.

Highest temperature, 27th	71.5°
Lowest temperature, 3rd	21°
Highest mean temperature, 26th	57°
Lowest mean temperature, 5th	26.5°
Monthly mean temperature	39.3°
Monthly range	50.5°

Pluviameter.

Days rain fell, 2.	
Greatest rainfall, 15th	0.23 inches.
Days snow fell, 3	1.5 "
Greatest snowfall, 1st, 2nd, 8th	
Total precipitation	0.4 "

Anemometer.

Direction of the wind:

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
7	16	6	15	14	8	7	9

Greatest number of miles travelled in 24 hours, 28th	700 miles.
Greatest velocity per hour	43 "
Mean velocity for the month	13.8 "

Clouds.

Cloudy days	15
Clear days	15
Mean cloudiness for the month	4

Remarks.

The weather during the first week of April was generally cold and cloudy. On the 3rd and 4th, the low pressure from the Western States moving eastward, gave us strong westerly gales and the lowest pressure of the month. Snow occurred during the time.

The weather became finer after the 5th, and continued so until the 15th. On the 15th, the atmospheric pressure rapidly decreased with rain from the East, the rain continuing until the afternoon of the 16th. Cloudiness with a steady average temperature prevailed from the 16th to the 21st, the atmospheric pressure gradually increasing and continuing high to the end of the month.

The early growth of fall and spring crops was greatly checked by the low temperature of the month.

MAY.

Barometer.

Highest barometer, 3rd, 2 p.m	29.064 inches.
Lowest barometer, 2nd, 7 a.m	28.344 "
Highest mean barometer, 3rd	29.014 "
Lowest mean barometer, 19th	28.484 "
Monthly mean barometer	28.746 "
Monthly range	0.720 "

Thermometer.

Highest temperature, 23rd	83°
Lowest temperature, 29th	29°

Highest mean temperature, 23rd	69.8°
Lowest mean temperature, 28th	40°
Monthly mean temperature	52.0°
Monthly range	54°

Pluviameter.

Days rain fell, 7	
Greatest rainfall, 19th	1.26 inches.
Total precipitation	2.504 "

Anemometer.

Direction of the wind :—

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
7	20	8	20	5	5	10	12

Greatest number of miles travelled in 24 hours, 2nd	775 miles.
Greatest velocity per hour	44 "
Mean velocity for the month	14.7 "

Clouds.

Cloudy days	19
Clear days	12
Mean cloudiness for the month	4.7

Remarks.

The mean atmospheric pressure was low at the beginning of the month. The gales of the 2nd and 14th were strong, those of the 2nd veering from S. W. to W. and N. W.

The depression which occurred on the Upper Lakes on the 15th, gave us numerous showers on that day.

With an area of high pressure over the Lake Region towards the end of the month, sharp frosts occurred.

The mean temperature was below the average, the rainfall was considerably above the average for May.

JUNE.

Barometer.

Highest barometer, 14th, 2 p.m.	29.306 inches
Lowest barometer, 9th, 7 a.m	28.616 "
Highest mean barometer, 14th	29.270 "
Lowest mean barometer, 9th	28.636 "
Monthly mean barometer	28.934 "
Monthly range	0.690 "

Thermometer.

Highest temperature, 20th	89°
Lowest temperature, 16th, 27th	45°
Highest mean temperature, 20th, 23rd	75°
Lowest mean temperature, 10th	52.6°
Monthly mean temperature	67.7°
Monthly range	44°

Pluviameter.

Days rain fell, 8	
Greatest rainfall, 21st	0.632 inches.
Total precipitation	2.072 "

Anemometer.

Direction of the wind :—

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
6	18	7	15	7	3	4	15

Greatest number of miles travelled in 24 hours, 13th	403 miles.
Greatest velocity per hour	21 "
Mean velocity for the month	8.8 "

Clouds.

Cloudy days	8
Clear days	22
Mean cloudiness for the month	3.5

Remarks.

The weather for the first week was warm and clear. On the 9th and 10th it became colder. A few cloudy days followed. The temperature again fell on the 13th and 14th; it shortly rose again and remained dry and warm until the 21st.

On the 24th and 25th, there was rain, the rain of the 24th being warm, and accompanied by heavy lightning and thunder, that of the 25th being cold.

The weather for the remainder of the month was fine and warm. The average atmospheric pressure was high, the highest being reached during the fine weather of the last week.

JULY.

Barometer.

Highest barometer, 3rd, 2 p.m.	28.934 inches.
Lowest barometer, 31st, 7 a.m	28.480 "
Highest mean barometer, 8th	28.902 "
Lowest mean barometer, 3rd	28.508 "
Monthly mean barometer	28.751 "
Monthly range	0.454 "

Thermometer.

Highest temperature, 1st	88°
Lowest temperature, 15th	41°
Highest mean temperature, 1st	76.6°
Lowest mean temperature, 14th	54°
Monthly mean temperature	62.7°
Monthly range	47°

Pluviameter.

Days rain fell, 7	
Greatest rainfall, 31st	0.719 inches.
Total precipitation	1.861 "

Anemometer.

Direction of the wind :—

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
6	6	5	21	0	29	4	13

Greatest number of miles travelled in 24 hours, 7th	668 miles.
Greatest velocity per hour	44 "
Mean velocity for the month	11.7 "

Clouds.

Cloudy days	10
Clear days	18
Mean cloudiness for the month	4.5

Remarks.

The depression of the 2nd in the North-West Territory, reached Ontario on the 4th, producing rain on the 4th and 5th. A similar cause gave us rain on the 12th. The small depression on the 18th, gave us a small shower, the one of the 30th and 31st, a showery close to the month.

AUGUST.

Barometer.

Highest barometer, 9th, 2 p.m	29.184 inches.
Lowest barometer, 29th, 7 a.m	28.444 "
Highest mean barometer, 9th	29.158 "
Lowest mean barometer, 29th	28.490 "
Monthly mean barometer	28.767 "
Monthly range	0.740 "

Thermometer.

Highest temperature, 18th, 20th	93°
Lowest temperature, 29th	39°
Highest mean temperature, 20th	78.6°
Lowest mean temperature, 5th	57.5°
Monthly mean temperature	65.°071
Monthly range	54°

Pluviameter.

Days rain fell, 10	
Greatest rainfall, 29th	0.764 inches.
Total precipitation	1.877 "

Anemometer.

Direction of the wind :—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
8	4	10	3	2	20	15	27

Greatest number of miles travelled in 24 hours, 23rd	420 miles.
Greatest velocity per hour, 23rd, p.m	27.714 "
Mean velocity for month	9.588 "

Clouds.

Cloudy days	17
Clear days	10
Mean cloudiness for the month	4.1

Remarks.

The weather during the first two weeks of this month, was favourable for farm work, being of an even temperature, not too cool and not too hot. This month has made itself particularly noticeable, by the hot weather which prevailed from the 13th till the 22nd, the mercury in one case reaching 93.° in the shade, a temperature higher than any temperature of last year.

In comparing the rainfall of this season, with the same month of last year, we find that last year there were only two days on which rain fell, this year rain fell on ten. The total precipitation last year was 0.2 inches.

The rain which fell this month was so counteracted by the intense heat, that the growing crops derived little good from it, and in some districts the appearance of drought was very noticeable.

Although the temperature for this month was high, it was by no means unsteady, the heat being of a uniform character, accompanied by cool clear nights. The mean temperature was from 1 to 2½ degrees below the average for Ontario.

One peculiarity of this month was the absence of thunder and lightning in this district.

The prevailing wind of this month came from the south-west and north-west, some of the hottest weather occurring while it came from these quarters.

There was a light frost in some places on the 7th; from the 24th to 27th, destructive frosts were reported in many places.

The low areas of pressure came this month from the extreme north-west. The low depression of the 28th produced rain in western Ontario.

The barometric pressure was pretty steady during the month.

September.

Barometer.

Highest barometer, 13th, 9 p.m.	29.312 inches.
Lowest barometer, 28th, 9 p.m	28.514 "
Highest mean barometer, 13th	29.288 "
Lowest mean barometer, 17th	28.570 "
Monthly mean barometer	28.911 "
Monthly range	0.798 "

Thermometer.

Highest temperature, 10th, 7th	90°
Lowest temperature, 20th	28.5°
Highest mean temperature, 10th	75.3°
Lowest mean temperature, 18th	49°
Monthly mean temperature	63.°585
Monthly range	61.5°

Pluviameter.

Days rain fell, 12	
Greatest rainfall, 24th	.620 inches
Total precipitation	2.106 "

Anemometer.

Direction of the wind:—

N.	E.	W.	S.	N. E.	N. W	S. E.	S. W.
8	4	10	3	2	20	15	27

Greatest number of miles travelled in 24 hours, 24th	616 miles.
Greatest velocity per hour, 27th, 2 p.m.	40 "
Mean velocity for month	11.854 "

Clouds.

Cloudy days	17
Clear days	11
Mean cloudiness for the month	5.

Remarks.

The principal feature of this month was the intense heat which prevailed during the first part of it. During the first two weeks the temperature varied very little, the weather being hot and sultry accompanied by cool clear nights; towards the end of the month it was more uneven.

Considerable rain fell during the latter part of the month; from the 14th to the 18th, severe frost was general, causing considerable damage.

Complaints were heard in Western Ontario during the early part of the month, about the want of rain, pastures being burnt up.

The mean temperature was above the normal, from 2 to 4° in Ontario.

Rain fell on twelve days, the total precipitation being 2.106 inches, during same month last year, rain fell on only six days and yet the total precipitation was almost as great.

The weather during the latter part of the month was favourable to fall wheat seeding.

The prevailing wind of the month blew from the S. W. and N. W.

The barometric pressure was high.

An earthquake was recorded in some parts of Western Ontario at 3.30 p.m of the 19th.

OCTOBER.

Barometer.

Highest barometer, 25th 9 p.m	29.314	inches.
Lowest barometer, 22nd, 7 a.m	28.584	"
Highest mean barometer, 14th	29.254	"
Lowest mean barometer 22nd	28.618	"
Monthly mean barometer	28.914	"
Monthly range	0.730	"

Thermometer.

Highest temperature, 3rd	79°
Lowest temperature, 2nd	22°
Highest mean temperature, 4th	71.°333
Lowest mean temperature, 25th	30.°166
Monthly mean temperature	47.°418
Monthly range	57°

Pluviameter.

Days rain fell	16
Days snow fell	2
Greatest rainfall, night of 21st	
Total precipitation	3.091 inches.

Anemometer.

Direction of the wind:—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
8	9	12	3	18	15	2	22

Greatest number of miles travelled in 24 hours, 21st	614	miles.
Greatest velocity per hour, 22nd, 7 a.m	32.2	"
Mean velocity for the month	12.475	"

Clouds.

Cloudy days	17
Clear days	10
Mean cloudiness for the month	5.2

Remarks.

The first week of this month was showery, accompanied by a north-east wind.

Frost occurred on the 9th and 10th.

The weather from the 9th to the 11th was fine; on the 12th a heavy shower of rain fell, and was followed by fair weather and frost on the 15th. From the 17th to the 22nd, a wet spell occurred, with an occasional fine day.

On the night of the 22nd, there was a light fall of snow, which was followed by blustering weather up to the 24th, when it cleared and remained cold. During the cold spell hard frost occurred.

On the night of the 26th a drizzling rain began, which continued up to the 31st.

The weather for this month was very unlike that of the corresponding month of last year, both as regards heat and moisture.

The mean temperature of the month was higher this year than last, the mercury registering 3° lower this month than the same month last year.

In October, 1883, there were 6 days on which rain fell; this year there were 10, the total precipitation being 3.091 inches for this year, and 1.460 inches for last.

The atmospheric pressure was above the average. The prevailing wind was from the S. W. and N. E. The weather during the fore part of the month was favourable for growth, fall wheat developing a good top.

NOVEMBER.

Barometer.

Highest barometer, 18th, 2 p.m.	29.146 inches.
Lowest barometer, 23rd, 9 p.m.	28.348 "
Highest mean barometer, 3rd	29.137 "
Lowest mean barometer, 26th	28.415 "
Monthly mean barometer	28.815 "
Monthly range	0.798 "

Thermometer.

Highest temperature, 23rd	70.5°
Lowest temperature, 27th	9.4°
Highest mean temperature, 10th	45.6°
Lowest mean temperature, 24th	14.3°
Monthly mean temperature	31.2°
Monthly range	61.1°

Pluviameter.

Days rain fell 2		
Greatest rainfall, 4th	0.75	inches.
Days snow fell 3	4	"
Total precipitation	1.48	"

Anemometer.

Direction of wind:

N.	E.	W.	S.	N.E.	N.W.	S E.	S.W.
3	12	30	0	1	19	2	18

Greatest number of miles travelled in 24 hours, 23rd	839	miles.
Greatest velocity per hour, 23rd, 4 p.m	46	"
Mean velocity for the month	15.148	"

Clouds.

Cloudy days	25.
Clear days	5.
Mean cloudiness for the month	7.7

Remarks.

The weather for this month was very disagreeable, the whole month with the exception of a few days about the 15th, being one of rain and snow. In most every case the wet weather was followed by cold of two or three days' duration; flurries of snow occurred during the latter part of the month.

On the 23rd the atmospheric pressure was very low; during the night of the 23rd and the two following days, sufficient snow fell to make good sleighing, the sleighing remaining good to the end of the month.

This month was very unfavourable for taking up roots, especially the turnip, and farmers who delayed in this operation, had them considerably damaged by severe frosts.

The prevailing wind was the west.

This month, compared with the corresponding month of last year, was, taking the average, 4° colder.

DECEMBER.

Barometer.

Highest barometer, 26th, 2 p.m.	29.472	inches.
Lowest barometer, 15th, 7 a.m.	28.120	"
Highest mean barometer, 26th	29.384	"
Lowest mean barometer, 22nd	28.340	"
Monthly mean barometer	28.868	"
Monthly range	1.352	"

Thermometer.

Highest temperature, 31st	55°
Lowest temperature, 19th	– 18°
Highest mean temperature, 30th	44.3°
Lowest mean temperature, 19th	– 8.3°
Monthly mean temperature	25.9°
Monthly range	73°

Pluviameter.

Days rain fell 3		
Greatest rainfall, 7th		
Days snow fell 4	6	inches.
Greatest snowfall, 24th		
Total precipitation	2.1	"

Anemometer.

Direction of the wind:

N.	S.	E.	W.	N.E.	N.W.	S.E.	S.W.
3	3	11	18	6	11	7	30

Greatest number of miles travelled in 24 hours, 7th	873	miles.
Greatest velocity per hour, 7th, p.m.	41.7	"
Mean velocity for the month	15.6	"

Clouds.

Cloudy days	24
Clear days	4
Mean cloudiness for the month	7.7

Remarks.

This month began with a cold snap and good sleighing in some parts.

On the 3rd a thaw set in and continued till the 7th, removing all the snow. The weather from the 7th till the 14th was cold and cloudy. On the night of the 14th about two inches of snow fell.

From the 14th to the 26th the weather was cold and the sleighing excellent.

The frost about this time was intense, the minimum thermometer registering 18° below zero on the morning of the 19th.

On the 27th it became milder. The four following days were warm, not a trace of snow being left by the 31st.

This month was considerably colder than the corresponding one of last year.

MEAN METEOROLOGICAL Results for the Year 1884.

	1884. Guelph.	Average of 40 years, Toronto.
BAROMETER.		
Mean pressure for the year	29.191	29.616
Month of highest mean pressure	Jan. Dec.	September.
Highest mean, monthly	29.384	29.664
Lowest " "	28.174	29.572
Month of the lowest mean	January.	June.
Date of the highest pressure in the year	Dec. 26th.	
Highest pressure	29.472	30.358
Date of the lowest pressure in the year	2nd April.	
Lowest pressure	28.072	28.692
Range of the year	1.400	1.688
THERMOMETER.		
Mean temperature of the year	42.8°	44.17°
Warmest month	August.	July.
Mean temperature of the warmest month	65°	67.64°
Coldest month	January.	February.
Mean temperature of the coldest month	13.07°	22.73°
Warmest day	Aug. 18th, 20th.	
Mean temperature of the warmest day	76°, 78°	77°.85
Coldest day	Jan. 25th.	
Mean temperature of the coldest day	−9.6°	1.50
Date of the highest temperature	Aug. 18th, 20th.	
Highest temperature	93°	91°
Date of the lowest temperature	Jan. 25th.	
Lowest temperature	−35°	11.9°
Range of the year	128°	102°
PLUVIAMETER.		
Total depth of *rain* in inches	24.741	28.30
Number of days on which *rain* fell	68	110
Month in which the greatest depth of *rain* fell	October.	September.
Greatest depth of *rain* in one month	3.091	3.55
Month with most *rainy* days	October.	October.
Greatest number of *rainy* days in one month	16	13.
Day on which the greatest amount of *rain* fell	October 21st.	
Greatest amount of *rain* in one day	0.888	1.98
Total depth of *snow* in inches	59.5	
Number of days in which *snow* fell	31	
Month in which the greatest depth of *snow* fell	January.	
Greatest depth of *snow* in one month	35.5	
Month with most *snowy* days	January.	
Greatest number of *snowy* days in one month	11	
Day on which the greatest amount of *snow* fell	January 9th.	
Greatest amount of snow in one day	18	
Total precipitation in inches	30.691	

Your obedient servant,

R. B. HARE,
Professor of Chemistry.

PART III.

REPORT

OF THE

PROFESSOR OF VETERINARY SCIENCE.

GUELPH, DECEMBER, 1884.

To the President of the Ontario Agricultural College :—

SIR,—I have the honour to lay before you the second annual report from the Veterinary department of the Ontario Agricultural College. In presenting my first report last year, I took the opportunity of describing and explaining the subjects taught, and mode of teaching adopted in furnishing the students with what is considered a sufficient Veterinary education for the practical purposes of a farmer, so that I have nothing to add to that statement this year so far as the inside portion of my duties is concerned.

With regard to the outside department, there are some matters of interest to speak of.

In the process of time, when another year is recorded as having passed, there are generally some casualties worthy of notice occurring amongst a stock of a hundred head made up of horses and cattle, together with a flock of sheep, numbering at the present time about seventy-five. The past year has proved no exception in this respect, and I have to report some losses sustained.

DEATH OF HORSE.

The first one of much moment was the death of a four-year-old colt—one of a matched team with a good deal of Clyde in them—which succumbed to that very mortal affection in horse-flesh called inflammation of the bowels. This case did not differ from the usual course of this affection, in being sudden in its attack, and bringing about a fatal termination in thirty-six hours.

As to the cause there was nothing ostensible amongst the usual operating influences that could be assigned as acting immediately in the production of this attack; but this animal was somewhat subject to irritation of the bowels, shown by its having had two or three attacks of colic of a very mild character, at different times.

The weather was mild and unchangeable so that he was subjected to no exposure, to act as an exciting cause in this way; neither were there any irregularities in his diet that would lead one to suppose that it originated from any form of indigestion; so I concluded that there was predisposition in this animal.

THE NEW STOCK.

In entirely re-stocking a farm, where an unlimited number of animals are available for purchase, it gives a favourable opportunity for procuring those that are endowed with

a robustness of constitution, as indicated by a healthy conformation, so that the likelihood of the development of any constitutional hereditary disease, is reduced to a minimum, in these animals, as well as in their progeny. Taking our recently imported herd collectively, there is every reason to congratulate Professor Brown on the selections he has made, and I see no cause to find fault with the physique in any individual instance, as regards the healthy indications. But from the prevalence of "Tuberculosis" in well-bred cattle, and from its insidiousness, it may elude the observation of the most wary, when in an incipient stage; and some remarkably well formed animals become its victims, which is evidence of its contagiousness, and that it is not always the result of heredity.

At the time Professor Brown imported, foot-and-mouth disease was especially rampant in Great Britain, so that it was very unlikely that cattle could be moved in that country without becoming infected; the knowledge of which, caused these cattle to be watched very closely for any manifestation of the disease. On their arrival at quarantine, in Quebec, evidence that all was not right was noticed, on making a very close examination of the mouth. Professor Smith was sent for, and on examining them could hardly make up his mind that the extremely slight deviation from the natural state of the mouth, unaccompanied by any of the other usual lesions, could really be the dreaded foot-and-mouth. He and I made a subsequent visit together and concluded that it was this disease, although of the mildest type possible several of the other herds then in quarantine showed similar symptoms, and in the case of one herd; there was more nearly an approach to a definite development, but in no case was there any evident systematic disturbance, the patients never refusing their food, although the mouth was the organ solely affected.

So far as the College herd was concerned, and in fact any of the herds in quarantine at that time, nothing was to be feared as regards the consequences of the disease to them, for it was, as I have said, an extremely mild attack of what is in a very large majority of cases a comparatively simple and by no means fatal disease. But being aware that the germs of this disease retain their vitality for a considerable length of time—having been known to do so for a period exceeding a month —some anxiety was felt lest by any mishap it should be communicated to the cattle of this country; so that these cattle were detained somewhat beyond the usual period, and went through a very thorough process of cleansing and disinfection before removal, in order to insure the destruction of the germs that would be eliminated from the systems of any of the animals attacked, in the convalescent stage of the disease. That our efforts were a success is proven by the fact that none of the animals outside of the quarantine became affected.

It may not be out of place to state here that in my estimation the quarantine system, as carried out in Quebec, is a most efficient one, their arrangements and regulations being of such a character as to render the introduction of a contagious disease into this country from that port next to an impossibility. The Deputy-Inspector, Mons. Couture, V.S., under whose immediate management the whole institution is, treats every one with the utmost courtesy and consideration, consistent with the enforcement of the necessary regulations. Not only does he attend to any contagious disease, but he is unremitting in his attention to any animal, no matter what it is suffering from, so that no one's property is likely to be jeopardized by submitting to this most necessary detention, if we are to remain free from diseases of the class already alluded to, in this country.

Causes of Abortion.

Within the last two months we have been subjected to the annoyance of having our cows, one by one, slip their calves, until the total number of abortions sums up to six. The first two or three cases occurred in cows that did not represent much money, but the remaining cases were amongst the most valuable of the herd, hence our annoyance.

On several occasions before, this accident has happened in single cases, and two years ago this winter as many as three shared a similar fate, but now it begins to assume a formidable aspect, and it is difficult to tell exactly where it may end. From reports I have heard, some of which I know to be authentic, it seems more than usually prevalent this year. There are very few breeders of much experience in this country that have not

realized losses from this cause; but it is from Great Britain that we receive reports of its proving a scourge, almost equalling in destructiveness some of the notorious contagious diseases. On this account we have had an expression of opinion in writing from every class of individual interested, from the peers of the realm to the cow herd, not omitting the highest veterinary authorities, and various theories have been promulgated regarding the cause, yet no sufficient light has been thrown on the subject to enable any one to avoid its baneful consequences.

All are agreed that it may result from some accidental cause, such as an injury by violence to a pregnant animal, or that any severe disturbance of the nervous system caused by excitement, fear or anger, may bring it about; but under these circumstances it occurs in a number proportionate to those subjected to such influences, the operation of which we can often detect. It is not, consequently, this phase of the affection about which there is so much controversy with regard to the cause, but in that form of it, in which there is no apparent cause, cow after cow aborting in spite of any effort that has been made to prevent it, until all or nearly all the pregnant ones have slipped, those five or six months gone being especially prone.

Some of the best veterinary authorities have concluded that it is infectious, and some have gone so far as to state that they have discovered a microscopic organism in the discharge that follows the exit of the calf, which they consider to be the active agent in the production of the accident.

Those that think it infectious, in supporting their views, bring forth circumstantial evidence to prove its correctness by stating that herds of cows that have previously calved favourably, on being moved into fresh quarters, where the accident had hitherto occurred to a marked extent, the new arrivals became victims to the same condition. Also, from introducing a cow into a herd that had left a stable in which the disease was prevalent, on the stranger aborting, a like occurrence presented itself amongst the others. They also claim that they can cause it to take place by smearing the maternal passage of a pregnant cow with the matter from the expelled membranes of one that has miscarried. All this certainly, if not positive proof, is strong evidence of its infectiousness.

Others hold that the influence which causes one case to follow another is sympathetic, the emanations from a miscarriage producing the effect, but it does not seem to me that this theory is so logical as the other, for on noticing a case resulting from an accidental cause which is apparent, we do not find that others follow, as in the manner described, especially if precautions are taken to remove any trace of the accident, which seems to have no effect under the other circumstances. However, it would seem that this sympathetic action does exist to some extent according to some observers, and that a pregnant cow coming in immediate contact with the flux from the womb of one that has aborted will bring about the same misfortune.

Our first two or three cases occurred during the autumn on pasture, and from the occurrence of so many cases under those conditions, caused us to look for the presence of ergot, or any other form of fungus on the fodder, but none was to be found; and the subsequent occurrence of cases after housing, and the feeding of different provender, were sufficient to prove that no diseased grasses could have been the cause. In the first case or two that appeared in the stable, isolation, disinfection and burning of the "after birth" were carefully carried out, but still another case or two presented themselves, which caused us to make a radical change in the surroundings, by renting a stable fully three quarters of a mile from the College one, and moving those cows which, from their period of pregnancy, we were most alarmed about; a man was told off to attend to this lot solely, so that as little communication as possible would be had with the other cattle. Unfortunately this new arrangement was not successful in preventing another very valuable cow from losing her calf, which occurred some five or six days after the change; however, everything has gone well since, nearly a month having elapsed from the time the last loss was sustained, and I am very sanguine in the hope that no more will be realized.

The conditions under which the College cattle live are certainly unfavourable in some respects. I mean with regard to the constant disturbance to which they are subjected by so many people being about. It can easily be understood that pregnant animals are all the better for being kept as quiet as possible, in reason especially when far gone

in that condition, so that when they have to be moved up a dozen times a day and often more in being exhibited to visitors, it is apt to act adversely on them; also, from such numbers of students passing to and fro, and coming in contact with them, generally, especially when the treatment they may receive at the hands of some of them cannot be ensured as being humane or good, no matter under whose supervision these students may be.

These remarks are equally applicable to the fattening stock, for it is no doubt during periods of quietude that most flesh is accumulated. The excitement and state of unrest caused by such animated surroundings must certainly militate against, and alter the results of, many carefully carried out experiments, in other respects; all this of course is unavoidable, but should be understood in justice to the animals fed, as well as the system adopted in feeding.

Sheep.

On the arrival of the sheep in quarantine some of them began to develop signs of foot-rot, and it went through them all with very few exceptions, but was of a mild character in most of them, some few cases proving rather obstinate and not yielding to the shepherd's assiduous attentions until some weeks after their arrival in their new home, but all are quite free from it now.

A very valuable Southdown ram showed an unthrifty appearance, coughed occasionally at first, but developed into a very distressing cough before long. His appetite failed him until he ceased eating altogether for some days before his death. He also became very lame in the off hind leg for the last two weeks of his existence.

A *post mortem* revealed a large abscess in each lung, involving most of the lung structure, and just at the hip-joint there was another abscess, accounting for the loss of power in the limb spoken of.

I am anticipating a *post mortem* on another ram, and expect to find similar lesions. I am of the opinion that this disease must have been present at the time they were purchased, though in an incipient and ill-defined form, so as not to excite suspicion of its presence.

In my experience, this is the form that lung disease generally assumes in sheep, there being a great tendency to the formation of matter (pus) in these organs.

This concludes the more important and serious conditions to which my attention has been drawn since my last report.

Your obedient servant,

F. C. GRENSIDE, V.S.

PART IV.

REPORT OF THE PHYSICIAN.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, 29th December, 1884.

To the Honourable A. M. Ross,

Commissioner of Agriculture for the Province of Ontario:

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

During the early part of the year we had quite a number of the young men ill, the result of cold. One young man was attacked with congestion of the lungs and pleurisy, and although he so far recovered as to be removed to his home he gradually sank and died.

We have had several accidents, some of them of a serious nature; but all have recovered and are in their usual health.

There are many other cases that I might mention, but they are just such as are met with in every day practice.

I cannot close this report without again requesting an isolated apartment for the sick, and thus guard against disease, and save the sick the noise and commotion that cannot otherwise be avoided in an Institution of this kind.

I have the honour to be, Sir,

Your obedient Servant,

E. W. McGUIRE.

PART V.

REPORT

OF THE

PROFESSOR OF AGRICULTURE,

FARM MANAGER AND EXPERIMENTAL SUPERINTENDENT.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,

31st December, 1884.

To the Honourable A. M. Ross,

Commissioner of Agriculture.

SIR,—I enter the tenth year of my work here under circumstances of unusual interest, and that require some time and room to make fully clear—if it be possible to do so in this form. Your own recent elevation to office—making the fourth Commissioner under whom I have had the honor to labor—demands, so to speak, a more strict "Roll Call" than has hitherto been requisite, and hence I beg your indulgence for what may appear an overlengthy document.

The great point to the Province is the Educational standing our College and Farm have attained, and whether they grow or lessen as part and parcel of our national requirements. The reflective note, in opening these brings up many interesting reminiscences of gentlemen who stood the brunt of the battle in our cause, and who are still prepared to defend the union of pen and plough, as a systematic branch of training for the young men of a new country.

It is not worth while now, however, to either express regret or congratulation at some things in our history, because our present status can well exercise lots of charity; but, because there is danger in popular applause it becomes a serious duty of those responsible to the Government to shew cause for the future of what has been committed to their charge.

The bill our school is destined to fill is possibly less than what we have already on the card, for experience year by year has shewn that we are offering more than is actually required by the country. Ten years may be taken as a sufficient testing period for almost any enterprise, and are certainly very full for an educational one, so that we can confidently build upon what has been required of us in the College and on the Farm during that time.

In the first place, then, the farmer's son, and all others aiming at farming, have said very distinctly that they come to an Agricultural College to learn agriculture—direct practical and scientific agriculture, and nothing else. At the average age of twenty years, men are all the men they will ever be as regards aims and independent feelings—they are not school boys nor subjects to be handled according to a set rule of any sort, they feel their own wants, know best what they require, and invariably make for what they want most. At such an age the average student is not prepared to return to his three R's even should they be found wanting, for although we sometimes hear of such, it is unquestionably the exception to find a twenty-year-old "boy" at the desk with those of fifteen. In coming to our College, therefore, the farmer's son prefers to be taught in those branches of his profession that he can see and feel as of immediate use on his return home. It is a serious personal matter to him if he is thrown back upon his Mathematics and English, irrespective of personal desires.

We have lived then to know our own wants and those of the average student, and it can be no reflection on our work that change is desirable—much otherwise, for we grow with the growth of the country, and those for whom the Institution was designed: an unchanging education may be safely set down as a non-progressive one, and not likely to fulfil its objects. We know why at other colleges students in taking say a Mathematical course, must also take subjects allied to Mathematics, and so the Agricultural student is asked to take those that bear a similar relation.

But even in this I think we are asking too much. As yet the world's experience has failed to shew that the practical farmer needs more than a familiar acquaintance with the *Principles* of the sciences that affect his business. It is an old exploded notion that a farmer should be a practical Chemist and Botanist. I would fail to shew that we could do without any of the professors of these sciences, as much as I would fail to prove that the farmer should not have a liberal English education. This is not the point. What I desire to submit is that, in order to produce a plant and animal to the best advantage it is simply unnecessary to take them to pieces as the expert alone can do after a life-time's work. Our Chemistry and Botany should be therefore but an appreciative peep into how they affect the farmer in producing the particular plant and animal, under conditions.

When President Johnston and others laid the foundations of this, it was largely upon the failures of other similar Institutions, and hence much of our past success; now, with a growth of ten years it is time to take stock, in order to prune, graft, and organise for another decade.

As an experimental station the Government have dealt so liberally with us, and so much has already been done in some lines, that it is difficult to indicate where to improve or extend. Extension in chemical research is perhaps desirable, but as you will see from this report we have made a wide departure in such work, the value of which will soon be estimated. As we possess unusual appliances in live stock study, the country should ere long be full of everything relating to adaptibility of breeds to Canadian conditions.

II.—FARM CROPPING, 1884.

To Prof. William Brown:

Sir,—I have the honour to submit to you the Report of the Farm and Live Stock departments. It affords me much satisfaction to be able to inform you that the past year has been one of steady progress in these departments. I have endeavoured, as far as the time at my disposal would permit, to improve the appearance and condition of the large tract of land under cultivation, and clear up part of the unbroken portion. The fields have undergone a great change; fast stones have been removed from all, except Nos. 19 and 21 which have not yet been finished, but will be, it is expected, next season. Although it cannot be said that the farm is yet free from thistles, it must be admitted that comparatively few remain in any of the fields, while many of them are entirely clean.

When it is known that farms adjoining us are very prolific in the production of these pests, the difficulty of eradicating them in our own may easily be imagined.

Field Cropping.

Below will be found a narration of the crops gathered from the different fields during 1884.

Fields.

No. 1.—Twenty acres, ten which were under turnips, yielding 800 bushels per acre; nine acres of this field were under mangold, yielding 953 bushels per acre; the balance of one acre was sown with carrots (White Belgian), yielding 900 bushels.

No. 2.—Eighteen acres, all under hay, first crop bringing 1½ tons per acre.

No. 3.—Twenty acres, four acres of turnips, yielding 750 bushels per acre; four of potatoes yielding 202½ bushels per acre; ten acres were sown with corn to be used as green fodder and for filling silos to make ensilage; the balance—two acres—are planted with tree clumps.

No. 4.—Twenty acres, pasture and bush.

No. 5. " under hay, yielding two tons per acre.

No. 6. " hay, crop yielding 1½ tons per acre.

No. 7. " " "

No. 8. " " two tons "

No. 9. " sown with oats (Black Tartarian), yielding 50 bushels per acre.

No. 10. " ten of which were under fall wheat, yielding eighteen bushels; this wheat was very rusty, hence the deficiency; the balance of the field is planted with fruit trees.

No. 11.—Twenty-three acres, summer fallowed and sown with fall wheat, and seeded with timothy; the other grasses will be sown in the spring.

No. 12.—Fifteen acres uncultivated and used as pasture.

No. 13.—Twenty acres; fifteen sown with oats, which being badly rusted, yielded but thirty bushels per acre; one acre under vetches and oats, used as green fodder, was a fine crop; the balance—four acres—are at the disposal of the students as a recreation ground.

No. 14.—Twenty-five acres—experimental field.

No. 15.—Twenty acres hay, crop yielding two tons per acre.

No. 16.—Twenty-five acres hay, " 2½ "

No. 17.—Seventeen acres, eleven of which were sown with white barley, yielding forty bushels per acre; the remainder five acres of black barley yielded forty-five bushels to the acre.

No. 18.—Thirteen acres, sown with spring wheat (White Russian), yielding thirty bushels per acre.

No. 19.—Thirty acres hay, crop yielding 1½ ton per acre.

No. 20.—Remains uncultivated.

No. 21.—Sixteen and one-half acres, sown with peas, yielding thirty-five bushels per acre.

It may be remarked that too large a proportion of the farm has been allotted to the growing of hay. So many fields being under hay crop is in consequence of the live stock being sold to make room for the fresh importations. On this account about sixty acres, which were intended for pasture, were not used and thus the crop was harvested.

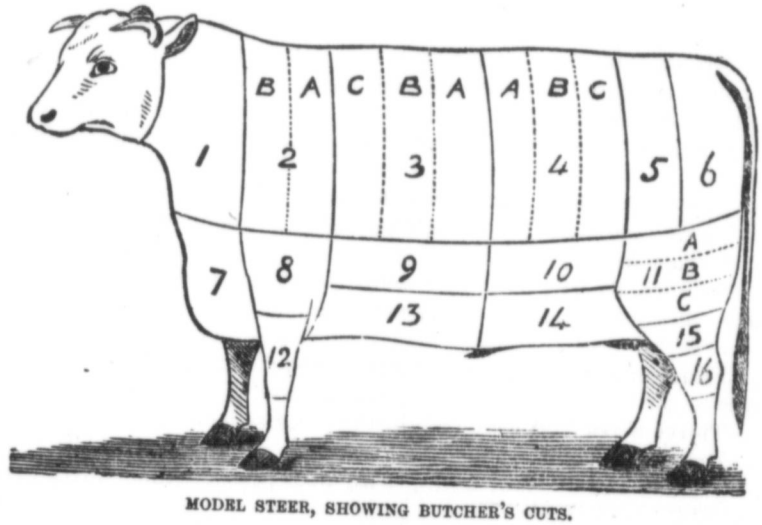
The Live Stock.

Since my last report a marked improvement has taken place in the Live Stock department. In compliance with the request of the Government you visited the Old Country and there purchased a large number of thoroughbred cattle and sheep. The selection now to be seen in the stables is probably the finest in America. There are ten breeds of cattle

represented in the stables. Among the many fine animals which command the admiration of stock raisers, "Rob Roy," the celebrated Shorthorn bull, stands pre-eminent. He is a model Shorthorn in every respect, and one that will stand the criticism of the most experienced and intelligent breeder. The Hereford, Polled Angus, and Holstein bulls are also splendid specimens of their breed. In fact the collection of cattle on the whole is really an admirable one. The recent importation of sheep comprises eight different breeds. It is unnecessary to particularize them. Suffice to say, therefore, they are fine specimens, and are greatly admired by all who have seen them.

It is not easy to estimate the value which this importation is to the College and Farm. A thorough practical knowledge of all the points and characteristics of the different breeds can now readily be imparted to the students. They take a deep interest in attending to the stock, and appear to profit much by the practical experience which they may so easily acquire. The special Live Stock class has made rapid progress during the past year. It comprises twenty-five students. I deliver lectures to them daily, on the important subjects embraced in stock raising. It may not here be inappropriate to enumerate the points which I particularly explain to the class. They are (1) the treatment of cattle, sheep and swine; (2) judging and handling store and fat cattle; (3) milking properties of cattle; (4) when cutting up the meat for the College, I explain the different parts of beef, mutton and pork, stating the market value of each part of the carcase. This instruction is to the students a sequel of what has been told them relative to the points in live animals. It also furnishes them with a practical knowledge of what the prime parts of the animal are, and the relative value of it when alive.

To more plainly illustrate the nature and value of the instruction which the students receive in their departments, the accompanying outline of a model steer, ready for the shambles is given. On it are shown the butcher's cuts, with the names and average price of each part subjoined.



MODEL STEER, SHOWING BUTCHER'S CUTS.

	cts.
1 —Neck	5
2A—1st Chuck Cut	11
2B—2nd Chuck Cut	10
3A—1st Rib Cut	12½
3B—Centre Rib Cut	15
3C—3rd Rib Cut	12½
4A—Wing Cut	12½
4B—Sirloin Roast	12½
4C—Centre Cut with Tenderloin	15
5 —Sirloin Steak	12½
6 —Rump	10
7 —Brisket	8
8 —Shoulder Roast	10
10 —Upper Flank	8
11A—Round, or Buttock	12½
11B—Round, or Buttock	10
11C—Round, or Buttock	10
12 —Fore Shank	3
13 —Navel	8
14 —Lower Flank	7
15 —Hock	5
16 —Hind Shank	3

The above table shows the prime parts of the animal. The student will readily perceive the importance of developing the animal in those parts which receive the highest

price from the butcher. The necessity will then occur to him of selecting cattle for feeding which are well formed and which give promise to be models for the butcher's market. If the store animal is long in the neck and legs and heavy in the bone, the probabilities are that its market value will be depreciated by the large proportion of coarse meat. The value of the student thoroughly understanding the tastes and requirements of the butcher, cannot be overestimated, as on at knowledge, to a great extent, depends his success as a feeder.

Remarks.

It affords me much pleasure to be able to testify to the worth of the windmill pump in supplying water to the stock in the south-west portion of the farm. This mill was erected during the summer of 1884 by Mr. Wm. O'Connor, agricultnral implement manufacturer, of Guelph. A wooden tank, with a capacity of three thousand gallons, is situated on an elevated platform beside the pump. Into this tank the water is pumped. Pipes run from the tank into troughs in five different fields, and thus all the stock in these fields have a regular supply of pure spring water. The arrangement which regulates the supply is an ingenious piece of mechanism. Floaters are placed in the tank and troughs. As soon as all the vessels are full, these floaters close the taps and shut off the water. The water, in consequence of not getting into the tank, is forced into a cylinder attached to the pump. The force of water in this cylinder puts the windmill out of gear. When an animal commences drinking at one of the troughs the machinery is again in operation and continues so until there is no more water required. Thus at all times there is a plentiful supply of water on this part of the farm. The benefits derived from having such an arrangement are numerous, and everyone in connection with the stock department considers the windmill a great boon. Knowing the value of it, I would respectfully suggest to you the advisability of recommending that another windmill be placed in the north-east portion of the farm for the stock there. This, I think, is an important matter and deserves earnest consideration, as the cattle should at all times have access to water and not be confined to it at stated intervals. The beast is the best judge itself of when it requires a drink; and water should always be free to it.

Almost continually during the past season we experienced a great deal of trouble and loss through neighbouring cattle trespassing on the farm. In summer they run over the crops and do considerable damage, and in the fall they destroy our newly seeded meadows. The greater part of our line fences are of the old rail or snake style. I would recommend that a board fence be placed in their stead, and then we would have little to fear from the intrusion of neighbouring animals. The poor rails in the present fences could be used as fuel for the farm engine, and the good ones would do valuable service in repairing the inside or cross fences.

While referring to this question there is another very important matter which I desire to lay before you. The peculiar shape of the farm as it now stands, renders it practically impossible to lay it out in as regular and convenient a style as would be desired. This is in consequence of the breaks made in the block by the three tracts of land owned by Messrs. Stone and Hamilton. These portions comprise about 150 acres in all, and were they in possession of the Government, the whole block would constitute the Experimental Farm. Then a lane could be run the full length of the place and fields of uniform size laid out. The annoyance now experienced from cattle trespassing on our fields would then be obviated, as it would be next to an impossibility for the animals to break down the road fences. To be more explicit, I would here submit a plan of the farm, showing the property owned by Stone and Hamilton. The irregular shape which the rear end of the farm now presents will be seen at a glance.

In response to the recommendation made in my last report, part of the implement shed is now being fitted up with shafting, pulleys, etc., for running farm machinery during the winter months. It will be so arranged that a self binder, reaper, mower, and seed drill can be in operation at the same time. The object of this is to accustom the students to the machinery. They will be instructed how to take apart and set up each machine, so that they will naturally become familiar with each part of them. I expected that a much larger and more comfortable building would have been assigned for this purpose, as

I had in view the desirability of teaching the students hand sowing. The place now being arranged is, however, much too small for such purpose. It would be well if the Government, when considering the erection of new buildings, should bear in mind the necessity of a structure such as the one I have alluded to.

There are two men at present at work in clearing field No. 12 so as to make it arable. The land in this field is excellent and it promises to be the best on the farm when properly worked. It will, however, never be in a state of cultivation until well drained, as it is very low. There is an absolute necessity for having this field drained. Nos. 17 and 18 are well cleared, but also require drainage. I hope and trust the Government will place a sufficient sum to the credit of the drainage fund to enable us to drain these three fields.

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

P. J. Woods.
Farm Foreman.

III.—LIVE STOCK.

We are now in possession of nearly all, if not all, in cattle and sheep life that stands of any considerable value to the civilized world. It is something to say that our Farm is unrivalled in this respect, and as you honored me with the selection, I beg now to submit report of what I found and have done.

1.—Britain the Home of Live Stock.

To very many of our farmers the position of Britain as a breeder of Live Stock is largely unknown. The wonder is how such a small country can hold so many valuable herds and flocks of so many distinct varieties, and beat the American Continent in maintaining them in all their goodnesses. From the sea shore in a straight line fifty miles, up to four thousand feet above its level, we touch the home of no fewer than twenty prominent varieties of cattle and sheep—each so different in points and characteristics as would seem to demand an island for itself, bearing all the physical conditions that are known to be necessary in helping to make the particular breed. Then, to an American it is more than a wonder how lower life with so much stamina and general richness can be upheld subject to all the fog, and dust, and rain, and smoke, and rawness, and cloud that seem to prevail 365 days a year. Skill, climate and soil have made Britain's herds and flocks, and nowhere else can the same thing be done and maintained.

2.—Britain's Herds.

England's greatest combination of beef and milk is as prominent in numbers and power of good things as ever. In comparison with other breeds the Durham of Old England maintains a stately majesty of position that reminds one of "Landseer's famous dog picture."

Times will boom for most things of any national importance, ranches will rise and fall, the Dairy interest fluctuate, and Live Stock trade generally will go and come according to supply and demand, but no form of national or international trouble will ever lower the blood of Booth or Bates in the eye of John Bull.

The writer had simply to bow in passing Warlaby for the one side, and Hindlip Hall for the other side, of the same house. These are the representative herds respectively of Booth and Bates at the present moment in England. The many others of equal merit cannot even be named because of their numbers, and what surprised me as much as any

thing was my inability to distinguish any prominent difference in general type between the two "bloods" in Short Horns. I went unprejudiced—I remain unprejudiced.

I found a marked recognition in practice of breeding for better constitutions, to meet the outside markets of the world, and at the same time to throw off the grossness of frame that had crept into some herds. Constitution and quality in a compact medium frame are not in any way opposed to nature, and are certainly most desirable for the American and Canadian market. I was much pleased to find that while Short Horn breeders are, as a matter of business, paying some attention to the colors to which we are at present wedded, they are not afraid to use *white* quite freely. I think there is less pampering than formerly existed, though a decided increase of flesh amongst the Herefords. It is likely that the present demand for this magnificent grazier is tempting to make condition fill the American eye. If this is not cautiously handled there will be a serious reflex some day, and yet I admit that the breed can hold lots of flesh and do well. It is not difficult to see a near lull among these, that will last till the present extensive exportations require replenishing. I think it would be well were Hereford breeders more particular about markings and pedigree. That *white* is against either the Short Horn, the Hereford, or the Aberdeen Poll, is not admitted of course, but an uniformity of color is clearly desirable when there is a prevailing type, as recognized by the leading men. These apparently small things *pay*. The rush has been so keen and fast for Herefords, that I found some breeders unable either to name their animals or give their pedigree.

The increasing feeling in the States and Canada for what are called "Scotch Short Horns" was not unknown. While it is desirous to encourage every point that goes to make a perfect animal for a particular purpose, there need be no fear on the part of England proper that her type of Short Horn has not all the field she can possibly fill; for example, while I think I secured the best bull in Britain *for our purpose*, from Scotland, I am certain there are others in England equally good for other purposes.

But Scotland's new beefer is unquestionably the Aberdeen Angus Poll. In these times of *specialties* this breed of cattle is bound to fill a big place in the world's products. The hardiness, early maturity, general quality, and weight of the Watson—McCombie Poll cannot fail to lead where average physical conditions prevail. I do not say any extreme conditions. It was really a very pleasant duty to inspect, as I did, nearly every prominent herd of these in Scotland, and to see so much "canny," foreseeing, practical judgment exercised in their extensive production. I could not buy from some even at £1,000 a head, and yet I gave the highest price that had ever been paid for a bull. The black diamonds of the north of Scotland will make warm ground for the Short Horn and Hereford. The polls of the south of Scotland, usually called Galloways, are gradually obtaining the place that no other breed can fill so well. That they are destined to lead where all other beefers fail, I think there is no doubt, and in view of our first purchase of this breed I took care to obtain the oldest and best blood that Scotland possesses. The American continent is not a lover of Devons, because of their want of size and early maturing in these fast times. Yet, the Devon has had a place and may improve it considerably in connection with the butter factories of the States and Canada. These, with the Dutch, Guernsey, and Jersey, our farm secured for the purpose of testing by strict experiments how far they are adapted to Ontario requirements in milk, cream, butter and cheese.

3.—British Farmers.

I had the honor of addressing the British farmers through their own Agricultural Press—the object of my letter being to indicate what a fine field Canada is for those who desire to prosecute the breeding of live stock under conditions that Britain cannot now afford to all. I have not since had an opportunity to acknowledge the large number of letters in response, and my inability of personal reply to each. This response from the farmers of Britain sent me home with mixed feelings. To find so much intelligence and enterprise, as it were, tied-up and struggling, seemed to a colonist very curious. I am not a believer in sub-division of landed property, and trust aye to find large estates and progressive landlords, but I cannot understand why unfettered men, as every tenant actually is, hold so fast and long to the flesh pots. Then, I wish to record what seemed

to me a very glaring inconsistency. As a stranger to the mother country, during the agricultural difficulties of the last decade, I was prepared to find many changes—such as naturally follow hard times. In my run of over 2000 miles in England and Scotland in search of the eighteen breeds of cattle and sheep, I had necessarily good opportunities of seeing all classes of farms and farmers. In not one instance did I find the thread-bare coat, the haggard look, nor the starving kine of the decaying husbandman. On the contrary, I found no lack of good things—even to the profuse cellar;—not, remember, alone at the larger class of farms, but with those of small holdings. So also, why is it that the British farmer—the average one—won't work with his own hands, and brave the agricultural wolf, as to which he has made so much ado of late? In many cases I found him idling in the house while their men were at work in the field. Farmers have no right to cry hard times and act in this manner,

I cannot too fully express thanks to the very many who gave counsel and help in securing what was unquestionably one of the most unique and specially valuable selections of live stock. I got some very fine animals, and necessarily had to pay for them. When you pick a man's herd or flock, high prices will hold. Britain need never fear for her agriculture so long as she can produce the pasture and the live stock she is now doing, at the same time keeping in good terms with the other fields of the world.

4.—British Flocks.

It is perhaps because Canada is weaker in sheep than in cattle that I thought more, as a whole, of the sheep of Britain than her cattle. It is a proud thing to say that Britain holds every breed of sheep but one in the world of any important value to herself or any other country. The Merino has not yet succeeded in securing a place where so much of its wool is used—a fact attributable to its inferior position for the butcher. But amongst Britain's thirty different types of sheep, there are practically but ten that any one—an experimental station, especially—need trouble about. I was specially struck by the free practice of in-and-in breeding in flocks, and how it can be so safely pursued there in comparison with the real or assumed dread of it on the American continent. Britain can grow wool as well as mutton, but not needing to do so as a matter of necessity, it was another surprise to find so many grandly woolled flocks of every breed. There is more risk in importing diseases with sheep than any other class of animals, because of their own numerous troubles in Britain, coupled with the carrying property of wool. Our views of the hardy character of the Leicester were fairly upset by finding them shorn and on exposed pasture in cold, wet weather in the end of April in Ayrshire—doing well. They still represent Bakewell's "Soda Water Bottle," in the Border as well as English type, and distinct enough in want of paunch and under wool; but what splendid backs and forequarters! We, states a Canadian, like the gray-faced better than the white Cotswolds, thinking them hardier, better in quality and with better fleeces. The Canadian period for Lincolns is either gone or has to come. The American impression of roughness and want of compactness among Lincolns was not borne out by what I saw of them in England. To be unable at times to distinguish a Lincoln from a Leicester is anything but evidence of such a character, and it is doubtful if we have done justice to one of England's swamp sheep. We have no hopes of making any value for Canadian purposes of Scotland's black-faced Highland. A hardy British breed does not necessarily imply ability to withstand extremes of climate. Heat will kill some animals quicker than cold, and our study of sheep life says that not only will the wool of this breed deteriorate rapidly here, but constitution will also suffer. Three years will tell something with what we have on hand. But the Cheviot has a better prospect with us; for, in addition to a better wool value even than the Leicester at present, its possession of Leicester blood and more southern habits will command its use in crossing with scrubs for certain purposes. An Ontario manufacturer offers us now four cents per pound more for Cheviot than for Leicester wool.

We can say a good deal already about Down experience, with the exception of Hamps. These we now have for the first time, and if they behave as well as the Shrops have done, Canada will be pleased indeed. They are much stronger built, and finer in

wool than the Shrop. We have not lost faith, however, either in Oxford or South Down, though the one may be called too big and the other too small for some purposes. The four Downs of England are making her exhibitions more interesting every year, encouraged no doubt by different crop-growing and disease among cattle.

5.—British Pastures.

It is mild to say that but for her pastures Britain would have been a poor place, agriculturally, during the past decade. But her pastures are pastures—rich enough in wealth, sweet, always crisp, always fresh—a new crop every morning, a clean bed every night, and abounding in shelter and water. British pastures smell of fatness twelve months a year.

6.—British Proprietorship.

It may be expected of me as an old country factor, or estate agent, that something should be said about what I thought of British proprietors after a long absence. The change in personal interest, if not personal management on the part of very many of her owners, is more real than the outside world kens. More home staying, more advice with the manager, and much more public talk, if nothing else, so that lords and land laws are familiar terms enough. Whatever may be Britain's agricultural future, I trust she will never want for such a stamp of tenant proprietors as I had the honour of meeting in Ayrshire. In a high-lying, somewhat exposed district, not far from Robbie Burns' home, this gentleman cultivates about 450 acres of a partly stiff clay, and more of a light sandstone shale soil. The general character of the estate is decidedly favourable to dairying, and consequently there are as many as sixty-five pure Ayrshire cows, twenty yearling heifers, as many two-year-olds, and ten bull calves. There are also one hundred breeding ewes of the Leicester-Cheviot cross, the combination of early maturity and hardiness so much liked, together with ten blood Clyde mares, pure bred, and each worth $800. The valued rental is $3,500 a year. Cropping is usually seventy acres grain, thirty of roots, one hundred of hay, and 250 acres permanent pasture. His practical faith in quantity and variety of plants in pasture will astonish most Canadians. For permanent runs he sows:—

Italian Rye		10 lbs.
Perennial Rye		24 "
Orchard		6 "
Meadow Fescue		4 "
Crested Dog's Tail		3 "
Timothy		3 "
Peas		4 "
		64 "
White Clover	2	"
Red "	2	"
Yellow "	2	"
Alsike "	1	"
		7 "
Seeds per acre		71 "

These for the lighter soils, and fifty-four pounds *only* for heavier ones. Manures are applied to the root division and to the pastures. Of special manures, he uses 225 pounds mineral superphosphate, 56 pounds sup. of potash, and 56 pounds nitrate of soda per acre. The manures purchased bill about $4,000 annually, and the cake account never less than $4,500. Sheep produce all goes off in June as lambs. Revenue otherwise derived from direct dairy products, young horses, fattened pigs—as much as $1,000 a year—and oats. Fillies are mostly kept, but colts all sold as yearlings at an average of $700 a

piece. The food of cows in winter is generally straw and turnips before calving, with hay, and one and a-half pounds per head daily of cotton cake. The buildings are first-class, with covered manure shed, and liquid manure conveyed to tanks a-field. The proprietor lives in Glasgow mostly, and visits the farm about once a month. There is no extravagance anywhere apparently, though the master is a follower of the hounds.

7.—Our new Importations of Live Stock.

The very liberal appropriation of $25,000 for this purpose has been expended. In offering and accepting of the honour of the selection of specimens of no fewer than twenty different breeds of cattle and sheep, the government ran considerable risk and I much danger—risk in Canadian judgment and danger of personal reputation. No one man can possibly be the best judge of so many distinct types, and for a public institution where thousands have to be pleased, the task was far from enviable. There was not even the shadow of a holiday about the business, but hard physical and mental work day and night without intermission, for nearly three months.

What I did, and did not do, in every case in Britain, would be an unnecessary writing detail, but a few general remarks will not be out of place.

In a few instances I found it a disadvantage to represent a government, but in the majority of cases it was not so, indeed considerably favourable as a matter of business. Our college and farm is so well known in Britain that many breeders desired to connect by sale, and some did us the honour of reducing prices to cement the tie.

I offered higher prices for cattle than for some of those we secured, but the Great Tops of England and Scotland could not be bought. I looked first at the animal and then at the pedigree—never pedigree first. I thought it absolutely essential to have a good pedigree, but more important to get animal form. As between male and female, I considered it good policy to place more money proportionately on the former than on the latter, and I am glad to say that we succeeded, without a single exception, in having every cow or heifer in calf or with a calf at foot, so that in place of twenty-six females, we have really imported fifty-two of them, including calves.

In view of the well known objection to white among Durhams in Canada and the States, I declined a bull in England at one-fifth less money than given for the one imported—the one being equal to the other, and the former much younger. The market must be respected. Similarly, I had to bow to our own prejudice in the case of Ayrshires—dark or white leading in Scotland, but being objectionable here. With a first-class mixed pedigree, I think we obtained one of the best Durham bulls in Britain. I saw two better Herefords, and three better Aberdeen Poll bulls than those we hold.

On the character of the whole importation, I beg to quote from several good authorities:—

The Shorthorn bull, "Rob Roy," (45484) was obtained from Mr. Duthie, of Collynie, Aberdeen, under favour to the Experimental Farm. This magnificent animal was refused to a Canadian in 1883 at any price, and in his letter to Mr. Brown, Mr. Duthie says: "I never parted with an animal with so much regret as I do with Rob Roy, and had it not been for the way in which you have behaved, and for the credit of our breed, I would never have put him in price." With reference to this bull, the *Live Stock Journal* of England says:—"The bull is Rob Roy (45484), a very large and handsomely-formed red, bred by Mr. James Gordon, of Arabella, Ross-shire, out of a cow named Luxury, which Mr. Gordon obtained from the Midland Counties of England, and got by the well known 400-guinea showyard hero, Rosario (35315), whose sire was the celebrated Duke of Aosta. Mr. Gordon purchased Rosario at the Highland Show at Glasgow in 1875—the year in which the Duke of Aosta and his two beautiful sons (Rosario and Pioneer), swept everything before them at the three national shows. By many good judges, Rosario was considered the best bull of that remarkable trio, and Rob Roy is very little inferior to his sire. Larger in size and fully as wealthy in flesh, Rob Roy is perhaps scarcely so gay and so attractive in character as his sire was in his youth, but he has, indeed, very few faults. He is long in the frame, admirably let down behind, broad and level on the back, with great wealth of flesh, excellent quarters, and good head and horn."

SHORTHORN "ROB ROY" (45484).

SHORTHORN "ROB ROY" (45484).

The cows, Princess Royal 8th and Mademoiselle, from the same herd, are beautiful types of the proper beef and milk combination in a Shorthorn; they are true females of grand quality, and even throughout. "Mademoiselle," says the critic already quoted, "is a long, level, light roan, with the choicest of feminine character, and exceedingly fine quality."

Baroness Wild-Eyes is a neat specimen of the Bates' blood, and secured for educational objects from Mr. Evans, of Uffington, England.

The Hereford bull, Conqueror (7510), stood very much unknown to either the American or English breeders because of the comparative privacy of Her Majesty's herds at Windsor, and would certainly not have been sold but for reasons similar to those expressed by Mr. Duthie. The same high class journal of England says: "At the head of the Herefords is the beautiful two-year-old bull, Conqueror. In the hind quarters he is not so well filled out as could be desired, but otherwise is admirably formed. His shoulders are well laid in, his ribs wide and well covered, loin strong, cover of flesh very rich, quality excellent, and character faultless, his head and horns being very attractive. As noticed two weeks ago, Conqueror was bred by the late Mr. Carwardine, Stockton Bury, got by the celebrated Lord Wilton (4740), and out of Coral, by Rodney (4907), the sire and dam of Mr. Taylor's second prize two-year-old bull at the Royal Show at York last year."

With a view to experimental work, the very large cow, Bloomer,—"wide and deep in the frame, richly fleshed and of good quality,"—and Cronkhill Duchess 2nd,—"handsome and attractive,"—may be taken as specimens of this class.

No better authority on Aberdeen Angus Polls can be had than Mr. McDonald, editor of the journal already quoted, and with reference to those at the Ontario Experimental Farm, he says: "Of this popular and very valuable breed, Professor Brown has taken with him some very good specimens; two of them, in particular, are of very high merit, namely, the two-year-old bull, Strathglass (2,357) and the four-year-old cow Kyma (4969), purchased from Mr. Wilken, Waterside of Forbes, Alford. Strathglass was bred by Lord Tweedmouth, Guischan, Inverness-shire, out of the 155-guinea cow, Witch of Endor, and got by the Pride bull, Heir of Glory, and won the first prize in the yearling class at the Royal Show at York last year. He was purchased by Mr. Wilken, when a calf, at 103 guineas, and it is worthy of notice that at the Tillyfour dispersion sale, his dam was by many good judges accorded the premier position for symmetry, quality and character; also, that the dam of his sire, Pride of Aberdeen 9th, was the highest priced animal at that memorable sale. Large in size, and very well fleshed, Strathglass is specially good over the loins and back ribs, while he is deep in the carcase, of good quality and excellent masculine character. The cow that accompanies him from the Waterside Herd is a very thick, handsome and heavily-fleshed four-year-old, of good character and fine quality. Although not more than four years old, she has at foot her fourth calf—a very nice bull, got by Paris 4th (2277). Her last year's bull calf was sent to Canada, to the Hon. J. H. Pope, Minister of Agriculture. She was first at the Aberdeen Show as a heifer with calf at foot, and first at Alford last year in the cow class. Two good cows were secured at Mr. Bennett's dispersion sale at Marypark, Inveraven, and along with these goes a promising bull calf from Mr. Grant's herd at Advie." For notes to Sybill's Darling 2nd—an Aberdeen Angus Poll cow of high merit—see pedigree.

The Galloways are not only of the best families, but unusually good specimens of the breed. Stanley 3rd, of Drumlanrig, by the famous Black Prince, is a long, level and very promising young bull.

The Devon bull, Rose's Duke, is from the Stowey Court herd, still so well known for purity and good size, and the cow, Esmeralda (4433), from Windsor, is such an unusually large, well-formed animal, as will probably draw some criticism.

The specimens of Ayrshire cattle are from herds well and favorably known in Scotland. The pedigree notes indicate individuality that has already been sustained since importation.

The Guernseys and Jerseys were obtained direct from these Islands by the agency of Mr. Fowler, of Bushey, England.

The *Live Stock Journal* says: "All these animals are of the choicest quality and characteristic shapes."

"Very good as is the collection of cattle, that of sheep is equally good, if not, indeed, even better." This introduction by Mr. McDonald is enough. The pedigrees and notes to each of the classes are sufficient to guide those interested.

As the country desires to know the character of our male animals by pedigree, I have pleasure in giving each.

SHORT-HORN.

Rob Roy (45484).

Red, calved 23rd June, 1880; bred by J. A. Gordon, Udale, Scotland.

		BRED BY
	sire Rosario (35315)	A. H. Browne, Doxford.
dam Luxury	by Heir of Windsor (26364)	Mr. Carr, Stackhouse.
2. d. Lemon	" Havelock of Lucknow (16242)	Lord Walsingham, Merton Hall.
3. d. Legacy	" Lablache (10387)	C. Barnett, Stratton Park.
4. d. Lovely Kate	" Hosills (14720)	Mr. Pym, The Hasells.
5. d.	" Young Wynyard (15524)	Earl of Hardwicke, Wimpole.
6. d.	" Young Linton (4206)	" "
7. d.	" Burleigh (3244)	Mr. Pym, The Hasells.
8. d.	" Woodville (2856)	Mr. Whitaker.
9. d.	" George (1068)	Marquis of Exeter.
10. d.	" Constellation (919)	Marquis of Exeter.
11. d.	" Young Favorite (254)	C. Colling.
12. d.	" Midas (436)	Mr. Grant.
13. d.	" Major (397)	C. Colling.

Price, £450.

Rob Roy (45484), in 1882, won 1st prize at Dingwall in the class of two-year-olds. In 1883, at the Highland Society's Show at Inverness, he won 2nd prize in a large class of bulls.

His sire, Rosario (35315), won 1st prize at "The Royal English," "The Royal Irish," and "The Highland and Agricultural Society of Scotland," Shows.

His dam, Luxury, won 1st prize as a cow at Birmingham.

HEREFORD.

Conqueror (7510).

Calved 25th April, 1882; bred by T. J. Carwardine, Stockton Bury, Eng.

	sire Lord Wilton (4740)	W. Tudge, Adforton, Herefordshire
dam Coral	by Rodney (4907)	T. T. Carwardine
2. d. Blossom	" DeCote (3060)	Thos. Edwards, Wintercott
3. d. Fera	" Heart of Oak (2035)	J. Rea, Monoughty
4. d. Rosemary	" Counsellor (1939)	Phil. Turner, Pembridge
5. d. Silver	" Downton (1219)	John Ashwood, Downton.

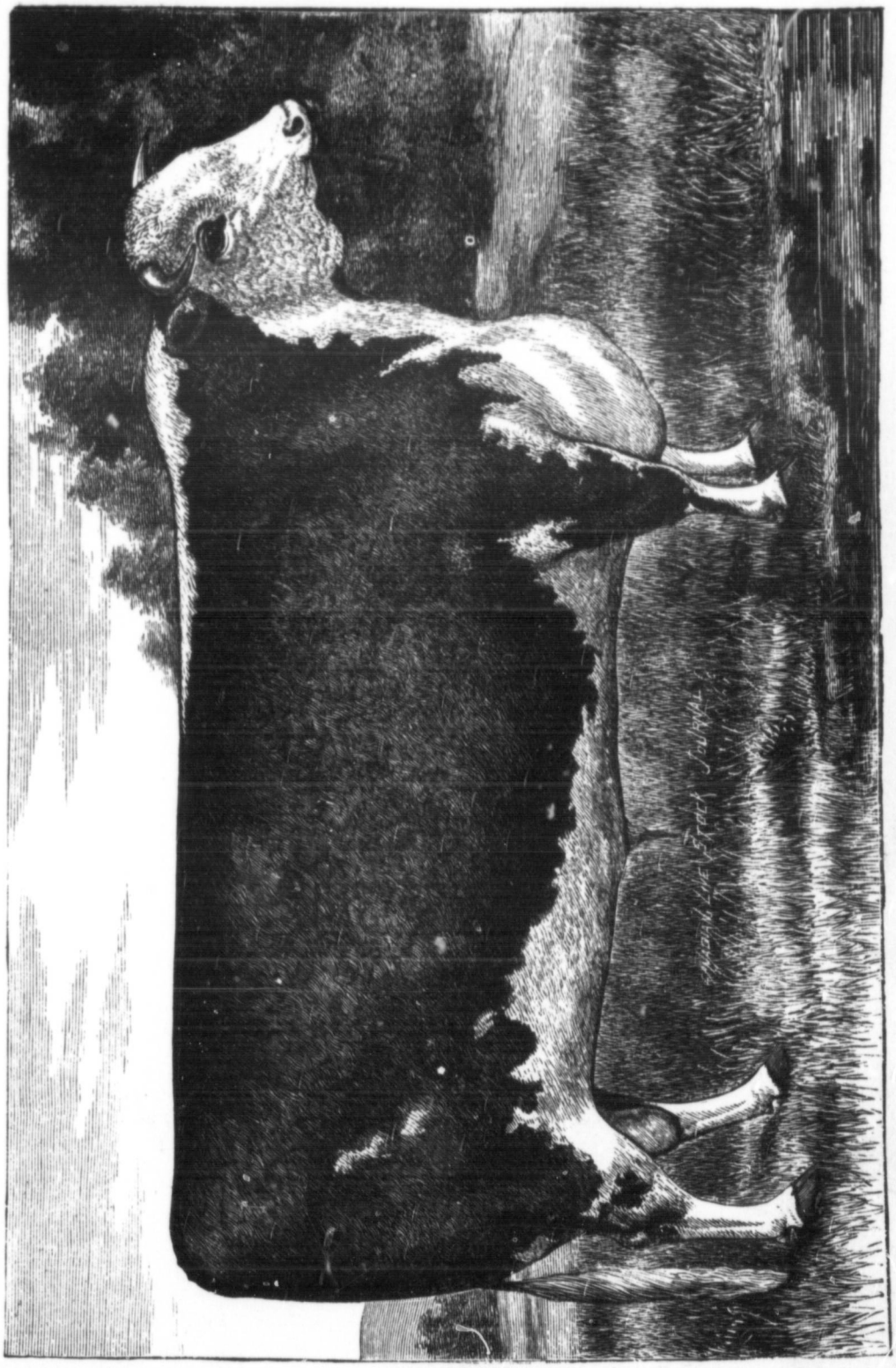
Price, £500.

Rodney (4907) and Coral are the sire and dam of Mr. Taylor's 2nd prize two-year-old bull at the Royal Show at York, 1883.

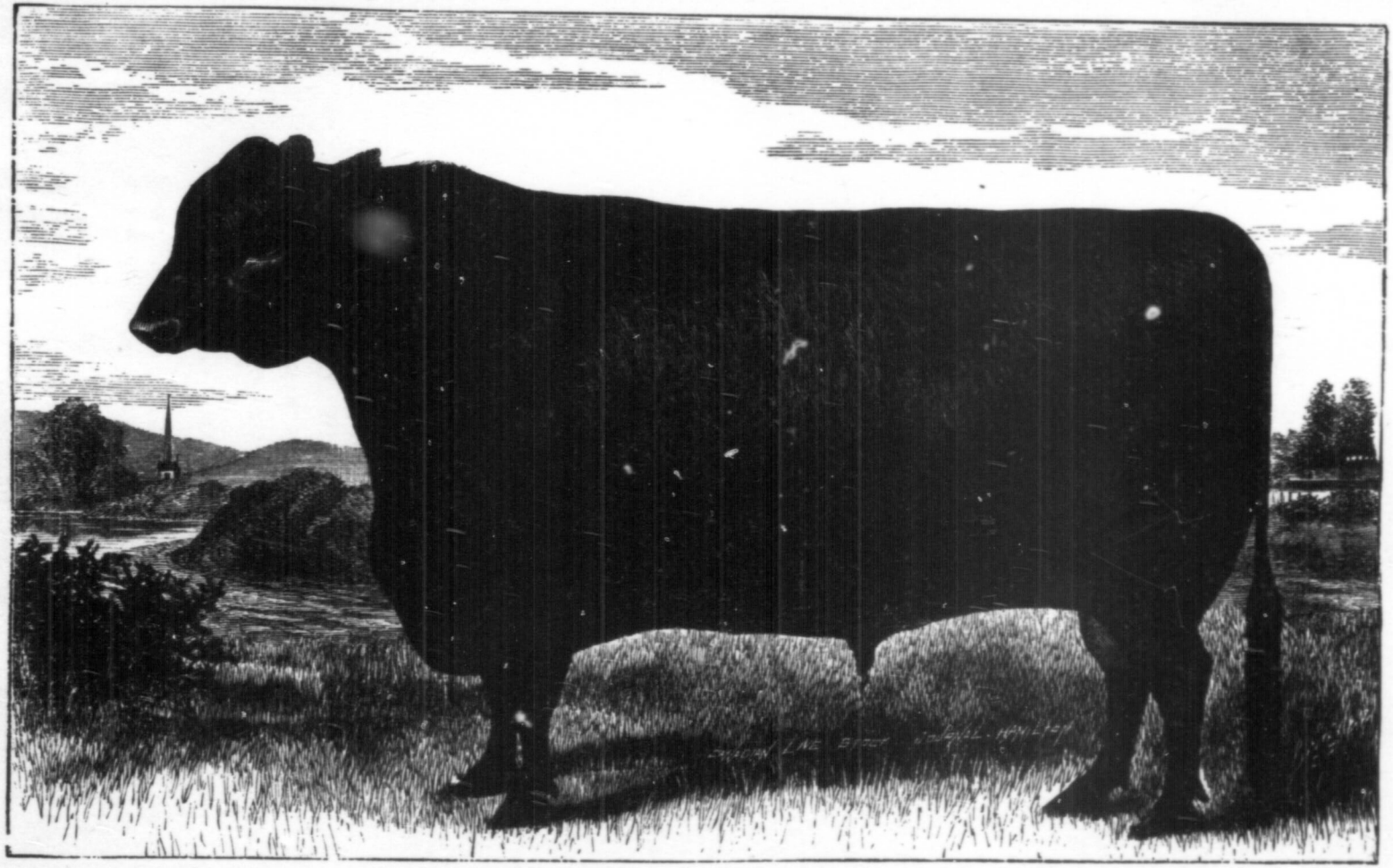
Lord Wilton (4740), called the invincible, is acknowledged the greatest Show Bull and sire of the present day. Winner of 1st prize at the Royal Agricultural Show at Taunton, also at the Bath and West of England, held at Croydon and at Hereford in 1875, besides the champion prize in 1880, 1881, and 1882. He was sold in October last for $20,000 when 11 years old.

He is by Sir Roger (3850), he by Sir Thomas (20), and he by Sir Benjamin (36), bred by Mr. B. Rogers in 1856.

With reference to the Lord Wilton (4740) blood, *The Field* of England, 8th March, 1884, says: "According to general confession there has been only one Hereford known to the present generation of breeders at all comparable to Horace (3877). The Americans are running wild just now after the progeny of both. The sensation created by Horace's stock was equalled at the Royal Show at Derby in 1881, by the extraordinary merit of Lord Wilton's sons and daughters. Mr. Carwardine sold Sir Bartle Frere (6682) for exportation to America for £600. It may fairly be doubted whether there is another animal of any cattle breed at the present day owning such a numerous progeny."



HEREFORD, "CONQUEROR" (7510).



ABERDEEN POLL, "STRATHGLASS" (2357).

ABERDEEN-ANGUS POLL,

STRATHGLASS (2357).

Calved 19th March, 1882; bred by Lord Tweedmouth, Guisachan, Inverness.

			BRED BY
	sire	Heir of Glory (1746)	Wm. McCombie, Tillyfour.
dam	Witch of Endor (3528)	by Valiant (663)	Wm. McCombie, Easter Skene.
2. d.	Mayflower 2d of East Tulloch (3521)	" Emperor of East Tulloch (396)	Sir G. M. Grant.
3. d.	Mayflower " (3519)	" King Henry (390)	The Earl of South Esk.
4. d.	Bamba (1200)	" Duke of Wellington (219)	Robt. Walker, Portlethen.
5. d.	Bengie (276)	" Stanley of Portlethen (14)	" "
6. d.	Young Duchess 2d (32)	" Porty (50)	" "
7. d.	Old Maggie (681)		

Price, £500.

Strathglass was only once exhibited, gaining first prize as a yearling at the Royal Society's Show at York, 1883.

Heir of Glory, his sire, brought 155 guineas, when a yearling, at the Tillyfour sale in 1880.

Paris (1473), Heir of Glory's Sire, was one of the McCombie winning group at Paris in 1878, and 1st prize bull in his class.

Strathglass' dam, Witch of Endor (3528), was also one of the winning Tillyfour group at the Paris International, 1878, gaining the 1st prizes for best and best beef animals.

Strathglass' portrait fronts the first page of Vol. VIII of "The Polled Herd Book."

DEVON.

ROSE'S DUKE.

Calved 7th April, 1883; bred by Walter Farthing, Stowey Court, Bridgewater.

	sire	General Colley (1564).	
dam	Rose (4903)	by Croydon Boy (1309).	
2. d.	Rosa 2nd (3885)	" Duke of Devon (1056).	
3. d.	Red Rose (3006)	" Royal Duke (918a).	
4. d.	Rosa (——)	" Mr. Stranger.	
5. d.	Rose (——)	" "	

Price, £45.

Rose's Duke was purchased for the Windsor Herd immediately previous to transfer to the Ontario Experimental Farm,—Mr. Tait, H. M. Commissioner, desiring to pay a compliment.

GALLOWAY.

STANLEY 3RD OF DRUMLANRIG (1793).

Calved 1st January, 1882; bred by Duke of Buccleuch.

			BRED BY
	sire	Eskdaill (1559)	Duke of Buccleuch.
dam	Lady Stanley of Drumlanrig (2858)	by Pretender (617)	John Underwood, Crofts.
2. d.	Lady Stanley (1670)	" Hossack (1319)	John Wallace, Kirkcudbright.
3. d.	Jane of Breconhill (3354)	" Emancipation (1318)	John Graham, Lockerbie.
4. d.	Rosy of Breconhill (3353)	" Black Jock of Pedderhill (1316).	Geo. Graham, Riggfoot.

Price, £100.

Eskdaill was 3rd at Castle Douglas as a yearling; his sire, Black Prince of Drumlanrig (546), had a remarkable show-yard career, besides his breeding qualities. He was first as a yearling at Castle Douglas and at Highland Society's Show at Kelso, and won the Highland Society's first prize at Stirling when two

year-old, and the three-year-old at Inverness in 1874, their gold medal at Glasgow 1875, and Aberdeen in 1876, and the last time at the Dumfries Union show in 1876, when he won 1st.

Lady Stanley was 2nd at Lockerbie, 3rd at H. S. Glasgow, 2nd at Carlisle, and 1st at Dalbeattie in 1875; 1st at Lockerbie, H. S. Show, Aberdeen, Carlisle and Dumfries Union in 1876; 3rd at the Royal of Eng.; Liverpool; 1st and cup at Carlisle and 1st at Dalbeattie in 1877.

Stanley 3rd was 2nd at the Royal of Eng., at York, and 3rd at the Dumfries Union Show in 1883.

AYRSHIRE.

CAMPBELL OF DRUMLANRIG (462).

Calved April, 1882; bred by the Duke of Buccleuch.

sire Kiel of Craigman (148)

dam Myres (319)

Price, £42.

His dam, Myers (319), was 4th in the Ayr Derby of 1874. 1st as a three-year-old at New Cummock in 1874, and as the same in calf or milk, and 1st as best cow of any age. Also 1st as a three-year-old in milk at Muirkirk in 1874, and 1st as cow of any age and best bred animal. Besides several prizes at Tarbolton in 1872-3-4.

GUERNSEY.

CETYWAYO (37).

Yellow, fawn and white; calved 12th May, 1882; bred by John LePage, St. Saviour's, Guernsey.

No. 1 on horn.

sire Presto (14).

dam Princess 2nd by Premier (31) .. ..James LePage, Neuve Maison, Parish of the Catel, Island of Guernsey.

BRED BY

Price £50.

Cetewayo's sire, Presto (14), won 1st Prizes at the Royal Agricultural Shows in 1881 and 1882.

JERSEY.

"ST. MARY'S BOY" (535).

Solid Grey, switch and tongue black; calved 10th Feb., 1883; bred by E. P. DuFeu, St. Mary's Parish, Jersey Island.

sire Careful Lad (331).

dam Morning Star (759).

Price £45.

This bull is grey in color and all the heifers are fawn, a variety not so desirable to those who breed for uniformity of herd, but thought to be an important feature experimentally for this station.

HOLSTEIN.

"WILLEM 3rd" (290) N. H. B. *Calved March 20th, 1882.*

Bred by J. Bakker, Wierengerward, N. H.

sire, Willem, 82, N. H. B. Dam, Zwaart.

LINCOLN.

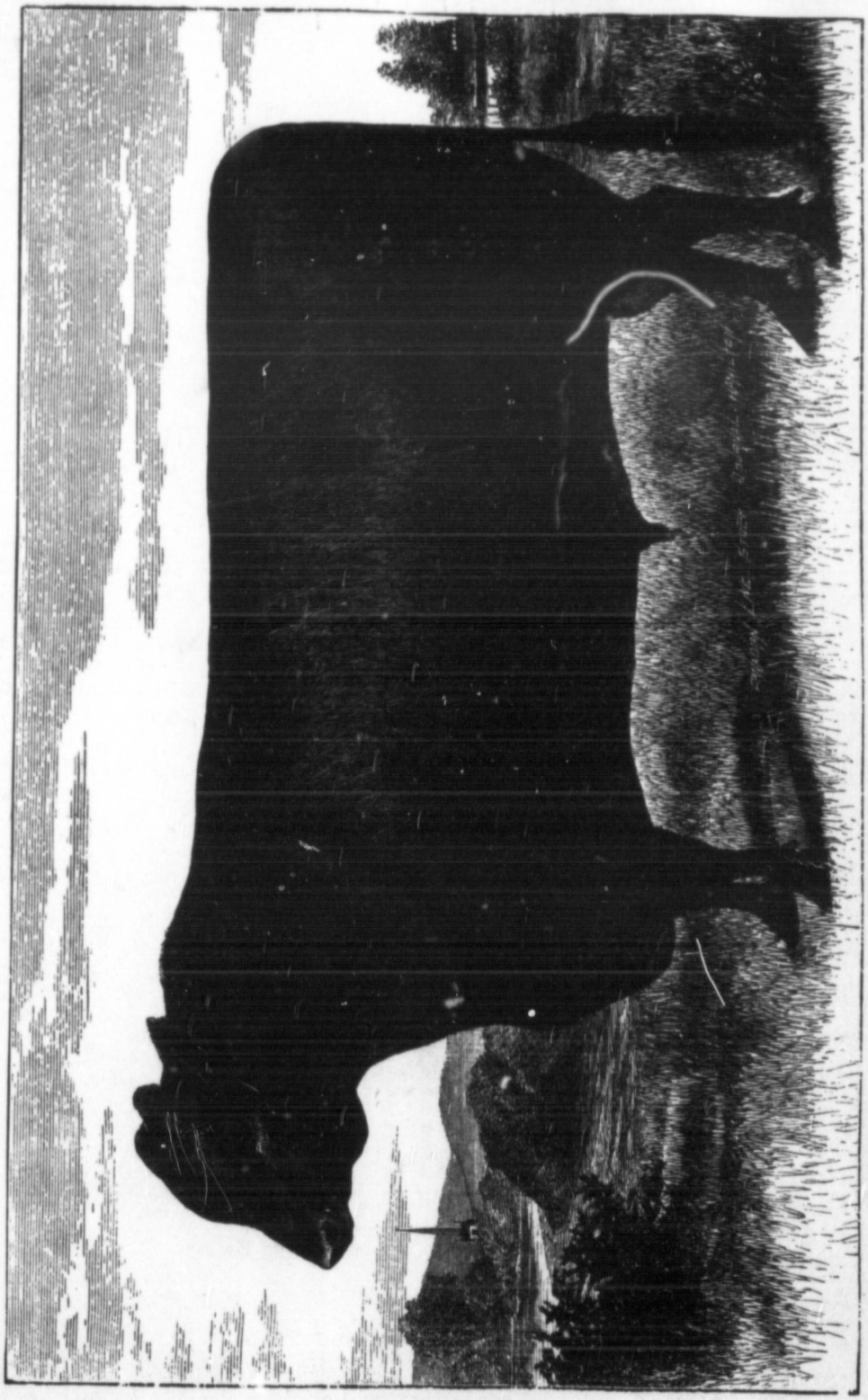
"NOCTON, 1884." *Lambed Spring, 1883*

Bred by R. Wright, Nocton Heath, Lincoln.

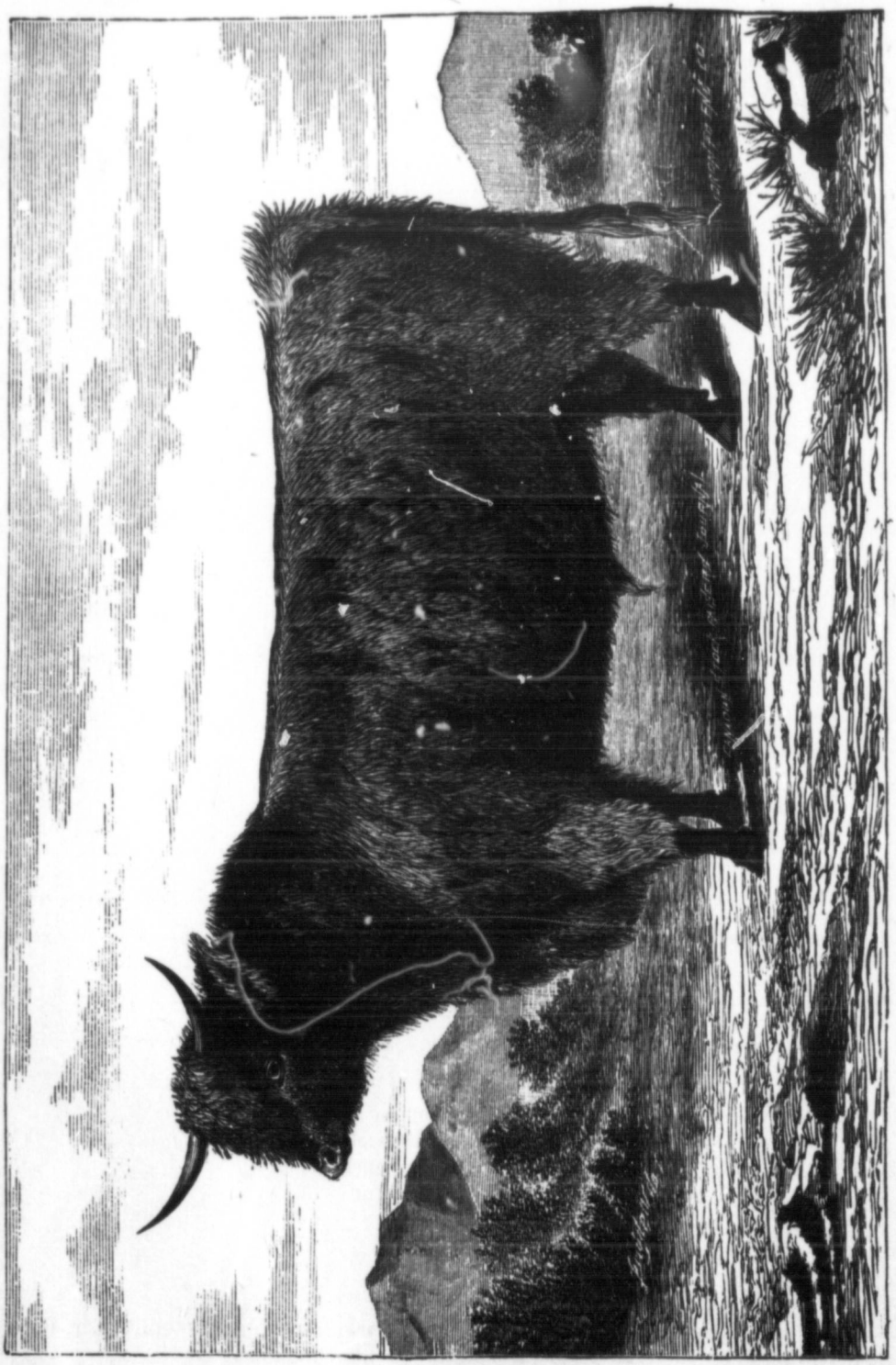
sire " R. Wright.

grand sire " T. Needham.

Price £30.



ABERDEEN POLL, "STRATHGLASS" (2357).



HIGHLAND BULL.

HIGHLAND BULL.

COTSWOLD.

"SWANWICK." *Lambed Spring, 1883.*

Bred by Russell Swanwick, Cirencester, Gloucestershire.
sire Young Carlisle.
g. " Carlisle. First prize ram at the Royal at Carlisle.

Price, £23.

"GILLETT, 1884." *Lambed Spring, 1883.*

Bred by T. & S. G. Gillett, Kilkenny, Bampton.
sire Oaklands " John Gillett, late of Oaklands.
dam bred by T. & S. G. Gillett.

Shown with his mother in a pen of five ewes with lambs; took 1st prize for best pen at the Oxfordshire Show in 1883.

Price, £30.

LEICESTER.

"WALLACE." *Lambed Spring, 1883.*

Bred by Robt. Wallace, Mauchlin, Ayrshire.
sire "90-Guineas," bred by Messrs. Clark, Old Hamstock Mains.
dam "Old Perth," bred by R. Wallace.
g. sire a £37 ram of the Mellandean strain.
g.g. " the £195 Polwarth Ram.

"90-Guineas" gained third prize at the H. S. Show in Glasgow, and 1st and Roxburgh Medal at Kelso in 1882.

"Old Perth" is dam of shearlings that were 1st at the H. S. Show at Perth in 1879, and second at the same at Glasgow in 1882.

Price, £50.

HIGHLAND.

"Young Victor." *Lambed Spring, 1882.*

Bred by Jas. Craig, Craigdarroch.
sire Old Bowlie " James Craig, Craigdarroch.

"Young Victor" took 1st prize and 1st and medal for best sheep in yard at Ayr, in 1883. Also several other prizes.

Old Bowie is the most famous strain of blood of the breed, and has taken in his time firsts at Ayr as shearling and aged ram.

Price, £10.

CHEVIOT.

"MARSHALL, 1884." *Lambed Spring, 1883.*

Bred by William Marshall, Merton Mains, Thornhill.
sire " Mr. Scott, Girnwood, Hawick.
dam bred by Mr. Grieve, Branxholme Braes, Roxburghshire.

Price, £10.

OXFORD DOWN.

"BLAKE, 1884." *Lambed Spring, 1883.*

Bred by A. Brassey, Heythrop Park, Chipping Norton, Oxfordshire.
sire "Tyfield" " A. F. M. Druce.
sire of dam "Royal Birmingham," bred by Mr. Brassey.

"Royal Birmingham is 1st prize shearling of 1876.

Price, £20.

"BRASSEY, 1884." *Lambed Spring, 1883.*

Bred by A. Brassey, Chipping Norton, Oxfordshire.
sire Royal Derby, 1st prize shearling of 1882.
sire of dam Royal Kilbourn, second prize shearling of 1879.

Price, £20.

HAMPSHIRE DOWN.

"PARSONS, 1884." *Lambed Spring, 1882.*

Bred by W. Parsons, West Stratton, Micheldever, England.
grand sire " W. Newton.
Descended from a lamb bred by James Rawlener, Wilton, Salisbury.

He was the *best* of the pen of five ram lambs which took 1st prize at Royal Agricultural Society's Show at Reading, 1882.

Price, £40.

"WILTS, 1884." *Lambed Spring, 1883.*

Bred by W. Parsons, West Stratton, Micheldever.
sire " " "

which was also in prize pen mentioned in notes preceding.

Price, £35.

SHROPS.

"ROYAL STAMP" (1699). *Lambed Spring, 1882.*

Bred by John Evans, Uffington, Shrewsbury.
sire "Royal Gem" (1024)
dam's " "Bristol Reserve" (144)
g. dam's " "Grand Duke" (620).
g. g. dam's " "Union Jack" (1252).

This ram was let in 1883, to R. Thomas, Esq., for 70 guineas.

Price, £65.

"MONARCH." *Lambed Spring, 1883.*

Bred by John Evans, Uffington, Shrewsbury.
sire "Lord Coxcomb" (743).
dam's " "May Duke" (837).
g. dam's " "Royal Taunton" (115).
g. g. dam's " "Cardinal" (53).

Price, £35.

'ALLSOPP 1884." *Lambed Spring, 1883.*

Bred by Sir Henry Allsopp, Bt. Hindlip Hall, Worcester.
sire "Chisham's No. 8" (376) bred by Lord Chisham.
dam bred by Mr. Smith, Sutton Maddock,—sire "Lothair" (779).
sire's sire "Son of Mansell's No. 8" bred by Lord Chisham.

Sire's dam an R. A. S. E. prize that won in 1879, 1st at Kilbourn, 1st and champion at Manchester, 1st and special at Worcestershire and Malvern, 1st at Worcestershire and Stonebridge in 1881, and 2nd at Worcestershire and Dudley in 1882,—being one in a pen of five at the above.

Price, £10.

SOUTH DOWN.

"WALSINGHAM, 1884." *Lambed Spring, 1882.*

Bred by Lord Walsingham, Merton, Norfolk.

sire a son of "Royal Taunton,"—first prize ram.

dam by a grandson of "Viceroy."

The son of "Royal Taunton" was half brother to the yearling ram sold to George Carew-Gibson for 200 guineas, and great grandson of "Royal Manchester," for which an offer of 500 guineas was refused.

Price, £52 10s.

WOODS, 1884." *Lambed Spring, 1883.*

Bred by Lord Walsingham, Merton, Suffolk.

sire—Royal Reading, first prize ram.

dam sister to the Oxford and Royal Bristol first prize yearling ram.

The sire was by the Royal Bristol two-year old prize ram.

Price, £105.

LIST AND PRICES OF IMPORTATIONS.

CATTLE.

Short Horns.		
1 Bull	$2,250	
3 Cows	1,900	
		$4,150
Herefords.		
1 Bull	$2,500	
3 Cows	1,285	
		3,785
Aberdeen Polls.		
1 Bull	$2,500	
3 Cows	1,100	
		3,600
Galloways.		
1 Bull	$500	
2 Cows	600	
		1,100
Devons.		
1 Bull	$225	
1 Cow	300	
		525
Ayrshires.		
1 Bull	$210	
4 Cows	650	
		860
Guernseys.		
1 Bull	$250	
2 Cows	350	
		600
Jerseys.		
1 Bull	$225	
3 Cows	675	
		900

Holsteins.		
1 Bull		
3 Cows	$750	
	750	
		1,500
—33 head.		
		$17,020

SHEEP.

Lincoln.		
1 Ram		
3 Ewes	$150	
	150	
		300
Cotswolds.		
2 Rams		
4 Ewes	$265	
	125	
		390
Leicesters.		
1 Ram		
6 Ewes	$250	
	250	
		500
Cheviots.		
1 Ram		
2 Ewes	$50	
	25	
		75
Highland.		
1 Ram		
2 Ewes	$50	
	25	
		75
Oxford Downs.		
2 Rams		
6 Ewes	$200	
	300	
		500
Shropshires.		
3 Rams		
20 Ewes	$550	
	500	
		1,050
Hampshires.		
2 Rams		
6 Ewes	$375	
	170	
		545
South Downs.		
2 Rams		
3 Ewes	$785	
	265	
		1,050
		$4,485
Total for 33 Cattle	$17,020	
Total for 69 Sheep	4,485	
		21,505

Expenses applicable to above.

British Railway Freight	$550	
Ship Freight	1,200	
Food on Board Ship	320	
Insurance	200	
Expenses of Purchase, and Management	650	
Quarantine, including food, etc	1,020	
Railway to Guelph	350	
		$4,290
		$25,795

It appears, therefore, that in importing one hundred head of a large variety of animals it is safe to add *one-sixth* more to this total original cost, or, to put the estimate in more detail, we have for:

	Cattle.	Sheep.
Average original cost per head	$515 00	$60 00
Proportion of British expenses	33 00	3 00
Proportion of Shipping	40 00	6 50
Proportion of Quarantine	17 00	.....
	$600 00	$69 50

8.—Sale of Christmas Beef, 17th December, 1884.

Age, Weight and Measurements (in inches), on 5th December, 1884.

Lot.	ANIMAL.	Age in days.	Weight.	Gain per day.	Length of Carcass.	Heart Girth.	Depth through Crops.	Flank Girth.	Paunch Girth.	Thickness through Crops.	Width of Loin.	Length of Quarter.	Height from Ground.			Price and Purchaser.
													Shoulder.	Brisket.	Flank.	Tail.	
	Shorthorn Grades.		Lbs.														
1	"Dudley"	1097	1970	1.80	94	94	34	93	111	24	26	26	59	22	28	60	$121. Stephen Hall, Blenheim, Ont.
2	"Digby"	1005	1820	1.81	87	93	32	90	109	25	25	27	57	21	28	58	$122. H. J. Laurie, Hamilton.
3	"Derby"	1011	1930	1.91	87	97	35	94	107	25	26	26	60	20	29	59	$126. L. O. Barber, Guelph.
4	"Lady Olive"	636	1300	2.05	78	84	29	82	98	22	26	23	50	20	27	53	$81. H. J. Laurie, Hamilton.
	—																
	Aberdeen Poll Grade.																
5	"Aboyne"	903	1700	1.87	84	94	34	87	104	24	25	23	58	21	29	57	$100. —. Allison, Galt.
	—																
	Hereford Grades.																
6	"Huntingdon"	980	1634	1.67	78	92	32	89	103	23	23	25	53	19	26	55	$112. J. Dingle, Hamilton.
7	"Hartford"	780	1630	2.09	83	92	32	87	101	24	24	24	54	18	29	55	$151. C. Satchell, Ottawa.

	J. Dingle, Hamilton.	C. Satchell, Ottawa.
	$112.	$151.
55		55
26		29
19		18
53		54
25		24
23		24
23		24
103		101
89		87
32		32
92		92
78		83
1.67		2.09
1604		1630
780		
7	"Hartford"	

Cost of Producing these Fat Cattle Per Head.

1st year, including calf value, milk, and all other food, with attendance	$ 39 96
2nd year, food and care	57 77
Four months of third year	20 88
	$118 61
Less profit realized on charging market prices for food grown on farm	42 88
Total actual cost of production	$75 73

Being 4½ cents per pound live weight.

The food consumed consisted of hay, roots, green fodder, bran, peas, corn, oats, oil cake and Thorley Condiment,—averaging during winter of second year,—9 lbs. hay; 25 lbs. of roots; 8 lbs grain, and 2 lbs. of cake daily.

Value.—At exportation price of 6 cents, there would be a cash profit of $24 per head on these cattle, and nearly double this is sometimes realized for Canadian Christmas Beef.

Dogs for Sale.

Six Dogs and one Bitch. Littered November 22nd, 1884.

Sire "Conrad" .....bred by R. F. Hunter, Scotland.
Dam Luna..... " "Bob"..... .....bred by Duke of Buccleugh, Scotland.
" Lassie ..... " "Laddie".....bred by H. M. The Queen.

"Conrad" won 1st prize in Toronto, in 1884, and "Bob" gold medal there in 1881.

9.—On Hand for Public Sale, 1885.

We are already in possession of the following young animals, and hope to have as many as thirty head of cattle and sixty sheep for our public sale during the second week of September:—

Shorthorns—One bull and one heifer.
Herefords—Two bulls and one heifer.
Aberdeen Polls—Four bulls.
Ayrshire—One heifer.
Guernsey—Two heifers.
Jersey—One bull and one heifer.
Holstein—One bull.

Send for our sale Catalogue about 1st August.

IV.—EXPERIMENTAL DEPARTMENT.

1.—Feeding of Cattle and Sheep, 1883-84.

Conditions.

1.—Half-bred Shorthorn Steers, averaging exactly twenty-four months at finish.
2.—Equal stable accommodation, management, and grooming.
3.—Similar previous management.
4.—Equalizing of animals in groups.

5.—Weighing of every article of every meal, and water consumed.
6.—Weighing of unconsumed food.
7.—Animals weighed every week.
8.—The changing of every group of cattle to different food every term of twenty-eight days.
9.—The daily record of stable temperature.
10.—All grain ground into rough meal, hay whole, except in cooking, and roots sliced.
11.—Feeding at 7:30 a.m.; 11:30 a.m.; 2 p.m.; 5 p.m. and 8 p.m. daily.
12.—Exercise for half an hour daily.
13.—Rock salt always in manger.

I.—Mixture of Grain in Cattle Feeding.

Results per head during 196 days, with 21 animals, three per group per term; from 3rd November, 1883, to 18th May, 1884.

Term	Weight

I.—Mixture of Grain in Cattle Feeding.

Results per head during 196 days, with 21 animals, three per group per term; from 3rd November, 1883, to 18th May, 1884.

Term of 28 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature of Stable.
					Hay.	Roots.	Grain.	Bran.	Water.	
1st	949	1041	92	3.285	249	640	250	126	1259	45°
2nd	1087	1155	68	2.405	251	672	252	126	1130	39°
3rd	1091	1150	59	2.238	250	668	225	126	834	35°
4th	1165	1214	49	1.726	252	674	252	126	777	38°
5th	1177	1221	44	1.56	241	660	251	126	999	40°
6th	1174	1218	44	1.56	247	416	252	125	1011	50°
7th	1338	1420	82	2.89	297	240	333	135	1250	55°
Per head, daily	(1140)	(1202)	(62)	2.238	9.1	20.25	9.25	4.5	37.04	43°

Analysis of Mixture-Feeding.

1. A steer averaging 1,171 lbs. consumed daily $9\frac{1}{10}$ lbs. hay, $20\frac{1}{4}$ lbs. turnips, $4\frac{1}{2}$ lbs; bran, 37 lbs. water, with $9\frac{1}{4}$ lbs. of corn, peas, oats, white barley, and black barley in equal parts by weight = in all $43\frac{1}{4}$ lbs. of fodder and grain daily.

2. This rate of consumption was equal to four per cent. daily of the animal's weight.

3. The highest daily rate of increase was $3\frac{1}{4}$ lbs. fully, the lowest $1\frac{1}{2}$ lbs. fully, and the mean for the whole period was $2\frac{1}{4}$ lbs. nearly.

4. The daily consumption of 37 lbs. water was nearly equal, weight for weight, with the regular food—the highest daily rate of water being 45 lbs., and the lowest 27 lbs. The demand for water was distinctly less during cold and most during warmer weather—turnips being equal.

5. The reduction of turnips to nearly one-third of the usual amount caused the animals to consume twelve per cent. more hay, and twelve per cent more grain.

5. The consumption of turnips, more or less, did not seem to affect that of water to any marked extent. When 9 lbs. turnips were given per day in a mean temperature of 55°, the additional nineteen per cent. of water drank was, by all other comparisons, owing more to temperature than to want of turnips.

7. With the temperature averaging 50° and a ration of 15 lbs. turnips per day, the animals drank about an average quantity of water.

8. But the uncertainty of drawing definite conclusions in what influences animal life is well illustrated in the two examples of the least daily increase of 1.56 lbs., where the consumption of food and water is almost exactly alike, with the exception of roots, and yet the mean temperature of the term varies as much as 10°.

9. The cost of adding one pound to the weight, by this method of feeding, amounts to $8\frac{1}{2}$ cents, charging grain at one cent; hay one half cent; roots one sixth cent; and bran one half cent per lb.

10. The nutritive ratio for the whole period was:—1 : 4 . 68.

II.—Mixture of Grain with Oil Cake, in Cattle Feeding.

Results per head, during 196 days, with 21 animals.

	Weight	Weight	Daily Rate	Food Consumed	

II.—Mixture of Grain with Oil Cake, in Cattle Feeding.

Results per head, during 196 days, with 21 animals.

Terms of 28 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.						Mean Temperature.
					Hay.	Roots.	Meal.	Oil Cake.	Bran.	Water.	
1st	950	1048	98	3.524	242	638	250	84	126	1235	45°
2nd	1041	1108	67	2.369	251	672	251	84	126	1303	39°
3rd	1155	1209	54	1.928	248	661	224	84	126	950	35°
4th	1150	1192	42	1.050	195	661	236	84	126	945	38°
5th	1214	1267	53	1.920	242	651	248	84	126	916	40°
6th	1221	1277	56	2.010	233	442	261	84	126	1306	50°
7th	1277	1297	20	.702	294	227	263	84	133	1168	55°
Per head, daily	(1144)	(1200)	(56)	1.929	8.7	20.15	8.85	.3	4.51	39.91	—

Analysis of Mixture of Grain with Oil Cake.

11. The average steer, among twenty-one head weighing 1,172 lbs., eat daily $8\frac{7}{10}$ lbs. of hay; $20\frac{1}{7}$ lbs. turnips; $4\frac{1}{2}$ lbs. bran, and $1\frac{3}{4}$ lbs. each of corn, peas, oats and black and white barley, in addition to 3 lbs. of oil cake.

12. Every day, on an average, each animal drank as much as 40 lbs. water—most in the highest mean temperature, with two-thirds ration of turnips, and least during lowest temperature, with full ration of roots.

13. The daily increase, per head, was almost exactly 2 lbs. over the period—being greatest—(as much as $3\frac{1}{2}$ lbs.) during the first term in a temperature of 45°, when more than the average water was drunk, but all other things equal; and least (not $\frac{3}{4}$ lbs.) during the closing term, when the average temperature was highest (55°), and a little more grain and hay were consumed.

14. Twenty-one animals, throughout a period of one hundred and ninety-six days, indicated very clearly that they required five per cent. less hay and fully five per cent. less grain, when 3 lbs. of oil cake per head per day were added to their ration.

15. The greatest quantities of grain and hay were consumed wmnheeore water and fewer roots were used—temperature being considered.

16. The cost of production, by giving oil cake with a mixture of grain, amounted to $11\frac{1}{2}$ cents per pound of the added live weight.

17. The nutritive ratio of such feeding is:— 1 : 4 . 01.

III.—Mixture of Grain with Thorley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

III.—Mixture of Grain with Thorley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms of 28 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature.
					Hay.	Roots.	Grain.	Thorley.	Bran.	Water.	
1st	982	1088	106	3.786	245	636	243	42	123	1283	45°
2nd	1031	1091	60	2.107	236	669	232	42	124	1065	39°
3rd	1085	1165	80	2.869	250	672	225	42	126	868	35°
4th	1120	1177	57	2.035	220	662	242	42	126	975	38°
5th	1121	1174	53	1.900	242	653	352	42	126	978	40°
6th	1302	1338	36	1.303	248	442	255	42	124	1306	50°
7th	1263	1344	81	2.892	265	235	322	42	135	1113	55°
Per head, daily	(1129)	(1197)	(68)	2.409	8.85	20.25	9.5	1½	4.51	38.71	43°

Analysis of Mixture of Grain with "Thorley," in Cattle Feeding.

18. Seven groups of cattle—three in each group—alternating every twenty-eight days, during a period of one hundred and ninety-six days, from November to May, have given the following record by the consumption daily of $8\frac{8}{10}$ lbs. hay; $20\frac{1}{4}$ lbs. turnips; $4\frac{1}{2}$ lbs. bran, and $1\frac{9}{10}$ lbs. each of corn, peas, oats, black barley, and white barley, along with $1\frac{1}{2}$ lbs. of what is called "Thorley's" condiment.

19. The daily rate of increase per head was $2\frac{4}{10}$ lbs.—the extreme averages being $3\frac{3}{4}$ lbs. and $1\frac{1}{3}$ lbs. per day.

20. The greatest increase was during the first term, with a mean temperature of 45°, when somewhat less grain and more than the average water were consumed, and the least increase took place in a mean temperature of 50°, with the consumption of sixteen per cent. more water than the average, and on two-thirds ration of turnips.

21. The consumption of water, throughout the entire period, was $38\frac{3}{4}$ lbs. per head daily—increasing and lessening with the temperature more than with the food—being as much as thirty per cent less in a mean temperature of 35°, as against 50°.

22. When the average amount of water and one-third ration of roots were used, with forty per cent. more grain and ten per cent. more hay, the daily increase attained nearly 3 lbs., or seventeen per cent. over the mean of all the terms under this experiment.

23. Yet, the greatest amount of turnips with the least grain and least water in the lowest mean temperature, gave results equal to those named in the preceding paragraph.

24. It cost $11\frac{3}{4}$ cents to add one pound to the average animal that weighed 1,163 lbs.

25. The nutritive ratio of this course was:— 1 : 4 . 50.

IV.—Corn in Cattle Feeding.

Result per head during 196 days, with 21 animals.

Terms of 28 days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature.
					Hay.	Roots.	Corn.	Bran.	Water.	
1st.....	965	1045	80	2·839	247	641	250	126	1095	45°
2nd.....	1006	1073	67	2·380	251	672	252	126	1127	39°
3rd.....	1019	1077	58	2·077	249	669	224	126	778	35°
4th.....	1202	1259	57	2·059	251	672	252	126	969	38°
5th.....	1182	1244	62	2·211	248	656	246	126	712	40°
6th.....	1246	1303	57	2·029	251	442	262	126	1002	50°
7th.....	1340	1415	75	2·684	296	234	328	135	1108	55°
Per head, daily	(1137)	(1202)	(65)	2·325	9·15	20·33	9·25	4·5	33·62	43°

Analysis of Corn Feeding.

26. Over a period of 196 days, the average steer of 1,170 lbs., in a batch of twenty-one, consumed daily fully 9 lbs. hay, $20\frac{1}{3}$ lbs. turnips, $4\frac{1}{2}$ lbs. bran, and $9\frac{1}{4}$ lbs. corn; at the same time drinking, on an average, $33\frac{2}{3}$ lbs. water.

27. The daily rate of increase was $2\frac{2}{3}$ lbs., the extremes being $2\frac{8}{10}$, and 2 lbs. fully.

28. During a mean temperature of 43° in a stable, tied up cattle drank more water, weight for weight, than the hay and roots they consumed.

29. The lowest rate of increase was during a mean temperature of 50°. with a two-thirds ration of turnips, and an exact average of corn—the highest rate of increase occurred in a mean temperature of 45°, with a full ration of turnips, and slightly less corn.

30. One-third ration of turnips, with fifteen per cent. more hay and twenty per cent. more corn, in a mean temperature of 55°, gave the second highest rate of increase under this head.

31. During the lowest mean temperature 35°, the animals drank twenty per cent. less water, consumed fourteen per cent. less corn, and gave the third lowest rate of increase —other things being about equal.

32. It cost fully eight cents for every pound added to the live weight of the average cattle beast by this method of feeding.

33. The nutritive ratio for the whole period was:— 1 : 4 . 85.

V.—Peas in Cattle Feeding.

Results per head during 196 days, with 21 animals.

V.—Peas in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms of 28 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature of Stable.
					Hay.	Roots.	Peas.	Bran.	Water.	
1st.....	974	1032	58	2.071	185	518	195	101	1022	45°
2nd.....	1045	1085	40	1.440	252	639	252	126	1104	39°
3rd.....	1073	1120	47	1.715	251	671	225	126	1002	35°
4th.....	1077	1121	44	1.559	249	664	244	126	955	38°
5th.....	1259	1302	43	1.500	251	662	252	126	1076	40°
6th.....	1244	1263	19	.672	248	442	262	126	1081	50°
7th.....	1303	1367	64	2.297	297	239	333	135	1319	55°
Per head, daily.....	(1140)	(1185)	(45)	1.608	8.82	19.56	9	4.42	38.56	43°

Analysis of Peas.

34. The average steer, weighing 1,163 lbs., consumed daily $8\frac{8}{16}$ lbs. hay, $19\frac{1}{2}$ lbs. turnips, nearly $4\frac{1}{2}$ lbs. bran, and exactly 9 lbs. of peas.

35. Twenty-one animals during 196 days have recorded a daily increase per head by such feeding of $1\frac{6}{10}$ lbs.

36. The highest daily rate was given during the highest temperature, when most water was drunk, when most peas were eaten, and the fewest turnips given; the lowest record occurred immediately previous to the greatest, in a temperature of 50°, with two-thirds ration of turnips, and exactly the average of peas and water.

37. The unusually low increase of two-thirds of a pound per head per day in one of the terms with peas may be accounted for in subsequent notes.

38. During the whole period with peas, the animals were more thirsty and drank water more regularly than any others over the series of experiments, and irrespective of temperature, more than others.

39. The food cost of adding one pound to the live weight by this process was exactly eleven and a-half cents.

40. The feeding ratio was :— 1 : 3 . 84.

VI.—Oats in Cattle Feeding.

Result per head during 196 days, with 21 animals.

Terms of 28 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature.
					Hay.	Roots.	Oats.	Bran.	Water.	
1st	1029	1111	82	2.098	247	639	249	126	1171	45°
2nd	1048	1076	28	.982	240	645	228	119	825	39°
3rd	1108	1170	62	2.215	251	672	225	126	875	35°
4th	1209	1255	46	1.642	250	671	248	126	874	38°
5th	1192	1236	44	1.560	216	655	246	126	803	40°
6th	1267	1297	30	1.071	241	440	248	122	930	50°
7th	1277	1332	55	1.958	271	236	318	132	1171	55°
Per head, daily	(1161)	(1211)	(50)	1.76	8.8	20.2	8.99	4.45	33.94	43°

Analysis of Oats in Cattle Feeding.

41. In this trial the consumption of food per head per day with an average animal of 1,186 lbs., consisted of $8\frac{8}{10}$ lbs. hay, 20 lbs. turnips, almost $4\frac{1}{2}$ lbs. bran, and 9 lbs. oats.

42. The rate of increase throughout amounted to $1\frac{3}{4}$ lbs., the greatest being during the entry term, when an average of most things were used, and the least being immediately succeeding when a daily rate of 1 lb. was recorded by the use of eight per cent. less oats.

43. Temperature evidently regulated to a large extent the consumption of water, as in other examples, and the average of 34 lbs. per head per day is, however, below the mean.

44. Equal oats and hay by weight in the feeding of store-cattle have therefore made a record of fully $1\frac{3}{4}$ lbs. per head per day, and the amount of turnips in the diet does not appear to materially affect the results.

45. Twenty per cent. more oats and ten per cent. more hay, with one third ration* of roots in a mean temperature of 55° gave one-seventh more daily increase than the average of all the period.

46. It cost ten and a-half cents to add one pound to the live weight of the cattle under this trial.

47. The nutritive ratio was :— 1 : 4 . 61.

* Note.—A full ration of roots in these tests is 25 lbs.

VII.—White Barley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms	Weight	Weight	Daily Rate	Food Consumed

VII.—White Barley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms of 28 days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature of Stable.
					Hay.	Roots.	Barley.	Bran.	Water.	
1st	915	1006	91	3.262	239	640	251	126	1233	45°
2nd	969	1019	50	1.791	238	665	234	124	949	39°
3rd	1146	1201	55	1.958	252	672	225	126	866	35°
4th	1130	1882	52	1.847	247	671	250	126	789	38°
5th	1217	1246	29	1.000	251	658	250	125	1002	40°
6th	1286	1340	54	1.916	244	408	251	123	1016	50°
7th	1311	1349	38	1.375	295	205	336	142	1076	56°
Per head, daily	(1140)	(1193)	(53)	1.878	9.01	19.99	9.17	4.55	30.36	43°

Analysis of White Barley in Cattle Feeding.

48. Here, a store steer that averaged 1,166 lbs. during the experiment, consumed daily 9 lbs. hay, 20 lbs. turnips, 4½ lbs. bran, and 9⅙ lbs. common barley, along with 35⅓ lbs. of water, in a mean temperature of 43° from November to May.

49. Under these conditions it gained in weight at the rate of 1.88 lbs. daily, ranging from 3¼ lbs. per day to exactly 1 lb. as the lowest.

50. The greatest increase occurred in a mean temperature of 45°, with actually 44 lbs. of water, when other things were about equal to the average, and the lowest increase took place in a temperature of 40°, with an average quantity of water and an average of all other conditions.

51. It took 9 lbs. hay (timothy two parts and one part red clover), 23½ lbs. swede turnips, 4½ lbs. wheat bran, and 9 lbs. ground oats, to add 1 lb. to the live weight of a steer averaging 1166 lbs. during a trial of 196 days in a mean temperature of 43°, when also 35⅓ lbs. of water were drunk daily.

52. The exact average rate of increase was realized in the lowest mean temperature 37°, and when all other things were about equal.

53. It cost ten and one-tenth cents per pound of the added live weight by this experiment.

54. The nutritive ratio was :— 1 : 4 . 79.

VIII.—Black Barley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms	Weight	Weight	Daily Rate	Food Consumed

VIII.—Black Barley in Cattle Feeding.

Results per head during 196 days, with 21 animals.

Terms of Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.					Mean Temperature.
					Hay.	Roots.	Barley.	Bran.	Water.	
1st.....	905	969	64	2.262	232	609	219	121	1704	45°
2nd.....	1111	1146	35	1.279	247	659	236	122	1122	39°
3rd.....	1076	1130	54	1.922	250	665	235	126	636	35°
4th.....	1170	1217	47	1.678	250	672	251	126	984	38°
5th.....	1255	1286	31	1.130	244	655	248	126	952	40°
6th.....	1236	1265	29	1.035	232	636	224	116	937	50°
7th.....	1297	1345	48	1.690	232	621	307	130	1021	55°
Per head, daily.....	(1150)	(1194)	(44)	1.571	8.91	19.78	8.72	4.42	34.50	43°

Analysis.

55. The average steer, in this case, weighed 1,172 lbs., and eat daily almost 9 lbs. of hay ; $19\frac{3}{4}$ lbs. turnips ; $4\frac{4}{10}$ lbs. bran, and $8\frac{3}{4}$ lbs. black barley.

56. By this, its daily rate of increase was 1·57 lbs. during the whole period of 196 days—the greatest increase or $2\frac{1}{8}$ lbs. being during the first term, when the extraordinary quantity of 61 lbs. of water per day were used in a mean temperature of 45°, along with ten per cent. less barley than the average, considerably fewer turnips, and ten per cent. less hay. How is this ?

57. The least daily rate of increase per head per day occurred during the sixth term —1 lb. fully. This may have been influenced by the higher mean temperature of 50°, by the somewhat less grain consumed, and by the two-thirds ration of roots.

58. The water used in this test averaged $34\frac{1}{2}$ lbs. per head per day, and varied considerably, as affected by temperature and amount of food consumed. The small quantity —23 lbs.—during the lowest mean temperature of 35° in January, although accompanied with the second lowest consumption of barley, nevertheless produced an average daily increase of almost 2 lbs. per head.

59. The cost of producing the 1 lb. to the live weight amounts to eleven and three-quarter cents.

60. The nutritive ratio by this test was :— 1 : 4 . 78.

IX.—Uncooked Food in Cattle Feeding.

Results per head, for 112 days.

Terms of 56 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.				Mean Temperature of Stable.
					Hay.	Roots.	Meal.	Bran.	Water.	
1st.....	884	1036	152	2.705	532	1802	433	316	1817	42°
2nd	1052	1140	88	1.583	533	1779	483	343	1352	36½°
Per head, daily	(968)	(1088)	(120)	2.14	9.5	31.97	8.18	5.88	28.3	39¼°

Analysis.

61. In a mean stable temperature of 39¼°, during one hundred and twelve days from November to February, the average steer of 1,028 lbs., consumed daily the following food uncooked : 9½ lbs. hay, 32 lbs. turnips, 5 9/10 lbs. bran, and 8⅙ lbs. mixed meal.

62. Upon these it made an average daily increase of 2⅐ lbs., the highest rate being during the first term of fifty-six days in a mean temperature of 42° when 32½ lbs. of water were drunk per day, with a little less grain and bran ; and the lowest rate of 1·58 lbs. increase occurred during the second term in a mean temperature of 36½°, with 24 lbs. water daily and more grain and bran, but equal hay and oats.

63. The cost of production by food under these conditions was exactly 9½ cents per pound of animal increase.

64. The nutritive ratio in feeding was :— 1 : 4 . 46.

X.—Cooked Food in Cattle Feeding.

Results per head, for 112 days.

Terms of 56 Days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Increase.	Food Consumed.							Temperature of Stables.
					Meal.	Hay, when		Roots, when		Bran, when		Water.	
						Dry.	Wet.	Dry.	Wet.	Dry.	Wet.		
1st.....	892	1052	159.5	2.842	428	500	968	2561	1761	316	764	1537	42°
2nd.....	1036	1164	127.6	2.279	585	552	1071	2593	1783	343	740	1468	36½°
—	(964)	(1108)	(144)	2.56	9.04	9.45	18.2	46	31.64	5.88	13.43	56.77	39½°

Analysis.

65. The average steer entered at 964 and came out at 1,108 lbs. in fifty-six days, thus adding 2·56 lbs. per day, upon $9\frac{1}{2}$ lbs. of hay that was cooked by steaming, 46 lbs. turnips also steamed, with $5\frac{9}{10}$ lbs. of bran steamed, in addition to 9 lbs. of a mixture of grain that was not cooked.

66. Hay gained one hundred per cent. by steaming, bran fully more so, and turnips lost seven per cent.

67. Making allowance for temperature, there was practically no difference in the consumption of water during the terms—the average being $26\frac{3}{8}$ lbs. per head per day.

68. The use of 26 per cent. more grain during the second or coldest term, with a little more hay and bran, did not equal the produce of the first term.

69. It cost nine cents per pound for every pound added to the live weight, no allowance being made for expense of cooking.

70. The feeding value by nutritive ratio was:— 1 : 4 . 35.

XI.—Hay, Roots and Bran in Cattle Feeding.

Results per head during 56 days, with 18 animals.

Terms of 28 days.	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Rate of Increase.	Food Consumed.				Mean Temperature of Stable.
					Hay.	Roots.	Bran.	Water.	
1st.....	798·5	862·5	64	2·285	339·5	953·5	219	809·5	45°
2nd.....	862·5	899·6	37	1·317	333·5	999·5	252	613·	39°
Per head, daily....	(830)	(881)	(51)	1·8	12·02	34·87	8·41	25·42	42°

Analysis.

71. In this test the average steer weighing 856 lbs. consumed daily 12 lbs. hay, almost 35 lbs. turnips, and 8½ lbs. bran, with 25½ lbs. water, in a mean temperature of 42°—increasing $1\frac{8}{10}$ pounds per day.

72. The cost to produce the one pound additional live weight was fully 9 cents.

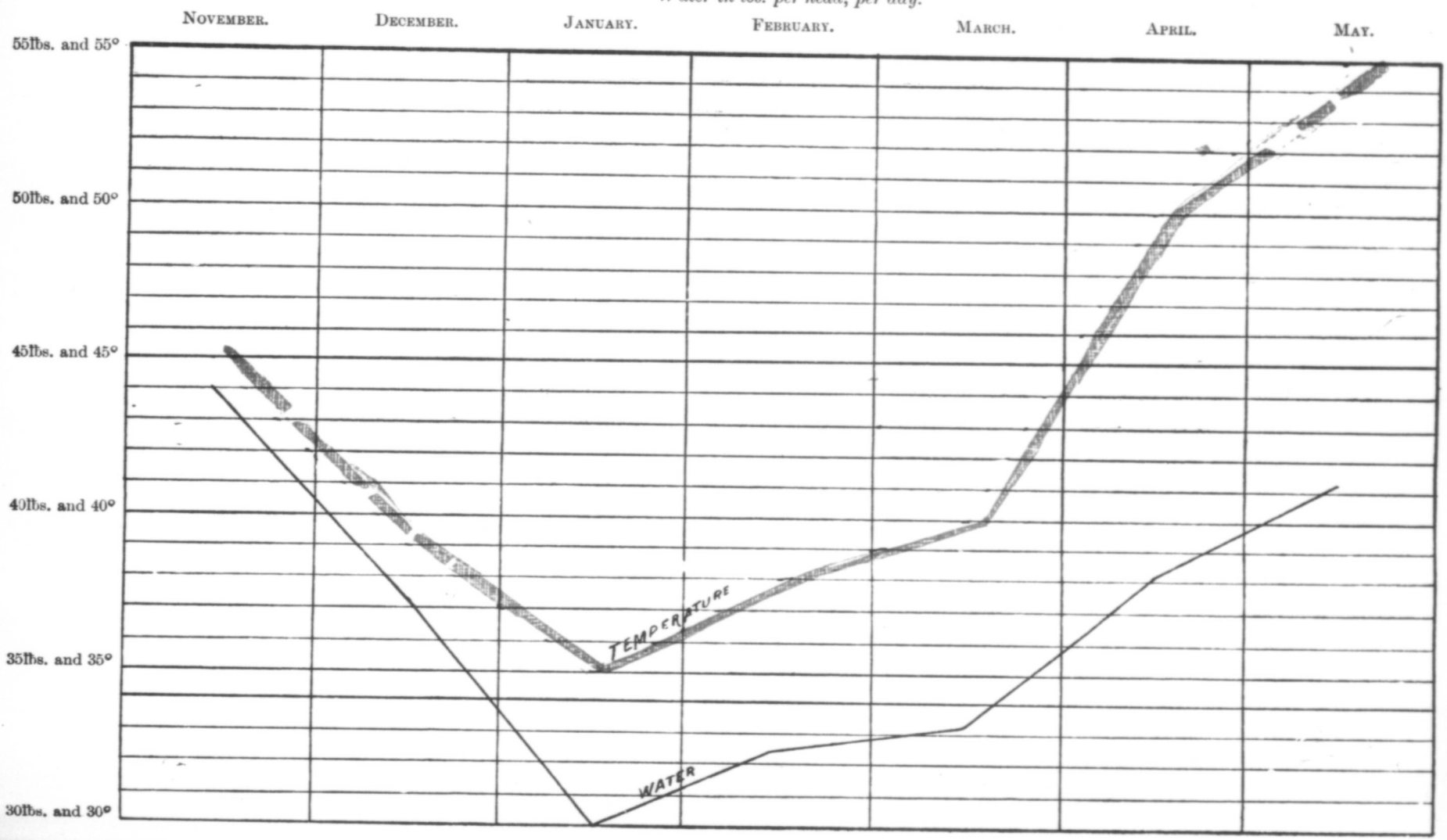
73. Nutritive ratio for whole period equalled :— 1 : 4 . 27.

12 lbs. hay,
mperature of

cents.

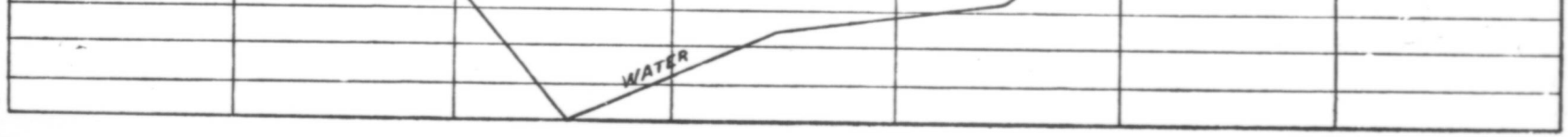
COMPARISON OF MEAN TEMPERATURE, WITH THE WATER CONSUMED BY CATTLE IN EXPERIMENTS, 1883-4.

Water in lbs. per head, per day.



XII.—Water and Temperature in the Winter Feeding of Cattle.

Terms.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	
	November.	December.	January.	February.				Water per Head



30lbs. and 30°

XII.—Water and Temperature in the Winter Feeding of Cattle.

Terms.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	Water per Head per Day, by kind of Food. Mean for period.
	November.	December.	January.	February.	March.	April.	May.	
Temperature—Mean.	45°	39°	35°	38°	40°	50°	55°	
Water per Head per Day.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Mixture of grain	44.96	36.78	29.78	27.75	35.68	36.11	44.64	37.04
Mixture, with cake	44.10	46.53	33.93	33.75	32.71	46.64	41.71	39.91
Mixture, with Thorley	45.82	38.03	31.00	34.82	34.93	46.64	39.75	38.71
Corn	39.10	40.25	27.78	34.61	25.43	35.78	39.57	33.62
Pease	36.50	38.00	35.78	34.10	38.43	38.61	47.11	38.56
Oats	38.25	29.46	31.25	31.21	28.68	33.21	41.82	33.94
White Barley	44.03	33.89	30.93	28.18	35.78	36.28	38.43	35.36
Black Barley	60.85	40.07	22.71	35.14	34.00	33.46	36.46	34.50
Uncooked	32.43	24.14	.....	.....	.....	.....	.....	.....
Cooked	27.43	26.21	.....	.....	.....	.....	.....	.....
Hay, Roots and Bran	28.89	21.89	.....	.....	.....	.....	.....	.....
Water—Means per head per day for all foods	44.20	37.87	30.39	32.44	33.20	38.34	41.18	(36.6 lbs.)

Analysis.

74. The consumption of water by a two-year old fattening steer from November to May, is evidently regulated much more by the temperature of the stable than by character of food.

75. During the whole period of one hundred and ninety-six days the mixture of grain with oil-cake used most water, practically 40 lbs. per head, per day; the mixture with Thorley's condiment is second, peas third, the mixture itself fourth—and nearest the average of the whole (37 lbs.); white barley fifth; black barley sixth; oats seventh, and corn the least of any, about $33\frac{1}{2}$ lbs.

76. It seems somewhat contradictory that the animals on cooked food took more water than those receiving uncooked, and that when hay, roots, and bran alone, formed a ration, they did not consume more than 22 lbs. of water per head per day.

77. In the case of grain feeding the extremes of water used were 61 lbs. per head per day in November, with black barley, and the same ration in January has the minimum of $22\frac{3}{4}$ lbs.

78. The comparison of temperature with water consumed is illustrated in diagram herewith; there is a clear parallelism in the two lines from November through the whole winter to May.

79. In November the mean temperature was 45°, and water consumed $44\frac{1}{5}$ lbs; in December 39° and 38 lbs.; in January, 35° and $30\frac{1}{3}$ lbs., thus far very close agreement; in February, 38° and $32\frac{1}{2}$ lbs.; in March 40° and $33\frac{1}{5}$ lbs.; middle stage which though wider is yet in companionship; and in April, we have 50° with $38\frac{1}{3}$ lbs., and 55° and $41\frac{1}{6}$ lbs. for May. While the greatest consumption of water does not exactly follow the highest temperature, as comparing November and December against April and May, we have to remember that upon the great change from pasture to stall feeding in the fall the animals would require more water irrespective of temperature, than they did after lengthened habituation to house and food, as in April and May.

XIII.—Comparative Results in Cattle Feeding.

Food.	Average weight of steers during experiment.	Daily Rate of Increase.	Cost of adding 1 lb. to live weight.
	lbs.	lbs.	cts.
Mixture of Grain	1171	$2\frac{1}{4}$	$8\frac{1}{2}$
Mixture with Cake	1172		$11\frac{1}{2}$
Mixture with Thorley	1163	$2\frac{2}{5}$	$11\frac{3}{4}$
Corn	1170	$2\frac{1}{8}$	8
Peas	1163	$1\frac{3}{5}$	$11\frac{1}{2}$
Oats	1186	$1\frac{3}{4}$	$10\frac{1}{2}$
W. Barley	1166	$1_{1\,0}^{9}$	$10_{1\,0}^{3}$
B. Barley	1172	$1\frac{3}{5}$	$11\frac{3}{4}$
Hay, Roots and Bran	1028	$2\frac{1}{7}$	$9\frac{1}{2}$
Uncooked	1108	$2\frac{3}{5}$	9
Cooked	856	$1\frac{4}{5}$	9
	1122	2	10

80. For rapid production, irrespective of cost, in the winter feeding of cattle, we have then (1) uncooked food, (2) mixture of grain with Thorley, (3) corn, (4) the mixture itself followed by (5) hay, roots and bran, (6) mixture of grain with cake, (7) white barley, (8) cooked food, (9) oats and peas and black barley equal.

81. For rapid and cheap production combined, corn is decidedly ahead; then the mixture of grain, followed by uncooked food, and hay, roots, bran; all the others are above the average, both in cost of production and slow rate of production.

82. The grand average of daily rate of increase and cost of production is 2 lbs. at ten cents per pound.

83. The nutritive ratio for the whole series equals about:— 1 : 4 . 46.

XIV.—Maturing of Shorthorn Grades.

Shorthorn Grade Steers, on 15th July, 1884.

Name and Birth-Day.	Age in days.	Heart Girth.	Weight. lbs.	Daily Rate of Increase.
		ft. in.		lbs.
Dudley, 15th December, 1881.....	942	7 5	1,730	1·84
Derby, 16th March, 1882.....	859	7 6	1,696	1·97
Digby, 16th March, 1882.....	851	7 3	1,660	1·95
	884	7 5	1,695	1·92

Analysis.

84. The cross of the shorthorn bull with the grade cow (a very indefinite thing) of Ontario, properly attended to from beginning, and pushed all through, weighs 1,700 lbs. when 884 days old— two years and five months.

85. The daily rate of increase per head has been almost two pounds on an average.

86. Feeding since weaning has been,—peas, corn, oats, bran, cake, hay, roots and green fodders, in quantities as required.

87. These animals are in competition with the Hereford and Aberdeen Angus Poll grades, elsewhere noted, and should be exhibited at shows this year, as well as at the Agricultural and Arts Christmas Show, at Guelph.

XV.—The Maturing of Hereford Grades.

Hereford Grade Steers, on 15th July, 1884.

Name and Birth-Day.	Age in days.	Heart Girth.	Weight lbs.	Daily Rate of Increase.
		ft. in.		
Huntington, 9th April, 1882.....	827	7 4	1,560	1·88
Heathfield, 6th October, 1882.....	647	7 1	1,505	2·34
Hartford, 28th October, 1882.....	625	7 0	1,459	2·33
	700	7 2	1,508	2·18

Analysis.

88. These are the first cross between a Hereford bull and half-bred Shorthorn grade cow, and are exactly 700 days old, on an average to-day, 15th July, 1884.

89. The average animal weighs 1,508 lbs., which is equal to $2\frac{1}{6}$ lbs. per day, including birth weight, as in the other cases.

90. Food and management have been exactly similar to the Shorthorn and Aberdeen Angus Poll grade steers, with which they are in competition.

XVI.—The Maturing of Aberdeen Angus Poll Grades.

Aberdeen Angus Poll Grade Steers on 15th July, 1884.

Name and Birth-Day.	Age in days.	Heart Girth.	Weight. lbs.	Daily Rate of Increase.
		ft. in.		lbs.
Aberdeen, 24th June, 1882	751	7 4	1,625	2.16
Aboyne, 27th June, 1882	748	7 4	1,570	2.10
Abernethy, 2nd August, 1882.....	712	7 4	1,600	2.25
	737	7 4	1,598	2.17

Analysis.

91. These Aberdeen Angus Poll grade steers, bred similarly to the Hereford grades are on an average exactly two years old to-day, 15th July, 1884.

92. The average weight of 1,600 lbs. gives a daily rate of increase of $2\frac{1}{6}$ lbs. per head.

XVII.—Oats and Hay in Sheep Feeding.

Results per head, per day, with four head for fifteen weeks, beginning 10th Nov., 1883.

Food Consumed.			Daily Increase.	Weekly Increase.	Weight of average animal at finish.
Oats.	Hay.	Roots.			
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$1\frac{3}{4}$	$2\frac{2}{3}$	$1\frac{1}{3}$	.372	2.60	143

93. The sheep in this test, and all the others hereto noted, are Oxford Downs and Shrops grade wether lambs, dropped on an average in March, 1883, and, with the exception of the high and low feeding, were alternated to the different foods in pens, as described.

94. The average wether lamb receiving per day $1\frac{3}{4}$ lbs. oats; $2\frac{2}{3}$ lbs. clover hay, and $1\frac{1}{3}$ lbs. turnips, gave a daily average increase of fully $\frac{1}{3}$ of a pound, at a cost of nine cents per pound to the added weight of the animal.

XVIII.—Peas and Hay in Sheep Feeding.

Results per head, per day, with four head for fifteen weeks.

Food Consumed.			Daily Increase.	Weekly Increase.	Weight of average animal at finish.
Peas.	Hay.	Roots.			
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$1\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{10}$	.25	1.75	$123\frac{1}{4}$

95. In this example the average wether lamb consumed fully $1\frac{1}{2}$ lbs. of peas, nearly $2\frac{1}{2}$ lbs. hay, and $1\frac{1}{10}$ lbs. turnips per day, and increased in live weight at the rate of $\frac{1}{4}$ lb. per day; cost twelve cents per pound of added weight.

XIX.—Beans and Hay in Sheep Feeding.

Results per head, per day, with four head, for fifteen weeks.

Food Consumed.			Daily Increase.	Weekly Increase.	Weight of average animal at finish.
Beans.	Hay.	Roots.			
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$1\frac{1}{8}$	$2\frac{7}{10}$	$1\frac{1}{4}$	.136	.952	117

96. The daily consumption by this ration was $1\frac{1}{8}$ lbs. beans, $2\frac{7}{10}$ lbs. hay, and $1\frac{1}{4}$ lbs. turnips, and the increase to live weight scarcely 1 lb. per week, which makes a cost of nineteen cents to produce every pound added to the live weight of the average wether lamb.

XX.—Low Feeding with Sheep.

Results per head, per day, with four head for fifteen weeks.

Food Consumed.			Daily Increase.	Weekly Increase.	Weight of average animal at Finish.
Hay.	Pea Straw.	Roots.			
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
$2\frac{1}{2}$	1	4	·9	·63	$111\frac{1}{2}$

97. Upon a daily ration of $2\frac{1}{2}$ lbs. clover hay, 1 lb. pea straw, and 4 lbs. turnips, the average wether lamb increased in weight at the rate of nearly $\frac{2}{3}$ of a pound per week, and the cost of producing one pound to live weight amounted to twenty-two cents.

XXI.—High Feeding of Sheep.

Results per head, per day, with four head for fifteen weeks.

Food Consumed.								Daily Increase.	Weekly Increase.	Weight of average animal at Finish.
Oats.	Peas.	Beans.	Bran.	Hay.	Roots.	Oil Cake.	Thorley.			
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
·507	·354	·101	·601	1·992	1·269	·27	·12	·2	1·4	125

98. The food above enumerated is the daily ration as consumed by the average wether lamb, upon which it increased in weight at the rate of $\frac{1}{5}$ of a pound per day. Cost of production, twelve and one-half cents per pound.

XXII.—Comparative Results in Sheep Feeding.

Wether Lambs.

——	Weekly Increase per head.	Weight at Finish.	Cost per lb.
	lbs.	lbs.	cts.
Oats and hay	2·60	143	9
Peas and hay	1·75	124	12
Beans and hay	·95	117	19
Low feeding	·63	112	22
High feeding	1·40	125	12½

Analysis.

99. The rapid and cheap production of mutton in winter has been attained best by the use of oats and hay, and second by peas and hay; this places six wether lambs as equivalent to one two year old steer. The average of these two only distinct ordinary forms of feeding sheep in this test equals ⅓ of a pound per head, per day, and ten and one-half cents for the added pound in weight.

100. Beans do not seem to act as profitable grain for sheep, as the rate of growth of the average wether is little over half, and the cost of production is double that of peas.

101. That poor feeding is expense feeding is well illustrated here; not one-third the ordinary rate of progress, and twice the cost of production, must be very much the position of those who practise what they consider economy.

102. The case of what is called "high feeding," although apparently good in results is yet not equal to moderate management of lambs, which can evidently be expensively fed for their age, and even kept back by a high pressure process.

XXIII.—The Sale of Forty Head of Winter-Fed Cattle.

103. The cattle handled during the winter of 1883-4, in connection with the foregoing experiments, were sold to A. Goodfellow, of Guelph, for shipment to Britain, on 15th June last.

104. They averaged 1,355 lbs., and fetched six and one-half cents, thus realizing $3,523. In this, allowance is not made for six light weights sold to a local butcher.

105. The forty head of store steers, averaged 931 lbs., and cost when purchased in middle of October, five cents per pound, or in all $1,862. The very important question now is:

How did they pay?

106. The method of the Ordinary Farmer is:

Cost of forty store cattle, $46.55	
Sold same for $88 a head	$1,862
Balance	3,523
Or $41.45 of profit per head. Attendance and bedding to balance manure.	$1,661

107. That of the Moderately Advanced Farmer is:

Cost of forty store cattle	$1,862
Market cost of grain fed to cattle, etc., $21 per head	840
Total cost	$2,702
Sold cattle for	3,523
Cash profit	$821
Add value of 300 loads of manure at $1	300
Or a profit of $28 per head.	$1,121

108. The system of debiting and crediting on the part of the Science and Practice man is:

Cost of store cattle		$1,862
Cost of food consumed		1,696
		$3,558
Attendance	$265	
Bedding	84	
		$349
Total actual cost of production		$3,907
Sold cattle for		3,523
Apparent deficit		$384
Value of manure calculated upon chemical and experimental data		1,017
Balance		$633
Or a profit of $16 per head.		

109. The method of The Ontario Experimental Farm is as follows:

Cost of store cattle		$1,862
Market cost of food and bedding	$1,780	
Less profit on market price	850	
Attendance		$930
		265
Sold for		$3,057
		3,523
Actual cash profit		$466
Credit 300 loads manure at $2.50		750
Balance		$1,216
Or a profit of $30 per head.		

110. The mean of all these methods of calculation is $29 per head.

XXIV.—The Influence of Food on Wool.

Ontario Agricultural College,
July 4th, 1884.

The Honourable A. M. Ross,
Commissioner of Agriculture.

Sir,—Two years ago at Professor Brown's suggestion I examined the wool of several varieties of sheep for the purpose of estimating the relative and absolute diameter of the fibres of each variety as well as the number of serrations to the inch in each. I am led to believe that since the time of Youatt these were the first systematic measurements published, and therefore, are of interest, apart from their direct practical value, as indicating the changes in the quality of wool which have occurred during a definite period during which the various breeds have been carefully tended and improved.

It was my intention to follow up this line of observation, by examining wools from the various breeds under different conditions, but other work prevented my carrying on any observations until last winter, when I requested Professor Brown to allow me to test the influence of food on the wool. With his usual kindness and willingness to accommodate, he placed at my disposal eight sheep, six Shropshire grades and two French Merino ewes. These were divided into two groups, three Shropshire grades and one Merino being in each, and of these groups one was subjected to "high" feeding and the other to "low." At the commencement of the experiment wool was clipped as short as possible from the shoulder of each subject, carefully labelled, and kept for future measurement. The experiment was commenced on November 22nd, 1883, and continued until April 30th, 1884, thus extending over a period of 161 days. During the progress of the experiment, by an unfortunate and annoying mistake of certain of the students, the grades were shorn, and were thus thrown out of the experiment, leaving only the two Merinoes to be observed.

During this time, then, one Merino was fed upon clover-hay, pea-straw, roots, pea-meal, oats, bran, oil-cake, beans, and Thorley's cattle food; the other on clover-hay, pea-straw, and roots. The former diet is indicated hereafter, by "high-feeding," the latter by "low-feeding." On April 30th a small sample of wool was again clipped as closely as possible from the shoulder of each, and reserved for measurement, and shortly afterwards both ewes were shorn, the clip being carefully weighed.

Perhaps it may be as well to define certain terms to be used hereafter. The distinguishing feature between wool and hair is the presence in the former of a more or less evident curl or "kink," produced by the individual fibres being wavy, the sinuations of one fibre fitting into those of the fibres in front of and behind it. These are usually referred to as the "*spirals*," a term, however, not strictly applicable, "*sinuations*" being preferable. By the microscope the "*diameter*" is ascertained, a term sufficiently common to require no further comment. But under the magnifying power of the instrument it is further seen that the surface of each fibre is covered with numerous close set scales, overlying each other like the shingles on a roof, their uncovered edges giving the fibre a more or less transversely striated appearance. These are the "*imbrications*," or "*serrations*."

The following table will give a condensed view of the result of the measurements made upon the four specimens of wool. It may be mentioned that the figures given are the average of a number of measurements in each case, since there is always a slight variation to be found in a number of fibres, very noticeable in the diameter and the imbrications, so that in the case of these two particulars, a slight difference only will not be sufficient to base distinctions upon. In fact, the same fibre at different points of its length will exhibit wide differences in its diameter.

I.—Low Feeding.

Time.	Length of Clip in inches.	Sinuations to inch.	Diameter.*	Imbrications to inch.
At commencement of experiment	$1\frac{7}{16}$	16	965	2464
At close of experiment	2	13	878	2387

Weight of entire clip at close of experiment..... .....13 lbs.

II.—High Feeding.

Time.	Length of Clip in inches.	Sinuations to inch.	Diameter.*	Imbrications to inch.
At commencement of experiment	$1\frac{1}{2}$	16	1000	2324
At close of experiment	$2\frac{5}{16}$	16	1044	2348

Weight of entire clip at close of experiment.....17 lbs.

* The figures given under the head of Diameter represent the number of fibres which could be placed side by side in the space of an inch. Accordingly the average diameters of the fibres at the commencement and close of the high feeding were respectively 1/1000 and 1/1044 of an inch.

To compare in the first place the two sheep at the commencement of the experiment. Both were taken from pasture for the experiment, and were therefore under similar conditions. The length of clip of the one chosen for low-feeding was slightly less, the sinuations were the same, the diameter was slightly greater, and the imbrications slightly more numerous. At the close of the experiment the wool of the high-feeding sheep is $\frac{1}{4}$ inch longer than that of the other, the clip is four pounds greater weight, there are more sinuations, and a less diameter, but the number of imbrications is about the same.

The most important comparison is to be drawn between the same sheep at the beginning and end of each experiment. This may perhaps be best expressed by a table, in which loss is expressed by the sign of subtraction.

Experiment.	Length of Clip.	Sinuations.	Diameter.	Imbrications.
Low feeding	$\frac{9}{16}$	— 3	— 87	— 77
High feeding	$\frac{13}{16}$	0	0	0

It will thus be seen that even in the short space of 161 days, the quality as well as the quantity of the wool has very appreciably deteriorated by poor feeding, and it will also be seen that good pasturage is quite as good for the quality of the wool as the most nutritious foods fed to a stalled sheep.

I am pleased to see that the measurements I have made this year correspond very closely with those made two years ago, I have now made some sixty measurements of the diameter and number of serrations of Merino wool, and as a result of the same it may be stated that good Merino wool in this part of the country will give 1,000 fibres to the inch, and an inch of each fibre will possess 2,300 imbrications.

It may be interesting to compare the measurements of our Merinoes with those from other localities. Youatt in 1840 gives as the diameter of Merino wool 750. Dr. Manly Miles, in his work on "Stock Breeding," published last year, gives a number of measurements of various breeds from different localities. The following are the measurements he gives for Merino wools:

Merino ram	1212	from flock of E. Hammond, Vermont.	
"	1186	"	"
"	1185	"	"
Merino ewe	1275	"	"
"	1183	"	"
"	1138	"	"
"	1223	"	"
"	1274	"	"
Merino ram	1164	from Lapeer, Michigan.	
" ewe	1064	"	"
" "	1164	"	"
" "	1023	"	"
" "	1022	"	"
Merino ewe	1199	" Melbourne, Victoria, Australia.	
"	1230	"	" "
"	1173	" Victoria, Australia.	
"	1500	"	"
"	1376	"	"
"	1079	"	"
"	1266	" New South Wales, Australia.	
"	1325	" Buenos Ayres.	
"	1180	" Argentine Republic.	
"	1334	"	"
"	1184	"	"
"	1208	"	"
"	1450	"	"
Rambouillet	1035	"	"
"	1062	"	"
"	1150	"	"

It will be noticed from this list that all the measurements (mine included), indicate a much greater fineness of wool than do Youatt's measurements. Miles says with regard to this:—"As these samples, from widely different localities, are, without exception, much finer than the specimens examined by Mr. Youatt, we may safely attribute the change to the same causes that have produced the modifications of form and feeding qualities that characterize the improved breeds."

Taking the average of all the measurements from the one country, and assuming that by Merino in the list is meant the Spanish breed we get the following:—

Average of	Vermont wools	
"	" Michigan "	1209
"	" Australia "	1087
"	" Argentine Republic wools	1260
"	" French Merino from Argentine Republic	1280
"	" " " O. A. C	1062
		1000

From this it will be seen that the O. A. C. French Merino is almost as good as that from the Argentine Republic, there being only a slight advantage in favour of the latter. On comparing the Spanish Merinoes, however, one finds that although the Vermont, Australian, and Argentine Republic specimens are very close, those from Michigan are considerably thicker. It is stated that the colder the climate, the finer will be the wool. Here we see that the wools from the warmer climates are the thinner. How is this to be explained?

I believe the explanation is to be found in the influence of the food. It has been pointed out above that good pasture is as efficaceous in producing fine wool as the richest of what may be termed artificial fodders. In our climate it is only during a portion of the year that the flocks can be at pasture; during the winter months they feed on less nutritious substances, which will diminish the quality of the wool. In the Argentine Republic and Australia, on the other hand, the flocks are on the "run" during the entire year, and are thus in almost constant possession of good nutritious food. As regards the Argentine Republic, Darwin* says: "The plain here looked like that around Buenos Ayres; the turf being short and bright green, with beds of clover and thistles, and with bizcacha holes. I was very much struck with the marked change in the aspect of the country after having crossed the Salado. From coarse herbage we passed on to a carpet of fine green verdure." In Australia the circumstances are apparently not so favourable, but still, to quote Randall:† "Its vast plains, occasionally highly fertile, but more usually only detached spots, afford pasture throughout the year."

One may conclude from these facts that the food has a greater influence on the wool than the climate, and that the greater fineness of the wool in the south—contrary to what one would expect—is owing to the greater length of time spent on the pasture in those localities than in the north.

With regard to the measurements of the Vermont sheep, which are only slightly below those from Australia, nothing can be said, since no particulars regarding their mode of management are given. The fact of our own French Merinoes approaching so closely to those of the Argentine Republic also requires some explanation which, however, is not hard to find. Our sheep have had good care, and in addition have probably been influenced by the temperature, so that it is allowable to conclude that had the climate influences been the same in both cases, a much greater difference would have been noticed. And further, it is to be noticed that although the "pasture" wool and the "high feeding" wool are as good as the South American wool, yet the "low feeding" wool is very much inferior.

The inferences to be drawn from the above observations are briefly as follows:—

(1) The nature of the fodder has a manifest influence on the quality of the wool.

(2) The influence of food on wool is greater than that of climate.

(3) Pasture is equal to the most nutritious food in producing wools of good quality.

(4) Sheep that can pasture all the year round will, as a rule, produce better wool than those which on account of severe weather require to be fed in a pen during part of the year.

I remain, Sir,

Your obedient servant,

J. Playfair McMurrich,

Professor of Biology and Horticulture.

* Darwin. Voyage of H. M. S. *Beagle*.

† Randall's Sheep-Husbandry, with an account of the different breeds, etc., 1860.

XXV.—General Observations.

The making of prime beef for the British market is one peculiarly suitable to Ontario. The decided character of winter enables farmers to calculate very accurately, both as to number of head, food required, and results as to animal increase. The grain and fodder crops of the Province are also profuse and cheap, and, as generally understood, excellently adapted to the production of beef. It requires no science to know that a mixture of all or nearly all the crops of the field, is a good thing for cattle life. Experience is plentiful amongst us on this subject, and yet we do not know much about the effects of special foods, or certain combinations of them, under precisely similar conditions. I desire very particularly to call the attention of our farmers and feeders to some very marked indications of animal growth in our experiments during the past winter. I shall premise that the reader has carefully studied the notes and tables of this report; if not, he cannot go with me so well into these general observations, few as they may be.

As a practical farmer generally does then, we make a mixture of equal parts of ground peas, oats, barley and corn, along with the usual quantity of good hay—two-thirds timothy and one-third red clover—weight for weight with the grain, and then the weight of these three makes up the quantity of turnips that go to the daily ration of a steer put up in the fall to be finished for the market when two years old, the following spring. The animal eats, drinks, sleeps, chews the cud, voids, grows, and is groomed and exercised; that is all, apparently. Such then was our standard ration and management to which we were to refer all other forms of feeding. At the end of the long series of tests, this standard gave the *second best* results in what everybody aims at—rapid growth and cheap production. Second among eleven, and why not first?

The comparative standing, chemically, of the various rations used is this:—

Comparative Chemical Feeding positions of the various rations used.

Highest 1.	—Peas: nutritive ratio	1:3·84
2.	—Mixture with oil cake, ratio	1:4·01
3.	—Hay, roots, and bran "	1:4·27
4.	—Cooked "	1:4·35
5.	—Uncooked "	1:4·46
6.	—Mixture with Thorley "	1:4·50
7.	—Oats "	1:4·61
8.	—Mixture "	1:4·68
9.	—Black barley "	1:4·78
10.	—White barley "	1:4·79
Lowest 11.	—Corn "	1:4·85
	Mean	1:4·46

In the ration, of which peas formed the bulk of grain, the feeding value was *lowered* by admixture with the other ingredients; in all other cases the feeding standard, or nutritive ratio, was *raised;* peas stand as high as 1:2·7 by itself, nearly equal, indeed, to linseed cake. Remembering this, it will now be noticed from the list that our standard mixture is only eighth place chemically, and yet it gave the second best results in cattle feeding. We could discourse at considerable length on several points of this enquiry, such as rapid production, irrespective of cost; but it is desirable to confine what are notes only, to the real practical aims of the feeder—rapid and cheap production.

The first comparision with our standard should be made with what coarse grain Ontario gives us well for our purpose,—peas, barley, and oats.

Though lowered in nutritive value by mixing with hay, roots and bran, the peas ration is yet very much higher chemically than any of the others, and accordingly, we would expect corresponding results in animal increase, if not in cheapness. It does not do so, however, and thus we meet with one of the puzzles that troubles the scientific student. This experimental station has, in previous years, shewn that peas take a high posi-

tion in animal feeding—and we must not forget this—but now the record is much lower; we want more than 1⅔ lbs. per head per day, and a less cost than 11½ cents per pound. We want fully 2 lbs. and less than 9 cents.

The two kinds of barley have made an even record, being, for all practical purposes, equal to each other, and their average is very little under that of oats. Oats, therefore, have taken their proper place, when chemically considered, in relation to barley.

Corn (Maize), as the prominent coarse grain of the United States, is not, chemically, of very high standing, as by itself the nutritive ratio is only 1:8·3, and although in our mixing of it with hay, roots and bran, it has been raised to 1:4·84, this position is still the *lowest of all the list*.

When, therefore, we have the most distinct evidence, by twenty-one head of cattle throughout seven months, that corn, as a regulating portion of a ration, has given in cheap and rapid production, no less than twenty-five per cent. better results than the average of all the others, and ten per cent. better than the best of the others, a fair judgment can be made as to its value in the winter feeding of cattle, irrespective of any chemistry. Why is it? It is high in *digestible* organic substances, therefore, low in indigestible; and it is also high in digestible fat. If these experiments stand as a correct guide, it would pay to feed corn at seventy cents per bushel as against peas, oats and barley at an average of fifty-six cents. It is worth noting that in the use of corn very much less water was consumed throughout the whole test, almost ten per cent. less than the mean of the others.

It is not, after all, more the cost of the food than its chemical standing that regulates the cost of producing beef?

If a man had no grain to spare, but plenty hay and turnip, with considerable bran from his own grists, it appears by these notes, that he could turn out steers at less cost and a greater daily rate of increase than the average of those who feed barley, oats and peas. This is not the first time the Ontario Experimental Farm has drawn attention to the rapid and cheap growth of *young* store cattle upon such a diet. Now there are several points here that are really important:—go back to chapter XI and note that the animals were the youngest of the lot—weighing only 850 lbs.—that therefore, having bone and muscle to build, they got just the kind of food to do this, namely, hay, roots and bran—from which also they obtained no less than a feeding ratio of 1:4·27—the third highest among the eleven. That the like things would finish an older cattle beast as well and as fast as certain grain, does not follow; but clearly these experiments are an important indication as to the economical feeding—not fattening necessarily—of young store cattle. Necessarily, with as much as 35 lbs. turnips per head per day, the water used was low, although it might be judged that as much as 8½ lbs. bran and 12 lbs. hay—which were not drenched—would make the animals drink more than 25½ lbs.

The point between cooked and uncooked food is not a very large one; there is less increase by cooking, it costs more, and is likely to make a more tender travelling animal.

When our standard mixture of grain is spiced with oil cake and "Thorley" respectively, the results are interesting. The daily rate of increase has been in favour of "Thorley," a rate second only to the uncooked ration among the whole eleven, while the cake gave a solid average and a slightly less price per pound of the added live weight, than "Thorley." The chemical feeding position with oil cake is very prominently increased—second only to peas, and so far as we know, considerably higher than "Thorley." Were "Thorley" as cheap as oil cake, the cost of production would be strongly in favour of the former; but we fed a high rate of the Thorley condiment and a medium of the cake.

An unusual feature of our winter feeding experiments was the weighing of all the water drunk. The notes already given and the diagram that accompanies them, should be carefully studied. There is an agreement between the amount of roots consumed and the water that the animal requires afterwards; but yet it is second to that of the temperature of the stable; neither is the character of the other foods a prominent agent in affecting the consumption of water. (See detail notes.) That as low a mean temperature of 42° affects the consumption of water so much, seems to be unusual, even theoretically.

I do not wish to say much here in regard to the maturing of the Shorthorn Hereford, and Aberdeen Angus Poll grade steers. "Come and see them" is the best report at present; they are worth seeing. When an offer of about $700 is made, *and refused*, for

three head of grade steers that weigh about 1,600 lbs. each, there may be, to adopt what Dr. Johnson said about the angler—"a fool on the one side and a fool on the other." At the present moment the Hereford grades are still slightly ahead in daily rate.

The sheep-feeding experiments are submitted with some diffidence, and are but preliminary to more extended work.

2.—WHAT WE HAVE ON HAND EXPERIMENTALLY FOR 1884–5.

1. Fattening of 20 store steers.
2. Fattening of 3 speyed heifers.
3. The percentage of cream from milk of ten distinct breeds of cattle, under winter and summer conditions.
4. The proportion of butter from milk and cream of ten breeds, winter and summer.
5. The quality and other properties of butter, as obtained by various methods from milk of ten breeds, summer and winter.
6. Cream and butter from ten breeds of cattle, winter and summer, by deep setting in ice; deep setting by gradual cooling; and by centrifugal separation.
7. The size of butter globules in milk of ten breeds, under various conditions, winter and summer. (Illustrations.)
8. The size of butter globules in relation to quantity of cream and butter from ten breeds of cattle.
9. Cream from different breeds, and different conditions of the same breed, in relation to prices paid to patrons of creameries.
10. The churning of butter in relation to size of butter globules.
11. The centrifugal separation of cream from milk in relation to quantity from different breeds.
12. The question of butter-making in winter, with special reference to creameries.
13. The chemical analysis of milk from different breeds of cattle.
14. The relation of chemical analysis to ordinary methods of testing cream and butter in milk.
15. The testing of a newly-calved Holstein heifer, in milk, cream, butter and cheese, summer and winter.
16. The cheese curd from milk of ten different breeds of cattle, during winter and summer.
17. Ensilage corn in the production of milk, cream, butter and cheese.
18. Turnips in the production of milk, cream, butter and cheese.
19. Abortion among cows in relation to milk production.
20. The feeding of calves on skimmed milk, in connection with sending cream to butter factories.
21. Contrast in rearing calves by sucking—Shorthorn, Hereford, Aberdeen Poll, Guernsey, Ayrshire and Jersey.
22. Is abortion among cows contagious, infectious, sympathetic, food influence, or management?
23. The growth of calves from eight breeds.
24. Fattening a score of common store steers from 1,000 to 1,350 lbs. in six months of winter, for the British market.
25. The possibility of making *yearling* beef fit for exportation.
26. The Shorthorn, Hereford, Aberdeen Poll—beefing contest at the Ontario Experimental Farm.
27. Fattened shearling wethers of six distinct grades—their cost, wool, weight and value, for the British market.
28. Cross-bred lambs from ten different sources.
29. Lambs from nine distinct breeds—their number, weight and estimated value.
30. Wool, in weight and value, from nine breeds.
31. How thirty varieties of cultivated grasses have stood two severe winters in Ontario.
32. Abstract of proposed public sale of live stock at the Ontario Experimental Farm, September, 1885.
33. The silos 1884-5.

Spring Wheat.

From Oakshott & Co., Reading, England.

16. April Bearded	May 6th	August 21st	6.41	1.132	41.5
17. White Fyfe	" 5th	" 21st	3.58	1.772	36.9
18. White Fyfe	" 5th	" 21st	2.16	1.185	34.8
19. White Russian	" 5th	" 21st	8.00	1.970	43.1
20. White Russian	" 5th	" 21st	12.58	2.677	46.5

Rate of seeding—6 pecks per acre.

Barley.

From Oakshott & Co., Reading, England.

2. Golden Drop	May 3rd	August 21st	48.43	3.168	44.5
4. Golden Melon	" 3rd	" 21st	49.47	3.076	47
6. Peerless White	" 3rd	" 21st	47.91	2.790	49.8
8. Thanet	" 3rd	" 21st	51.66	3.126	48.1
10. Chevalier	" 3rd	" 21st	50.52	2.978	48.1
12. Empress	" 3rd	" 21st	53.54	3.101	45.6
14. Mercury	" 5th	" 11th	40.31	B	40.3
15. Black	" 5th	" 11th	A	E	61

Rate of seeding—6 pecks per acre.

With the exception of the "Mercury" and Black, all the varieties were about equal in maturing, the earliest and best on the ground being the "Mercury," a six-rowed variety.

Oats.

From Oakshott & Co., Reading, England.

Rate of seeding—2 bushels per acre.

No. of Plot.	Variety.	Seeding.	Time of Ripening.	Yield per Acre.		Weight of Grain per measured bushel.
				Grain in Bushels.	Straw in Tons.	
1	Black Tartarian	May 3rd	August 14th	43·52	3·225	22·
3	White do	" "	" 21st	44·41	3·674	20·
5	Racehorse	" "	" 11th	46·32	2·321	24·
7	Victoria	" "	" 11th	46·02	2·421	33·8
9	Waterloo	" "	" 14th	69·41	3·282	31·5
11	Early Blossom	" "	" 14th	58·37	2·530	37·9
13	Fort William	" 5th	" 21st	25·14	2·777	17·8

The "Racehorse," "Victoria," and "Waterloo" varieties were well headed on 11th July, being the earliest of any, even earlier than our own well known Black Tartarian. The Black and White Tartarian were late in filling—the latter particularly late, and both were very much injured by rust—the Black more than the White. Most of the new varieties got from England have turned out well—the Waterloo particularly so. They are all branched varieties.

All the crops of this range were much injured by rust—in some cases as much as 50 per cent.

TURNIPS UNDER FOUR FORMS OF FERTILIZERS.

PLOT.	CROP PER ACRE.		FERTILIZERS PER ACRE.	
	Leaves.	Bulbs.	Kind.	Amount.
	Lbs.	Bushels.		
71	12,960	315.6		
72	17,280	544.3	F. Y.	14 tons.
73	15,580	424.0	Nitrogen.	150 lbs.
74	14,020	422.0	Super.	350 "
75	10,940	381.6	Muriate of Pot.	150 "

GREEN FODDERS, 1884.

On plot 81, corn (western variety) cut on gave $9\frac{1}{10}$ tons per acre.

On plot 82, spring rye cut on July 7th gave $3\frac{1}{10}$ tons per acre.

Following the spring rye we seeded with rape (broadcast) as a catch crop, on August 6th. This was cut on October 7th, and yielded $7\frac{9}{10}$ tons per acre.

On plot 83 we have prickly comfrey, which yielded only three cuttings this summer, as follows:

May 28th	8.6	tons per acre.
July 7th	7.9	"
October 7th	7.6	"

In all, therefore, $24\frac{1}{10}$ tons per acre.

On plot 85, we have Lucerne laid down 16th May. This year we made three cuttings only, as follows:

June 3rd	2.1	tons per acre.
July 2nd	2.6	"
July 28th	1.8	"

In all, $6\frac{1}{2}$ tons per acre.

It is but fair to note that this particular plot does not possess more than six inches of good surface soil, and the subsoil unsuitable for any deep-rooting plants.

On plot 86 were tares and oats. These, cut on 17th July, yielded $6\frac{8}{10}$ tons per acre.

Sanfoin, red, white, crimson and alsike clovers, made a fair show, except the crimson, which will not stand our winters.

GRASSES (GROWN SEPARATELY).

(And as all seeded in May, 1883.)

Timothy.—Our prominent hay plant requires no comment.

Orchard.—As usual, early, strong, bunchy, withstanding drought, and holding out late in Autumn. Poor for hay, good for pastures.

Creeping-agrostis repens.—A slender-leaved plant with creeping roots, not of any prominence for Ontario purposes.

Tall Oat.—This again has done remarkably well with us. It flowers nearly all the season. The produce per acre this year was unusually large.

Italian Rye.—Much injured by the winter, but where associated with other grasses, has stood much better.

Perennial Rye.—See remarks on Italian Rye.

Red Fescue-festuca rubra.—A variety resembling a hard fescue, and of secondary importance. Nearly all the Fescues are hardy and do well here.

Sheep's Fescue-ovina-festuca.—Another of the less valuable of the variety.

Tall Fescue-festuca aelitor.—This gives early foliage, and, as it loves moisture, may become one of our valuable meadow plants.

Hard Fescue-festuca Duriscula.—Reliable enough, if valuable enough.

Various-leaved Fescue.—Quite a typical plant, but probably not so reliable in drought.

Fine-leaved Fescue.—Very hardy, but of meagre growth which, we presume, is according to kind.

Large-leaved Fescue.—A very different looking plant from the other Fescues, resembling the oat grass.

Meadow Foxtail-alopecurus pratensis.—This deserves special notice, with a view to the future of our permanent pastures, and as we do not find it has as yet obtained a place in Canada.

Sweet-scented Vernal.—Again a failure—will not stand our winters.

Crested Dog's Tail.—Here also, we will have to bid good-bye to this variety—both as regards its nutritive value and want of hardiness.

Red Top.—One of our reliables, and already well-known to many, but must be associated with others to secure its best value.

Wood Meadow.—Has done well, and would make up one among others for permanent pasture under shaded, damp conditions.

Rough Stalk Meadow-podtrivialis.—This is distinguished from the Smooth-stalked variety by rough leaves and stems.

Yellow Oat-avena flavescens.—Does not do well alone, but very good among others.

Mangolds.

From Several Special Fertilizers.

Plot.	Manure.	Crop, 1883.	Crop, 1884.	1884.	
				Bulbs.	Leaves.
	lbs.	lbs.	lbs.	lbs.	lbs.
112	Nit. of Soda, 300	29,990	20,240	12,340	7,900
113	Super. 400	36,040	19,810	13,320	6,490
114	N. of Soda 300, Super. 400	33,380	21,230	13,340	7,890
115	F. Y. 14 tons	30,880	25,680	18,740	6,940
119	No manure	9,340	13,240	8,520	4,720

Mangolds.

(With Lime and Salt on a peaty soil.)

Manure applied in June, 1883.

Seeding on 27th June, 1884.

Plot.	Crop per acre. lbs.	Bulbs and Tops.	Leaves.
105, nothing	16,410	13,200	3,210
106, Salt (300 lbs.)	35,240	28,220	7,020
107, Lime (3 tons)	29,200	24,400	4,800

Special Ffrtilizers on Oats and Barley.

Plot.	Manure.	Crop.	Total Yield per acre.		Weight Per Bushel. lbs.
			Grain. bush.	Straw. lbs.	
134	Sup. and F. Y.	Probestier Barley.	19.3	1210	46.3
135	M. of Pot. and F. Y.	"	10.3	905	44.8
136	No manure	Fort William Oats.	16.6	1695	31.
137	Sup. M. of Pot. and F. Y.	"	48.3	1815	34.
138	Nit. of Soda and F. Y.	"	48.3	2335	32.5
139	Powdered L. Stone and F.Y.	"	42.2	1705	32.
140	F. Y.	"	47.9	2510	35.

NEW PEAS FROM ENGLAND.

PLOT.	KIND.	Yield per acre. Bushels.
157	Prussian Blue	20.4
158	Early Dun	22.
159	Maple	27.8
160	Early Britain	28.3

WINTER WHEATS.

VARIETY.	Crop per acre.		Weight per bushel.
	Grain.	Straw.	
	bushels.	lbs.	
Michigan Early Amber	13·5	3545	47·4
Martin Amber	11·4	2995	50·3
Bonnell	14·5	3285	48·9
White Mountain	8·1	2150	46·5
Roger	14·9	2940	53·2
Soule	20·6	3240	53·8
Egyptian	11·2	2520	50·
Clawson	18·3	2700	57·
Finlay	19·9	2605	58·5
O. A. C.	25·4	2895	60·

V.—THE ONTARIO EXPERIMENTAL FARM CREAMERY.

It has long been a subject of comment that Canada had no place in the markets of the world as a producer of good butter; that we were notorious enough for a certain kind of butter, and that all the appliances of the country pointed to a very different condition of this branch of farm industry.

A very great deal of theoretical teaching has been growing upon us on this subject during the last three years, and the Province to-day is pretty full of its literature—though not of good butter. Several influences have contributed to public action in this neglected business. There has been, as already stated, American and European censure, which, honouring us with all that could be advanced in praise of our cheese, our beef, eggs and poultry (not mutton)—could not account for the total dearth of even ordinary butter; then also, private interest in dairy implements made some warm discussions here and there, which of late developed into the advocacy of three systems for the manufacture of butter—that of each farmer making his own; that of cream gathering and manufacturing

at established places, and that of the centrifugal system. In addition to these, there has been, as there will be in most affairs, a desire for change in those districts where disappointment—real or fancied—has followed the introduction of some other industry, and I think it is right to say that our Legislature has had all and more than a fatherly interest in the improvement of Canadian butter.

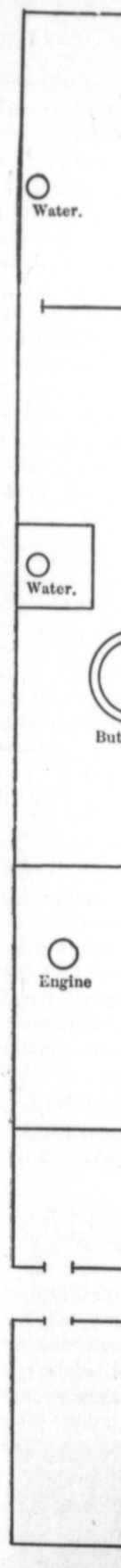
With a view, therefore, of educating and putting to practical test as a profitable investment for individuals or companies, the Ontario Legislature resolved to establish a butter manufactory in connection with the Experimental Farm, which has been named "The Ontario Experimental Farm Creamery." The personal inspection and advice of Mr. Wanzer, of Darlington, Wisconsin, was secured during the month of April last. This gentleman's standing as a practical expert in the cream gathering system is well known everywhere, and his recommendations have been strictly adhered to during the past test season. In company with several friends of the enterprise, Mr. Wanzer visited many farmers in the neighbourhood of Guelph, explaining the working of the same, and indicating how it would affect the patrons financially. Receiving sufficient encouragement by this tour, the Government proceeded to alter the internal arrangement of what we call the old Cheese Factory—a brick building situated in the new orchard of field No. 10 of the farm, and in due course the machinery and all appliances were ready for a start as late for the season, as 25th September last. Sixty-one patrons were secured who promised cream from about 275 cows. The position necessitated three routes for gathering—one team or single horse being employed at each daily, or every alternate day, as required.

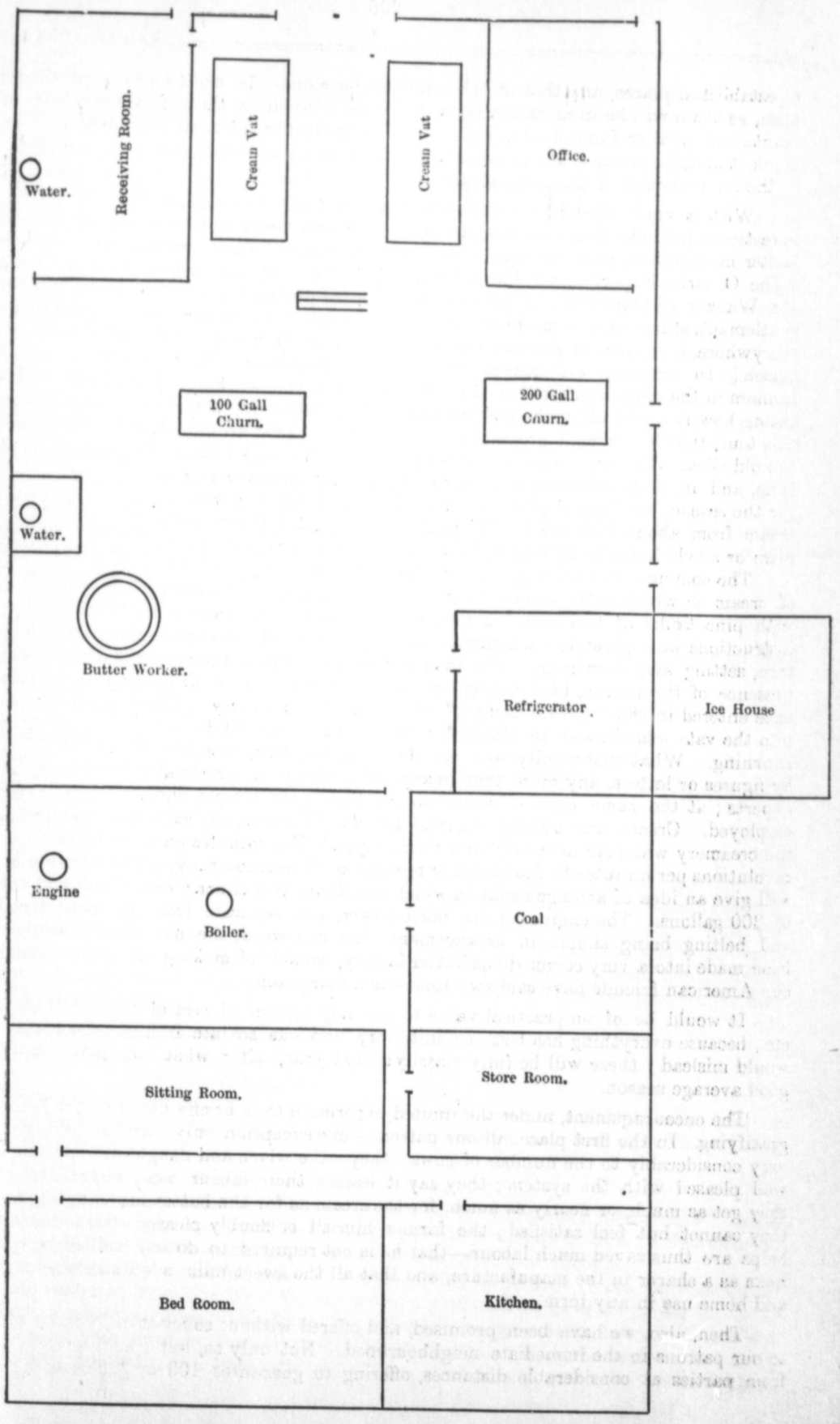
The common shot can $3\frac{7}{16}$ gallons, $8\frac{1}{2}$ inches diameter, and 19 in. deep—two inches of cream on which is the standard for one pound of butter. These were distributed along with pine tanks of two sizes, as required for setting the cans in cold water. Minute instructions were given to each patron in regard to thorough system, cleanness, temperature, setting and skimming. The teamster of each route performed the skimming in presence of the patron, both noting the number of inches in their books, and the same at once entered in the "Cream Ledger" on arrival at the factory. The cream being poured into the vats was allowed to stand for twelve hours to attain a certain acidity before churning. What that acidity was, we do not know, nor, possibly could it be explained by figures or letters, any more than many other things in practical manipulation among experts; at the same time it seems to me that some simple chemical test might be employed. Cream was usually churned the day following arrival. The temperature of the creamery was kept about 60° and churning took fifty minutes on average, by forty-five revolutions per minute of a four-sided or box churn. The accompanying plan of the creamery will give an idea of arrangements, in which are shewn two churns, one of 300 and another of 200 gallons. The engine of six horse power, and separate from the boiler, shafting and belting being simple in arrangement. In one word, the old Cheese Factory has been made into a very commodious butter factory, capable of making easily one ton daily—our American friends have said two tons—as a maximum.

It would be of no practical value to give any figures of cost of management, plant, etc., because everything has been so initiatory, and was so late in the season, that they would mislead; these will be fully classified next year, after what, we trust, will be a good average season.

The encouragement, under the limited experience thus briefly detailed, has been most gratifying. In the first place, all our patrons—one exception only—are preparing to add very considerably to the number of cows; they—the wives and daughters especially—are well pleased with the system; they say it lessens their labour most materially, and as they get as much, or nearly as much, for the cream as for the butter made by themselves, they cannot but feel satisfied; the farmer himself is doubly pleased—first that his fair helps are thus saved much labour—that he is not required to do any hauling or run any risks as a sharer in the manufacture, and that all the sweet milk is left at home for calves and home use in any form.

Then, also, we have been promised, and offered without solicitation, a large addition to our patrons in the immediate neighbourhood. Not only so, but I hold several letters from parties at considerable distances, offering to guarantee 100 or 200 cows if we will





THE ONTARIO EXPERIMENTAL FARM CREAMERY.

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make special routes for them, and it has even been suggested that we should *gather by railway*. It will therefore be my duty to make very early arrangements with the Commissioner of Agriculture for next season.

It is my duty, pleasant indeed, to thank Mr. Wanzer for the thorough interest—unremunerative to him—he has taken in our butter-making by machinery, and to the two gentlemen he sent to give us our A B C lessons. Mr. Williams, as outside manager, evidenced an aptness and business tact of no ordinary character, and Mr. Logan, as practical butter expert, obtained full golden opinions; both being first-class in their profession. We are also due thanks to Jas. Taylor, auctioneer, for much help by his intimate knowledge of the country. A good deal of the butter was sold to private parties, and as it is necessary in such a new enterprise to give ourselves a name in the public markets of the world, we sent three tubs each to well-known commission agents in Montreal and Toronto; in New York and Boston, and in London, Liverpool and Glasgow, inviting the most free criticism on the quality of the material. As their opinion should be of some value to the country, and of practical application to the creamery, I beg to give extracts from their letters so far as received:—

From G. Bowles, 13 West Smithfield,
London, England, 6th November, 1884.

"I beg to state they are three tubs of fine butter, and will sell freely here at 130/, and as weather gets colder, will go for 140/; the colour is all right, the only fault is it is a shade too salt; send me all you possibly can."

From Messrs. A. Ayer & Co.,
Montreal, Nov. 10th, 1884.

"We have looked at it critically, two tubs are really fine, such as we are paying 25c for, but one tub is much coarser and more ordinary."

From Messrs. Wiggin & Upton, Boston,
9 North Market Street.

"We have given it an examination, and find it very good. We think we can handle your goods to advantage, and if you have some smaller tubs we think it would be well for families."

From Andrew Clement, Esq.,
Cheese Bazaar, Glasgow.

"I am glad to say the quality is up to the mark; it is just a little over-salted and too high in colour for our market, but this can be easily remedied; the colour we like is just a nice straw, not the deep red colour of yours. I have sold it at 130/. With the slight improvements I have suggested it would take well in this market, and at all times meet with a ready sale. I think your Government is doing an immense benefit to the country in giving such an opportunity to dairymen of learning their business on the best lines of butter and cheese.

From Messrs F. C. Barger & Co,
82 Warren St., New York.
25th November, 1884.

We examined very carefully; one tub was fine in flavour, straight in color, and in every way high quality; the others were not clean flavoured, and had light streaks and spots in colour.

On 3rd October, Mr. Wanzer wrote me as follows:

"Should any points arise in the management of the business, I hope you will make free to communicate with me; anything I may do to aid you shall be free. I feel measurably responsible for the successful inaugaration of this system in Canada. . . . Pay your farmers all you can for cream. We are paying at present 19 cts. for cream, and selling the butter at 30 cts. in New York, leaving a profit net to us of 5 cts. per lb. . . . The question with your people should not be—does this butter suit us, but does it suit the export trade; your creamery butter should fetch 10 cts. more in the market than good dairy butter; you will see a wider difference than even this, if you refer to the Boston,

New York and Philadelphia markets. If Canada through the creamery system can double the value of her butter, and at the same time cheapen the cost of making, she has made the two spears of grass grow where but one grew before."

A summinary, in paragraph form, of the work of the past season will be convenient for many of our readers.

Notes of Preliminary Test in 1884.

(Cream Gathering System.)

1. The building cost $3,000 and machinery $1,000, in all $4,000 as capital account.
2. The building consists of a receiving room, wash-room, working-room, cream vat room, office, ice room, store room, engine room, and four dwelling rooms for the butter maker.
3. The machinery consists of two cream vats, two churns (200 and 300 gallons respectively), one butter worker, one boiler and engine of 6 horse-power, the whole capable of making one ton of butter per day.
4. The creamery was worked experimentally for 33 days in September and October.
5. There were 61 patrons who gave cream from about 250 cows.
6. The cans used were the common shot gun ($3\frac{7}{10}$ gallons, $8\frac{1}{2}$ x 18 inches for milk space), two inches of cream on which are said to be the standard for one pound of butter.
7. The average daily receipt of cream from each patron was fully 2 inches or 4 on the can, from 4 cows by estimate.
8. The average price paid for the inch of cream (2 inches on can) was $20\frac{1}{2}$ cents.
9. This by estimate was equal to 10 cents per cow daily.
10. By estimate it took $2\frac{1}{5}$ gallons, or 23 lbs. of milk, to produce the 1 lb. butter inch of cream.
11. The average price obtained for the butter was 28 cents in Britain, $29\frac{1}{2}$ in the States, and 25 in Canada, irrespective of cost of delivery.
12. The prices obtained for butter per lb. from various agents were :—

London, England	28 cents.
Liverpool, "	28 "
Glasgow, Scotland	28 "
New York	29 "
Boston	30 "
Montreal	25 "
Toronto	26 "
Guelph	24 "

13. The average daily make of butter was 125 lbs., by churning 50 minutes, the cream having been kept in vats for 12 hours at a temperature of 62°.
14. 1,763 gallons of buttermilk were got from 3,655 inches of cream, being in the proportion of $\frac{2}{5}$ of a gallon of buttermilk to every pound of butter, or every inch of cream may be said to have consisted of nearly *one-half buttermilk.*
15. Buttermilk fetched 10 cents per gallon delivered in the city, and on an average is worth 3 cents per gallon for sale or pork feeding.
16. Butter was salted at the rate of 1 oz. to one pound, and packed in pine tubs of 62 lbs.
17. The average route in cream gathering was $11\frac{1}{2}$ miles out and in, or 23 miles daily travelling for one team.
18. The skimmed milk left at home by this system is estimated to be worth half price, or $3\frac{1}{4}$ cents per gallon, thus for every inch of cream or pound of butter removed there was left 7 cents of skimmed milk.
19. From the accompanying estimate the following analysis of the cost of a pound of butter is obtained :—

Gathering	$2\frac{1}{2}$ cents.
Cream, cost	19 "
Making	$1\frac{3}{4}$ "
Marketing	1 "
	$24\frac{1}{4}$
Less value of buttermilk	$1\frac{1}{4}$
Actual cost of production	23

20. It costs the farmer about 5 cents in summer and 10 cents in winter to produce one pound of butter.

ESTIMATE FOR A CREAMERY SUPPLIED FROM 500 COWS.

Receipts.

Sale of 67,000 lbs. butter at average of 27 cents (500 cows May to October)		$18,090 00
Sale of 30,000 gallons buttermilk, part sold and part feeding pigs, etc., at 3 cents, average		900 00
		$18,990 00

Expenditure.

Paid for 65,000 inches of cream at average of 19c	$12,350 00	
Four gathering teams at 2.75 per day	1,300 00	
Butter maker at $65 per month	390 00	
Assistant and occasional outside inspector	250 00	
Butter tubs, 1,300 at 35c.	455 00	
Fuel, oil, etc., for engine	30 00	
Storing ice	40 00	
Salt, coloring and linen cloth	50 00	
Repairs and incidentals	50 00	
Books, postage, etc.	10 00	
Freight on delivery of butter at various markets	325 00	
Interest on $4,000 invested capital	320 00	
		15,570 00
Balance being profit		$3,420 00

NOTE.—The patrons to pay for tanks and cans.

VI.—MECHANICAL DEPARTMENT.

ONTARIO AGRICULTURAL COLLEGE,
December 29th, 1884.

MR. BROWN,

Dear Sir,—At the close of another year, which is the tenth of our existence as an Agricultural College, I am reminded that the time has come round to take a retrospective view of how we have been employed in this Department during the year that has gone. I have much pleasure in submitting the following statement by referring to the labour records. I find the first names of students entered is October 3rd, 1883, and the work consists of general routine, chiefly repairs about the College buildings and farm steading, and in erecting a small barn, 18ft. x 28ft., by one of the dwelling houses.

There were likewise made a number of wheel-barrows for use about the stables and farm-yards. There were also made for use on the farm, four new waggon-boxes and old ones repaired.

About the middle of January, 1884, plans were prepared for erecting an Experimental Laboratory in field No. 15, and also a small house for holding weather indicators. Material was prepared forthwith, and both houses constructed in due time.

After the Easter term, and for the Garden Department, field operations were commenced by putting up fifty-eight rows of cedar posts, in all over seven hundred, and stretching wire thereon for the purpose of training grape-vines. There were also—in view of receiving a d ation of the British Scientific Association—a number of repairs executed on the green-houses, consisting of new flower-stands, passage walks, stairs and shelves, the glass was likewise overhauled and re-bedded. A number of large flower boxes were built, and also side-walk leading from the College to north side-line road, and an approach gate erected there.

There has not been much done this season in new field fencing, but a great deal has been done in keeping up the old, which to a considerable extent need renewing. Caps and face-pieces were put on along south side of field 15, and a new fence put up enclosing part of field No. 3.

There was also erected a windmill for pumping water to fields Nos. 3 and 4, 7 and 8, and likewise south lane; this, though not under my direction, was more or less under my superintendence, by seeing to foundations, providing watering troughs, floats, etc. I may here state that this has been found a great convenience and thoroughly serves the purpose.

After the new importation of live stock we found the stable accommodation insufficient, and accordingly it was decided to extend the existing bull-shed 30 feet, giving additional room for six animals in loose-stalls, each 10 ft. × 14 ft. 6 in. with a road-way 10 feet wide between, and a spacious grainery overhead.

During the month of September we were engaged in fitting up our experimental dairy, this room 16 ft. × 24 ft. with large cellar containing heating apparatus for equalizing temperature. It has marble tables, testing tubes and other necessary appliances for butter-making. There is also in this room one of Professor Fyord's approved Burmenister & Wain's Danish Centrifugal Milk Tester. As this machine is something new and novel in its construction, allow me to describe its use and how we apply it: A brass disk 12 in. in diameter having twelve tubular pendants 6 inches long by 1½ diameter, in which are placed the glass tubes containing the new milk. Through the centre of this disk is inserted a vertical spindle, having a hand pulley 2¼ inches diameter, the motion being transmitted by 1½ inch belt from a horizontal counter shaft with driving pulley 19½ inches diameter, revolving 140 times per minute, hence driving the vertical-shaft and disk 1214 revolutions per minute, which is the motion required. On one end of counter shaft and overhung the journal, is a driving pulley 5½ inches diameter, motion being transmitted by band wheel with crank of 14 inch throw on each end of shaft, having a travel of 147 feet per minute, and exerting a power of ·40 or less than one half horse-power. The result is obtained, viz.: the cream is separated from the milk by centrifugal velocity in from twenty five to thirty minutes.

I have also to mention that for the purpose of pasturing the different breeds of sheep in the same field, we built and erected 500 panels and heads of portable fencing.

Near the close of the summer term I was notified that a new cattle stable would be required, capable of feeding twenty head. This building, 82 feet by 17 feet, was proceeded with and completed, and has now been in use for some time.

I may notice, in a closing word, that the mechanical department has overtaken more work this season than at any previous period in the same time, and the workmanship, in some cases, required to be of a higher order. We were under the necessity of having one permanent assistant, and in some instances more outside help was required to accomplish the work by a specified time. As a means of educating, the students employed in the department have had every advantage of both seeing and doing the various details of skilled labour that were under operations from time to time.

This, sir, is a general outline of the work of the mechanical department from October, 1883, to October, 1884.

I am, sir,

Your obedient servant,

JAMES McINTOSH.

GUELPH, January 2nd, 1885.

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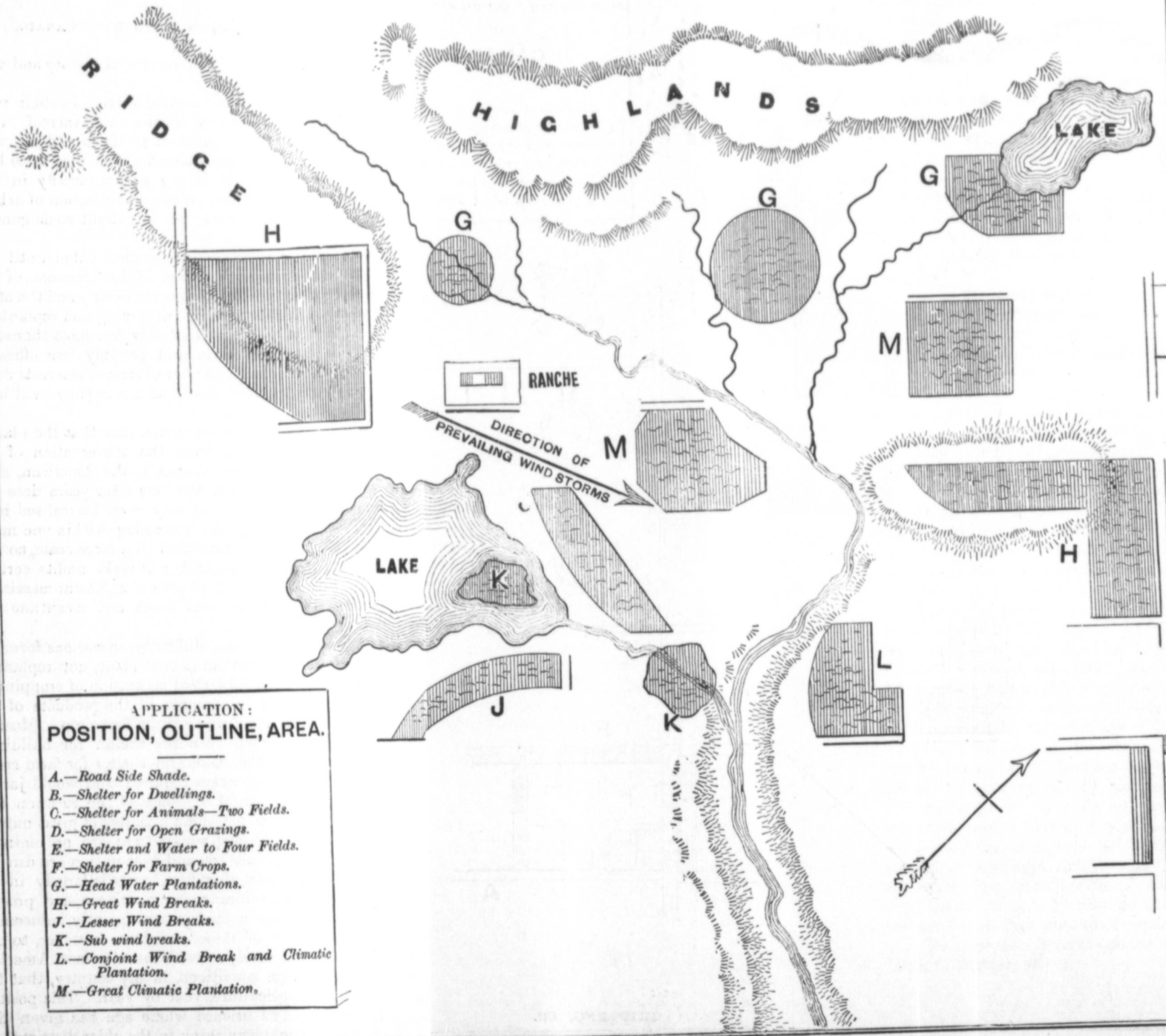
THE APPLICATION OF Scientific and Practical Aboriculture TO CANADA.

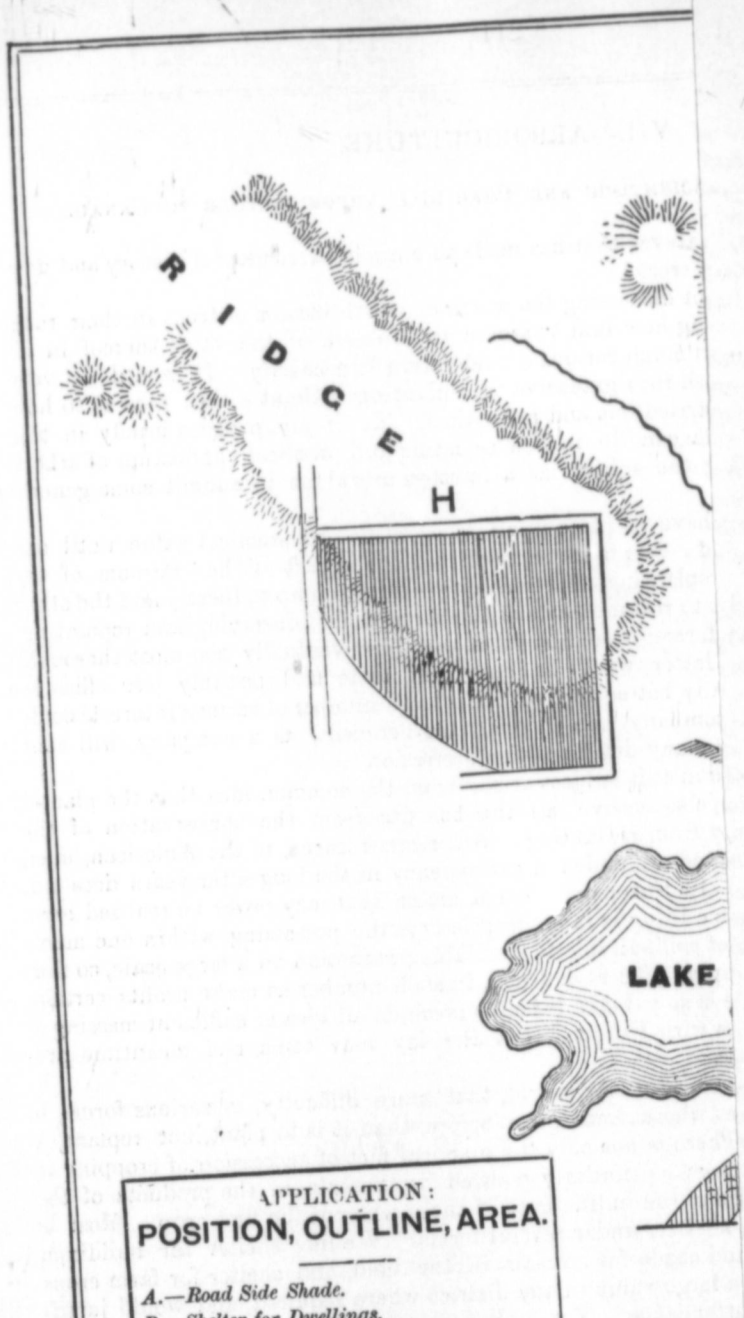
1.—*Road-side Shade.*
2.—*Shelter for Dwellings.*
3.—*Shelter for Large Grazings.*
4.—*Shelter for Agricultural Crops*
5.—*Climatic Amelioration.*
6.—*Revenue from Wood Sales.*



APPLICATION:
POSITION, OUTLINE, AREA.

A.—Road Side Shade.
B.—Shelter for Dwellings.
C.—Shelter for Animals—Two Fields.
D.—Shelter for Open Grazings.
E.—Shelter and Water to Four Fields.
F.—Shelter for Farm Crops.
G.—Head Water Plantations.
H.—Great Wind Breaks.
J.—Lesser Wind Breaks.
K.—Sub wind breaks.
L.—Conjoint Wind Break and Climatic Plantation.
M.—Great Climatic Plantation.

GRIP ENG. CO.



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VII.—ARBORICULTURE.

The Application of Scientific and Practical Arboriculture to Canada.

Is there any country whatever that has made an eminent agricultural history and does not now complain of want of trees?

Advanced nations are not discussing the worth or worthlessness of trees in their rural economy; they are considering how best to secure the fulness of the value thereof in all their bearings. In doing this much serious consideration is necessary. It would be very unwise for any country to rush into extensive tree planting without a clear idea as to how the work should be begun, carried out and maintained. It is my purpose briefly in this paper to show what Canada can do in the scientific and practical application of arboriculture, and before handling the subject as a forester, allow me to submit some general views.

Canadian forestry will have no place in all its scientific and practical value until one of two things be accomplished: One is the conviction on the part of her farmers of the necessity of conserving and replanting, therefore, their education up to these; and the other is the power by Government to resume parts of the country for conserving and replanting. Both will be difficult. The former would be the slower but eventually the most thorough, because of self-interest; the latter would be more immediate and possibly less efficient, practically, though scientifically better applied. No large number of various interests could be so well arranged as by a company, and therefore Government, as a company, will have to become foresters in all the many details of the profession.

Much of our indifference in this subject arises from the common idea that the planter cannot himself personally hope to receive all the benefits from the conservation of the present trees, and particularly from replanting. American returns, to the American, must be smart, strong, and undoubted; the idea of permanency in the long after years does not concern us so much as now. In Europe it takes a shape that may never be realized here, because of one thing—that one thing is large proprietory, the possessing within one man's power all the area and class of soil suitable to profitable production on a large scale, so that even that one man can employ officers and men in such number as make profits certain. Cultivated Canada meantime is so sub-divided as to preclude all idea of sufficient massing of woods to receive equal results with Europe,—but the day may come, and meantime progress must be made otherwise.

I believe it is the experience of the world, that more difficulty, in various forms, is found in reclothing with trees where trees grew before, than it is to plant, not replant, a country for the first time. There is not only the practical fact of succession of cropping in its scientific and natural bearings, as similarly realized for example in the products of the field, but the more serious one of the indifference of those who cut the first crop. Most of us think of trees as means of shelter, under several forms. We like shelter for buildings, shade for ourselves, shelter and shade for animals in the field, and shelter for farm crops. These alone would make up a large value in any district where required, and would justify all the cost and subsequent attendance. Yet we have another aspect of the question that takes an equally strong place in our regard; *Climate* is not alone a matter of great outside causes, but one intimately related to local influences, among which trees are pre-eminent. We have no time to show how temperature, rainfall, moisture, and evaporation are directly influenced by a small or large surface of trees, and how, therefore, water is largely in the hands of trees for distribution. This second duty of forestry as a science and practice would even seem to swallow up the previous question, and is consequently inducement alone to its prosecution on our part. Were neither of these sufficient, however, to convince, the third great reason for tree cultivation will surely convert even the most American amongst us. It is no matter of doubt, under average conditions, in any country, that tree culture is more profitable as a crop than its own agriculture, year by year. This position is not open to question, but clear and marked in all experience where age has given time for proof. The area of trees in Canada is not an unknown thing in the older districts, and it is not true that it is poorly wooded in comparison with other countries. The United States can show twenty-five, and Canada nearly fifty per cent. of the cultivated districts as

still under trees. This is possibly larger than any other continent, if we except the northern part of Europe, where agriculture is necessarily at a discount, and where forest is practically untouched. The cause of our discontent then is not want of forest per nation but its regular distribution to subserve all the needs of the nation.

The existing condition of our forests is the very first consideration in this enquiry. Outside of the lumbering interest, which of itself is simply a taking without system, there is no enclosing, preserving, caretaking, or conserving in any sense except the right of individual ownership, some of whom do act the forester, but nationally there is nothing recognized. The average "bush" of North America is a beautiful sight and yet a sad one. The artist must revel in its variety of form and foliage, but the fighting for place, the smothering and rotting for want of light and air can only be estimated by those who are scientifically and practically foresters. I do not mean that our forests in every case should be managed similarly to those in Europe, because much of our best timber requires very different conditions, but similar principles ought to guide our management.

There are really no figures to give as to the extent of Canadian forest, either as to gross area or special kinds of timber. The small map recently issued by Dr. Bell, of our geological survey, gives a good idea of the northern limits of the principal trees, but, of course, it cannot help in either of the particulars named. As the country, with the exception of prairie, was originally all forest, and as we have cleared about 25,000,000 of acres for agricultural purposes, it may be said that the whole country is still under trees with these exceptions. What the extent is to a million acres nobody knows, nor do a million acres one way or the other affect our subject.

We have four distinct fields of operation in the future of Canadian forestry: 1st. The untimbered lands such as prairie. 2nd. The older cleared portions. 3rd. The recent forest settlements, and 4th the untouched forest. Each of these will require different methods as to conserving, clearing and replanting, although all will be subject to one grand system of operations. To submit details now would be unnecessary when the object is to impress principles.

But yet another aspect of the question is the requisite proportions of tree surface to that under farm crops. What should it be? This is just one of the things that we do not know and that we are not likely ever to know as a point for general practical guidance. When I had the honour of addressing the British Science Associotion, at Dundee, in 1867, and at Norwich, in 1868, upon the claims of arboriculture as a science, they knew little upon this point in a country possessing greater physical distinctions than Canada. The conditions are so various as affected by climate, altitude, latitude, aspect, soil, sea or lake neighbourhood and vegetation, that no possible number of observations in any length of time could say how much for one district or so much for another. However, men do come to realize through science and practice—practice especially—that a farm or district needs the protection in certain places, and thus a country could easily be reclothed to the extent required for such shelter, if not for regulation of climate and other considerations, to which we will soon refer. The point then of immediate shelter is within everybody's knowledge, and needs no scientific guidance, and I may here say no governmental spurring. But the greater field of climate as an unknown one practically in this relation, is more a national problem, and still very much a scientific inquiry, and what it will have to say in regard to the proportion of trees to farm crops no one can tell. Of course if men disregard everything but the direct profits from trees as a crop upon land, another century may actually find some countries going back to the days of too many leaves and too little arable. Viewing trees in all their relations I am of opinion that upon an average of conditions in Canada, one-fourth of the surface should be covered by them, and as this is just one-half of what we have at present all over the forest districts, there rests the apparent inconsistency of wanting to conserve and replant all the while that we possess double what is required. This brings out the fact that it is the *irregular distribution* of tree surface in our case that gives trouble,—that some parts have more than required, and others have been overcleared.

As the subject grows upon our attention, we are next concerned with what parts of the country should be conserved or replanted, and in this part of the study it is obvious that our views cannot be confined to single farms or even special sections. Referring, as

we must, to the great overruling influences, as previously indicated, we have to deal with geographical features that may embrace thousands of acres that have to be subserved with one or more massing of trees. Just where to conserve or replant, how much on the spot or spots, so as to gather and dispense all the virtues that trees are known to possess, is the great problem of the future. To say that we should only replant our less valuable soils is nonsense, though apparently sensible enough from an agricultural standpoint; that high lands should be conserved or reclad as against lower parts is largely true, though not generally applicable, and that conserving and replanting must go hand in hand and take place anywhere as found best through experience, is correct in every sense.

Following this view of the subject there is naturally that of suitability of certain kinds of trees for special purposes. We have soils and climates wherewith to do almost anything in tree life from the pine of the far north, which luxuriates in an apparently bare rock cleft, to the walnut of the south, that must send its carroty root several feet into a rich soil. The preparation of the soil, methods of planting, including fencing, draining, knowledge of enemies and friends in nature, and all the management throughout, in order to attain the highest results, are not for our time on this occasion.

And now for the more special purpose of these notes,—and in order to place myself properly with the Association, it is fair, as a matter of business, to note that what I am advancing is founded on British experience, beginning in 1854 and ending in 1870, during which time I had the immediate control of the formation, the planting, and subsequent management of something like twenty-one millions of trees, principally on the Seafield estates, in Banff and Invernesshire, and the Invercauld estates in Aberdeenshire.

In order to success anywhere there must be put in operation, upon a system, such a combination of the scientific and practical knowledge that at present exists as shall most likely bring about the fullest realization of tree value. That system is universal in its application, however small or large the scale, or however varied the conditions. Whether we pull down or rebuild, or make entirely new, the system will apply, and as it is by entirely new work that any system is best exhibited I will ask you to go with me to the Prairie. The subject then is almost an entirely treeless one, with an undulating, but generally uniform level surface, an occasional ridge, a lake, a river, cutting deep through the unshaded land, and bounded on the north-west by high lands as I have outlined on the map. Here, men need never hope to gather wealth of agriculture in all its branches without the help of trees. I think there exists nowhere in the world an example of *universal farming reliability* unattended by trees. I see no great future for Manitoba and our Northwest unless extensive systematic forestry precedes. The sooner our Government realizes this the better. All methods of farming, railway and water communication, minerals, natural grazing, or any other form of good things will never "make" a country without trees. We are not theorising in this. *A peopled agricultural country is an impossibility without trees.*

In our treeless region, therefore, experience has made us acquainted with a variety of wants that can be subserved by trees, and science points to more. Together, then, they make ap a bill that may be thus summarised:

1. Roadside shade.
2. Shelter for dwellings.
3. Shelter for cultivated farm crops.
4. Shelter for open natural grazings.
5. Shelter for enclosed grazings.
6. Head water conservation.
7. Wind breaks.
8. Climatic amelioration.

Either of these would of course serve more purposes than that implied by its name, but a full illustration of the system requires a form for each.

Now this map professes to show all these: from the single shade tree up to the great climatic plantation, the area or district embraced and the size of each of the classes would be subject to requirements, from one acre to as much as 1,000 acres each; the system or principle is not affected by size, but, position and form, or outline, are prime factors.

Size would be regulated by the particular physical features of the district and the object in view; form by prevailing winds as well as the particular object, and partly by physical features.

In our prairie example on the lower right hand corner of the map we have a farm of 160 acres made up as follows:

Timber	30	acres.
Cultivated	125	"
Orchards, garden, buildings, roads	5	"
Total	160	

The fields and roads lie northwest and southeast, and therefore northeast and southeast. By preference the buildings are situated on the southern angle of the farm at a junction of a concession and a side road. In the first place, the roads are lined with shade trees, which serve as shade to animals in some of the fields as well. Then the dwelling house and orchard, while open to the southeast, south, and southwest, are shaded by ornamental standards and lined on the north and northwest by trees. This tree line may be called the 2nd sub-wind-break of the farm. The barns, with two small fields or paddocks, are also open to the south and protected from the colder winds by a narrow belt of timber in positions similar to the others. The six other fields are, in the first instance, sheltered by a broad belt all around from the east, *via* north to the west, capable of breaking and mellowing the whole farm for cropping. But, for live stock, under such circumstances, and with twenty acre fields, it is necessary to provide other shade and shelter. This is best supplied by what I have proved in actual practice both in Scotland and Canada. I know of no better form and position of a shade and shelter clump of trees than that illustrated in Fig. C., and the position of which is also shown in our farm example. It serves two fields, and from whatever direction the wind comes, or the sun shines, the animals can find a retreat in either field. You cannot shoot a straight line across this clump and not find a safe corner.

Then, in the adaptation of one form of shelter to four fields (Fig. E), is neat and serviceable, and when supplied with water in the centre is a very valuable acquisition to pastures. In the case of extensive open grazings, the circular belt (Fig. D) is also best for various reasons. It resists and breaks wind storms better than other outlines; it is less liable to damage by cattle or wind, is more compact and affords more outside shelter. There should be two passages not far apart and facing south as much as possible; one passage is not enough with a large number of cattle going and coming, and provision is necessary for a stack of hay in the centre.

These are what may be called the purely agricultural divisions of arboriculture, and are definite and practical enough, upon which little difference of opinion is likely to arise. In what remains of my subject there may be not only difference of opinion in regard to details, but considerable difficulty in satisfying that anything more is needed than what has already been sketched. It will be said: As each farm has its proper amount of shade, shelter, fuel supply, and even wood revenue otherwise, what more does the country require?

I have not seen in any work on rural economy that it is as much the duty of nations to administer their arboriculture as their laws of health. Then while everyone acknowledges that without the proper measure of trees there cannot exist the proper health, political economy, science, agriculture and all society, is equally interested in this question, and as I have already indicated its national aspect, it is only necessary to point out how more than the immediate farmer's work is required.

Over a great plain, such as our prairie, where storms rage unchecked, where rains come and go irregularly and uneconomized in any form, and where sunshine is unmellowed, it is necessary to establish agents for the purpose of sub-serving these and other climatic purposes. Assuming that all the country were planted to the extent already shown for

immediate farm use, there exists nothing in particular spots—no plantations exactly placed to conserve head water streams, no great and small wind-breaks, and no great climatic plantations—the agents respectively.

On the map these are shown in position, proper outline and extent. *Position* is regulated by elevation and neighbourhood of other physical conditions, such as water surface, and high land ; *outline* is regulated by direction of prevailing winds, conformation of surface, and partly by public roads, while the *extent* is directed by the indefinitely known influence that a certain body of trees possess over climate ; climate being understood as distribution of rainfall, evaporation, natural drainage and temperature.

I am aware that we cannot reason on this from any clear or precise experience, and are driven to draw conclusions from actual facts, and there seems to be no doubt that it requires a certain massing and kinds of trees to ameliorate climate, narrow strips and clumps being insufficient, or incapable of doing so.

Head water plantations, as implied in the name, must surround, or be in the immediate neighbourhood of, sources of streams, and have an outline to nurse them, with area consistent to the importance of the source. The circular form is good and applicable to the two springs at G., or it may be oval as illustrated at the mouth of the valley, and would also take the position and area of that at the small lake.

Great wind-breaks being meant to defend the smaller plantations as well as particular districts, have to be carefully outlined, of very considerable extent, and must command an exact position. In the example of H, on the ridge, which is designed to break the storms from the adjoining ranch, several points are noticeable : The land occupied by the plantation is within one block, or range of roads, and therefore does not encroach ; it occupies also part of a ridge that generally is less valuable for agricultural purposes, it is formed to cut or feather the storms that prevail in the district—south west by west—a point in forestry of very great importance indeed ; it is massive or in sufficient body to resist and is situated so as to break the main force of the storms. It may be remarked that it would be better to extend the plantation eastward upon the point of the ridge, this I have avoided in order to make the example more difficult.

The other great wind-break is of a different form, while serving a similar purpose. It parallels with the public roads, makes no awkward corners for cultivation of adjoining land, faces prevailing winds with the exception of southeast end, and will protect a large area of country.

Lesser wind-breaks, as at J., are placed where, either by the form of the country on the prevailing wind side, or where a larger break is difficult to establish. The example on the east of the large lake exhibits both. Position here is very important, and it will be observed that outline and area are arranged to receive the storms across the lake, break them, and yet yield to them.

Sub wind breaks are easily arranged and can take various forms and sizes to suit conditions as at K.

Another kind of plantation, as already referred to, is that which I call climatic—the objects of which have been explained. Their position in a country among others is not so easily reasoned, either scientifically or practically. Area is obviously of more consequence than form, because it requires a great field of leaves to do what leaves are said to do in climatic amelioration. M. with eight sides, and the other with four, are designed as concentrated masses adapted to Canada, and of course in their case, more than other plantations, the cost of establishment would be less per acre, and would also better meet the item of revenue. It is an example of a conjoint wind-break and climatic plantation.

Canadian forestry, whatever its future, will never realize all it should unless hand in hand with science.

Estimate of Financial Position of a Mixed Plantation of 100 Acres in Canada, Manitoba and the North-West Particularly.

Revenue.

1st Thinning when 15 years old, 3,000 poles, 20 feet long, at 3 cents, fully....	$100
2nd Thinning at 13 years ; 8,000 trees, at 5 cents.....	400

3rd Thinning at 25 years; 15,000 trees, 12 inches diameter at base, 40 feet, at 30c.	$4,500
4th Thinning at 35 years; 25,000 trees, 20 inches diameter, 50 feet, at 50c....	12,500
5th Thinning at 40 years; 30,000 trees, 22 inches diameter.....	22,500
6th Thinning at 45 years; 21,000 trees, 25 inches diameter, at $1.....	21,000
7th Thinning at 50 years; 18,000 trees, at $1.10.....	19,000
Gross Revenue.....	$80,000

10,000 trees failed, leaving 20,000 trees, or 200 per acre as permanent crop.

Expenditure.

1,000 rods of fence, at 75 cents, part soil, part timber.....	$750
Drainage of portions.....	250
150,000 trees, 1 year seedling, 1 year transplanted, at 1c.....	1,500
Planting same.....	575
Freight on trees.....	150
Original cost.....	$3,225
Per acre.—$32.	
Replanting failures for three years, 5,000 trees.....	$100
General attendance, up-keep of fence, etc., for 15 years.....	300
Gross cost.....	$3,625
Per acre until revenue begins—$36.	
Cost of thinning and hauling to roads.....	$13,100
General superintendence and incidentals for 35 years.....	3,500
Gross expenditure.....	$20,225
Balance being clear revenue.....	60,565
	$80,790

No allowance is made for interest on outlay and rent of land, on the one hand, nor for interest on revenue, and value of grazing for 25 years, on the other hand. Neither is credit given for climatic amelioration, nor for value of permanent crop.

VIII.—MISCELLANEOUS.

1. Food in Cattle Life.

We have before us a tabular statement of an unusually interesting character. I think it is very likely that no similar statement, in variety, and possibly practical value, has ever been issued from *one place* before. Nine years is a short time in the work of an experimental station, if it has been alive, and a terribly long one if otherwise. I have gathered, and now present for the first time, a cumulative account of no fewer than 50,000 notes upon what fattening cattle have said at the Ontario Experimental Farm from 1876-84. The details of these have appeared in the Reports of that period, and have elicited criticisms in many forms in America, and Europe, and Australia. As the agent of the government, and responsible for these experiments, I do not claim that we have discovered anything very new or remarkable for the farmer or scientist, because they are not of that character that go in search of the unknown above or below us: they are part of our everyday handling, and therefore the more attractive. Then, also, I do not necessarily submit any chemical light on this occasion—valuable and interesting as such always is.

The only chemist we consulted in the lengthened series of experiments was Professor "Cattle Stomach," whose practical judgment and truthfulness has never been doubted by anyone.

It is well first of all to remember that the conditions were as uniform and alike as could possibly be secured in conducting the experiments we have to discuss, so that to all human ken nothing influenced the results excepting food, and yet of course it is well known that an eighteen years' experience is better than one of nine.

Then again, it must always remain a matter of some doubt as to the extent that one kind of food influences another, even when one is given in smaller quantity than another, so that when in two separate rations of, say, peas and corn as regulators, which must be accompanied with some hay for health's sake, if nothing else, it cannot be said how far the hay influences the one grain more or less than the other. That the food to be experimented with should be regulated by *quantity* is evident, and it is upon this practical ground we take stand on this occasion.

	Natural Order.	Daily Increase per Head.	Cost per lb. of added Weight.
		lbs.	c.
1. Permanent pasture	A	2.05	2
2. Hay pasture	B	1.15	5
3. Mixture of corn, peas, oats and barley with hay, roots and bran	P	2.25	8½
4. Cooked hay, roots and bran, with mixture of grain, uncooked	Q	1.80	9
5. Hay, roots and bran, without grain	C	2.14	9
6. Corn, with hay, roots and bran	F	2.00	9¼
7. Peas, with hay, roots and bran	E	1.91	9½
8. Uncooked hay, roots and bran with mixture of grain	K	2.60	9½
9. Oats, with hay, roots and bran	D	1.64	10
10. Mangolds, with hay and mixture of grain	M	2.38	10⅛
11. Turnips, with hay and mixture of grain	L	2.30	10½
12. Cut hay and roots, with bran and corn	H	2.10	11⅛
13. Mixture of grain, with oil cake, hay, roots and bran	R	2.00	11½
14. Mixture of grain with "Thorley," hay, roots and bran	S	2.40	11¾
15. Barley (black) with hay, roots and bran	J	1.60	11¾
16. Barley (common) with hay, roots and bran	I	2.02	12
17. Rice meal, with hay, roots and bran	O	1.81	12
18. Sugar beet, with hay and mixture of grain	N	2.70	12⅛
19. Wheat (damaged) and valued at 60c. per bush., with hay, roots and bran	T	2.00	12½
20. Uncut hay and roots with bran and corn	G	1.76	14
		2.02	10

Market Prices of Feed.

Corn	$ 0 62 for 56 lbs.
Peas	0 72 " 60 "
Oats	0 40 " 34 "
Barley	0 66 " 48 "
Rice Meal	35 00 per ton.
Bran	11 00 "
Hay	10 00 "
Turnips	0 08 for 60 lbs.
Mangolds	0 10 " "
Sugar Beet	0 12 " "
Linseed Cake	30 00 per ton.
Thorley Condiment	0 05 per lb.

The above table is an abstract of the whole series handled since 1876, shewing in the first column what I call the natural order of the foods used, that is from the most natural and common kinds up to the more uncommon, in alphabetical order; the second column gives the daily increase per head to live weight, and the third the food cost of each pound of the added weight of the animal, according to market prices noted. The whole list is given in order of cost of production.

The discussion of these twenty forms of cattle feeding is now the subject of this paper.

I.—Permanent Pasture.

Our experience—not Ontario experience, necessarily—of the value of the mixture of good grasses with clovers is of the most decided character. There are now twelve reliable grasses for this purpose, four of which have been introduced and established at our station; these with the five kinds of clover to be mentioned form a variety of plants for animal wants equal, if not actually superior, to any combination of artificial food. It is European experience, and should undoubtedly be Canadian also, that such pasture established and maintained as it ought to be in these days gives a larger and cheaper result in animal growth and products than can possibly be obtained in any other way. I cannot over-rate the importance of this crop; it comes early in the spring, plant after plant, according to its kind, in succession—just as nature provides plant after plant for her dependents—it withstands drought very effectually, retains moisture, and holds out long into the fall; it is the most healthy of all foods, and the more it is cropped the better it becomes, under proper management. The seeds do not cost over $5 per acre, and once established is the least expensive to maintain. It is better adapted to the growth of young animals of any class and to the production of milk than to finish off prime beef and mutton, but even in these things it holds a high place. The table shews a daily rate of 2·05 lbs. at a cost of two cents per pound. Why is England now placing more than one-half of all her *cultivated* area under such a crop, and with all her age and experience, knows of no better method of conserving and producing wealth per acre. While we may never reach British results, we have already shewn that one acre will maintain seven sheep, and 1¼ acre one cattle beast yearly. The national importance of this simple crop is very evident, and should be driven home very hard in these days of grain *vs.* live stock; it is not one admitting of any doubt, but proved under a variety of conditions—as several Ontario farms have followed our facts. If every farm in Ontario had ten acres of such pasture, the 1,000,000 thus handled would turn out 480,000 store cattle more than at present, *without increasing our cultivated area or production of other crops.* I would like to submit some points for the dairy in this connection, but it may come up again. Meantime be assured that permanent pasture is the backbone of the agriculture of any country.

Grasses and Clovers for Permanent Pasture in Ontario—Quantities per Acre.

GRASSES.		CLOVERS.	
Timothy	7 lbs.	Lucerne	4 lbs.
Orchard	4 "	White	3 "
Italian Rye	2 "	Red	1 "
Perennial Rye	2 "	Alsike	1 "
Tall Oat	2 "	Yellow	1 "
Yellow Oat	2 "		
Red Top	2 "	Clovers	10 "
Meadow Fescue	3 "	Grasses	30 "
Meadow Fox Tail	3 "		
Bent	1 "	Per Acre	40 "
Kentucky Blue	2 "		
	30 "		

ii.—Hay Pasture.

By this I mean the pasture we have so much of in Canada in the rotation of cultivated hay from timothy grass and red clover—timothy the great and grand fodder plant of the American continent, and the clover so full of many good things for other crops and animals. No one who has any respect for Canadian agricultural history can belittle timothy and clover. But they never did and cannot possibly constitute a pasture in the sense of wealth, reliability and endurance. We may allow all the special causes of propitiousness soil, management, and district climate here and there throughout our country, and yet must admit that pasture after hay is no pasture; the very plants are not favourable, and hence altogether one of the prominent weaknesses *now* of our system of farming. No doubt we secure a good bite in June and September, but for continuous beef or dairy value our present stamp of pasture is woefully short, even under good shelter and water. The remedy is not one of absolute change, because we cannot part with such old and valuable friends, but fodder ought to be one thing and pasture another. One and one-seventh pound per head per day on an average is Canadian experience in the growth of store cattle on hay pasture, and this at a cost of five cents per pound of the added weight, results so far inferior to every other form of feeding that comment stands still.

v.—Hay, Roots and Bran without Grain.

The great object of fattening is production of greatest quantity at the least cost in the shortest time—irrespective of other conditions such as manure value, of which we do not take account at present. In the natural order of this enquiry—after summer conditions—we should look for fodder that can be plentifully and cheaply produced for winter use, such as hay, straw and roots; many farmers give no more, but it is not usually looked upon as other than bare maintenance—growing the bone and muscle of young animals well enough, but slow at fattening. In this branch of our experimental work we added bran to the hay and roots, but no other grain whatever, and of course the fodder in proportionately larger quantities than had grain been allowed. The result in cost and progress has been unexpectedly gratifying—something so good that one pauses to consider whether, irrespective of the value of manure, many of our feeders are not in error with so much grain and other forms of more concentrated cattle food. Five and one-seventh pounds per head per day at a cost of nine cents per pound are above the average of the whole series—higher than several that had the like fodders with large rations of grain. It is possible in this example that vigorous youth got all it wanted to grow bone and frame. Necessarily it took much bulk of fodder to do so, for the cost is greater than two examples on the card where various grains were plentifully supplied. The lesson is a good one, however, and bids us exercise greater charity than is common to those who pursue what is called the slower or old-fashioned system.

ix.—Oats with Hay, Roots and Bran.

To say in these times, that giving oats in addition to hay, roots and bran, may not add to the greater daily rate of increase to store cattle, will be received with considerable doubt. I know of no reason, scientific or practical, why necessarily, animals must increase more rapidly in weight because they consume so much grain of any sort, with the more natural forms of food such as hay and roots; it may as reasonably be said that some cultivated plants should grow and fruit very much better because they are supplied with certain forms of fertilizers, which they do not very often, or that grain supplied to animals on permanent pasture will always accelerate their growth, which it does not. Our experience by this experiment is just a mean cost of the whole of them, but only a daily increase of $1\frac{2}{3}$ lbs.

vii.—Peas, with Hay, Roots, and Bran.

In place of oats as the regulating grain of a ration, peas were established, and there never has been any doubt about its high standing as a grower of beef and mutton. An acre of this grain in Canada always means the making of two fat bullocks every winter, and when we allow for its value also—both in straw and grain for sheep, the pea may be said to do for Canada what corn does for the States. Its greater heating properties tell of more continuous use with young animals. You will observe by the table that it has not come up to the average in daily rate, though little short of it, but is under the average in cost.

vi.—Corn, with Hay, Roots and Bran.

The same quantities and kinds of fodders, led by corn, is next in natural order. There is possibly no other form of coarse grain known to the civilized world, that holds such an important place as this one—for man and all other animals. It is a pity Canada cannot grow enough, or even a touch of enough for herself; we can produce plenty of its fodder, but proportionately little of its grain as you know. At the same time we have been getting it at less price, pound for pound, than our own peas, and as it is a growing fact that so long any kind of grain can be got for *one cent* per pound, it pays to fatten animals upon it, we have not much to grumble about. Note the cost of production and rate of increase, as standing close to the mean of all the series.

xx.—Uncut Hay and Roots, with Bran and Corn.

This was a case of supplementing the ordinary fodders with some grain—in small quantity, of course, so as not to over-influence the fodders, and in opposition to that given in No 5, C, already referred to. Here is an example of slow and costly progress by the use of large quantities of Hay and Roots, even though touched up with some grain—the most costly of all the set, and the third lowest in daily increase—hay pasture not included.

xii.—Cut Hay and Roots, with Bran and Corn.

But the like fodders cut and pulped, and accompanied with the same kinds and quantities of grain have told a considerably different story. While somewhat over the average in cost of production, this form of diet has given a very considerably larger rate of increase—second only to six others. The inference is—and yet this may not have been the only cause—that the fodders though in large quantities were *prepared* partly for assimilation, and rushed the weight of the growing animal better than in the uncut testing.

xvi.—Barley (common) with Hay, Roots and Bran.

It will interest not a few to mark the very good place taken by our Malting Cereal in all the coming and going of these cattle-feeding tests. We have found very clearly

that given in sufficient quantity—one-third more of weight than peas, for example—barley fattens well and makes a good handler, but it needs quantity, and hence the proportionately greater cost of production, as well from the fact that it has been more costly per pound than oats, peas, or co If barley could be fed at one cent per pound, it would take a very high place as le food—as high as corn.

xv.—Barley (black) with Hay, Roots and Bran.

Our other kind of barley is a Russian, large, flinty, and black, and weighing 60 lbs. per bushel; owing to its newness and large cropping properties we determined to test its feeding value, against the other. As you will notice we got just a little less cost in production, but one-fifth less rate of increase. The cattle did not take to it nearly so well, its flintyness, or want of meal, is evidently unfavourable but of course we must give another trial or two before pronouncing decidedly.

viii.—Uncooked Hay, Roots and Bran, with Mixture of Grain.

This resembles No. 20, G. to some extent, with the exception of the grain which, however was a mixture here, and not corn alone. Properly placed it stands against No. 4, Q. where all the fodder was cut and cooked. Iu all our experience at Guelph, among pigs, sheep and cattle, there has never been any doubt about the higher feeding value of uncooked against cooked food—other conditions being equal and favourable—such as warmth, change, and healthy good-doing animals; of course a good deal of the very high daily rate and comparatively low cost of this example may be owing to just that exact variety of grain—small as it was—necessary to give extra acceptability to the larger fodders.

xi.—Turnips, with Hay and Mixture of Grain.

That winter with us will not admit of the same liberal use of turnips as is common in Britain, we know, yet we ventured 50 lbs. per head per day, with 3 lbs. bran and 6 lbs. of a mixture of grain to yearling steers.

In order to ascertain the effects of a certain food, that food must be the over-ruling regulator throughout the trial, and no other kind should, if possible, accompany it so as to interfere materially with its special effects. I refer to this now because it may be said that the bran and grain did much of the work under this chapter, but, had neither grain nor bran been given, with such a large quantity of roots the effect would unquestionably have been, under Canadian conditions, insufficient maintenance, and where there is an uneven flow of all the animal life, no experimental work can be safely pursued, because the effect of any special food is *overborne* by the *wants* which exist through insufficient maintenance. I hold then that, in our circumstances at least, it is necessary to feed grain with roots, and here the grain was not in such quality as to over-rule anything else. But, besides these considerations, I think the nature of the green fodder called turnips, is one that by bulk and different chemical composition, decided the animal growth in question.

I have explained this much about turnips, food, cattle, etc., to try and account for the large daily rate of 2.30 lbs., and the average cost of 10½ cts. per pound,—a result that must be gratifying to believers in this rather expensive crop per acre.

x.—Mangolds with Hay and Mixture of Grain.

We have stepped, so to speak, from Scotland to England—from turnips to mangolds—and I wish we had the opportunity to impress the importance of this root against even the turnips. It is unnecessary to delay in any explanation of this experiment; the mangolds have given a slightly better increase as well as less cost.

Allow me also to include the sugar beet feeding in this summary, which has also held its place chemicaliy.

xvii.—Rice Meal with Hay, Roots and bran.

By rice meal is meant the *moulie* of Quebec—the rice being mixed with one-half of oats and peas—rice of itself being too gritty, even when ground, to make a palatable food for cattle. We got, however, a very fair result, but at too much cost.

iii.—Mixture of Corn, Peas, Oats and Barley, with Roots, Hay and Bran.

We have hitherto been among the high costs of production—pastures excepted, of course—and in one word we are now down to $8\frac{1}{2}$ cents per pound—the lowest of all these tests in grain feeding, at the same time having secured the high rate of $2\frac{1}{4}$ pounds per head per day to live weight.

While handling the mixed grain ration, observe that the like things (Nos. 13 and 14 in the card) spiced with oil cake and Thorley condiment, give on an average about equal results to the *clean* or plain mixture, but at twenty-five per cent. greater cost.

xix.—Wheat.

I used to say that wheat would have no place among other grain in the feeding of live stock, but I would not like to say so to-day. Three years our farm was in circumstances with damaged winter wheat to test its feeding value with cattle. Valued at 1 cent per pound we obtained a good round rate of increase, two pounds per head per day, at a higher cost of production, however, than many others.

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2. Canadian Agriculture.

The trite saying that the history of its agriculture is the history of that country, applies much more to Canada, or indeed to any of the British Colonies, than it does to Britain. The reasons for this are too simple to be specified, and the one fact alone, that the possession of Canada being the outcome of the agricultural swarming of other countries will convey the whole position.

Thus, then, as our national history is a short one, so our agriculture has a short history. It is not more on an average than fifty years since both of them had a place in the world's catalogue of "mine and thine." The men of these days are very much the men who began both, and hence the British Association for the Advancement of Science this year was actually shaking hands with the fathers of Canadian agriculture—the very men who cut the first tree, who held the first plough, and reaped the first crop of grain on this immense northern continent—still we are proud to say, a part of the British possessions. As we dip into the progressive aspect of our subject, it will be evident that there has been no "new era," no "transition period," nor any great landmark, so to speak, in Canadian agriculture as in that of Britain. Our fathers and ourselves have had no cause "to reap tiny crops beneath the shade of the feudal castle, aye ready at the shout of the warder or the trumpet call, to throw down the sickle and seize the sword." Ours has been the unchecked march of the invader bringing destruction to one crop (trees) and then a glorious fruitage from others.

It forms a somewhat remarkable reflection that while we—not our forefathers only, but we—were clearing the forest and stretching our arms westward, Britain not only had no reaping machine nor steam engine, but not even a common scythe, *everywhere*. The mother, in the person of the British Association, was here to-day seeing what progress one of her sons has made during the last half century, and in the manly pride of our independence we asked her to think what she was herself when she bade us God speed.

Canada is a forest. Nothing ever did and nothing yet strikes the comprehensive observer so much as the seemingly endless forest—over mountain and valley, and indeed everywhere. This is the first feature of our country to which we invite your attention.

Without trees we would probably have had no agricultural history—the removal of them has given us an agricultural history.

I submit most respectfully—particularly to an august body of scientific and practical thinkers—that the irregular and excessive forest clearing of a newly-acquired country is not only an inevitable sequence of man's unrestrained domination, but an absolute necessity to progress and wealth. On another occasion I may have to submit some things upon arboriculture, and here all I need to say on this point of our forestry is, that even assuming that Canadian pioneers were conversant with whatever light there was half a century ago with regard to the proper proportion of tree surface to arable surface, the struggle to win a home even under all the propitiousness of soil and climate was too hard and lengthy to stand flavoring with book knowledge, or anything that did not produce immediate bread and butter.

But still farther. The forest agriculture of our country possesses a significance that some of us do not sufficiently measure. The comparative reliability of a country largely covered with trees for health of all animals and production of variety of crops is a fact everywhere acknowledged. It would not be difficult to place this in several parts of the world, and over the great breadth of the Dominion we have no difficulty in finding strong proof of both the extremes as well as the exact measure of healthy conditions. Our forest lands have more variety of aspect, more variety of soil, better drainage, better water supply, and a more reliable climate than our prairies, for example, possess. The other well known advantages of woodlands do not form part of my agricultural subject, yet the Canadian farmer has had necessarily to act the part of a forester more than those in older countries.

Canada is a land of fresh water seas. This, the second great feature of the country, is a prominent agricultural one, as it has regulated very much of the settlement and still regulates much of the climate and traffic of our best districts. The extent of the lake shores of Canada is simply unknown, and those inside the commercial area far outnumber those of any other country by many thousands of miles.

Canada is a prairie, and practically for agricultural purposes we did not know this ten years ago. These untimbered, level, dried-up seas may yet play a very important part in our agricultural history, both as to grain and live stock, upon which I shall afterwards devote some thoughts.

But Canada is also a land of mountains. Our east and west extremes are bound by an average of 3,000 feet and 8,000 feet respectively above sea level.

The physical features with the flora and geology of the Dominion of Canada, other than these very abstract ones, are wonderfully diversified and interesting, and must be dealt with also very concisely. We have swamps, beaver meadows, marshes, and hill grazings in great numbers and large areas.

We have thousands of miles of rivers, many navigable to great distances, and stretching in their natural navigation to 1,000 feet above sea level. We have over 100 distinct varieties of indigenous trees and shrubs, many of great commercial value, and the flora otherwise I dare not touch upon, even our geology is neither so varied nor as yet so well outlined as some other countries, but it has an agricultural significance that has made history enough in particular districts, and, indeed, the geologist has of late years been the forerunner of our extended civilization—his report being always ahead of settlement.

The distinctive soils of the country in the order of their prominence are:—Loams, vegetable deposits, alluvials, clays, sands, and marls. By reason probably of the wider field there is less mixing of these than in an area such as Britain, and our geographical position has given a high proportion of glacial covering. The climate of Canada does not vary so materially as may be supposed from the great geographical range embraced. We seem to have seven climate belts; the extreme eastern, embracing Newfoundland and part of Quebec; the gulf area, including Nova Scotia and part of New Brunswick; the St. Lawrence area, including Quebec; the lake region, embracing Ontario and Hudson Bay south; the great inland or prairie lands; the Rocky Mountains and the Pacific Range. These, in their summers and winters, are pretty well marked by both their outside and local influences as to rainfall and temperature, and consequently are the great regulators of our detail agriculture in this stretch of 3,500 miles.

Having some acquaintance with the very distinct public objection to either a lengthy or statistical paper on what is expected to have some popularity, I do not propose to weary, but some figures are indispensable. The Dominion of Canada at present cultivates about 22,000,000 acres, or just equal to the same thing in Great Britain and Ireland, exclusive of permanent pasture. The improved pasture area of Canada is 7,000,000 acres as against 25,000,000 of the Mother Country. The respective populations being 5,000,000 and 35,000,000, we can easily make comparisons of cultivated land per head. The average size of farms in Canada is a little under 150 acres. The average annual gross value of produce is $23 per acre over all the Provinces—the extremes being as much as $43 and $15. Clear profit may be placed at an average of $3 per acre—that is after paying for labour, maintenance, interest on capital invested and other charges. The average farm carries live stock to the value of $8 per acre, which fact alone points to grain as yet in place of beef and mutton. Land when rented fetches $3.80 per acre per annum. The average purchase price of land throughout the Dominion is about $35 per acre, the extreme averages being $40 and $12. Buildings stand at an average of one-fourth the value of the land in cultivation, and are included in the foregoing figures.

The annual taxes upon land consist of a township rate, a school rate, and a county rate, in all amounting on an average to 10c. per acre, or $15 per the average farm of 150 acres, or in other words the rent of an average 1½ acres in Britain.

There are six different kinds of farming, usually called —(1.) mixed farming. (2.) grain farming. (3.) dairying. (4.) pasturing. (5.) live stock breeding. (6.) fruit growing.

Land is being actually occupied (not purchased necessarily), at the rate of 383,000 acres, and reclaimed at the rate of 100,000 acres per annum, and wheat production has increased at the rate of 70,000 acres per annum, throwing aside the odd acres.

A new country, therefore, has several very marked agricultural statistics that must be interesting to very many. Production runs away from population at an immense rate; they are not corresponding elements in national progress. Our population has clearly been, is now indeed, essentially an agricultural one, not many large congregations of the non-farming classes anywhere. But the annual value of produce per acre is very considerably less than from older well cultivated lands in Britain, and the annual expenditure per acre both in labour and fertilizers is remarkably low in our case—$15 as against $40 in Britain.

This draws us to some features of farm science and practice as characteristic of Canada, and the first one is the old one of exhaustion of soils by the repeated cropping of one class of crops without help. The practical importance of such management has I think been misunderstood, and while I have no idea of excusing the practice, I have no intention of allowing any misconception to go unchallenged.

That the growing of wheat after wheat many times in succession is right scientifically and practically under certain conditions no one denies. The point is, when to stop. An average of 40 bushels or only 15 bushels per acre is Canada's experience. We did not stop at 16 bushels, because (1) we could easily increase the productive area; because (2) grain is less expensive to produce; because (3) it is a lazy system of farming, and thus most acceptable to the many as against the few; and because (4) the product has always been in demand. Can we say, then, that many good excuses did not exist to justify the practice? Then, while theory says and practice indicates that such a system of cropping exhausts the soil, science has not always said so. Can we, therefore, severely blame average humanity, toiling hard to make a home, when abundance for the time being was easily realized?

Another feature of our farm practice is the very limited one of special fertilizers even under our improved husbandry, and their profuse existence in our own country. I am not now speaking of average farming, but of the best. It is a fact in Canadian experience that the full measure of a variety of crops under suitable rotation upon average soil, with the best of farm yard manure, can be maintained without the use of special fertilizers, and that the extensive application of them does not give corresponding returns. Practice replies, that thorough cultivation and the best of home-made manure are enough. Science says that such practice must return as much as is removed. Permit the theory that (1) our old lands still retain some of their original richness—latent it may be, but still there, which properly treated, always responds; that (2) our arid climate does not associate with

special fertilizers either to stimulate or fertilize as they are known to do in more humid circumstances; and that (3) even the climate itself is actually richer in plant food elements than Europe, in addition to the important fact of so much grain being fed to cattle six months of the year.

But our agriculture is peculiar in other respects. Practically, we have only two divisions of the year—summer and winter. To Europeans, we have neither spring nor autumn—particularly no spring term. Hence, seed-time with us is a time of great pressure, necessitating such action, and therefore much temporary work, that are unknown in British experience. Hence, we possess machinery that takes the place of much of the manual labour of other countries, and our horses are more active and enduring. Man himself rises in physical activity and brain power to meet the requirements of the climate. I think no one has yet given Canada the full measure of value she deserves for climate. This must be owing to want of knowledge to assign a cause—for the effects are very patent. We are nearly all north of latitude 45°, and necessarily have such extremes of temperature as either do not propagate or encourage, or destroy most of the disease germs that we know do luxuriate in more temperate zones. As this is more remarkable among the live stock of the farm than other animals—or man, it may be, owing partly to the immediately favourable change upon cattle and sheep that are yearly imported from Britain. What a fine field this should be to the keen hygienist?

The farming of Canada is also characterized as affected by her sunshine and showers. Both are better defined than the same things in Britain or the United States; we never have the uncertain heat and rainfall of the one, nor the terrible cyclones of the other.

And now, allow a few notes on the undeveloped agriculture of Canada. The progress of Canadian agriculture was necessarily, in the choice of land, one of taking the best and leaving the worst. This method in a small area would be very marked as regards the difference between the best and poorest soils; but, as it has been over a wide continent that is yet thinly populated, the picking and choosing is not at all a prominent thing. It is a fact at the present moment, even in the older districts, that the one-half of the uncultivated land is distinctly equal to the cultivated, and that the bush or forest of the newer townships possesses soil in every respect equal to the older ones. Not only so, but what long ago was considered waste in the form of swamp and stoney ridge is now, though uncultivated, valued as part fit to bear crops. It is a very common circumstance to see men leaving the old homes in search of new lands all the while that good investments exist in the immediate neighbourhood. This arises from the feeling of want of room, or of restlessness, or of speculation, so common on this continent. The existence, then, of so much good land easily secured is of itself a hindrance to development in the sense of older countries, and yet, of course, it is this very spirit of possession that has made the country.

Canadian agriculture is undeveloped as regards thorough ordinary tillage. While our rich climate bids us take things easy, it is certain were we to devote more time and labour to common cultivation the increase would amply repay. Men, however, that is average humanity, are content with living well under the easiest possible conditions. I could give many splendid exceptions, nevertheless. Part of our agriculture is also undeveloped in the sense of inappropriate produce. Changes in farm practice are just as legitimate as in other professions, so that if some of us persist in growing grain instead of beef and mutton, when flesh is wanted, there is misapplied farming on the part of the nation.

The hindrances to the development of our agriculture are very much those of other new countries. The almost unlimited field for speculation on the part of wealthy individuals and companies holding large tracts to the exclusion of common settlement is one of these; so also is the temptation to engage in more immediately lucrative professions, such as sea fishing and lumbering. The possession of much money on the part of many, especially new settlers, is not a prominent drawback, because our experience as yet is clearly in favour of moderate means bringing out men's greatest activity and worth. The migratory habits of a large proportion of the agricultural population are certainly a hindrance to *better* farming, if not to progressive occupation. The easy sale and transfer of landed property and the want of much of the older country feeling for birthplace all go to make up this list.

Yet there are many improvements in progress. Drainage particularly is already a feature in our agriculture, with better fences and roads. The establishment of a greater

variety of grasses, and their production in the form of permanent pasture, is one of the latest lines of improvement. It would be foreign to such a rapid sketch as this to specify crops in detail.

With the exception of wheat, barley and fruit, Canada is not an exporter of crops. As produced in the form of beef she is so. The proportion of crops is as follows :

Cerials—One-half.
Hay—One-fourth.
Pasture—One-eighth.
Roots—One-sixteenth.
Leguments—One-sixteenth.

In this I do not make allowance for the very new and special grain growing of our great North-West.

The general character of the farming of Canada and its specialties are well marked by districts, and through nationalities to some extent. Beginning on the east, we have oats, barley and potatoes as peculiar to the Maritime Provinces, with a pretty general indifference to improved live stock ; Quebec is very distinct agriculturally, and cannot well be compared to anything else we have, or clearly to that of any other country ; it resembles a large market gardening system, with live stock ordinarily suited to French requirements. Farther west, Ontario Province is essentially British in cropping and live stock, but growing more of grain and less pasture proportionately, and as already noted, fewer cattle and sheep per acre. Then Manitoba, and what is called the North-West, are yet in the preliminary stage of grain production—wheat and oats principally ; and British Columbia gives a variety of crops in addition to natural pasture.

I think one of the best evidences of better "thinking" among our farmers is system of rotation in cropping ; it is now common, and telling prominently in our increased annual produce. The better winter feeding of live stock is also but a recent and now a leading feature of our practice. But the live stock interest otherwise is well worth a thought : That Canada, and Ontario in particular, is peculiarly adapted for this purpose is well known. Its variety of physical conditions, the invigorating and purifying character of its winters, and the ability to produce the kinds of crops so essential to animal life at all seasons, have already marked us as the breeding ground for all others connected by land. Consequently, the demand upon Ontario for the best pure-bred farm-stock has already out-run all bounds. At the same time our neighbours are wise enough to take advantage of our admirable quarantine —climatic as well as in transit—ere taking home what they purchase from other countries. Canada can produce pure-bred animals at almost half the British cost, because it has the cheaper crops and the fewer risks of death by freedom from diseases, and it can feed and finish beef and mutton at less than half the cost of the same things, in stall and on pasture. What Canada can do in the extensive production of cattle and sheep on the pastures called ranches is now in course of experiment. The field is a very large one. If gone about with all the light of the present day judiciously applied, it cannot fail of becoming a success. The Rocky Mountain plains on the one end and the hills and valleys of the Maritime Provinces on the other, are waiting development in the extensive and cheap production of beef, mutton, and wool.

With the exception of the United States, no country receives so much governmental help in its agriculture as Canada does. Not only for the Dominion as one, but every Province has a special Minister of Agriculture, giving special aid to Agricultural Exhibitions; aid to special lines of industry such as cheese, butter, fruit, entomology, veterinary, and general agricultural education.

I do not anticipate too much when I say that every Province will have its own Agricultural College soon. The example under the Ontario Government at Guelph is evidently, by its vigour and wide range of success, stimulating the other Provinces, as it has actually already done to others in Britain, Australia, and the United States.

The effect of the United States upon Canadian agriculture is necessarily a very clear one. In crops we produce some that they cannot do so well, and they of much more than we can ; thus commercial interchange is not only close geographically, but for mutual progress should be thoroughly reciprocal. They want live stock, we want corn (maize) ; they

have no clear road to the British market, we have no hindrances to it; they require facilities, we want money.

But irrespective of their agricultural products the much greater population of the United States will always exercise a beneficial influence on whatever Canada has to spare from her own surface.

Thus, then, Canadian agriculture in relation to Europe plays a somewhat similar part, and yet a competative one both to the United States and Europe. We are at that stage in national enterprise when bone and sinew are good, yet immature, and as a young man feeling his way in the world. We have maturity and wealth opposing us even up to our own doors, and those same things meeting us everywhere else. It is obvious, therefore, that our own future in the world's agricultural market must be cautiously and firmly handled. These are no times of half measures and indecision. To peddle beef and flour in Britain against her own farmers and all other comers implies more than commercial acumen; it means such a disposition of our landed estate, politically, scientifically, and practically, as shall bear the crucial test of the best men of all nations.

INVENTORY AND VALUATION OF LIVE STOCK AND IMPLEMENTS, ETC.

HORSES:

8 working horses	$1,700 00	
4 instruction horses	550 00	
1 express horse	75 00	
		$2,325 00

CATTLE:

1 Shorthorn bull	$450 00	
1 Shorthorn bull	2,500 00	
4 Shorthorn cows	3,357 00	
1 Shorthorn bull calf	150 00	
1 Shorthorn heifer calf	150 00	
		6,607 00
1 Hereford bull	$3,000 00	
3 Hereford cows	1,310 00	
2 Hereford bull calves	500 00	
1 Hereford heifer calf	250 00	
		5,060 00
1 Polled Angus bull	$2,600 00	
4 Polled Angus cows	2,500 00	
4 Polled Angus bull calves	1,000 00	
		6,100 00
1 Devon bull	$325 00	
2 Devon cows	500 00	
		825 00
1 Galloway bull	$600 00	
2 Galloway cows	800 00	
		1,400 00
1 Ayrshire bull	$310 00	
4 Ayrshire cows	1,050 00	
1 Ayrshire heifer calf	70 00	
		1,430 00

CATTLE—*Continued.*

1 Guernsey bull	$350 00	
2 Guernsey cows	550 00	
2 Guernsey heifer calves	150 00	
		$1,050 00
1 Jersey bull	$325 00	
2 Jersey cows	650 00	
1 Jersey bull calf	125 00	
I Jersey heifer calf	100 00	
		1,200 00
1 West Highland bull	$200 00	
		200 00
1 Holstein bull	$1,100 00	
3 Holstein cows	1,200 00	
		2,300 00
17 Grade cows	$850 00	
6 Grade steers	750 00	
3 Grade calves	120 00	
21 fattening cattle	1,260 00	
		2,980 00

SHEEP:

1 Lincoln ram	$160 00	
3 Lincoln ewes	180 00	
2 Cotswold rams	285 00	
5 Cotswold ewes	175 00	
1 Leicester ram	260 00	
8 Leicester ewes	362 00	
1 Highland ram	60 00	
1 Highland ewe	22 00	
1 Cheviot ram	60 00	
2 Cheviot ewes	45 00	
2 Oxford rams	220 00	
9 Oxford ewes	530 00	
2 Hampshire rams	395 00	
8 Hampshire ewes	320 00	
3 Shropshire rams	580 00	
14 Shropshire ewes	500 00	
1 Southdown ram	270 00	
5 Southdown ewes	312 00	
36 Grade ewes	360 00	
29 Fattening wethers	174 00	
		5,270 00

PIGS:

2 Berkshire boars	$175 00	
5 Berkshire sows	175 00	
1 Middle York boar	40 00	
1 Middle York sow	50 00	
1 Essex boar	30 00	
1 Essex sow	25 00	
6 Feeding pigs	48 00	
		543 00

ABSTRACT:

Cattle	$31,477 00	
Sheep	5,270 00	
Horses	2,325 00	
Pigs	543 00	
	$39,614 00	
Total for live stock		$39,615 00

IMPLEMENTS, ETC.

Value of farm implements per inventory	$5,400 00
Value of garden stock and implements	1,887 00
Value of experimental stock and implements	1,000 00
Value of carpenter tools, etc	400 00
	$8,687 00

PART VI.

REPORT OF THE FOREMAN

OF THE

HORTICULTURAL DEPARTMENT.

DECEMBER 31st, 1884.

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

SIR,—In submitting the following report on the practical horticultural work of this Institution for the closing year I beg to say that much has been done this season toward the completion of the improvements commenced two years ago. The drains leading to the building and walks connected therewith are now all but finished so far as practicable, until the further necessary alterations are decided upon.

The large lawn in front of the college was seeded down in the spring, using about forty pounds of seed to the acre, viz., thirty-five pounds Canadian blue grass (Poa Compressa), and five pounds white clover, both perfectly hardy and permanent, of good colour, and calculated to endure both the severity of winter and drought of summer, forming a close and uniform sole which we think quite equal if not superior to the mixture of six or eight varieties frequently recommended as the finest English lawn grasses, but which in our Canadian climate often prove very unequal and unsatisfactory.

I am glad to say, however, that notwithstanding a somewhat trying season for young grass on account of the exceedingly dry weather throughout the month of August, we have been fortunate enough to secure a good catch, and if the coming winter is not very unfavourable we expect to have a good lawn next season. As provided for in the plan, an arboretum has been formed consisting of such trees and shrubs as are thought to prove sufficiently hardy to endure the extremes of our climate. With this object in view a small selection was made in 1880 by a committee of the Fruit Growers' Association, and planted on the west front of the College grounds; but to admit of regrading and change of drive leading to the buildings, which was decided upon the following year, it was found necessary to move the plants again into nursery lines where they have stood until the past spring when the ground was prepared for their reception. The above selection has been increased from year to year until now that it may be said to be a large collection, the principal list of which was given in a former report.

The most of them are now planted on the lawn, distributed in groups according to their respective families or natural orders, the shrubs and smaller sized trees in front of the College and the larger trees in rear.

The following shows the families and genera represented, also the number of species and varieties in each group:—

	Genera.	Species and Varieties.
Ancardiaciæ, or Sumach family	2	5
Aquifoliaceæ, or Holly "	2	3
Araliaceæ, or Zoywort "	1	2
Betulaceæ, or Birch "	2	10
Bignoniaceæ, or Bignonia "	2	6
Calycanthaceæ, or Calycanth "	2	3
Caprifoliaceæ, or Honeysuckle family	6	25
Celastraceæ, or Spindle Tree family.	2	4
Coniferæ, or Pine family	14	46
Cornaceæ, or Dogwood family	2	7
Corylaceæ, or Oak "	6	28
Ericaceæ, or Heath "	4	5
Euphorbiaceæ, or Spurze "	2	3
Hamamelidaceæ, or Witch Hazel family	3	4
Hypericaeæ, or St. John's Wort "	1	2
Juglandaceæ, or Walnut family	2	7
Lauraceæ, or Laurel "	1	2
Leguminosæ, or Pulse or Bean family	9	23
Magnoliaceæ, or Magnolia family	1	2
Malvaceæ, or Mallow "	1	5
Myrtaceæ, or Myrtle "	2	2
Oleaceæ, or Lilac "	4	28
Rhamnaceæ, or Buckthorn "	2	3
Rosaceæ, or Rose "	10	36
Rubicaceæ, or Madder "	1	2
Rutaceæ, or Ruewort "	1	1
Salicaceæ, or Willow "	2	32
Saxifragaceæ, or London Pride family	5	16
Styraceæ, or Storax family	1	2
Tamaricaceæ, or Tamarisk family	3	6
Urticaceæ, or Nettle family	3	13
Verbenaceæ, or Verbain family	2	2

It will here be seen that the arboretum so far embraces 32 families, 100 genera, and 334 distinct species and varieties.

In addition to this the nursery ground still contains a number of the larger class of trees, prominent among which are the maple, linden and chestnut families in considerable variety, intended to be planted east of the buildings as soon as the ground is available for that purpose.

The nursery ground here referred to consists of five plots in the experimental field, allowed by Professor Brown for nursery purposes. Each plot is one-tenth of an acre in extent, and is bounded on the north and south sides by hedges of different shrubs, intended as permanent specimen hedges of both a useful and ornamental character. As yet only five of these hedges are planted, viz., Norway spruce, arbor-vitæ or white cedar, buckthorn, barberry and privets. The plots contain a variety of forest trees and shrubs, such as maple—several varieties, ash, elm, birch, linden, white oak, butternut, Norway and native spruce, etc. Many of these were raised in the gardens and experimental departments, while others were procured quite young, intended to be planted in forest clumps on various parts of the farm, partly for their effect in breaking views, and partly for the purpose of showing what progress may be made by forest trees under cultivation. These experiments on a small scale may prove interesting to many, now that the subjects of how to protect and how to replenish our forests is attracting so much attention throughout the Provinces and other countries.

The first of these, a clump of 500 black walnut trees, was planted five feet apart in the spring of 1880, under the superintendence of Professor Brown. The plants, two years from seed, may be said to have done very well, especially the last two years they have made a luxurious and healthy growth, but quite bushy and many branched, not so tall, straight, and clean as desirable for young trees intended for useful timbers. I now feel convinced that had the nuts been planted at the same date instead of the young plants, and getting the same care in cultivation, that cleaner and taller specimen trees would now be the result, and in my opinion this will hold good in all nut-bearing trees, if not in all hardwood trees having a large tap-root, the cutting of which in transplanting checks the leaders and encourages or allows the lateral or side shoots to get the ascendancy, hence a broad irregular top with short stem or trunk, comparatively worthless for their timber, although very desirable for ornamental purposes, as single specimens in the lawn, etc.

Five additional clumps of similar size were planted in succession, composed of the following trees: butternut, hard maple, white ash, European and American larch, and a mixed clump, including black walnut, butternut, ash, birch, larch, linden and elm. The butternut has not been very successful, probably on account of the soil, being planted on a dry bank adjoining a gravel pit. The hard maple, from being planted rather late in the season, and the roots getting somewhat dry in transhipment, have hardly equalled expectations, but I have no doubt will recover with time. The white ash, although doing well, had to be removed the second year—the field in which it was planted being required for permanent experimental purposes. The larch, as well as the various trees in the mixed clump, show a vigorous and healthy growth which promises all the success desirable.

Orchard.

Of the old apple orchard only a few trees now remain, and what fruit they produced this season was mostly picked before maturing,—a few barrels of very indifferent apples being all that was left to collect at the proper season. The younger trees planted in the borders of the kitchen garden about eight or nine years ago, I regret to say suffered severely last winter, so much so that some of the finest and best formed trees both of apples and pears, just coming into bearing, had to be cut down, and I fear there are many more that will never recover; in the spring, when breaking into leaf, their unhealthy appearance, by stunted growth and partially developed foliage, clearly indicated that something was wrong. Suspecting the borer, we subjected them to a close scrutiny in hopes of discovering the cause, but the most careful examination revealed no enemy that we could either punish or prevent by cutting or breaking the young twigs and branches; the bark seemed shrunk, and the innerwood discolored by dark irregular streaks, lacking that clear green and white colour characteristic of a free and healthy circulation. This apparent disease or blemish could be traced down the tree to near the snow-line, below which all seemed as it should be, perfectly sound and healthy; we were thus forced to the conclusion that it is a clear case of winter-killing—a misfortune I fear more prevalent in this section than many are willing to admit, attributable, we believe, to the height of this locality over the surrounding country, exposed to the severest storms from whatever direction they come.

The young orchard established in 1880, under the superintendence of a committee of the Fruit Growers' Association of Ontario, with the laudable object of testing what fruit may be produced profitably in the provinces, as well as to supply all the necessary demands of the Colleges and afford an opportunity of interesting the students in fruit culture.

Operations were commenced on a small scale the first year, in a twenty acre field known as No. 10, lying south of the College buildings, and the planting enlarged each successive year until now that the ground is mostly occupied, with the exception of about 1½ acres reserved for new and untried varieties which may from time to time be introduced. In all 1336 trees have been planted in the following proportion: 987 apples, 183 pears, 89 plum and 77 cherry, embracing the following number of varieties of each, viz.: 130 varieties of apples, 55 of pears, 29 of plum and 21 of cherry. Each spring since the commencement we have had to replace a few, but the victims of last winter outnumber those of the two previous winters by considerable odds. In noting the casualties this fall

we find 210 apple, 80 pear, 37 plum and 15 cherry trees completly dead, or so near it that they will have to be removed in the spring.

The trees have invariably done well the first season, the failures in planting not exceeding one or two per cent., as the strong growth from the roots and lower portion of stems clearly demonstrate. The extremes of winter seem to be the sole cause of such disasters, but fortunately we have many well known hardy varieties able to outlive the ordeal, and I have no doubt from the energy and enterprise displayed by the fruit growers of to-day, this variety will yet be largely increased.

The small fruits, viz., currants, gooseberries, raspberries and strawberries are planted in a portion of the apple orchard, covering from three to four acres, in lines between the larger trees, each in considerable variety. All have been fairly productive, specially raspberries, which was an abundant crop and fully met all demands for College consumption. The Philadelphia proved the most prolific variety, but the small size and irregular form of berry make it less attractive than some of the others. The Cuthbert was very fine, a large berry with firm flesh, stands handling well, and for all purposes perhaps the most satisfactory variety that we have, although Turner, Herstin, Thwack and Highland-hardy, as well as some of the black sorts, Davisons, Thornless, Dorchester, Gregg, etc., all proved good, and have made promising canes for next year's fruiting. Currants and gooseberries, notwithstanding our efforts to subdue the caterpillar, were somewhat punished by the ravages of that intolerant pest, which was unusually persistant this year, yet an average crop for the age and size of the bushes was secured. Strawberries, of which we have twenty-three varieties, suffered considerably from winter killing, and hardly came up to the mark of an average crop; also from inroads made by general pickers at unseasonable hours, which materially reduced the proceeds. Wilson's Albany, Crescent seedling and Monarch of the West, we found the most prolific and stand the best of any of the varieties in our collection.

Vineyard.

The grapevines occupy about 2½ acres in the upper end of field No. 17, lying north of and directly in rear of the college buildings, having a high and airy position, with a southern aspect, but unduly exposed to the west, from which come most of our severest storms.

This position was chosen in 1881 as the best available at that time, and some 440 vines planted the same season, in lines at a distance of 12 feet apart each way, and the following spring enlarged to its present dimensions, containing 650 vines, embracing over 90 varieties.

The planting was a good average success, and the first and second year's growth all that could be expected; last year two canes were grown from each plant and carefully tied up throughout the growing season to temporary stakes; these canes being intended for permanent limbs, from which the young and bearing wood is to be grown. This mode of training, which may be called the renewal system, having been decided upon as the best we know of for this section of the country, where it is absolutely necessary that the vines be laid down for winter protection. This being the third year from planting, and calculated as the first for bearing, it was necessary to provide something in the way of a permanent trellis for their support, consequently material for wire-fencing was prepared during the winter months, and constructed as early in the spring as such work was practicable, under the superintendence of the farm mechanics. Cedar posts from five to seven inches in diameter were placed three feet in the ground mid-way between the vines, running north and south.

The trellis consists of four No. 8 galvanized wires; the lower wire 18 inches from the ground, and the upper one five feet, the two others dividing equally the intermediate spaces, thus forming a substantial and lasting trellis.

Unfortunately success thus far has not equalled our efforts. Last year, 1883, the summer was unusually wet and cool, consequently vegetation was slow and late, the vines continuing to grow vigorously into the month of September with the fruit barely changing colour, when the frost on the sixth and seventh night of that month stripped them of their

foliage, and cut back the young unmatured wood in some instances to near the ground, which materially reduced the fruit-bearing wood for this season, nevertheless what sound wood was left gave throughout the months of July and August the prospects of a fair crop, but again we were doomed to disappointment by the early fall frosts. I find in some notes of observations taken during the summer, under date of September the 12th, Champion and Janesville vines, fruit almost ripe ; Moor's Early and Early Dawn well coloured ; Delaware, Hartford Prolific, Brant, Massasiot, Lindley and Clinton just showing colour, etc. Again, September 17th, a general improvement on all those named, and Concord with some others colouring fairly. On the following day, the 18th, I found that a raid had been made the previous night and some of the best fruit carried off or in the dark destroyed. On the same night there came a severe frost which cut down both the fruit and our further faith in vines for the season ; only about a bushel of partially injured grapes was gathered.

Kitchen Garden.

This department has been entirely satisfactory in every respect ; vegetables of all sorts were abundant in their season, meeting in full all the requirements of the college, and such varieties as can be saved are stored in sufficient quantity for winter use. It is needless to particularize when all were equally good both in quantity and quality, and all in excess of the average year's crop. In the spring and early summer months of every year there is a pressing demand for fresh vegetables which we cannot supply in the quantity called for without some more efficient system of forcing, the small amount of lettuce and radish that can be raised under a few hotbed lights (which is the extent of our present conveniences) is quite inadequate to supply the table of say 140, and only serves to encourage the demand for more.

The following fruits and vegetables were supplied to the college during the year :

January.

Cabbage, 3¾ dozen at 75c.	$2 81	
Celery, 2 doz. at 75c.	1 50	
Onions, 7¼ bushels at 90c.	6 52	
Carrots, 11 bushels at 75c.	2 75	
Parnsnips, 5¾ bushels at 45c.	2 81	
Turnips, 3¼ bush. at 20c	70	
Salsify, ¾ bush. 80c.	60	
Beets, 3 bush. at 30c	90	
		$18 59

February.

Cabbage, 6¾ dozen at 75c.	$4 06	
Carrots, 8 bush. at 25c.	2 00	
Onions, 8 bush. at 90c	7 20	
Turnips, 8 bush. at 20c.	1 60	
Beets, 1 bush. at 30c.	30	
		15 16

March.

Cabbage, 16½ doz. at 75c	$12 37	
Onions, 7½ bush at 90c.	6 75	
Turnips, 2½ bush. at 20c.	50	
Carrots, 5½ bush. at 25c.	1 37	
Beets, ½ bush. at 25c.	12	
		21 11

April.

Cabbage, 3½ doz. at 75c.	2 62	
Carrots, 2¾ bush. at 25c.	68	

Onions, 2¼ bush. at 90c.	$2 08	
Parsnips, 2½ bush. at 45c.	1 12	
Beets, ½ bush. at 25c.	12	
Sundries	15	
		$6 77

May.

Parsnips, 2 bush, at 45c.	$ 90	
Carrots, 9 bush. at 25c.	2 25	
Beets, 1½ bush. at 25c	37	
Onions, 1¾ bush. at 90c.	1 50	
Rhubarb, 12 bush. at 75c.	9 00	
Lettuce, 5½ bush. at $1	5 50	
Salsify, 2 bush. at 80c	1 60	
Asparagus, 390 bundles at 4c	15 60	
Sundries	45	
		37 17

June.

Lettuce, 5 bush. at 50c.	$ 2 50	
Rhubarb, 18½ bush. at 70c	12 95	
Spinach, 14½ bush. at 5c	7 25	
Beets, ½ bush. at 70c	35	
Peas, 3½ bush. at $1	3 50	
Gooseberries, 36 quarts at 12c.	4 32	
Strawberries, 176 boxes at 7c	12 32	
Asparagus, 705 bundles at 4c	28 20	
Onions, 20 bundles at 5c	1 00	
Herbs, etc	1 25	
		73 64

July.

Rhubarb, 2 bush. at 70c	$1 40	
Peas, 9¼ bush. at $1	9 25	
Onions, ¾ bush. at 90c.	67	
Cucumbers, ¾ bush. at $1.60	1 20	
Spinach, 2 bush. at 50c.	1 00	
Carrots, 1½ bush at 40c.	60	
Potatoes, 10¾ bush. at $1	10 75	
Beets, 4 bush. at 35c	1 40	
Lettuce, 1¾ bush. at 50c	87	
Beans, 2½ bush. at $1.20	3 00	
Asparagus, 74 bundles at 4c.	2 96	
Strawberries, 35 boxes at 7c.	2 45	
Gooseberries, 132 quarts at 8c.	10 56	
Currants, 52 quarts at 12c.	6 24	
Raspberries, 728 quarts at 10c.	72 80	
Black currants, 71 quarts at 15c.	10 65	
Sundries	45	
		136 25

August.

Potatoes, 21½ bush. at 75c	$16 12	
Carrots, 2 bush. at 40c.	80	
Beans, 7½ bush. at $1.25	9 37	
Beets, 1 bush. at 50c.	50	
Cucumbers, 13½ bush. at $1.20.	16 50	
Onions, ¾ bush. at $1	75	

Apples, 6 bush. at 80c	$4 80	
Peas, 7¾ bush. at 80c	6 20	
Lettuce, ¼ bush. at 40c	10	
Peppers, ⅛ bush. at 80c	10	
Turnips, ½ bush. at 20c	10	
Corn, 18 doz. at 8c	1 44	
Cauliflower, 2 doz. at $1	2 00	
Vegetable marrow, 3½ doz. at $1	3 50	
Cabbage, 3½ doz. at 60c	2 10	
Raspberries, 325 boxes at 10c	32 50	
Herbs, etc	60	
		$38 78

September.

Potatoes, 102 bush. at 50c	$51 00	
Tomatoes, 11½ bush. at 60c	6 75	
Crab apples, 1½ bush. at 80c	1 20	
Onions, 1½ bush. at 90c	1 35	
Carrots, 2 bush. at 25c	50	
Apples, 27½ bush. at 50c	13 75	
Cauliflower, 9 dozen at 96c	8 64	
Corn, 37 dozen at 3c	2 96	
Vegetable marrow, 1 dozen at 72c	72	
Cabbage, 4¼ dozen at 60c	2 55	
Citron, 4½ dozen at $1	4 50	
Celery, 2 dozen at 50c	1 00	
Melons, 1½ dozen at 60c	90	
Sundries	1 50	
		97 32

October

Beets, 1½ bush. at 40c	$ 60	
Onions, 5½ bush. at 80c	4 40	
Tomatoes, 2 bush. at 50c	1 00	
Carrots, 4 bush. at 30c	1 20	
Potatoes, 9 bush. at 50c	4 50	
Turnips, 3 bush. at 20c	60	
Celery, 38½ dozen at 50c	19 25	
Cauliflower, 4 dozen at 60c	2 40	
Cabbage, 7½ dozen at 50c	3 75	
Melons, 1 dozen at 60c	60	
Vegetable marrow, 7 dozen at 60c	4 20	
Squash, 2 dozen at 60c	1 20	
Red Cabbage, 7 dozen at 60c	4 20	
Radish, 17 bunches at 5c	85	
		48 75

November.

Celery, 29 dozen at 50c	$14 50	
Vegetable marrow, 6 dozen at 60c	3 60	
Squash, 1½ dozen at 60c	90	
Cabbage, 4 dozen at 50c	2 00	
Turnips, 5½ bush. at 20c	1 10	
Carrots, 5 bush. at 25c	1 25	
Onions, 6¼ bush. at 80c	5 00	
Parsnips, 3 bush. at 40c	1 20	

Salsify, 1¼ bush. at 80c.	$1 00	
Beets, ½ bush. at 40c.	20	
Sundries	25	
		$31 00

December.

Carrots, 6½ bush. at 25c	$1 25	
Onions, 6 bush. at 80c	4 80	
Parsnips, 5 bush. at 40c.	2 00	
Beets, 2 bush. at 25c	50	
Turnips, 3 bush. at 20c.	60	
Celery, 15 dozen at 50c.	7 50	
Vegetable marrow, 4 dozen at 50c.	2 00	
Cabbage, 3 dozen at 50c.	1 50	
		20 15
Supplied to Prof. Brown, Dr. Hare and others		121 21
Total		$724 60

Flower Garden.

The new flower garden directly in front of the College buildings is now complete in all its parts in accordance with the general plan of the grounds. The design is simple but effective, as was readily acceded by all who saw it during the summer months.

The outline is an oval shaped plot of grass 225 feet by 165 feet, surrounded by a gravel drive, and intersected both ways by gravel walks leading into a circular walk surrounding a plot 40 feet in diameter forming the centre; at present a flower-bed, but where we hope to see in the near future a fountain worthy of its surroundings.

Twelve flower-beds 36 feet in length radiate toward the centre, and two triangular beds at each end of the ellipsis, complete the design which formed a point of attraction to visitors throughout the summer. The older flower garden adjoining the greenhouses, and outlying borders, are now about the only landmarks by which visitors of former years can readily recognize this department.

In all over 5,500 flowering and ornamental plants were used in furnishing the beds and borders, including all the leading and well known varieties of half-hardy bedding plants, as well as some of the less common sorts recently added to our stock, among others a collection of nearly 200 hardy herbaceous or perennial plants, obtained last spring and now planted in a border by themselves arranged according to their respective families, which we hope will prove interesting as well as useful for botanical purposes.

Greenhouses.

No important changes have been made in the greenhouse during the year with the exception of what repairs were absolutely necessary to keep them in working order for the winter. We have repeatedly reported their unsatisfactory and unsafe condition, and from the fact of new plans being prepared and approved of for new buildings over two years ago, we were led to believe that each passing year would be the last for the present structures; consequently, to avoid unnecessary expenses all repairs were deferred until this year when it became indispensable to relay most of the glass, to paint the wood-work and renew a portion of the inside staying which from the first has been of a very primitive and temporary character.

Our collection of greenhouse plants being mostly of the softwooded class, is neither extensive, rare or valuable, but they are in a healthy condition, and we believe about all, both in variety and value, that our present conveniences will admit of. I need not here urge the erection of the new buildings: this matter has been brought before your notice, at various times and in various forms and the desirability of the object generally admitted;

I would simply remind you that the present structure, greenhouses, toolhouse and workshop combined is very unsightly in the position it occupies, neither comfortable for the students nor creditable to the institution, besides it is a standing obctacle in the way of the further improvements required in this part of the grounds.

During the winter months, as for several years past, a portion of each day was spent on practical instructions in the workshops or greenhouses, consisting of lessons on the various modes of propagating potting, training and pruning of plants, also grafting and budding, the objects explained and the art practised by all the students taking the regular courses.

By the 2nd year's students a fnrther course was pursued, including the general management of greenhouses, the various modes of heating, the temperature required, the watering, growing, hybridizing, etc., etc.

This course was continued to the end of the winter term when most of the students (I am glad to say) passad a very creditable examination.

JAS. FORSYTH,
Superintendent Horticultural Department.