SEVENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM.

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

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EXPERIMENTAL FARM,

FOR THE YEAR ENDING 31ST DECEMBER,

1881.

Printed by Order of the Legislative Assembly.

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REPORT OF THE PRESIDENT

OF THE

ONTARIO AGRICULTURAL COLLEGE,

GUELPH,

FOR THE

YEAR COMMENCING 1st JANUARY AND ENDING 31st DECEMBER,

1881.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, 31st December, 1881.

To the Honourable S. C. Wood,
Commissioner of Agriculture for the Province of Ontario.

SIR,—I have the honour to submit for your consideration the following report of work done in the Ontario Agricultural College during the year 1881, being the Seventh Annual Report of the institution.

As the Act of Incorporation passed by the Legislative Assembly of the Province of Ontario, on the 11th February, 1880, defines somewhat minutely the work of the College and the Farm, it is here quoted for the information of all who may wish to know the objects for which the institution is maintained :—

No. 60.] BILL. [1880.

AN ACT RESPECTING THE AGRICULTURAL COLLEGE.

HER MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows :—

1. The School of Agriculture, heretofore established in the county of Wellington, in this Province, for instruction in the theory and practice of agriculture, horticulture and arboriculture, and the conducting of experiments relating thereto, is hereby continued, at its present site, under the name of the "Ontario Agricultural College and Experimental Farm." School of Agriculture continued. Site. Name.

Nature of instruction.

2. The said college shall be furnished with all appliances, such as land, buildings, implements, tools and apparatus generally, as may be necessary for theoretical and practical education in agriculture, horticulture and arboriculture, and the course of instruction therein shall be with reference to the following subjects:—

(1) The theory and practice of agriculture;

(2) The theory and practice of horticulture;

(3) The theory and practice of arboriculture;

(4) The elements of the various sciences, especially chemistry, (theoretical and practical), applicable to agriculture and horticulture;

(5) The technical English and mathematical branches requisite for an intelligent and successful performance of the business of agriculture and horticulture;

(6) The anatomy, physiology, and pathology, of the ordinary farm animals; with the characteristics of the different varieties of each kind; with the management thereof in the breeding, raising, fattening and marketing of each, and with a knowledge of the cheese and butter factory systems;

(7) The principles of construction and skilful use of the different varieties of buildings, fences, drainage systems, and other permanent improvements, machinery, implements, tools and appliances necessary in agricultural and horticultural pursuits;

(8) And such other subjects as will promote a knowledge of the theory and practice of agriculture, horticulture and arboriculture.

Practical education insisted upon.

3. The education and instruction shall be at once theoretical and practical, the former known as a course of study, and the latter as a course of aprenticeship; and a time, not less than three and not more than five hours daily, on a yearly average, shall be spent in undergoing the latter, and for the encouragement of such labours, an allowance in part liquidation of expenses may be made; yet, notwithstanding, the course of apprenticeship may be dispensed with, if a satisfactory examination be previously passed in all the operations therein required.

Nature of experiments.

4. Experiments with the different varieties of cereals, grasses and roots, of trees, plants, shrubs, flowers and fruits; with different modes of cultivation; with different manures; with the breeding, raising and fattening of animals; with the products of the dairy; and with whatsoever else may be of practical benefit in adding to the knowledge of the facts, principles and laws of the science and art of agriculture, horticulture and arboriculture under the climatic conditions of this Province, shall be carried out on the experimental farm; and the modes of procedure and results published from time to time.

Publication of procedure and results.

Rules, regulations and curriculum of the college.

5. The government of the college shall be under and according to such rules and regulations as the Lieutenant-Governor in Council may from time to time prescribe; and such rules and regulations shall contain provisions for the standard and mode of admission, the course of study, and apprenticeship in each branch in which instruction is given, and may authorize diplomas, certificates of proficiency, scholarship or other rewards to be given, after examination, in any of such subjects; and may also impose reasonable fees for attendance.

Appointments to be made by the Lieutenant-Governor in Council.

6. The Lieutenant-Governor in Council may from time to time appoint a president and such professors, instructors, officers, assistants and servants as the Lieutenant-Governor in Council may deem necessary for the efficient working of said college, and the promotion of its usefulness, and may pass by-laws regulating and prescribing their respective duties.

Sessions, terms and vacations.

7. There shall be two sessions in each year, and two terms in each session; the winter session shall open on the first day of October, and close on the thirty-first day of March; the summer session shall open on the sixteenth day of April, and close on the thirty-first day of August; and the time between the closing and opening of the respective sessions shall constitute the regular vacations.

Affiliation of the college with the University of Toronto.

8. The Lieutenant-Governor in Council may agree with the University of Toronto for the affiliation of the said college with the said University, but only to the extent of enabling the students of the said college to obtain at the examinations of the said university such rewards, honours, standing, scholarships, diplomas and degrees in agriculture as the said university, under its statutes and the Acts of the Legislature in that behalf, may be allowed to confer.

Museum and laboratory.

9. In connection with the college there shall be a museum of agriculture and horticulture, together with the scientific and technical branches relating thereto, in order to afford aids to practical instruction, and illustrations of the agricultural and horticultural products of the Province; as well as a botanical and chemical laboratory to which vendors of seeds and artificial manures may send such seeds and manures, in order that after the proper inspection and tests their purity and strength may be reported for the benefit and protection of the agricultural community.

Gifts, bequests, etc., to college, museum or laboratory.

10. It shall be lawful for the Lieutenant-Governor in Council on behalf of the Province to accept, hold and enjoy any gifts, bequests, or devises of personal or real property or effects which any person may think fit to make for the purposes of the said college, museum or laboratory.

No religious test or profession required; but all facilities given for acquiring religious training.

11. The Lieutenant-Governor in Council may make such regulations as may be deemed expedient touching the conduct of the students, and their attendance on public worship in their respective churches or other places of religious worship, and respecting their religious instruction by their respective ministers, according to their respective forms of religious faith, and every facility shall be afforded for such purposes.

Reports and returns to the Legislative Assembly.

12. Full reports of the progress of the said college and farm shall be annually returned and submitted to the Legislative Assembly, which reports shall, amongst other things, contain:—

(1) A tabular statement with the name and residence of each student attending in each session of the year, together with the name, residence and occupation of the parent or guardian, the number of classes that each student attended, and his progress and efficiency therein;

(2) A return of the professors, instructors and assistants, with a summary of the instruction given by each;

(3) A copy of the examination papers used in the sessional examinations, and the results thereof;

(4) A summary of the operations in the various departments of the farm;

(5) A clear and succinct account of the modes of procedure and results of the various experiments carried on during the year;

(6) A detailed statement of the income and expenditure of the college and farm for the year;

(7) A copy of all rules and regulations made during the year by the Lieutenant-Governor in Council, regarding the standard and mode of admission, the course of study and the course of apprenticeship;

(8) A comparative statement showing the progress of the college and farm from year to year.

For the last four or five years the Ontario Agricultural College and Experimental Farm has been managed by two distinct heads—the President and the Farm Superintendent, who are to a large extent independent of each other. The President has absolute control inside, and the Farm Superintendent outside. Each is expected to work for the other; and neither is responsible for the discharge of his duties to any one but the Minister of Agriculture.

The outside work is divided into five departments—

I.—The Farm Department.
II.—The Live Stock Department.
III.—The Horticultural Department.
IV.—The Mechanical Department.
V.—The Experimental Department.

For all these my colleague Professor Brown alone is responsible. He hires the men, directs the foremen, makes the purchases, and does whatever else he thinks necessary for the accomplishment of the object in view. His report, in the second part of this volume, contains a full account of the work done in the outside departments during the past year; and I have much pleasure in referring to it as a repository of valuable information on matters pertaining to agriculture.

The inside work, on the other hand, is embraced under three heads—

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

For this I am directly responsible to the Commissioner of Agriculture, and through him to the Government of which he is a member. So, without further introduction, I beg to report as follows:—

I.—The Course of Instruction in the College.

Before proceeding to report on the year 1881, I shall give the 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 that I shall speak of the year's operations as a whole, and then of each term separately.

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

Sessions.

Winter Session—1st October to 31st March { Fall Term. / Winter Term.
Summer Session—16th April to 31st August { Spring Term. / Summer Term.

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 embraces the following subjects:—

First Year.—*Agriculture, Live Stock, Inorganic Chemistry, Organic Chemistry, Veterinary Anatomy, Veterinary Materia Medica, Zoology, Structural and Physiological*

Botany, Geology and Physical Geography, English Literature and Composition, Book-keeping, Arithmetic, and Mensuration.

SECOND YEAR.—*Agriculture, Live Stock, Agricultural Chemistry, Veterinary Pathology, Veterinary Surgery and Practice, Systematic and Economic Botany, Entomology, Meteorology, English Literature, Political Economy, Book-keeping, Mechanics, Levelling and Surveying.*

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

THE STAFF.

1. JAMES MILLS, M.A., *President.*

English Literature, Political Economy, Structural and Physiological Botany, and Zoology.

2. WILLIAM BROWN, C.E., P.L.S.

Agriculture, Live Stock, and Arboriculture.

3. J. HOYES PANTON, M.A.

Chemistry (Inorganic, Organic and Agricultural), Geology, Physical Geography and Meteorology, Systematic and Economic Botany, Entomology.

4. J. P. MCMURRICH, B.A.

(Lately appointed. Duties defined farther on.)

5. E. A. A. GRANGE, V.S.

Veterinary Anatomy, Pathology and Materia Medica, with the Practical Handling and Judging of Horses.

6. ALEXANDER MCTAVISH, 1ST CLASS PROVINCIAL CERTIFICATE.

(Lately succeeded by WILLIAM NATTRESS, 1ST CLASS A PROVINCIAL CERTIFICATE.)

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

THE YEAR 1881.

The year 1881 has not been marked by anything striking or unusual in the history of the College. It has rather been characterized by faithful work and substantial progress in the different departments of the institution. At the same time, it has not been altogether void of incident. I could speak of large additions to the library, the granting of diplomas for the first time, the appointment of a new professor, and other matters of special interest and importance; but it would interfere with the plan of my report to do so in this paragraph.

I think I may safely say that the institution is growing in favour at home and abroad. The applications for admission at the commencement of each session are more than we can accommodate. Several delegations from the neighbouring Republic have lately examined and approved our methods; and the farmers of Ontario have begun to urge the importance of a liberal outlay for the purpose of building a laboratory, constructing

suitable green-houses, and otherwise making more satisfactory provision for the efficient working of the several departments.

On looking over the list of students, I find that the attendance in 1881 has reached 217—1 from the United States, 1 from Bermuda, 1 from Ireland, 3 from New Brunswick, 3 from Scotland, 3 from Wales, 6 from Nova Scotia, 11 from England, 24 from the Province of Quebec, and 164 from Ontario,—*i.e.*, 75½ per cent. of residents and 24½ non-residents.

From an examination of the college roll in appendix 1, it will be seen that the Ontario students come from all sections of the Province. The list embraces 31 counties and 7 cities. The County of York has 11 representatives, Oxford 10, Wellington 10, Carleton 8, Lanark 8, and Huron 7; Brant, Grey, Perth and Simcoe, 6 each; the City of Ottawa 14, Toronto 7, and Hamilton 4.

Counties, etc.	*Students.*	*Counties, etc.*	*Students.*
Brant	6	Middlesex	3
Bruce	3	Norfolk	4
Carleton	8	Northumberland	1
Durham	2	Ontario	3
Elgin	5	Ottawa	14
Frontenac	2	Oxford	10
Guelph	1	Peel	2
Glengarry	3	Perth	6
Grey	6	Peterboro'	2
Haldimand	2	Prince Edward	1
Halton	2	Renfrew	1
Hamilton	4	Simcoe	6
Huron	7	St. Catharines	2
Kingston	4	Toronto	7
Lambton	2	Victoria	2
Lanark	8	Waterloo	4
Leeds	2	Wellington	10
Lincoln	2	Wentworth	5
London	1	York	11

Total number of students in 1881	217
Number of Ontario counties represented	31

To this may be added a statement showing the numbers by which the different religious denominations have been represented in the institution during the past year:

Episcopalians	81
Presbyterians	70
Canada Methodists	33
Baptists	9
Roman Catholics	6
Congregationalists	4
Primitive Methodists	3
Lutherans	2
Plymouth Brethren	2
United Brethren	1
Episcopal Methodists	1
Friends	1
Unitarians	1
Jews	1
Universalists	1
Swedenborgians	1
Total	217

Lectures commenced on the 1st October and continued throughout the first three terms of the scholastic year 1880-81—from the 1st October to the 30th June. During that 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 the very efficient drill instructor of the Wellington Field Battery. 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.
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 engaged 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 experiments.

In order to place systematically and clearly before the readers of this Report an outline of the literary work done in the institution, I have drawn up the following syllabus of lectures delivered by the professors in the several departments and sub-departments during the last scholastic year, commencing on the 1st October, 1880, and ending the 31st August, 1881 :

Outline of Class-Room Work.

(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.—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 of the most important elements; 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 the 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; etc.

Zoology.—Nature of life; vital force; difference between animals and plants; morphology and physiology; homology and analogy; definition of species; classification; subdivisions of the animal kingdom; characters of the classes and most important orders of *Invertebrates;* general characters of *Vertebrates;* classes and orders, with a brief description of each.

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.

Lectures on Composition.—The sentence, the paragraph, and the period; capitals and punctuation; style—its qualities and varieties. *Exercises in Composition.*

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

Department 5.—Mathematics.

Arithmetic.—Review of subject, with special reference to farm accounts; tables of weights and measures discussed; interest, discount, stocks and partnership.

Mental Arithmetic.—Calculations in simple rules, fractions, and compound 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.—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.—Subject continued—Special study of *Infusoria, Scolecida* and *Insecta.* General characters of the *Vertebrates*—the various orders, with morphological and physiological distinctions of each, illustrated by common examples. Special study of the families of the *Aves* containing the insectivorous birds, and the families of the *Mammalia* containing the farm animals.

Department 3.—Veterinary Science.

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

Department 4.—English.

Lectures on Composition continued.—Common mistakes in speaking and writing discussed and corrected; most important figures of speech defined and illustrated.

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

English Classics.—Committing to memory and critical study of Scott's "Lady of the Lake."

Department 5.—Mathematics and Book-keeping.

Arithmetic.—Equation of payments; percentage; profit and loss; stocks; partnership; alligation; 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, sainfoin, prickley comfrey, clovers, grasses; the cultivation and management most appropriate for each.

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

Department 2.—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.—Structural and physiological botany; internal structure of plants—cells and vessels; structure and development of the external parts of plants—root, stem, leaf, flower, seed, fruit; physiology of cells and vessels—chlorophyll, starch, gum, sugar, crystals, etc.; movements of fluids in plants, respiration, nutrition, reproduction; hybridization; modes of propagation; propagation of *varieties* by grafting, budding, layering and division; diseases of plants—smut, rust, mildew, etc.

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.

Lectures on the subject, and class-room exercises in business correspondence, etc.

English Classics.—Committing to memory and critical study of Goldsmith's "Deserted Village."

Department 5.—Mathematics.

Mensuration—Mensuration of surfaces—the square, rectangle, triangle, trapezoid, regular polygon, circle, sector, segment, etc. Special application to the measurement of lumber. Mensuration of solids—tethrahedron, cube, prism, cylinder, spherical segment, spherical zone, parabolid, frustrum of parabolid, spheroid, circular segment of spheroid, etc. 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, pease, 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.—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.

Lectures.—Etymological, syntactical, and rhetorical forms of the English language; history of its formation, its connection with other languages; rhetorical figures; their use and abuse; prose and poetic diction.

Composition.—Essay writing; familiar and business correspondence.

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

Department 5.—Mathematics.

Statics.—The mechanical powers; friction; the steam engine; strength of materials; units of work; etc.

Drainage.—General principles; discharging water-ways; how, where, and when to commence draining; depth of drains and distance apart; furrow drains; draining followed by other improvements; drainage implements; levelling.

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.—Science.

Agricultural Chemistry.—Subject continued from Fall Term.

Entomology.—Anatomy of insects; geographical distribution and classification of insects; metomorphosis of insects; insects injurious to vegetation, their habits and the best methods of checking and preventing their ravages—all illustrated by a good collection of 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 vessels.

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 and Political Economy.

Lectures.—Lectures on accuracy, purity, propriety, clearness, precision, strength, and grace; varieties of style described; false syntax discussed and corrected.

Composition.—Exercises in impromptu composition and letter writing continued.

English Classics.—The critical study of Shakspeare's "Macbeth."

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

Department 5.—Mathematics.

Dynamics.—Motion, forces producing motion, momentum, etc.

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

Road-Making.

SECOND YEAR—*(Continued.)*

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.—Science.

Systematic and Economic Botany.—Subject defined; principles considered in the classification of plants—plants classified; orders containing the plants of greatest importance to the agriculturist described; plants classified in regard to their economic value for food, medicine, fabrics, forage, timber, etc. The course illustrated by a large collection of well preserved plants.

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; adulterations in foods and artificial manures; injurious substances in soils.

Quantitative analysis of soils, manures, and farm produce.

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.

Department 4.—English.

Lectures.—Taste, characteristics of taste, standard of taste; pleasures of the imagination—their sources, viz., the novel, the wonderful, the picturesque, the sublime, the beautiful; wit, humour, ridicule, etc.

Composition—Business forms and correspondence; general letter-writing, etc.

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

Department 5.—Mathematics and Book-keeping.

Surveying.—Fields surveyed with chain and cross-staff; heights and distances found by the theodolite.

Book-keeping.—Review of previous work; laws relating to farming—deeds, mortgages, notes, etc., with laws relating thereto.

Having spoken thus briefly of the year 1881 as a whole, I now proceed to report more at length on the work of each term separately. As already intimated, the scholastic year began on the 1st October, 1880, and ended on the 31st August, 1881, while the financial year began on the 1st January and ended on the 31st December; and for this reason it is somewhat difficult to make our reports intelligible to ordinary readers. The following arrangement of the terms will, perhaps, illustrate what I mean:—

Scholastic Year— Fall Term (1880)
Winter Term (1881) } *Financial Year.*
Spring Term " }
Summer Term " }
Fall Term " }

From this it will be seen that the financial year embraces the last three terms of one scholastic year and the first term of another. The scholastic year commences with the fall term, and the financial year with the winter term. Hence the confusion which arises in the minds of some.

The Fall Term of 1880, *i.e.*, the first term of the scholastic year, having been treated of in last year's report, I shall begin with

THE WINTER TERM OF 1881.

5TH JANUARY TO 31ST MARCH.

The students in attendance were those who had entered at the commencement of the Fall Term in October, 1880, or previous to that date—126 in number; and the work was to a large extent a continuation of the subjects begun at that time.

LECTURES.

The regular students of the first year had a course of 165 lectures on the different subjects prescribed for the Winter Term—thirty on Agriculture and Live Stock, thirty-three on Chemistry, twenty-two on Veterinary Anatomy, thirty-three on English Literature and Composition, twenty on Zoology, twenty on Arithmetic, and seven on Book-keeping. During the same time the second year students attended 143 lectures, and spent twenty-two hours in the practical handling and judging of cattle, sheep and horses, under the supervision of the veterinary surgeon and the professor of agriculture. The subjects and lectures were: Agriculture and Live Stock, seventeen lectures; Aboriculture, five; Agricultural Chemistry, thirty-three; Entomology, eleven; Veterinary Pathology, twenty-two; Political Economy, twenty-two; English Literature, eleven; Natural Philosophy and Road-making, twenty-two.

"COURSE OF APPRENTICESHIP."

Regarding the course of apprenticeship in practical work, I may say that during the past year the students were regularly and systematically sent in rotation to all the outside departments, *i.e.*, to the farm, the live stock, the garden, the carpenter-shop, and the experimental department, so that it was in the power of everyone, who was at all industrious, to get a fair knowledge of whatever is to be learned in each department.

During the winter months it is sometimes difficult to find work of a kind suitable for the purposes of instruction. The experimental department is quiet, there is not much to do on the farm, and very little in the garden; consequently more time is devoted to the mechanical and live stock departments in the Winter Term than at any other season of the year. In this way not only is the difficulty met, but special opportunities are afforded the young men for learning the use of carpenter's tools, and acquiring a practical knowledge of the best methods of feeding and managing the ordinary farm animals.

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 one hour a week in handling, judging and comparing the different breeds and varieties of sheep and cattle. 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 an animal for beef and for 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, 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.

Natural Science.

In the department of Natural Science I have to report as I did last year, that good work has been done; but that the results would have been better and much more satisfactory to all concerned, if the institution had been provided with a good laboratory and apparatus suitable for making the experiments which constitute so large a part of the instruction in this important department. The professor of chemistry did all that any chemist could do, but he was much hindered by the utter insufficiency of our eight by twelve laboratory and its scanty equipment. The first year students, after completing the inorganic chemistry which they had studied throughout the Fall Term, took up the somewhat difficult but interesting subject of organic chemistry. A full course of lectures was delivered, embracing all the important organic compounds, while special attention was paid to the nature and sources of sugar, starch, oils, fats, the albuminoids or flesh-formers, and other substances which have a more or less direct bearing on agriculture and stock-raising. At the same time they received lectures from another professor on zoology, the object of which was to give them a general view of the whole animal kingdom, and thus make them more intelligent and appreciative students of particular parts of that kingdom under the heads of entomology and veterinary science. While the students of the first year were thus employed, those of the second year were attending lectures on agricultural chemistry and entomology. During the previous term they had learned the relation of chemistry to agriculture, 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, artificial fertilizers and farm-yard manure, the chemical composition of various fodders, and the nutritive value of each. With such subjects as these, they were occupied three hours a week, and spent one hour a week in examining specimens of the various insects which infest our crops and fruits, and in studying the best known means of checking and preventing their ravages.

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. Those delivered to the students of the second year, discussed various diseases and their treatment, especially the common ailments of the horse, as spavin, ringbone, curb, founder, inflammation and such like. Here again, for the purpose of making the instruction thoroughly practical, horses were regularly brought into the class-room and examined, first by the professor in presence of the class, and afterwards by the students themselves. Thus the veterinary surgeon was each day enabled to see whether his lectures were really understood by those to whom they were delivered. This part of the work, I am pleased to say, was heartily entered into and much appreciated by the second year men.

English Literature and Political Economy.

Our course of study is still the same, and the same subjects are emphasized. We spend no time on Latin, Greek, French or German; and not much on anything which has not a direct bearing on the ordinary duties of a Canadian farmer. The time may come when it will be proper to add drawing, elocution, and, perhaps, French or German to the list of studies; but at present it seems wise to resist the temptation in that direction. 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 respectability in church and state.

The kind of 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 the best English authors; and for this reason we devote all the time we can spare to that department.

During the Winter Term of 1881, the first year students spent one hour a week in writing letters and impromptu compositions, and two hours in the critical study of Scott's "Lady of the Lake." The second year men read Shakespeare's "Julius Cæsar," committing to memory the best passages, and devoted considerable attention to the study of Political Economy. Land, labour and capital passed under review; and some of the great problems connected with protection, free trade, and the functions of government were freely and warmly discussed.

Mathematics and Book-keeping.

In this department, the first year students commenced the study of book-keeping on the 5th of January, and continued that of arithmetic from the Fall Term. In the former, the master in charge having devoted special attention to the subject, gave a valuable course of lectures and a number of exercises on what may be called farm book-keeping—farm, field, garden and dairy accounts; in the latter, particular stress was laid on the commercial part of the subject, and the solution of such problems as are required in the business of the farming community. At the same time the second year students were engaged in the study of dynamics, hydrostatics, and road-making. The principles learned in hydraulics were applied in studying the construction and working of pumps, siphons, hydraulic rams and presses; and under the head of road-making, several matters of importance were discussed, such as road materials, the construction of various kinds of roads, lanes and walks—macadamized, gravel, plank, etc.; also the relative cost and value of each, under a variety of conditions. In this way the young men were interested in what might appear a very common place subject, and were led to see how our country roads might be greatly improved, without much additional cost, if the principles of grading and drainage were generally understood and acted upon.

The Horticultural Department.

In the course of the past year there have been better opportunities for instruction and learning in this department than at any time previous. The additions made by the fruit growers of Ontario to our list of trees and shrubs have greatly enlarged the field for observation and illustration.

During the winter months the second year students received instruction in grafting, budding, layering, and potting. They also made a special study of our hot-house plants;

and at the close of the term most of them succeeded in passing a satisfactory examination on the following paper:—

SESSIONAL EXAMINATIONS—EASTER, 1881.

Second Year.

Horticulture.

Examiner: James Forsyth.

1. Describe how hybridizing takes place naturally, how it may be accomplished artificially, and how hybridized varieties are perpetuated.
2. Describe the usual mode of propagating greenhouse plants, the material necessary, and the temperature required.
3. In the collection of plants before you, name—

(*a*) The monœcious plants.
(*b*) Those with perfect flowers.
(*c*) Those with endogenous stems.

4. Describe a soil suitable for potting a large number of greenhouse plants.
5. What is a double flower, and wherein does it differ from a single flower of the same species.
6. Make a selection of six plants suitable for window culture, giving the common and the scientific name of each.
7. Name four insects which commonly attack greenhouse plants, and state how they may be destroyed.
8. Identify the plants before you, giving the common and the scientific name of each—

(*a*) Name the orders to which they respectively belong.
(*b*) Describe fully plants 2 and 5.

The Mechanical Department.

In this department nothing new has been done, except the introduction of a circular saw for dressing posts and rafters, and ripping boards to any required width. Our shop is a very plain one, with three or four benches, and an outfit of such tools as are required for repairing and general carpenter work. The students are sent to this department, as to all the others, in rotation. They are first taught the use of the different tools, and afterwards employed in doing a variety of work, such as is constantly needed on the farm—making gates, waggon tongues, whipple-trees, etc., and repairing fences, barns and College buildings. Such is the regular routine, and last winter was no exception to the general rule.

Special Students.

From an examination of appendix 7, it will be seen that we have a special course for the convenience of farmers' sons who wish to attend lectures during the fall and winter months, and return home about the first April, in time for the spring work on their own farms. Such students, doing little or no outside work, are able to take in two terms all the lectures that regular students get in three terms. The following statement will explain what I mean:—

Regular Students.

Fall Term—1st Oct. to 22nd Dec.
Winter Term—5th Jan. to 31st Mar.
Spring Term—16th April to 30th June.
} Lectures half-day and work half-day, alternately.
Summer Term—1st July to 31st Aug.—Work all day on "Experimental Farm."

Special Students.

Fall Term—1st October to 22nd December.
Winter Term—5th January to 31st March.
} Lectures six hours a day.
Spring Term—16th April to 30th June.
Summer Term—1st July to 31st August.
} Work at home on their own farms.

Last year we had eighteen young men in this course—eight first and ten second year men. They attended lectures, one half of the day, with the regular students of their own year; and the other half, when the regulars were employed outside, they (the specials) had lectures by themselves on the work of the Spring Term. Thus, by omitting the labour outside and giving the professors extra work inside, they were enabled, during the Fall and Winter Terms, to take not only the lectures of those terms, but also the lectures of the Spring Term as well. The "Special Time Table," in appendix 2, shows the lectures delivered to the first and the second year specials on the work of the Spring Term. Time tables 1 and 2, in the same appendix, contain a list of the subjects which they took with the regular students in the Fall Term.

Easter Examinations.

The Easter Examinations always embrace the work of the Winter Session (1st Oct. to 1st April). Those of last year commenced on the 18th March and continued till the end of the month. The questions set on that occasion will be found in appendix 3. They are difficult enough to test the knowledge of the best students, but of such a character as to give every honest worker a fair chance to pass. The answers were carefully valued, and the candidates arranged in three classes according to the percentage of marks taken.

All below 33 per cent.....	"plucked."
33 per cent. to 49 per cent., inclusive.....	3rd class or passed.
50 " 74 " "	2nd class honours.
75 " 100 " "	1st class honours.

A complete record of all the candidates will be found in the class-lists (appendix 4)—not only those who passed or won honours, but also those who failed. A fair proportion got first-class honours in one or more subjects, and a few gained the high rank of first-class men in one or more of the five departments.

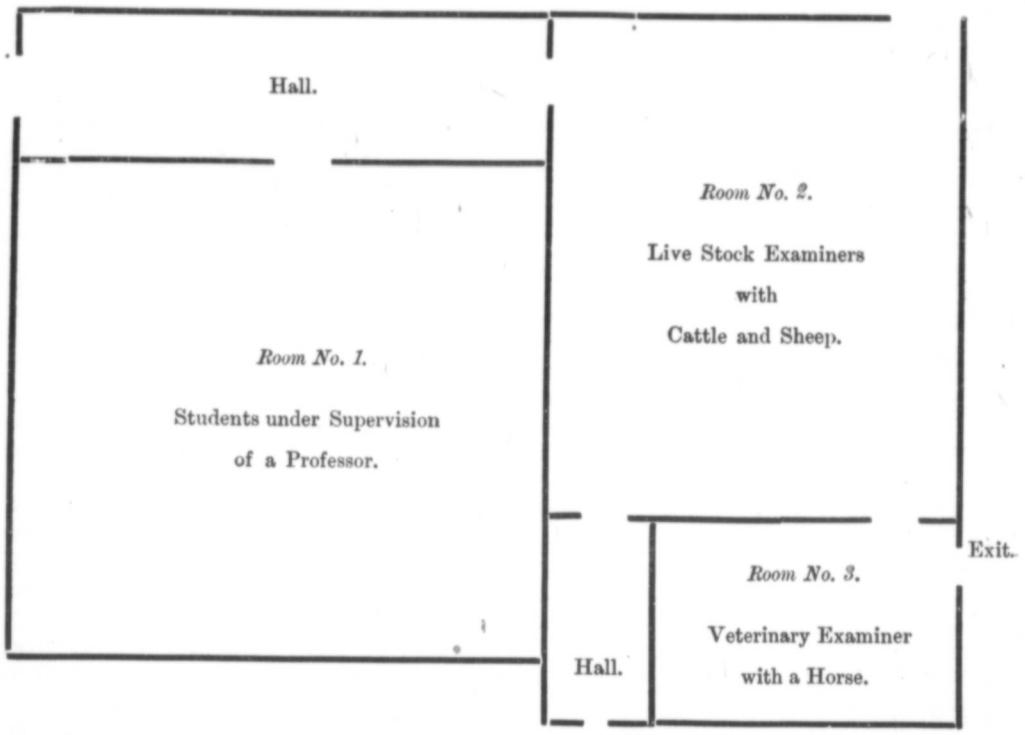
FIRST CLASS MEN IN THE DEPARTMENTS.

DEPARTMENTS.		FIRST YEAR.	DEPARTMENTS.		SECOND YEAR.
	Agriculture and Live Stock.	1. McArthur, J. 2. Stonehouse, M. 3. Shuttleworth, A. 4. Gibson, R.	I.	Agriculture and Live Stock.	1. Phin, R. J. 2. Motherwell, W. R. 3. Phin, W. E. 4. Ross, J. G. 5. Dickinson, C. S. 6. Leask, J. 7. Ballantyne, W. W.
II.	Natural Science.	1. McArthur, J. 2. Stover, J. W. 3. Barclay, E. H.	II.	Natural Science.	1. Phin, R. J. 2. Motherwell, W. R. 3. Phin, W. E. 4. Ross, J. G.
III.	Veterinary Science.	1. McArthur, J. 2. Jones, G. B.	III.	Veterinary Science.	1. Phin, R. J. 2. Phin, W. E. 3. Ross, J. G. 4. Newton, J. 5. Motherwell, W. R.
IV.	Eng. Lit. and Composition.	1. McArthur, J. 2. Barclay, E. H.	IV.	English Literature and Political Economy.	1. { Motherwell, W. R. { Ross, J. G. 3. Dickinson, C. S. 4. Phin, R. J. 5. Grindley, A. 6. Phin, W. E.
V.	Mathematics.	1. McArthur, J. 2. Bignell, E.	V.	Mathematics.	1. { Motherwell, W. R. { Ross, J. G. 3. Phin, R. J. 4. Ballantyne, W. W. 5. Phin, W. E.

LIVE STOCK ORAL EXAMINATION.

In my last report I called your attention to the fact that we had given the students a practical examination in the department of live stock. We did so, because we had discovered that it was possible for a young man to study books and copy notes of lectures till he could write very sensible answers to questions on any class of animals, and after all be utterly unable to describe or judge intelligently any particular specimen. The same plan was adopted last Easter. After the students had spent seven hours in writing answers to questions on agriculture and live stock, they were all subjected to an oral examination—the first year men on cattle and sheep, and the second year men on cattle, sheep and horses.

The animals to be handled and judged were taken into two rooms—cattle and sheep into one, and a horse into the other. The students were admitted one at a time; and when each had spent the allotted number of minutes in examining the animals and answering the questions, he passed out, and another took his place. The following diagram indicates the relative positions of the rooms used, and shows more clearly than words how the examination was conducted:



The class to be examined was sent early in the morning to room No. 1 in charge of a professor. At the hour for commencing the examination, the first student went from No. 1 to No. 2, to meet the live stock examiners. When through with them, he went to No. 3, to examine and judge an unsound horse; and from No. 3 he passed out of the building, to be succeeded by another.

The time occupied was four days; and although the work was tedious and fatiguing to the examiners, the results were quite satisfactory. The experience of 1880 bore excellent fruit in 1881. The candidates were better prepared, and the answers were much more prompt and intelligent.

PRIZE LIST.

Easter Examination, March, 1881.

First Year.

Agriculture.—1. McArthur, J. 2. Stonehouse, M.
Natural Science.—1. McArthur, J. 2. Stover, J. W.
Veterinary Science.—1. McArthur, J. 2. Jones, G. B.
English Literature.—1. McArthur, J. 2. Barclay, E. H.
Mathematics and Book-keeping.—1. McArthur, J. 2. Bignell, E.
General Proficiency.—1. McArthur, J. 2. Poe, J. P. 3. Stover, J. W.

Second Year.

Agriculture.—1. Phin, R. J. 2. Motherwell, W. R.
Natural Science.—1. Phin, R. J. 2. Motherwell, W. R.
Veterinary Science.—1. Phin, R. J. 2. Phin, W. E.
English Literature and Political Economy.—1. Motherwell, W. R., and Ross, J. G., (equal). 3. Dickinson, C. S.
Mathematics.—1. Motherwell, W. R., and Ross, J. G., (equal). 3. Phin, R. J.
General Proficiency.—1. Phin, R. J. 2. Motherwell, W. R. 3. Ross, J. G. 4. Phin, W. E. 5. Ballantyne, W. W. 6. Dickinson, C. S. 7. Grindley, A.

SPRING TERM.

16TH APRIL TO 30TH JUNE.

All the special students, and generally a few others, leave at Easter. Hence it has been found necessary to hold two Matriculation Examinations in the year; one on the 1st of October, and another on the 16th of April. To fill the places of those who left last Easter, thirty-four were admitted. They were examined on the 16th and 17th April; and lectures commenced on the 18th.

As the spring term affords special opportunities for practice 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 full charge of a farm —harnessing and driving horses, ploughing, sowing, harrowing, rolling, mowing with 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.

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, and samples of farm produce. 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; and hence they entered cheerfully and heartily into the work. So far all right; but the more earnest and anxious the students became, the more Professor Panton, our chemist, felt himself hampered by the want of accomodation and proper appliances in the little room which has been dignified with the name of "Laboratory." In systematic and economic botony 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 as far as possible by the gardener while the students were at work with him in the green-houses, 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-four lectures on the preparation, action and doses of about fifty kinds of medicine commonly used in veterinary practice; studied Goldsmith's "Deserted Village," and committed to memory the greater part of it; wrote familiar and business letters; began the study of mensuration; and continued that of book-keeping from the previous term. During the same time, the second year men took lectures on twenty-five or thirty additional 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 farm book-keeping; and went

twice a week into the fields with a master to apply what they had previously been taught under the heads of levelling, surveying, and drainage. The term closed with a six days' written examination on the class-room work and a practical examination on various operations in the outside departments.

The time had now arrived when it was necessary to decide who was entitled to the second silver medal which His Excellency the Governor-General had offered for competition among the students of the second year.

The Governor-General's Silver Medal.

The terms of competition were as follows:—

"1. All competitors must be second year students.

"2. They shall compete—

"(1) By a written examination at Easter on all the class-room work of the fall and winter terms.

"(2) By a similar written examination at the end of June on all the class-room work of the spring term.

"(3) By practical examinations at the above dates on cattle, sheep, pigs, horses, and the various operations taught or performed on the farm, in the garden or in the carpenter shop.

"3. The successful competitor must reach the required standard in the inside and the outside departments separately, that is, must make at least thirty-three per cent. of the marks in each subject, and an aggregate of not less than sixty-seven per cent. of the total number of marks in all the subjects prescribed for second year students."

One of the most difficult questions to solve in every progressive educational institution is how to conduct examinations so as to do full justice to all concerned. If students are examined by their own teachers or professors, however thoroughly and honestly the work is done, the public does not place full confidence in the results; and honours awarded by such examiners are apt to be discounted more or less to the disadvantage of the recipients. If, on the other hand, all examinations are conducted by outside parties, the work of education in the lecture-room is interfered with; for the lecturer must follow the examiner and teach to suit the examinations, or his lectures will be neglected. Hence it sometimes happens that an able lecturer—a man who thoroughly understands where to lay the stress in a course of study, is at the mercy of some tyro who wants to show the world what he knows about the mysteries of certain subjects. Of course this difficulty vanishes where none but thoroughly competent examiners are appointed.

Recognizing the evils and the benefits on the one side and on the other, I thought the best results would be secured by combining the two plans. Consequently I arranged so that the Easter examinations, on the work of the winter session, were conducted wholly by the professors of the College, and the June examinations, on the work of the summer session, almost entirely by outside examiners.. The marks obtained at these two examinations were added together, and the sum used to determine the standing in general proficiency. Not having funds to pay examiners for their work, I had to impose on the kindness and good nature of the following gentlemen, whose names are a sufficient guarantee throughout the Province that the results of the June examinations are thoroughly reliable:

Examiners of Second Year Students, June, 1881.

Agriculture	Professor Buckland, University of Toronto.
Live Stock	" " " "
Practical Handling and Judging of Cattle and Sheep	F. W. Stone, Guelph, and James Anderson, Puslinch.
Practical and Analytical Chemistry	P. H. Bryce, M.A., M.D., Guelph.
Systematic and Economic Botany	" " "

Veterinary Materia Medica .....Dr. Smith, Veterinary College, Toronto.
Practical Handling and Judging of Horses.. " " "
English Literature.....W. Tytler, B.A., Guelph.
Levelling and Surveying .....A. A. McTavish, 1st Class Prov. Certificate.
Ploughing .....James Anderson, Puslinch, and Evan McDonald, Guelph Township.
Mowing ..... .Prof. Brown and Evan McDonald.
Sowing by Hand ..... " "
Sheep Shearing .....Professor Brown.
Garden Operations .....James Forsyth.
Carpenter Work .....James McIntosh.

These gentlemen kindly gave us their assistance without any remuneration whatever; and for that assistance I beg to thank them on behalf of the students, the professors, and the Commissioner of Agriculture.

The competition for the medal was very keen. Four or five of the competitors were strong men; and although the summing up of all the figures indicated clearly who was entitled to the prize, the examiners felt that any one of the first five would have done honour even to a gold medal.

RANK OF COMPETITORS FOR MEDAL.

(1) Easter Examinations.	(2) June Examinations.	(3) June Examinations (Live Stock and Outside Work.)
1. Phin, R. J.	1. Ross.	1. Phin.
2. Motherwell, W. R.	2. Phin.	2. Motherwell.
3. Ross, J. G.	3. Motherwell.	3. Grindley.
4. Ballantyne, W. W.	4. Ballantyne.	4. Ross.
5. Grindley, A.	5. Grindley.	5. Ballantyne.

GENERAL PROFICIENCY INSIDE AND OUTSIDE EXAMINATIONS.

EASTER AND JUNE.

1. R. J. Phin, Hespeler, (Medallist).
2. W. R. Motherwell, County Lanark.
3. J. G. Ross, Montreal.
4. W. W. Ballantyne, Stratford.
5. A. Grindley, Montreal.

CLOSING EXERCISES.

PRESENTATION OF PRIZES AND MEDAL, GRANTING OF DIPLOMAS.

On the 30th day of June, a number of friends from Guelph and the surrounding neighbourhood met at the College to witness the closing exercises. Short addresses were delivered by James Innis, Editor of the *Guelph Mercury*; P. H. Bryce, M.A., Rev. Mr. Howie, Rev. Mr. Westmacott, and others. Several gentlemen took part in distributing the prizes which had been awarded on the results of the Easter examinations; and Prof[illegible] Buckland of Toronto University, on behalf of the Commissioner of Agriculture, presented the Governor-General's silver medal to R. J. Phin, a son of one of the leading farmers in the County of Waterloo.

The question of granting degrees, or diplomas, had been under consideration for some time; but no formal action was taken till last year. I am strongly opposed to giving degrees of any kind, unless to those who have passed through a somewhat extensive course of study, and are, in the proper sense of the word, *master* of all the subjects embraced in that course. I have no hesitancy in saying that the work at the Ontario Agricultural College is done as thoroughly as at any other institution in the country; but I do not think that the cause of agriculture would be helped, or our reputation improved, by granting degrees at the end of a two years' course. Hence I recommended the Commissioner not to make bachelors of agriculture, but to give a diploma admitting to the status of *associate of the College* every student who completes the course of study and passes satisfactorily all examinations on the subjects contained in the curriculum, and on the work of his apprenticeship. Such a diploma was prepared and granted to the successful candidates.

We determined at the outset not to cheapen the diploma by giving it to any who failed in the slightest degree to reach the standard fixed by our regulations. Hence, out of thirty-seven candidates, only nine were successful.

Associates of the Ontario Agricultural College.

Ballantyne, W. W.	Stratford, Ont.
Dickinson, C. S.	England.
Grindley, A. W	Montreal.
Motherwell, W. R.	County of Lanark.
Phin, R. J.	Hespeler, Co. of Waterloo.
Phin, W. E.	" " "
Pope, Herbert	County of Grey, Ont.
Ross, James G.	Montreal.
Robins, W. P.	"

VISITORS.

Members of Parliament.

In the month of February last, the Hon. S. C. Wood, Commissioner of Agriculture, and about forty other members of Parliament paid us a visit. On their arrival at Guelph they were met by the President of the College, the aldermen of the city, and the representatives of the press. The whole company at once proceeded to the College, where they were welcomed by the officers of the institution. The members of the House having come, not merely for pleasure, but in order to acquaint themselves practically with the *modus operandi* of the College, and see what use is being made of the money which they vote us from year to year, proceeded at once to the work of inspection. They examined the class-rooms, reading-room, library, dormitories, and gymnasium, but seemed to enjoy most of all their visit to the new dining-hall. After dinner, and a few words of encouragement from the Commissioner of Agriculture, Mr. Lauder, and others, some time was spent in examining the green-houses, barns, and live stock of the farm. It was then about three o'clock, and the party returned to the City of Guelph. I may say, in a word, that the visit was a very pleasant one, and I have no doubt it will be productive of much good.

Cornell Students and Others.

On the 17th and 18th May, we were favoured with a very pleasant visit from Professor Roberts, of Cornell University, who has charge of the department of Agriculture in that institution. He was accompanied by his wife, daughter, and fifteen of his students, and came for the purpose of making a thorough inspection of our College and mode of working. When that object was accomplished we drove them to see the well known herds of Messrs. Stone, Rudd, Watt, Armstrong, and Hunter, in this county, after which they started for Bow Park, professing themselves well-pleased and much profited by what they had seen and heard.

Nearly a month later we had Mr. Goold, Secretary of the Connecticut State Board of Agriculture, and a Mr. Olcott, who were sent as a committee to investigate our system, and report to the Legislature of their State. They did their work in a day and a half, and the result of their report is that the State of Connecticut has established an agricultural college which more closely resembles ours than any other institution at present in existence.

Farmers.

I think I am correct in saying, as I did last year, that many erroneous notions about the College are still entertained by a large number of farmers; and one is that regarding their relation to the maintenance of the institution. They are quite willing that the Government should vote hundreds of thousands for the support of asylums, prisons, and reformatories; and they do not seem to inquire very closely whether the money voted for such institutions is properly expended or not. But every dollar spent on the Ontario Agricultural College and Experimental Farm they regard as a direct addition to their taxes; and hence some of them oppose the whole concern, altogether irrespective of what it does or leaves undone. They are surprised and incredulous when told that it has not affected their taxes to the amount of one cent in the last five years, and that they would not pay a farthing less, if it were blotted out of existence to-morrow. Gradually, however, the idea is gaining ground that the interest of the country at large, and especially of the farming community, is, not to destroy or injure the College, but to correct what needs correction and make it thoroughly efficient in every respect. Personally, I have no objection whatever to the keenest criticism. If we were not well watched and closely criticised we might grow careless. The Farm was purchased and the College established to promote the interests of Agriculture and Stock-raising in the Province. Therefore, farmers, more than any other class, have a right to visit the institution, inquire into its working, criticise, and make suggestions from time to time. Those who have done so are generally our best friends. Mistakes have been corrected and prejudices removed.

On the 21st, 22nd, and 27th, June, we had seven large excursions of farmers, chiefly from the counties of Middlesex, Oxford, Wentworth, Simcoe, and Grey, under the auspices of the Northern Fair Association, Norwich Agricultural Society, South Simcoe E. D. and Essa Branch Agricultural Society, and the Grange organizations of Grey, Simcoe, and Wentworth.

The time of the excursionists was occupied in examining the College, the farm, the live stock, the garden and the experimental plots. Some found fault and others professed to be well pleased; but all agreed in urging that the Government should support the institution liberally, and make it as efficient as possible. Short addresses were delivered by leading agriculturists, and a resolution passed at the close of each day's proceedings.

North Middlesex Agricultural Society.

(Resolution.)

"At a meeting of the Executive Committee of the Northern Fair, held on Monday 11th July, 1881, it was unanimously resolved:—

"1. That the thanks of the North Middlesex Agricultural Society be and are hereby tendered to James Mills, Esq., M.A., the President of, and Professor W. Brown, the Manager of the Model Farm, for the courtesy shown by Messrs. Mills and Brown to the members of this Society and their friends upon the occasion of this Society's excursion to Guelph on June 21st, 1881, and more especially for their very lucid and patient explanations of the experiments heretofore conducted at the Model Farm, both in stock and in crops.

"2. That as an agricultural society, we do heartily endorse the course pursued at the Model Farm, not only in agricultural and breeding experiments, but as an agricultural training school of great benefit and utility to the future welfare of this Province.

"(Signed) A. A. McArthur,
"*President.*
"E. B. Smith,
"*Secretary of the North Middlesex Agricultural Society.*"

Grey Division Grange.

(Resolution.)

"Mr. A. Gifford, Secretary of 'Grey Division Grange,' rose to move a resolution, and in doing so gave his reasons. He had always felt a great interest in the Agricultural College, because he thought the education of farmers' sons should be obtained in such a way that they would not be withdrawn from the pursuit of farming, and because he had observed that the teaching and course of study in our High Schools, as a general rule, imbued young men with desires to leave the farm and enter some of the over-crowded professions. He held views perhaps more radical than the Principal, in regard to the subjects which should be taught in the College. He thought it was necessary to have several other branches in addition to English and the purely technical subjects which make up the course of study; and he hoped to see the day when the institution would not only be chartered but endowed, and have power to grant degrees in agriculture. He had great pleasure in moving 'that the thanks of those present be tendered to the managers for their attention and cordiality, and for raising the institution to the level which it now occupies,' and he expressed the hope that they would endeavour to raise it to a higher level every year. Mr. Joseph Goodfellow seconded the resolution, which was unanimously carried."

South Simcoe E. D. and Essa Branch Agricultural Society.

(Resolution.)

The following resolution was moved by C. Cooke, Treasurer, seconded by John Ross, President, and carried:—

"That we, the officers and directors of the South Simcoe E. D. and Essa Branch Agricultural Society, beg to tender our sincere thanks to Messrs. Mills and Brown, managers of the Ontario Agricultural College and Experimental Farm, for the very courteous manner in which we have been received and entertained by them on the present occasion of our first excursion to this institution, and our high appreciation of the very systematic and orderly manner in which the said institution is conducted, and which we believe is a credit to Ontario, and must eventually be productive of much good to the farming community."

The Wentworth Division Grange also passed a resolution of thanks to the officers; but as it expresses no opinion regarding the College or Farm, I shall not trouble you by repeating it. The other resolutions are quoted in order to show our readers and legislators that many of the farmers are beginning to take an interest in the College, and to urge the importance of making it thoroughly efficient in every department.

SUMMER TERM.

1st July to 31st August.

At the close of the spring term (30th June), when the year's lectures were over, several of the farmers' sons returned home to work on their own, or their fathers' farms in haying and harvest. Sixty-five remained with us, working nine and a half hours a day in the summer term (July and August). As at all other times, they were sent in rotation to the several departments, giving, of course, the largest share of their time where it was most needed, *i.e.*, on the farm. I shall not weary you with a detailed account of the routine in each department, but simply say that the young men received instruction in the fields, the yards, the gardens, and the shop. They spend a portion of their time in a special class for the purpose, learning how to dig, plough, harrow, sow, shear sheep, mow, cradle, drive a reaper, bind, shock, and such like; and did all there is to do in the summer months, on a four hundred acre grain and stock farm, and in the management of a large vegetable garden, flower garden, orchard, and lawn.

Harvest Home.

The term closed on the 26th August, with the Annual Athletic Sports and Harvest Home Procession. For several weeks previous, the young men occupied their evenings on the College campus in walking, running, jumping, putting the stone, and other exercises which tend to give character and muscle to a nation. Professor Philp's excellent band was employed to furnish music; and not less than a thousand visitors were present to witness the games. The weather was favourable; everything passed off pleasantly, and all seemed well-pleased with the entertainment furnished by the various tests of strength and speed. After the games came the Harvest Home Procession around the College grounds, and the presentation of the prizes by Mrs. Mills and Donald Guthrie, M.P. Thus terminated the scholastic year 1880-81.

FALL TERM.

(Scholastic Year, 1881-82.)

1st October to 22nd December.

The fall term opened on the 1st October with the full complement of students. Every vacancy was filled, and some parts of the building crowded, in order to meet the wishes of a number who made very earnest appeals for admission when it was almost too late. Eighty-two old students returned, and forty-seven new ones were admitted. Of the latter number, one is a graduate of a University, one an undergraduate, and twenty are students of High Schools; so that only twenty-five out of the forty-seven had to pass our matriculation examination.

The names of those now in attendance will be found in the second part of appendix 1.

The following lists show where they came from, and the religious denominations to which they belong:—

Counties, etc.	Students.	Counties, etc.	Students.
Bermuda	1	Montreal City	3
Brant	4	Middlesex	2
Bruce	2	Nova Scotia	6
Carleton	6	New Brunswick	3
Durham	1	Norfolk	2
England	8	Ottawa City	7
Elgin	5	Oxford	8
Frontenac	3	Ontario	1
Grey	4	Peel	2
Guelph City	1	Peterboro'	1
Glengarry	2	Perth	3
Hamilton City	2	Quebec	5
Haldimand	2	Scotland	2
Huron	3	Simcoe	5
Halton	1	Toronto City	2
Kingston City	2	Victoria	1
London City	1	Waterloo	2
Lincoln	3	Wales	2
Leeds	2	Wellington	5
Lambton	2	Wentworth	3
Lanark	2	York	8

Total number in attendance during fall term 129
Number of Ontario counties represented 28

RELIGIOUS DENOMINATIONS.

Episcopalians	50
Presbyterians	39
Canada Methodists	17
Canada Baptists	3
Plymouth Brethren	3
Lutherans	2
Roman Catholics	2
Primitive Methodists	1
Episcopal Methodists	1
Quakers	1
Jews	1
Unitarians	1
Universalists	1
Swedenborgians	1
Total	129

We admit students at the age of fifteen years, but experience has convinced us that the standard should be raised to sixteen or seventeen. At present the range is from fifteen to twenty-five—one at fifteen, three at twenty-two, five at twenty-three, two at twenty-four, and one at twenty-five; leaving one hundred and seventeen between the ages of sixteen and twenty-one. The majority are seventeen, eighteen, or nineteen. The following table gives the exact numbers at the different ages:—

AGES OF STUDENTS AT THE ONTARIO AGRICULTURAL COLLEGE IN THE FALL TERM OF 1881.

1	at the age of	15	years.
17	" "	16	"
28	" "	17	"
25	" "	18	"
28	" "	19	"
13	" "	20	"
6	" "	21	"
3	" "	22	"
5	" "	23	"
2	" "	24	"
1	" "	25	"

Total— 129; average age, 19 years.

The time tables in appendix 2 indicate the subjects which are taken up in the fall term, and the number of hours allotted to each. Lectures commenced on Tuesday, the 4th October, and continued without interruption till the 17th December.

The first-year students received two lectures a week on the characteristic points and peculiarities of the different breeds of cattle; had a full course with experiments on chemical physics and inorganic chemistry; commenced the subject of zoology, and spent some time in studying the anatomy and physiology of the horse. Under the head of English and mathematics, they read Goldsmith's "Deserted Village," wrote compositions once a week, 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 pasture 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 several lectures 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. Grange; they also read Shakspeare's "Julius Cæsar," and devoted some time to the study of applied statics, levelling, surveying, and drainage.

Terminal Examinations, December, 1881.

The regular examinations on the term's work commenced on the 17th, and ended on the 21st December. The questions were not particularly difficult; but having now decided to give every successful candidate a diploma at the end of the course, we exercised the utmost diligence to prevent the use of any illegitimate help, and examined the answers with the determination not to pass any who failed to reach the required standard. Thirty-two first-year, and seventeen second-year men passed in all the subjects of the examination. A number of others took a high stand in certain subjects which they liked, but failed in one or more which they disliked. The honour-list, and the names of the successful candidates having been published in the newspapers, I shall not introduce them here; I may, however, give a fuller outline of the work covered by the examinations:—

Outline of Class-room Work.

fall term.

FIRST YEAR.

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; model 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 subjects; elementary and compound substances; chemical affinity; symbols; nomenclature; combining proportions by weight and by volume; atomic theory; atomicity of the most important elements; 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 the 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, etc.

Zoology.—Nature of life; vital force; difference between animals and plants; morphology and physiology; homology and analogy; definition of species; classification; subdivisions of the animal kingdom; characters of the sub-kingdoms, classes, and most important orders; special study of *vermes.*

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.—Impromptu exercises once a week.

English Classics.—Committing to memory, and critical study of Goldsmith's "Deserted Village."

Department 5.—Mathematics.

Arithmetic.—Review of subject, with special reference to farm accounts; tables of weights and measures discussed; interest, discount, stocks and partnership.

Mental Arithmetic.—Calculations in simple rules, fractions and compound rules.

SECOND YEAR.

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.

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.

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

AGRICULTURAL COLLEGE,

GUELPH, ONT.

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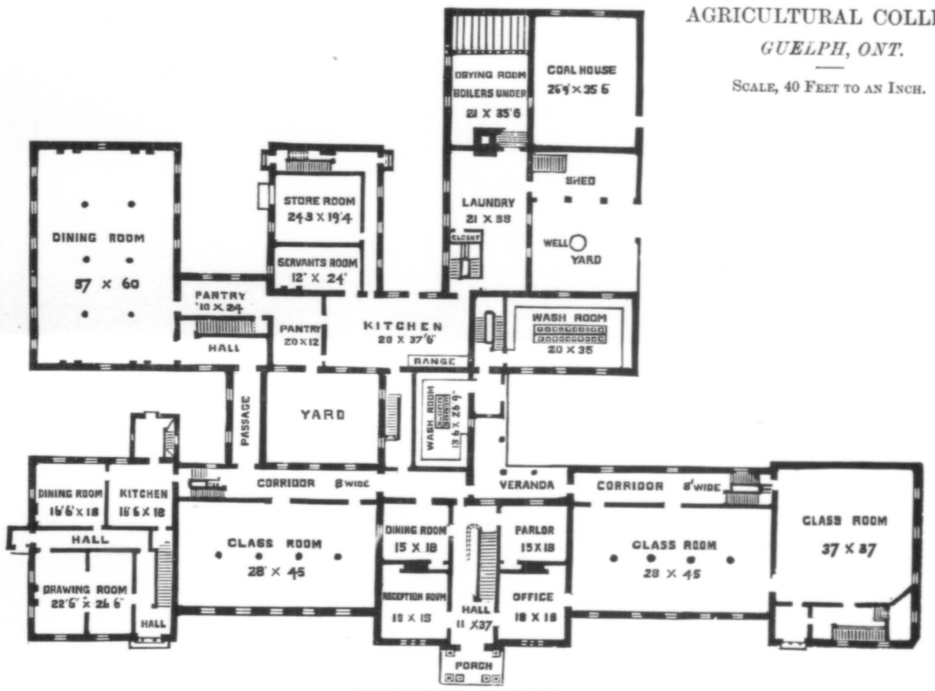

GROUND FLOOR PLAN.

AGRICULTURAL COLLEGE,

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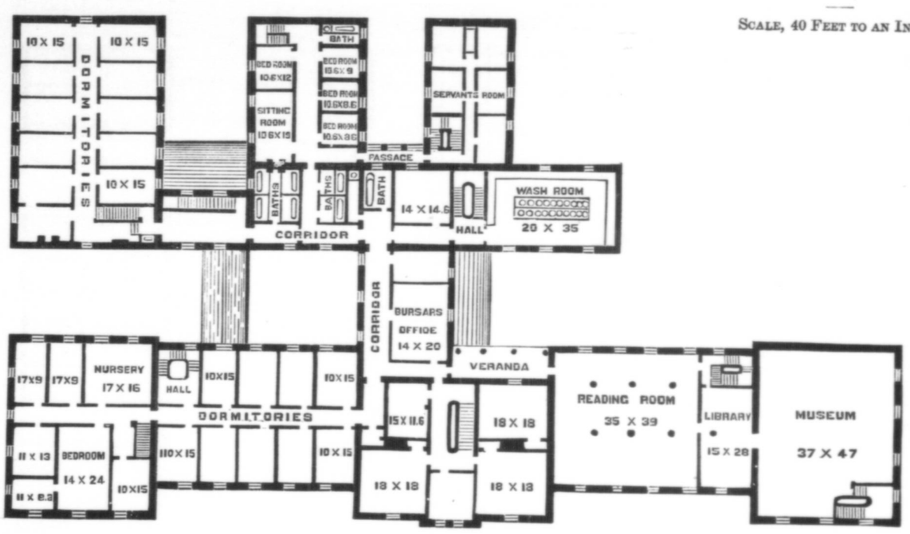

FIRST FLOOR PLAN.

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GUELPH, ONT.

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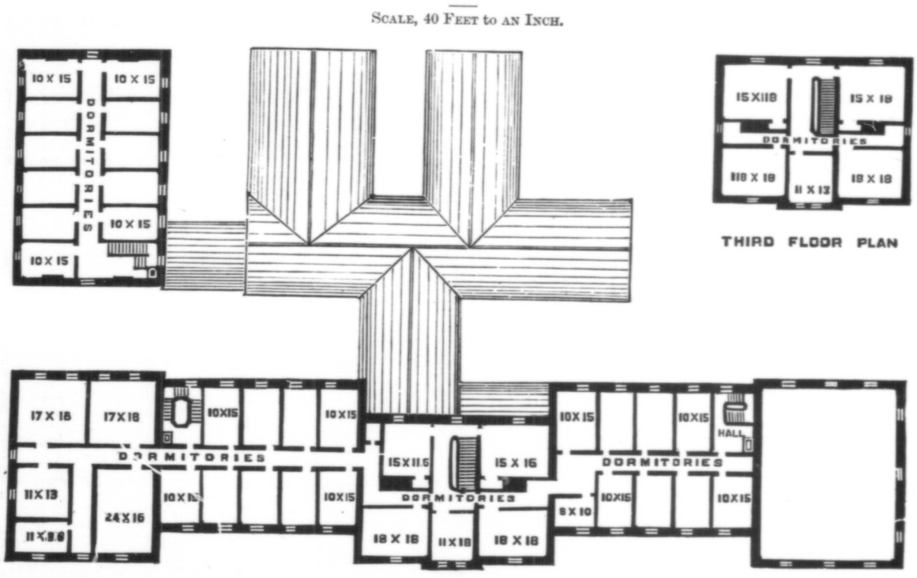

SECOND FLOOR PLAN.

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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.

Department 3.—Veterinary Science.

Veterinary 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 Literature.

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

Department 5.—Mathematics.

Mental Arithmetic.—Calculations in reduction, fractions, and analysis.

Statics.—Forces; the mechanical powers; friction; the steam-engine; strength of materials; units of work, etc.

Levelling and Draining.—General principles; discharging water ways; how, where and when to commence draining; depth of drains and distance apart; furrow drains; draining followed by other improvements; drainage implements, etc.

II.—THE BOARDING HOUSE AND COLLEGE BUILDINGS.

For the information of those who have not seen the College buildings, I shall quote a paragraph from my last report, and refer to the description prepared by the Government architect last year:

College Building.

"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 exactly, but the cost seemed too great and the country was not prepared for it, consequently it was decided seven 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, the building which you see outlined and described by the Government architect in Appendix 6—altogether different from what was originally intended; and though it is not what we would like, it nevertheless affords considerable accommodation, and serves the purpose very 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, two offices, a public reception-room, sixty-two students' dormitories, a large dining-hall, a servants' dining-room, a store-room, pantry, kitchen, scullery, laundry, drying-room, eight bath-rooms, nine bed-rooms for servants, the messenger's room, a parlor and bed-room for the Matron, a sitting-room and bed-room for the Assistant Resident Master, nine rooms in the left wing occupied as a dwelling house by the Professor of Agriculture, six rooms in the centre occupied by the President and his family, three wash-rooms, an engine-room and a coal-house. The size, position, and use of each

room can be better understood from an examination of the plans above referred to than from a verbal description. Hence I shall not attempt anything more elaborate under this head."

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 discharged faithfully and very efficiently the many and arduous duties of her department. The Assistant Resident Master has taken charge of the students at meals and assisted me in looking after them in the halls and dormitories. Altogether, the work has been done satisfactorily.

Daily Routine.

In regard to the surroundings of our students in the college, and the duties required of them, I may say that their bed-rooms are furnished with beds, bedding, bureaus, mirrors, wash-stands, 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 a quarter to six, make their beds and put their rooms in order. At half-past six they go to breakfast; and at seven 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 class-room. Both divisions then 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 to 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; all 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.

Where you have one hundred and thirty young men full of animal spirits boarding and lodging in the same building, it is by no means easy to maintain proper discipline. It is indeed a very difficult task, and one which imposes on those who are responsible, a load of care and anxiety from which there is no escape night or day. It requires kindness, firmness, tact, constant vigilance, and sometimes stern severity.

The conduct of our students is, generally speaking, good. Some, of course, do not work so well as they should, and a few are both idle and troublesome; but the great majority are quiet, industrious, and well-behaved young men. Whenever I find one persistently idle and mischievous, or vicious, I send him home, because my experience is that such boys almost invariably get worse instead of better, where they have so many

companions. Since my last report was written, I have found it necessary to dismiss twelve—one for idleness and disobedience, one for violation of rules and insulting impertinence, one for idleness and swearing, one for repeated insolence and disrespect to officers, and eight for persistent idleness, constant violation of rules, and bad conduct generally. I may say that very few of the number had the slightest intention of doing anything when they came to the college. Their influence was bad from the first, and I bore too long with them ; but at last I decided to make a thorough cleaning out. I did so, and since that time we have had honest work and little or no trouble.

III.—THE BUSINESS DEPARTMENT.

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

Correspondence.

The correspondence does not vary much in character from year to year, except that it requires more attention as the institution grows. It 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. In 1881 I distributed 1,600 copies of our last Annual Report, sent out about 1,000 circulars, and wrote nearly 1,800 letters. A report was sent early in the year to every Agricultural College in Britain and the United States; soon after to every Grange in the Dominion, and, since that time, to every person who applied for a copy.

Books and Accounts.

The Bursar, 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 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 by the President or the Farm Superintendent, and passed by the Auditor. He also keeps three distinct sets of books—

No. 1, showing the monthly expenditure under each head of the appropriation for salaries, wages, and College expenses.

No. 2, giving in detail the revenue and expenditure of the outside departments under three heads—(1) the farm and carpenter shop, (2) the garden, (3) the experimental department.

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 si le is placed the cost of the board and washing for that month, obtained from the books of the store-room and the laundry. At the end of the session those sheets are bound together and make the day-book for that session." Two hundred and seventeen such accounts were opened in the year 1881.

General Business.

In addition to his duties as book-keeper, the Bursar has to provide supplies for the boarding-house and take charge of the store-room. He is required to examine and weigh the meat and groceries as they are delivered, 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, takes charge of the College buildings generally, and is responsible not only for the managemgnt but for the discipline of the inside departments, as regards both officers and students.

In the month of June last, Mr. Thomas Johnston, who had held the office of Bursar for three or four years, was removed by death, and friends were left to mourn the loss of one of the truest and noblest young men that I have ever met. His intellect was vigorous, his memory strong, and his character without a stain. He was prompt, honourable, and scrupulously honest in all his dealings. His death was a real loss to the institution.

Mr. G. E. Thomas, of Toronto, was appointed Bursar soon after Mr. Johnston's death, and discharged the duties of the office very efficiently and satisfactorily till about the middle of October, when he became suddenly ill, and was so seriously affected in health and strength that he found it necessary to resign the position, and return to Toronto, where he is so well and favourably known.

Mr. Thomas was succeeded by Mr. A. T. Deacon, who is now doing his best to master the details of his varied duties. He finds the work and responsibility much heavier than he anticipated, but I have no doubt he will prove himself equal to the occasion.

Finances.

As the farm revenue and expenditure come under the report of my colleague, Professor Brown, I make no reference whatever to the one or the other in this statement. The financial tables in Appendix 5 are a summary of the College and boarding-house accounts for the past year. The first shows the expenditure; the second, the revenue; the third, the amount required for 1882; and the fourth, the College account with the Farm and Garden for 1881.

The sum of $20,030 was voted for maintenance last year, but it was on the supposition that the revenue would reach $8,500, so that the total amount which I was authorized to spend was $28,530. Fearing, however, that the revenue would fall short of the sum named, I thought it prudent not to incur any expenditure which could be avoided till near the end of the year, when I would be in a position to estimate more correctly the probabilities as to the amount of revenue; and the following statements show how unwise it would have been to have pursued any other course :—

Sum voted for maintenance in 1881	$20,030 00
Estimated revenue in 1881	8,500 00
	$28,530 00
Sum voted for maintenance in 1881	20,030 00
Actual revenue in 1881	7,384 16
	$27,414 16
Amount which the President was authorized to expend in 1881	28,530 00
Amount actually expended in 1881	27,573 62
Balance	$956 38

Table No. 2 is a brief statement of the College revenue for the year 1881, amounting to $7,384.16, and composed of the following items :—

Tuition fees	$3,522 75
Fees for Supplemental Examinations	64 00
Balances on board accounts	3,742 41
Other sources (*see* Table No. 2)	55 00
Total College Revenue in 1881	$7,384 16

This amount subtracted from the expenditure shows the net cost of the institution for the last twelve months:

Gross expenditure in 1881	$27,573 62
Revenue in 1881	7,384 16
Net expenditure in 1881	$20,189 46

Nearly two-thirds of the College expenditure is for the board, washing, and lodging of students. The amount expended under that head last year was not far from $17,000. Of course we charge for board and washing, but the allowances for labour in the outside departments are deducted from these charges. The Farm Superintendent, with the help of his foremen, decides what each student is to get for his work, and that amount, whatever it may be, is deducted from his board bill. The more each is allowed outside, the less he has to pay inside. Thus the Farm controls the College revenue; and, therefore, it is quite impossible for me or anyone else to say what the revenue for 1882 will be. The amount allowed for students' labour last year was $5,202.61. If this were added to our revenue, the net expenditure for the year would be reduced to $14,986.85, thus :—

Gross expenditure in 1881		$27,573 62
Revenue in 1881	$7,384 16	
Paid for students' labour on Farm	5,202 61	
		12,586 77
Balance		$14,986 85

Item VI. in Table No. 1 is an unforeseen expenditure which I could not well avoid. As the number of students increased, the requests for herd-books, cyclopædias, books on agriculture, etc., became so numerous and frequent that I could scarcely refrain from doing something; and not having any vote for the library, all I could do was to draw on the appropriation for other purposes in order to meet the demand for books. This is my explanation of the $356.53 found under the head referred to. The item of $2,000.03, at the end of the same table, was expended in purchasing furniture and furnishings for the dormitories constructed last year.

In the right-hand column of Table 3 will be found the estimated expenditure for the year 1882. The amount asked for the expenses of the boarding-house is the same as was voted last year, but there is a small increase in "Salaries and Wages," most of which is accounted for as follows :—

During the last year of Mr. Johnston's incumbency, and the first of mine, the task of looking after the students at night, so as to secure order and attention to studies, was performed by the President, the Assistant Resident Master, and the Professor of Chemistry; but a new wing was added to the building, the centre portion was raised another story, a separate three-story building was erected in the rear, the number of students was nearly doubled, and the Professor of Chemistry moved down town. The result was that the duties of the President and his Assistant were very much increased. The old wing had to be looked after as before, and the work of lecturing was no less, while the new wing to the south, the new story in the centre, and the new building in the rear, had to be kept under control—all with less help than was employed when everything

was centred in one wing. In a word, the duties were increased by one-half and the help diminished by one-third. I took charge four nights out of seven, and my Assistant, Mr. Mactavish, three nights, till about eleven o'clock. At length, after a year and a half, Mr. Mactavish resigned his position, because the salary paid him was altogether out of proportion to the work required of the Assistant Resident Master. Mr. Wm. Nattress took Mr. Mactavish's place, and J. P. McMurrich, B.A., was appointed about the middle of November to assist in the night work and take charge of the department of Horticulture. Hence the chief item of increase under the head of "Salaries and Wages."

Miscellaneous Items.

Progress during the Year.

Having spoken of the year's operations as a whole, and of each term separately under the three heads laid down at the outset, it may not be amiss to devote a few lines to stock-taking—to note the steps in advance, if any, during the past year.

So far as I can judge, we have held our own at every point, and are able to report progress under several heads. A Museum has been opened; large additions have been made to the Library; an Anemometer has been put up, and observations taken three times a day instead of twice, as formerly; pipes have been laid from the city water-works to the College; and a Professor of Horticulture has been appointed. So that in future the College, lawn, greenhouses, and farm-buildings will have an abundant supply of water at all times; the department of Horticulture will receive due attention; and, as shown by Professor Panton's report in the second part of this volume, the meteorological observations will be of practical value in settling climatic and kindred questions. On the whole, I think we are much better equipped for our work than we were a year ago; but, after all, we are utterly unable to meet the demands for instruction in Agriculture throughout the Province; and this leads me to repeat the substance of what I have several times urged from the public platform on the question of

Agriculture in our Public Schools.

1st. That the elementary principles of Agriculture should be taught in all our rural Public Schools.

2nd. That not more than two High Schools or Collegiate Institutes should be maintained in any county, and not more than one in each of the smaller counties in which there are no cities or large towns.

3rd. That the money now spent in supporting unnecessary, struggling, and rival High Schools in almost every county should be employed to establish and maintain an agricultural school in each of the thirteen agricultural districts of the Province, to be open during the fall and winter months, if not the whole year, for the purpose of giving farmers' sons, and others who intend to follow farming, instruction in geology and physical geography as related to agriculture; chemistry, agriculture, botany, forestry, and fruit culture; reading from agricultural books and papers, writing, spelling, and arithmetic; English grammar, literature, and composition, with special lectures on the characteristic points and management of the most important breeds of horses, cattle, sheep, and pigs.

Then our system of education would be complete, would make full provision for every class, and would not, as it now does, tend to draw our farmers' sons from the farm into the overcrowded trades and professions. For those who should decide to be farmers the full course would be the Public School, the District Agricultural School, and the Agricultural College; and for all others the Public School, the High School, and the University.

Library and Reading-Room.

We have a nice, cheerful Reading-room, and a commodious Library. The former is exactly suited to our wants; the latter is not quite large enough.

When the members of the Legislative Assembly visited us last winter they were so much impressed with our need of books that some of them brought the matter before the House a few days after, and the result was that over 3,000 volumes of choice reading were transferred from the library of the Education Office to the bare shelves of this institution. Since that time we have been able to boast of a very handsome library—not extensive, but well selected. It now contains 3,639 volumes of reports, herd-books, books of reference, and general reading.

We have also 42 papers and magazines on file in the Reading-room—six sent free by the kindness and generosity of the publishers, 31 furnished by the College, and five by the Literary Society.

Papers and Magazines.

(a) Sent Free.

Journal of Commerce (Montreal).
Journal of Agriculture (Montreal).
Canadian Entomologist (London).
Land Agents' Record (England).
Maritime Sentinel.
Monthly Weather Review (Toronto).—6.

(b) Furnished by the College.

Daily Globe.
Daily Mail.
Weekly Globe.
Weekly Mail.
Guelph Mercury.
Guelph Herald.
Canadian Farmer and Grange Record.
Farmer's Advocate.
Rural Canadian.
Canadian Monthly.
Grip.
Canadian Lumberman.
North British Agriculturist.
Irish Farmer's Gazette.
Mark Lane Express.
National Live-Stock Journal.
Scientific American.
Scientific American Supplement.
Boston Journal of Chemistry.
American Agriculturist.
Cultivator and Country Gentleman.
Country Gentleman's Magazine.
Gardener's Monthly.
Veterinarian.
Veterinary Journal.
Aberdeen Free Press.
Good Words.
Sunday Magazine.
Quiver.
Sunday at Home.
Leisure Hour.—31.

(c) Furnished by the Literary Society.

Canadian Illustrated News.
London Graphic.
Illustrated London News.
Harper's Weekly.
Scientific News.—5.

Books in Library.

	Vols.
Agriculture	421
Botany	50
Biography	280
Chemistry	86
Education	67
Entomology	26
Encyclopædias	35
Fiction	125
General Science	150
Horticulture	88
History	378
Literature	50
Meteorology	15
Mechanics	40
Miscellaneous	342
Magazines	726
Poetry	112
Religious	175
Reports	188
Travels	125
Veterinary Science	66
Zoology	80
	3639

Rules and Regulations.

1. Students are particularly cautioned against the following offences:
   (1) Loud conversation or other disturbance in the Reading-room.
   (2) Marking, defacing, or in any other way damaging the walls, furniture, etc., of the Reading-room.
   (3) Cutting from papers, magazines, etc.
2. Occupants of the Reading-room are specially requested to report the names of all persons found violating Rule No. 1.
3. Books may be obtained or exchanged any day (Sundays excepted) between 1 and 2 o'clock p.m.
4. No student is allowed to have more than one book from the Library at the same time.
5. No person shall retain a book longer than one week; but he may retake any book, unless another has registered his name for it.
6. Students are responsible for books while their tickets are uncancelled.
7. All books must be returned to the Library on or before the last Saturday in each term.
8. Students who violate any of these rules are punishable by fine or suspension.

Form of Card deposited when a Book is taken out.

ONTARIO AGRICULTURAL COLLEGE LIBRARY.

No.	Title of the Work.

Date.....*188*

.....*Signature.*

Books Read in Four Months.

	July.	August.	October.	November.	Total.
Agriculture	22	25	102	130	279
Natural Science	5	6	56	95	162
Veterinary Science	4	9	19	45	77
English	11	10	37	49	107
Mathematics	2	1	..	9	12
Miscellaneous	62	90	16	140	308
	106	141	230	468	945

Museum.

The first effective effort for the establishment of a Museum in connection with the College was made some time last June. The large class-room, 50 feet long by 40 feet wide, in the south end of the main building, was set apart for the purpose. We spent no money on cases or furniture of any kind, but simply removed the old desks, and placed in the room a number of things which had been lying about, or packed out of sight for months—natural history specimens, varieties of wood, samples of grain, casts of animals, models of agricultural implements, a herbarium, and a large number of maps and charts

of different kinds. We have made a beginning, and if the Government will only vote the money necessary to fit up the room and construct a gallery around it, the professors and students will do their best to make the collection a credit to the institution.

Gymnasium.

In my last Report I had the pleasure of referring to the fact that Captain McCrae, of Guelph, had presented the College with about $200 worth of an outfit for a gymnasium, consisting of a horizontal bar, parallel bars, bar-bells, dumb-bells, Indian clubs, etc., etc. Since then we have added something to the list of articles, and Sergeant-Major Clarke, of the Wellington Field Battery, has given the young men regular and systematic training in all the less violent gymnastic exercises. Nothing in connection with the College is more thoroughly appreciated by the students; and I have to express my regret that the institution has not paid Mr. Clarke a dollar for his services during the last two years. I hope, therefore, that the small sum placed in my estimates for the year 1882 will be voted as a slight compensation to a very able and faithful instructor in a branch of education which no nation can afford to neglect.

Literary Society.

We have also a Literary Society in connection with the College, which meets every Friday evening, in one of the class-rooms, to practise declamation, read essays, and debate questions relating to agriculture, stock-raising, and other matters of special or general interest. The discussions are often quite spirited; and there is no doubt that the work done in the society is a valuable addition to the educational appliances of the institution. In the performance of such work the young men have an opportunity of measuring their strength and testing their armour before they set out in the warfare of life; they gradually learn to speak in public; their wits are sharpened, their reasoning powers developed, and their manners improved. The regular meetings of the Society are open to the members only; but once a year they give a literary and musical entertainment to their friends in Guelph. The only difficulty in connection with these entertainments and other public meetings at the College is that we have no room large enough to accommodate half of those who would like to come.

Salaries.

When making out my estimates under this head, I asked for an increase in two or three instances, and, in order to satisfy myself that I was justified in doing so, I wrote to Lansing, Michigan, for a statement of the salaries paid in the Michigan State Agricultural College. I received such a statement, and after looking it over, I could not help feeling that some of our officers have had reason to conclude that their work is not fully understood or appreciated. From that statement, as given below, you will see that the salaries paid in the Michigan Institution at the present time amount to $20,443 a year; and all we ask from Ontario is $12,100.

Total salaries paid in Michigan	$20,443
Total salaries asked in Ontario	12,100
Difference	$8,343
College salaries paid in Michigan	$18,163
College salaries asked in Ontario	8,600
Difference	$9,563

In regard to the Farm, I may say that we pay more attention to practical farming and experimenting than they do in Michigan, and hence the salaries under that head

amount to something more in Ontario than in Michigan; but no one will venture to say that we make a mistake in giving greater prominence to that department of our work.

In Michigan, the boarding-house and dining-hall are managed by a steward and his wife; and no member of the Staff is required to spend any portion of his evenings in looking after the students, the halls and the dormitories. In Ontario, no steward is employed. The President takes charge of the boarding-house, and is assisted by the Professor of Mathematics and the Professor of Horticulture in looking after the students in the halls and dormitories.

As might be expected, the night-work is a great bore to the professors above named, because it occupies their attention during the hours that other people have for rest, study or recreation; and, this being so, their salaries should certainly not be less than what is paid to first-class masters in our High Schools. I do not ask such salaries as are paid in Michigan, where there is no night duty, but only $1,000 and board for each. If my request be granted, the comparison will be as follows:

(1) Biology and Horticulture in Michigan Agricultural College	$3,600
Biology, Horticulture and night duty in Ontario Agricultural College	1,000
(2) Mathematics in Michigan Agricultural College	2,400
Mathematics, night duty, and charge of dining-hall in Ontario Agricultural College	1,000

In view of these facts, and others brought out in the following comparison, I think the salaries asked for our professors should be granted without modification.

MICHIGAN AGRICULTURAL COLLEGE, LANSING.

Salaries

(Paid at the present time).

(a) COLLEGE.

1. President, Professor of Mental Philosophy and Logic	$3,000	
2. Professor of English Literature	1,800	
3. Professor of Chemistry	1,800	$2,600
4. Assistant in Chemistry	800	
5. Professor of Zoology and Entomology, and Curator of Museum	1,800	$3,600
6. Professor of Botany and Horticulture and Curator of Museum	1,800	
7. Professor of Mathematics and Civil Engineering	1,800	$2,400
8. Assistant in Mathematics	600	
9. Lectures in Agriculture	720	
10. Secretary;	1,500	
11. Superintendent of Horticultural Department..	1,200	
12. Florist	743	
13. Steward in charge of boarding-house	600	
Total College Salaries	$18,163	

(b) FARM.

1. Professor of Agriculture and Farm Superintendent	$1,800
2. Farm Foreman	600
3. Vegetable Gardener	600
	$3,000
Less Lectures on Agriculture charged to College	720
Total Farm Salaries	$2,280

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

Salaries

(Asked for 1882).

(a) COLLEGE.

1. President, and Professor of English Literature, who takes full charge of boarding-house	$2,000
2. Professor of Chemistry, Geology and Meteorology, who acts as Librarian	1,500
3. Professor of Zoology, Entomology, Botany and Horticulture, who acts as Assistant Resident Master and Curator of Museum	1,000
4. Professor of Mathematics, who takes charge of dining-hall, and acts as Assistant Resident Master	1,000
5. Lectures on Agriculture and Arboriculture	800
6. Bursar and Storekeeper	800
7. Professor of Veterinary Science	1,000
8. Instructor in Drill and Gymnastics	150
9. Physician	400
Total College Salaries asked	$8,600

(b) FARM.

1. Professor of Agriculture and Farm Superintendent	$2,000
2. Farm Foreman	600
3. Foreman of Horticultural Department	600
4. Foreman of Mechanical "	600
5. Superintendent of Experiments	500
	$4,300
Less Lectures on Agriculture charged to College	800
Total Farm Salaries	$3,500

College salaries in Michigan	$18,163
Farm " "	2,280
Total	$20,443

College salaries asked in Ontario	.....	$8,600
Farm " "	.....	3,500
		$12,100
Cost of Professors' houses in Michigan	.....	$34,500
" " " Ontario	.....	3,500

Engineer, assistants, messenger, servants and boarding-house expenses not included in either statement.

Wants.

The items under this head are so numerous, that I scarcely know where to begin. We require many things, but especially the following :—

(1) A washing machine worked by steam in the laundry.

(2) Three or four steam-kettles, and a new range in the kitchen.

(3) A laboratory furnished with the apparatus necessary for making reliable analyses of soils, manures, and feeding-stuffs, and fitted up so that at least sixty young men could be simultaneously employed at practical work.

(4) Six Cottages—

One for the Farm Superintendent,
" " Professor of Chemistry,
" " Professor of Horticulture,
" " Bursar,
" " Farm Foreman,
" " Gardener.

(5) New green and propagating houses, with a class-room, a botanical laboratory, and a botanical museum attached.

(6) The museum fitted up and furnished with suitable show-cases.

(7) A hall for public meetings.

I have spoken so often and so strongly about our need of a laboratory, that I shall not trouble you with a repetition of the periodical appeal, but refer you to Professor Panton's Report on his visit to the experimental stations at New Haven and New Brunswick, U.S. From it you will learn how far we are behind in this matter.

At an institution of this kind there are many duties which cannot be attended to within the hours that a man in any ordinary office is expected to work. It is always so in connection with a farm, and emphatically so where a farm and a college are managed together. Hence it is important that all our officers should reside on the premises; and for that reason I beg to recommend that the houses above referred to be built at once.

We have no propagating houses worthy of the name, and our greenhouses are altogether behind the times. They are not only too small, but the heating apparatus is so defective that many of the plants are stunted in growth, and some of the best are destroyed every winter with smoke. A portion of the Farm has been allotted to the Fruit-Growers' Association for the purpose of experimenting with fruit and forest trees, and a Professor has been appointed to take charge of the Department, and publish the results from year to year. Therefore, I beg to urge the necessity for building suitable green and propagating houses without delay.

I have the honour to be, Sir,

Your obedient Servant,

JAMES MILLS,
President.

REPORT

OF THE

PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, *December 31st, 1881.*

To the President of Ontario Agricultural College:

DEAR SIR,—In accordance with your desire, I submit for your consideration a few observations made while on a visit this summer to the Agricultural Experiment Stations located at New Haven and New Brunswick, the former in the State of Connecticut, and the latter in New Jersey.

I also take this opportunity to make some suggestions in reference to the department over which I have the honour to preside.

The question of Agricultural Experiment Stations is one which has received a large amount of attention in Germany during the past twenty years. It is only since 1877 that such institutions have made their appearance in the United States.

The first established on this side the Atlantic is situate in New Haven, and well known as the Connecticut Agricultural Experiment Station.

It is not a matter of surprise that Connecticut has taken the lead in this work, when it is remembered that this is the home of Prof. Samuel Johnson, the distinguished Professor of Agricultural Chemistry in Yale College. As far back as 1867, Prof. Johnson had given to the public two books of great interest and wide circulation among students of agricultural science—"How Crops Grow," and "How Crops Feed." Since then, his name has always been associated with work which has had for its object the spread of scientific knowledge among farmers. The establishment of an Experiment Station at New Haven in 1877 may be considered as an outcome of his efforts on behalf of scientific agriculture.

The interesting Annual Reports of this Station, sent to us from time to time, and carefully read, led me to have a strong desire to visit New Haven during the College vacation this year, and make some inquiries regarding the work accomplished.

The work intended to be accomplished here is to analyze and test fertilizers, cattle-food, seeds, soils, waters, milk, and other agricultural materials and products; to identify grasses, weeds, useful and injurious insects, and to give information on the various subjects of agricultural science, for the use and advantage of the community. On the occasion of my visit I had the pleasure of meeting Dr. Jenkins, one of the chemists, who showed me every attention, and very kindly gave me whatever information I desired. Prof. Johnson, Director of the Station, was unfortunately absent at the time of my visit.

The chief work of the staff up to the present has been the analysis of fertilizers. In Connecticut a large quantity of artificial manures are used yearly. Before the establishment of this Station these were frequently adulterated, but since many exposures of fraud have been published in the bulletins of the Station, a higher grade of fertilizer is sold, and much has been done to check imposition on the farmers.

It is thought that less of this form of analysis will be required soon, and that the staff will be enabled to spend more time in the solution of problems connected with

agricultural science, and the work of the Station be more in harmony with that done at similar places in Germany. Some scientific investigations have been made, but by far the greater part of the time has been spent in making analyses of fertilizers, feeding-stuffs and soils.

The Experiment Station is a department by itself. None of the chemists do any teaching, their whole time being occupied in analytical work. The staff is as follows:

1. S. W. Johnson, M.A., Director, who, in addition to his salary as Professor of Agricultural Chemistry in Yale College, receives one thousand dollars annually.
2. E. H. Jenkins, Ph. D., Practical Chemist.
3. H. P. Armsby, Ph. D., " "

In addition to these, there are several assistants, who vary in number according to the work on hand. When it is considered how slowly the work of analysis proceeds, and the number required to be made here each year, it is not a matter of surprise that so many should be employed at this place. The following is a summary of the work done in 1880:

Analyses of Fertilizers	141
" Feeding-stuffs	17
" Waters	7
" Soils, etc	20
" Miscellaneous	23
Total	208

In addition to this work, considerable time has been devoted to the study of methods for determining the quantity of certain constituents in fertilizers, etc.

The amount required to carry on the work during 1880 was about $6,000, $4,000 of which was expended in salaries, and $1,100 in laboratory requirements. The continual increase of work, and the desire to further scientific investigation, has led the Director to urge strongly the necessity of increasing the grant for the enlargement of the laboratory outfit and the establishment of a working reference library.

The next place visited is known as the New Jersey Agricultural Experiment Station, located in New Brunswick, the site of the State Agricultural College.

This is comparatively new, only having been established last year, and modelled, in its workings, after that in Connecticut—although at the Agricultural College it is entirely separated from that institution.

The work so far has been much of the same character as that at New Haven, but the staff look forward to a time of more practical investigation.

It seems strange that so much analytical work is required in connection with fertilizers, but experience appears to show that the time spent and expense incurred have been well repaid by a great improvement in the quality of the fertilizers sold.

The staff here consists of—

1. G. H. Cook, LL.D., Director, Professor of Agriculture in Rutger's College.
2. A. T. Neale, Ph. D., Chemist; salary $2,000.
3. Two Assistants.
4. A Secretary, whose whole time is occupied in work connected with the Station.

I had the pleasure of meeting Dr. Neale, who seems thoroughly wrapped up in his work, and sanguine in the success of the Station. He kindly gave every attention to my inquiries, and furnished me with much information concerning the work at which he is engaged. This place expects to enter, ere long, upon a thoroughly scientific series of experiments into the most economical methods of using fodders. I look forward with considerable interest to the coming Annual Reports of this Station.

At present a sum not exceeding five thousand dollars is yearly appropriated by the Legislature for the current expenses of this Station.

Both Stations, you will perceive, are entirely separated from the Agricultural Colleges where they are located. This separation seems to be essential to success, for where a chemist has much analytical work to do, his whole time is required for it—none

can be given to teaching, unless it be in showing students, occasionally, some of the operations performed in laboratory work. The more I learned about the working of these Stations from persons engaged at them, the more I became convinced that if ever an Agricultural Experiment Station is established at the Ontario Agricultural College, it will require to be a department in itself—entirely separated from the College. From what has been written as the results of my inquiries, you will be able to learn what staff is required, the current expenses and the nature of the work performed, at what may be appropriately called an Agricultural Experiment Station.

I shall now proceed to make some observations concerning the Chemical Department of the College here. Two great barriers present themselves to the accomplishment of practical work in this Department—want of accommodation, and a want of time.

Practical Chemistry cannot be taught successfully unless the students perform the operations themselves. Situated as we are here, this becomes almost impossible. Our laboratory—which is really the private room of the Professor of Veterinary Science—is capable of accommodating not more than six students at work, while in some cases one class may consist of forty to fifty. When this happens, the nearest approach to giving them instruction is to perform the manipulation while they look on. This is very unsatisfactory indeed, and more than once I have found, on asking a student to perform some practical work, he was at a complete loss how to proceed, although the work had been done before the class on several occasions, thus showing how necessary it is to use the hands as well as the eyes in the operations of Chemistry.

To overcome this difficulty, we require a laboratory capable of accommodating forty to fifty students at practical work. This, I believe, should be situated at a short distance from the main building, and provided with a lecture room, an apparatus room, a work room, general store room and a private room, besides the room for practical work.

Of the different Colleges which I have had the pleasure of visiting during the past three years, none appears to possess a laboratory so well adapted for the work of an institution like ours as that at Lansing. This is said to have cost twelve thousand dollars, but I am quite sure that a building equally commodious could be built here for a much less sum. With such a laboratory, the study of Chemical Science would become extremely popular, and our students would finish their course thoroughly equipped in knowledge which is becoming absolutely necessary for farmers to possess in order to keep abreast of the times. Many of the ablest papers on Agricultural Science, by such men as Lawes, Gilbert, Voelcker and Johnson, are not understood by a large majority on account of their ignorance of science.

Supplied with accommodation, another desideratum presents itself, viz., time.

There is a want of time at the disposal of the Professor of Chemistry, and also a want of time in the College course. You are aware that at present, during the College term, my duties require seventeen hours a week in the lecture-room—four days of three hours each, and one of five. With such a task weekly before me, there appears but little hope of my ever being able to work in the laboratory beyond arranging for coming lectures. Were the lectures upon one subject, the work would be to some extent lightened, but, instead of that, a course of lectures on Meteorology, Geology, Systematic Botany, Entomology and Chemistry, are required from the Professor of Chemistry. Besides all this, the general management of the library has fallen to my lot. It is not surprising, therefore, that I feel the work too much for the proper teaching of Chemistry, and that assistance will be required in the department of science. When a new laboratory is erected, I believe we should have another chemist added to our staff, whose principal duty would be practical work, such as making analyses of fertilizers, etc. There is ample work for two chemists in our College, one having his energies chiefly devoted to the teaching of chemistry, the other to practical work. Equipped with a commodious laboratory, and a chemist regularly employed in it, we would have facilities something like what we see in colleges of a similar nature in the States, and to some extent we would be able to do much of the work we see done at Agricultural Experiment Stations.

In reference to the Department of Chemistry, I firmly believe another year should be added to our course. It can never be expected that a student coming here for the

short period of two years can graduate an adept in chemical science, when universities thoroughly equipped demand a much more lengthened period.

The improvements which I would suggest for your consideration in connection with the Department of Science may be summed up as follows:

1. Improved accommodation.
2. Additional help.
3. A more extended course.

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2. METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1881.

During the past year the Meteorological Department of our College has received quite an addition to its instruments from the Magnetic Observatory at Toronto. Hitherto our observations have been of a somewhat imperfect nature, by being taken only twice a day instead of three times. This year I have endeavoured to have them taken in such a manner that they may become of ultimate service in questions pertaining to the climate of this locality.

Observations are regularly taken at the hours of 7 a.m., 2 p.m. and 9 p.m. daily. These are recorded in a book printed for the purpose, which we hope to keep carefully, and hand over to those who, in time to come, may succeed us in this work. We are now supplied with the following instruments:—

Anenometer—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 stated intervals. This is read at 9 p.m.

Minimum thermometer—Indicating the lowest temperature between times of observation. This is also read at 9 p.m.

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 next year I purpose furnishing for publication a summary of the month's observations. From these monthly summaries a condensed statement of the year's meteorology will readily be made out. During the year there has been considerable difficulty experienced in carrying out arrangements concerning the observations, but at present the plan adopted is working satisfactorily.

In my course of lectures on Meteorology, 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 in this subject several instruments are placed before the students, and a question always put is, "Read the instruments before you." The outline of the lectures is found in your syllabus of the course on Meteorology.

I have under consideration at present a series of experiments for the purpose of ascertaining some facts in reference to the temperature of different soils exposed to similar conditions. These I hope ere long to be enabled to carry out and embody in some future Report.

FORM OF RECORD PUBLISHED DAILY IN THE GUELPH PAPERS.

WEATHER RECORD.

ONTARIO AGRICULTURAL COLLEGE,
..... 1881.

Normal height of barometer at Guelph (1,100 feet 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.

Anenometer—
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 observations taken during the year 1881 :—

January.

Atmospheric Pressure—

Highest barometer	17th, 9 p.m.,	29.376	inches.
Lowest "	13th, 2 "	28.288	"
Highest mean barometer	17th, ...	29.226	"
Lowest " "	13th, ...	28.314	"
Monthly " "	....	28.664	"
Monthly range	....	1.088	"

Temperature—

Highest temperature	21st, 30°	
Lowest "	18th, 10°	below zero.
Highest mean temperature	21st, 21.6°	
Lowest " "	27th, 5.3°	
Monthly " "	.... 14.4°	
Monthly range	.... 40°	

Rain—

Days rain fell	1,	0.15 inches.
Day of largest rainfall	1st,	0.15 "

Wind—

Direction .....

N.	N.-W.	S.	S.-W.	S.-E.	N.-E.	E.	W.
9	30	3	12	6	9	3	24 times.

This month was distinguished for cold, being one of the coldest in many years. Sleighing was good, and the month was almost free from rain. The middle was characterized by some very cold days, accompanied with dampness; so much so, that horses travelling were completely covered with hoar frost.

Towards the close of the month the weather was beautiful, with excellent sleighing.

February.

Atmospheric Pressure—

Highest barometer	15th, 7 a.m.,	29.148	inches.
Lowest "	27th, 9 p.m.,	28.204	"
Highest mean barometer	15th, ...	29.074	"
Lowest " "	28th, ...	28.276	"
Monthly " "	....	28.904	"
Monthly range	....	0.944	"

Temperature—

Highest temperature	11th, 41°	
Lowest "	2nd, 16°	below zero.
Highest mean temperature	11th, 36.3°	
Lowest " "	2nd, 8.3°	"
Monthly " "	.... 18.6°	
Monthly range	.... 57°	

Rain—

Days rain fell	4,	0.34 inches.
Greatest rainfall	27th,	0.25 "

Wind—

Direction .....

N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.
..	4	40	4	16	20	12	4 times.

The temperature of this month was also below the average several degrees. The earlier part was particularly cold, but during the latter the weather became milder and rain fell.

March.

Atmospheric Pressure—

Highest barometer	15th, 7 a.m.,	28.022 inches.
Lowest "	20th, 9 p.m.,	28.116 "
Highest mean barometer	7th, ...	28.918 "
Lowest " "	4th, ...	28.186 "
Monthly " "	....	28.666 "
Monthly range	....	0.906 "

Temperature—

Highest temperature	10th,	41°
Lowest "	12th,	8°
Highest mean temperature	14th,	35°
Lowest " "	1st,	12.6°
Monthly " "	....	25°
Monthly range	....	33°

Rain—

Days rain fell	None.
Greatest rainfall	"

Wind—

Direction	N.	N.-W	N.-E.	S.	S.-W.	S.-E.	E.	W.
	15	60	10	5	5	5	2	10 times.

Considerable bright, clear weather occurred during this month. No rain fell, but several inches of snow (3rd very stormy.)

The latter part was characterized by windy weather.

April.

Atmospheric Pressure—

Highest barometer	23rd, 2 p.m.,	29.110 inches.
Lowest "	15th, 7 a.m.,	28.336 "
Highest mean barometer	23rd, ...	29.045 "
Lowest " "	15th, ...	28.543 "
Monthly " "	....	28.806 "
Monthly range	....	0.774 "

Temperature—

Highest temperature	24th,	79.8°
Lowest "	2nd,	14.5°
Highest mean temperature	24th,	59.9°
Lowest " "	4th,	22.1°
Monthly " "	....	39.8°
Monthly range	....	65.3°

Rain—

Days rain fell	2,	0.03 inches.
Greatest rainfall	1st,	0.02 "

Wind—

Direction	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.
	8	6	18	4	5	3	10	6 times.

The early part of this month was somewhat cold and stormy, but the temperature became very high for this season of the year and reached the highest for years.

The rainfall was exceedingly small, and the snow passed away without the melting influence of April showers. At Toronto the rainfall was the smallest taken in any April since the establishment of the Observatory.

By the 19th ploughing had commenced on several farms in the neighbourhood.

May.

Atmospheric Pressure—

Highest barometer	4th, 7 a.m.,	29.260	inches.
Lowest "	14th, 9 p.m.,	28.502	"
Highest mean barometer	3rd, ...	29.236	"
Lowest " "	14th, ...	28.698	"
Monthly " "	....	28.584	"
Monthly range	....	0.758	"

Temperature—

Highest temperature	28th,	89.6°
Lowest "	3rd,	31°
Highest mean temperature	12th,	76.4°
Lowest " "	3rd,	42.1°
Monthly " "	....	56.4°
Monthly range	....	58.6°

Rain—

Days rain fell	13,	1.36 inches.
Greatest rainfall	15th,	0.52 "

Wind—

Direction	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.
	6	21	16	13	9	9	3	15 times.

The mean temperature of this month was much above the average.

It commenced comparatively cool, but before the first week closed warm days appeared, and the temperature kept increasing until the fourth week, which was characterized by intense heat, the thermometer registering 89.6° in the shade.

The marked changes of temperature common to our climate at some seasons of the year are well illustrated in this month by comparing the 3rd (31°) with the 28th (89.6°).

June.

Atmospheric Pressure—

Highest barometer	15th, 2 p.m.,	29.042	inches.
Lowest "	3rd, "	28.494	"
Highest mean barometer	15th, ...	29.248	"
Lowest " "	3rd, ...	28.536	"
Monthly " "	....	28.772	"
Monthly range	....	0.548	"

Temperature—

Highest temperature	18th,	81.5°
Lowest "	6th,	37.4°
Highest mean temperature	28th,	69°
Lowest " "	6th,	50°
Monthly " "	....	58.4°
Monthly range	....	44.1°

Rain—

Days rain fell	12,	2.85 inches.
Greatest rainfall	28th,	1.01 "

Wind—

Direction	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.
	8	23	22	4	7	7	10	9 times.

The weather during this month was more or less overcast, but the rainfall was below the average.

During the second week the wind was very high, reaching a velocity of fifty-nine miles per hour on the evening of the 13th.

July.

Atmospheric Pressure—

Highest barometer	15th, 2 p.m.,	29.604	inches.
Lowest "	20th, 9 a.m.,	28.596	"
Highest mean barometer	2nd, ...	29.204	"
Lowest " "	20th, ...	28.616	"
Monthly " "	....	28.972	"
Monthly range	....	1.008	"

Temperature—

Highest temperature	9th,	91.5°
Lowest "	1st,	52.4°
Highest mean temperature	5th,	79.5°
Lowest " "	27th,	62.8°
Monthly " "	..	67.5°
Monthly range	..	39.1°

Rain—

Days rain fell	8,	1.01 inches.
Greatest rainfall	8th,	.58 "

Wind—

	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.	
Direction	10	7	18	10	9	10	12	6	times.

The first week of this month was intensely hot, but the temperature decreased during the middle and became much cooler towards the close. Though light showers occurred several times during the month, still the rainfall was much below the average of former years.

August.

Atmospheric Pressure—

Highest barometer	24th, 2 p.m.,	29.104	inches.
Lowest "	12th, 9 "	28.572	"
Highest mean barometer	24th, ...	29.150	"
Lowest " "	12th, ...	28.644	"
Monthly " "	....	28.940	"
Monthly range	....	.612	"

Temperature—

Highest temperature	30th,	97°
Lowest "	8th,	49°
Highest mean temperature	30th,	81°
Lowest " "	1st,	56.4°
Monthly " "	....	72.7°
Monthly range	....	48°

Rain—

Days rain fell	5,	2.15 inches.
Greatest rainfall	1st,	.95 "

Wind—

	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.	
Direction	11	19	10	7	8	16	7	15	times.

The heat during the closing week of this month was intense. The rainfall was small compared with last year, when over 4 inches fell at Guelph. The weather was more or less sultry throughout the whole month, and it was almost impossible to work in the fields during the closing days.

September.

Atmospheric Pressure—

Highest barometer	17th,	9 p.m.,	29.106 inches.
Lowest "	27th,	2 "	28.738 "
Highest mean barometer	17th,	....	29.084 "
Lowest " "	2nd,	....	28.444 "
Monthly " "	....	....	28.808 "
Monthly range	....	....	.368 "

Temperature—

Highest temperature	6th,	98°
Lowest "	14th,	45°
Highest mean temperature	6th,	83.3°
Lowest " "	21st,	55.7°
Monthly " "	....	68.4°
Monthly range	....	53°

Rain—

Days rain fell	9,	1.07 inches.
Greatest rainfall	19th,	.23 "

Wind—

	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.	
Direction	8	7	17	5	10	21	6	16	times.

This is the warmest September on record at the Toronto Observatory, the highest previous being in 1865, with a mean temperature 64.4°. Very little rain fell, while at Guelph last year the rainfall was 4.2 inches. The middle of the month was frequently overcast, accompanied by rain.

October.

Atmospheric Pressure—

Highest barometer	10th,	9 p.m.,	29.336 inches.
Lowest "	25th,	2 "	28.612 "
Highest mean temperature	20th,	....	29.268 "
Lowest " "	25th,	....	28.492 "
Monthly " "	....	....	28.985 "
Monthly range	....	....	.724 "

Temperature—

Highest temperature	3rd,	74.6°
Lowest "	27th,	28.8°
Highest mean temperature	3rd,	65.6°
Lowest " "	26th,	34°
Monthly " "	....	47.2°
Monthly range	....	45.8°

Rain—

Days rain fell	15,	4.81 inches.
Greatest rainfall	14th,	1.24 "

Wind—

	N.	N.-E.	N.-W.	S.	S.-E.	S.-W.	W.	E.	
Direction	27	16	25	11	10	24	15	14	times.

Early part of the month was cloudy, and continued until the middle, when rain fell for the greater part of the remaining days. The temperature for the month was several degrees above the average, and the rainfall also exceeded that of former years.

November.

Atmospheric Pressure—

Highest barometer	10th, 7 a.m.,	29.345 inches.
Lowest "	12th, 9 p.m.,	28.385 "
Highest mean temperature	10th, ...	29.282 "
Lowest " "	12th, ...	28.393 "
Monthly " "	....	28.805 "
Monthly range	....	.969 "

Temperature—

Highest temperature	8th, 66.3°
Lowest "	28th, 9.4°
Highest mean temperature	8th, 53.8°
Lowest " "	22nd, 15°
Monthly " "	.... 35.7°
Monthly range "	.... 56.9°

Rain—

Days rain fell	15,	2.53 inches.
Greatest rainfall	12th,	1.12 "

Wind—

	N.	N.-W.	S.	S.-W.	S.-E.	N.-E.	E.	W.	
Direction	4	8	12	31	8	5	6	13	times.

Snow fell for the first time on the 4th, and but little was added during the month. A marked difference compared with November, 1880, when sleighing was thoroughly established by the 19th. Though half of the month was rainy, still a comparatively small amount (2.53 inches) fell. During the months October and November, the latter part of the week, especially Saturday, was characterized by disagreeable weather.

December.

Atmospheric Pressure—

Highest barometer	9th, 9 p.m.,	29.636 inches.
Lowest "	31st, 7 a.m.,	28.178 "
Highest mean temperature	15th, ...	29.247 "
Lowest " "	30th, ...	28.238 "
Monthly " "	....	28.872 "
Monthly range	... .	1.458 "

Temperature—

Highest temperature	16th, 76°
Lowest "	31st, 8°
Highest mean temperature	13th, 47.6°
Lowest " "	31st, 19.2°
Monthly " "	.... 31.9°
Monthly range	.... 68°

Rain—

Days rain fell	10,	1.82 inches.
Greatest rainfall	22nd,	.48 "

Wind—

	N.	N.-W.	S.	S.-W.	S.-E.	N.-E.	E.	W.	
Direction	5	17	13	32	..	14	..	3	times.

Cloudiness has been a characteristic of this month, which in some respects has been quite out of season. The thermometer seldom recorded much below freezing point until

the last day of the month, when the minimum thermometer at 9 p.m. indicated the temperature 8° below zero. This was the coldest day. Some very pleasant weather occurred during the second and third week. Rain fell for ten days, and the month closed without any snow on the ground. Much of the weather was more like what we see in October than the closing month of the year.

MEAN METEOROLOGICAL RESULTS FOR THE YEAR 1881.

	1881, Guelph.	Average of 40 years, Toronto.
Barometer—		
Mean pressure for the year	29.264	29.616
Month of highest mean pressure	November.	September.
Highest mean monthly "	29.282	29.664
Lowest " "	28.186	29.572
Month of the lowest mean "	March.	June.
Date of the highest pressure in the year	Dec. 9th.	
Highest pressure	29.636	30.358
Date of the lowest pressure in the year	Dec. 31st.	
Lowest pressure	28.178	28.692
Range of the year	1.458	1.668
Thermometer—		
Mean temperature of the year	44.6	44.17°
Warmest month	August.	July.
Mean temperature of the warmest month	72.7	67.64
Coldest month	January.	February.
Mean temperature of the coldest month	14.4	22.73
Warmest day	Sept. 6th.	
Mean temperature of the warmest day	83.3	77.85
Coldest day	Feb. 2nd.	
Mean temperature of the coldest day	—8.3	—1.50
Date of highest temperature	Sept. 6th.	
Highest temperature	98°	91°
Date of lowest temperature	Feb. 2nd.	
Lowest temperature	—16°	—11.9°
Range of the year	114	102.0°
Pluviameter—		
Total depth of rain in inches	18.06	28.30
Number of days on which rain fell	94	110
Month in which the greatest depth of rain fell	October.	September.
Greatest depth of rain in one month	4.81 inches.	3.55
Month with most rainy days	October.	October.
Greatest number of rainy days in one month	15	13
Day in which the greatest amount of rain fell	Oct. 14th.	
Greatest amount of rain in one day	1.24	1.98

3. CATTLE FEEDING AND VALUATION OF FERTILIZERS.

As the feeding of cattle and the use of fertilizers are becoming every day of greater importance, I have thought it expedient to place in the hands of students of the Ontario Agricultural College some of the latest results of experiments in reference to the former, and a compilation of analyses which may enable them to pursue investigations in the feeding of cattle.

I have considered it advisable to add some remarks on the valuation of fertilizers, together with the analysis of the ash of plants, so as to enable thoughtful students to make a calculation as to the ingredients taken from the soil by certain plants.

Four things are thus to be considered—

I.—Remarks on Cattle-feeding Experiments.
II.—Analysis of Feeding-stuffs.
III.—Valuation of Fertilizers.
IV.—Analysis of the Ash of Plants.

These analyses have been compiled from the latest information on these subjects, and are printed for the use of students as a reference, so that the lecture hour may be spent in discussing principles, rather than giving a repetition of figures.

I.—Remarks on Cattle-Feeding Experiments.

For years the Germans have been in the vanguard in search of scientific truth. They have spared neither trouble nor expense in following out investigations which have shed a flood of light upon many problems of intense interest to the farmer. Lawes and Gilbert of England, almost single-handed, have pushed into the unknown region and gathered much from the silent workings of nature. To these men the agriculturist of to-day owes a great deal for information on scientific agriculture. The Americans are awake to the importance of science in agriculture, and consequently have, and now are establishing Experiment Stations, much of the same nature as those in Germany, where some of the most intricate questions in agricultural science are investigated. Already the American stations have done good work, and a richer harvest is in the near future.

With a view to assist in understanding the results already obtained, I shall endeavour to express, as concisely as possible, some of the principles necessary to be understood before a proper use can be made of the facts discovered at those places of scientific investigation.

In the work of cattle-feeding more definite knowledge is required as to the reasons why this or that food or method of feeding is best suited for the purpose. This is the desire of every intelligent and thinking farmer, and to this end men of science and men of practice are uniting their forces, and year after year new light is being discovered in the hitherto dark regions of agricultural science.

Among the pioneers of scientific agriculture the name of Liebig, a German chemist, stands first. It is not many years since the first of his results were published. About the same time Boussingault laboured with distinguished success in France; while in England we find Lawes and Gilbert entering upon a course of investigation, the results of which will give their names a lasting place in books on agriculture. These men, Liebig, Boussingault, Lawes and Gilbert, have been the heralds of agricultural science, but now there are hundreds fired with the same enthusiasm as led them on when the world scoffed at their work, and each year gives us much of interest from the laboratories of Europe and America.

The most extensive and thorough experimenting in the feeding of animals has been done during the last fifteen years in the European and particularly in the German Agricultural Experiment Stations. The result of these stations seems to point out that a great loss is sustained by farmers from the haphazard way in which they generally feed their stock. Consequently the questions of *feeding standards, rations, etc.*, have become

of great interest and practical value. These I hope to make perfectly clear, so as to enable you to push the inquiry yourselves, and add data to the hundreds of experiments which have already been made.

Four classes of experiment have engaged the attention of the investigators at these Experiment Stations:

1.—Practical Feeding Experiments.

In carrying out experiments of this class, chemical analyses are made of the fodder given to the animals. The results have been of great value in deciding what are the most economical kinds, mixtures, and amounts of food for the different domestic animals, as horses, cattle, sheep and swine, according as the production of meat, milk, labour, etc., are required of them. The results do not inform us what proportions of the different foods are digested, nor how fat and flesh are formed in the animal body.

Experiments of this class can be carried on by any farmer who is ready to exercise care and accuracy in his observations.

2.—Digestion Experiments.

These are a higher type of experiment. In carrying them out an attempt is made to ascertain what proportions of the different foods are digested; consequently not only the food, but also the excrement is measured, and its composition determined by chemical analysis.

Only a portion of the food consumed by an animal is digested; the remainder passes from the body as excrement. The digestive part only is nutritious. From this is derived the flesh, fat, milk, etc.

If we would know the nutritive value of different foods, we must learn how much is really digestible.

To ascertain this the fodder is measured and analyzed, so that the percentage of each constitutent is accurately known. The excrement is carefully collected, and likewise weighed and analyzed. By these means are ascertained how much of the different ingredients was contained in the food, and how much passed through the body undigested.

From the result of these experiments on digestion have been derived what are called "*digestion co-efficients.*" These represent what percentage of the several nutrients of any fodder is digestible. Take for example the following analysis of hay:—

Water	14.3
Ash	6.2
Protein	9.7
Crude fibre	26.3
Carbohydrates	41.0
Fat	2.5

The average of the experiments so far, gives the following proportion of the different nutrients digestible:—

Protein	56 per cent.
Crude Fibre	57 " "
Carbohydrates	63 " "
Fat	48 " "

These percentages are the so-called *digestion co-efficients*, consequently the amount of each ingredient multiplied by the corresponding *digestion co-efficient* gives the amount of digestible material in the hay; *e.g.:*

Protein	$9.7 \times .56 =$	5.4	per cent. digestible	Protein.
Crude Fibre	$26.3 \times .57 =$	15.0	" "	Crude Fibre.
Carbohydrates	$41 \times .63 =$	25.8	" "	Carbohydrates.
Fat	$2.5 \times .48 =$	1.2	" "	Fat.

Until lately the *Crude Fibre* (sometimes called *Cellulose*), was often omitted from the calculation, because it was considered to be indigestible; but the results of recent experiments seem to show that in most cases it has quite a large percentage of digestible material. The digestible portion of this substance and the *Carbohydrates*, such as starch, sugar, gum, may be considered as of equal value, pound for pound; but *Fat* produces a greater effect on the body than an equal weight of *Carbohydrates*.

It was formerly believed that the *Carbohydrate* (sugar, starch, gum) served chiefly as fuel in the body to maintain the animal heat, and that since a pound of *Fat* yields $2\frac{1}{2}$ times as much heat when burned as a pound of starch, it was therefore $2\frac{1}{2}$ times as valuable a food, and hence, in calculating the nutritive power of food the *Fat* was reduced to its "*starch equivalent*" by multiplying it by $2\frac{1}{2}$. Later experiments seem to show that the *Carbohydrates* do more than generate heat, and that for the purposes of feeding, the factor $2\frac{1}{2}$ will be replaced by a more correct one. However, in most calculations, the $2\frac{1}{2}$ is still retained, and the various ingredients reduced to a common basis as follows:—

Digestible *Fat*	$1.2 \times 2\frac{1}{2} =$	3	.. "Starch Equivalent."	
" *Fibre*.....		15	"	"
" *Carbohydrates*		25.8	"	"
Total.....		43.8	"	"
" *Protein*		5.4	"	"

The above percentages are taken from the example already considered.

This 43.8, the whole reduced to its "starch equivalent," divided by the 5.4, digestible *Protein*, gives 8.1, which, compared with 1, is termed the "*nutritive ratio*," and is usually expressed as 1 : 8.1. In other words, "*nutritive ratio*" is a comparison between the *Albuminoids* and the *Carbohydrates*, in which the quantity of digestible *Albuminoid* is taken as unity.

3.—Experiments on the Functions of the Food Ingredients.

These have been undertaken to throw light on how the animal utilizes nutritious material.

Food is made up of starch, sugar, fibre, fat, gluten, fibrin and legumen. In order to understand how to use it most economically, we must know what part each ingredient plays in supplying an animal's wants, and from which the flesh and fat are derived, and how the food is transformed into the complex substances required in the animal economy. To do this it is necessary to learn what the food contained originally, and what are all the final products of its transformation in the body, and also to what use they have been applied in the body.

In carrying out experiments of this class, the food, excrement, solid and liquid, are measured and analyzed. Experiment has shown that the nitrogen in the urine comes from the transformation of *Albuminoids* in the body, and that the amount of nitrogen in the urine is a measure of the amount of transformation of these substances. If, therefore, by comparisons made from day to day, the amount of nitrogen in the urine is found to be less than that of the food digested, it is safe to infer that the lacking portion has been retained in the body; but, if it is more than was digested from the food, it is consistent to infer that the store of flesh in the body is decreasing. By such means the effects of different food materials in the formation of flesh in the body are determined.

4.—Experiments on the Formation of Animal Heat and Muscular Force.

These are the most complicated series of experiments of all, and involve the solution of some of the most complex problems in feeding. In their solution the measurement and analysis, not only of the food but also of the final products of its use in the body, are required. It is necessary to learn the amount and composition of the solid and liquid excrement and the gaseous compounds given off through the skin and lungs as well. The air must be analyzed both before and after the animal breathes it.

It is readily seen that experiments of this class are extremely laborious and complicated, and exceedingly difficult to carry out.

The majority of the experiments of the last three classes have been made during the last ten years, and it is only quite recently that apparatus has been constructed successfully for their investigation. Even already, though the field of investigation has been but little explored, the practical results have proved exceedingly useful and of high theoretical value.

As an outcome of these experiments, we have what are called "*feeding standards.*" These are statements of the amount of digestible *protein*, *carbohydrates* and *fat* required for specific purposes, such as feeding for maintenance, feeding for fattening, feeding for work, feeding for the production of milk, and feeding for growing animals.

The scientific feeding of stock is not, properly speaking, a matter of so much hay, grain and roots, but rather of so much water, starch, sugar, gluten, etc., of which they are composed.

To use fodder economically, it is necessary to so mix and deal it out that the ration shall contain just the amounts of the various ingredients needed for maintenance or production, as required.

To do this successfully, four things are required:

1. A knowledge of the chemical composition of the fodder used; in other words, the amount of albuminoids, sugar, starch, fat, water, etc., it contains.

2. It is neccessary to know the proportion of these ingredients which are digestible, and how the different kinds of fodder must be mixed and fed, so that this digestible material shall be most fully digested and utilized and the least quantity wasted.

3. We must know what part each of these food ingredients plays in the animal economy, which are the "*flesh formers*" and the "*fat formers*," and from which heat and force are derived.

4. A knowledge of the quantity required by animals for maintenance, fattening, working, production of milk, and growth is also necessary. If these principles were well understood and followed, much waste of food would be prevented. It is with this object that the whole question of *feeding standards* is at present occupying the closest attention of many Experiment Stations in Germany. Suppose, for instance, that a farmer knew how much of the different food ingredients a cow requires to keep her in good condition, and at the same time to enable her to give a full yield of milk, how much of albuminoids, starch, fat, etc., she will use economically, and how much of these nutritive substances is contained in a hundredweight of turnips or hay. He could calculate very easily what proportion of these food materials he would require to mix together in order to make up an appropriate ration for a cow.

All our feeding stuffs are made up of *water*, *mineral matter*, and *organic substance*. This *organic substance* supplies two classes of ingredients, one containing nitrogen, *albumen*, *gluten*, *legumen*, *fibrin*, etc., usually called Albuminoids; the other containing no nitrogen, *sugar*, *starch*, *gum*, *fibre* and *fat*.

When properly mixed, nearly all the organic substance of the roots, fruits and cereal grains is digested. It will be seen at once how important it is to know more about the principles of *feeding standards* and *rations*.

The following are some conclusions derived from carefully made experiments in feeding:

1. Much of the crude fibre *(cellulose)* is digested, even as high as fifty per cent. This substance was formerly considered to pass through the system undigested. Crude fibre thus becomes of importance in feeding cattle.

2. Animals digest about the same percentage of a large ration as a small; that is, they will digest no greater proportion of a scanty allowance than of a large one.

3. That the same varieties of fodder varies in indigestibility according to conditions surrounding it during growth. Grasses raised on well-manured land are generally richer in nitrogen than when grown with less manure.

4. After blossoming, plants deteriorate in nutritive value. The older the plant, the less digestible and less rich in nitrogen. Thus it is, much of the nutritive value of

forage crops, as hay, clover, etc., is lost by allowing them to become too ripe before harvesting.

A proper knowledge of the laws relating to the digestion of food should engage the attention of every farmer, so as to enable him to economize the food he has. As a general rule, concentrated foods, such as grain, oil-cake, etc., containing not over seven or eight pounds of digestive albuminoids to one pound of digestible carbohydrates, may be fed with hay and clover without loss to the digestion of the latter. From this it can easily be understood how straw, chaff, corn-stalks, etc., may be of great value in a food mixture, for these are rich in *non-nitrogenous*, but poor in *nitrogenous* nutritive material. They become a valuable source of fodder when mixed and fed so as to secure the utilization of the digestive material which they contain.

Consequently, to economize these materials it is necessary to mix them with others rich in nitrogen, as pea-meal, oil-cake, etc.

The albuminoids have a large share in the work of nutrition. From these are derived the nitrogenous parts of the body, including the muscle, as well as the casein and albumen of the milk.

The fat in the body and that of the milk seems to be also formed in a large part from *Albuminoids*, and it is highly probable that they even contribute by their consumption to the production of muscular force. This being the case, it is manifest that the production of meat, milk, and work must require the use of large amounts of Albuminoids in the food.

From a series of experiments made to ascertain what amounts of *Albuminoids* and *Carbohydrates* are required for the maintenance of animals in a fair condition, it has been inferred that a daily ration for maintenance of an ox (1,000 lbs.), should contain .7 lbs. digestible Albuminoids and 8½ lbs. digestible Carbohydrates; that is, a nutritive ratio of 1 : 12¼. This ratio, you will remember, is obtained by dividing the number which represents the *Albuminoids* into that of the *Carbohydrates*.

The ration for a milch cow (1,000 lbs.) is put at 2.5 lbs. digestible *Albuminoids*, 12½ lbs. *Carbohydrates* and .4 lbs. *Fat* in 24 lbs. dry organic matter.

This gives a nutritive ratio of 1 : 5.4, thus:

.4 × 2½ = 1.00 .. "Starch Equivalent" or equivalent carbohydrate.
12.5 .. The Carbohydrates (starch, sugar, etc.).

13.5.

This 13.5 ÷ 2.5 = 5.4.

While these figures hold good in many cases, yet it must be remembered that a general rule cannot be laid down for all animals, because the composition of the plant is affected by manure, weather, and very much by how it was harvested and what condition it was in at the time of harvesting. The nature of the animal, too, has an effect. But there is no doubt that the principle of *nutritive ratios* in feeding indicates the pathway to economy in using fodder, and that to a thoughtful person supplies principles by the application of which the largest amount of profit can be derived from the food at his disposal.

The conclusion to be drawn from the facts obtained in reference to the nutritive power of fodder seems to be that our common fodder materials are apt to contain less nitrogenous material than is needed for the most profitable results.

Only the best quality of hay is sufficiently rich in nitrogen. Turnips, mangolds, potatoes, and roots generally contain, relatively, less *Albuminoids* and more *Carbohydrates* than suitable for production. We have two sources for supply of nitrogenous foods.

(1.) Cultivation of plants rich in nitrogen, such as peas, clover, beans, lucerne, and other leguminous plants.

(2.) The use of oil-cake, etc.

We shall now consider the plan followed in making up a *ration* which shall contain the quantities of digestible nutrients required by a *feeding standard*; *e. g.*, the *feeding*

standard for milk, already referred to, is in the case of a cow weighing 1,000 lbs., as follows:

Digestible Protein	2.5	pounds.
" Fat	.4	"
" Carbohydrate	12.5	"

This is a nutritive ratio 1 : 5.4, and should be found in food containing 24 pounds of dry organic substance.

To make up the ration which shall supply the requirements of this *standard*, we examine the tables for the analyses of the food to be used and the percentage of these foods that are digestible, and so arrange the mixture that the sum of the organic substances is equal to 24 pounds, and the proportion of albuminoids to carbohydrates as 1 : 5.4.

You will remember the *Fat* is reduced to equivalent *Carbohydrates* by multiplying by $2\frac{1}{2}$.

Accurate analyses cannot be given in fixed tables, but a very good approximation is supplied in the tables added. An exact correspondence with the *standard* need not be expected. *Feeding standards* are not to be considered as fixed rules, but more as guides, which must be intelligently adapted to individual circumstances.

Three points require special consideration in making up a *ration:*

(1.) The animal—age, nature, condition, and what is required of it—maintenance, work, fat, milk, or growth.

(2.) Surrounding conditions—warmth, etc.

(3.) The food—condition when harvested, the soil from which it was obtained, etc.

The following, obtained from the result of many experiments in cattle-feeding, are some of the *feeding standards* which have been adopted with success.

The calculations are daily *rations* for animals of 1,000 pounds live weight, in each case.

FEEDING STANDARDS (Wolff).

A.—Per Day and per 1,000 lbs. Live Weight.

	Total Organic Substance.	Nutritive (digestible) Substances.			Total Nutritive Substance.	Nutritive Ratio.
		Albuminoids.	Carbohydrates.	Fat.		
	lbs.	lbs.	lbs.	lbs.	lbs.	
1. Oxen at rest in stall.....	17.5	0.7	8.0	0.15	8.25	1 : 12.
2. Wool sheep, coarser breeds..	20.0	1.2	10.3	0.20	11.70	1 : 9.
" " finer breeds....	22.5	1.5	11.4	0.25	13.15	1 : 8.
3. Oxen moderately worked...	24.0	1.6	11.3	0.30	13.20	1 : 7.5
" heavily worked.....	26.0	2.4	13.2	0.50	16.10	1 : 6.
4. Horses moderately worked..	22.5	1.8	11.2	0.60	13.60	1 : 7.
" heavily worked	25.5	2.8	13.4	0.80	17.00	1 : 5.5
5. Milk cows	24.0	2.5	12.5	0.40	15.40	1 : 5.4
6. Fattening oxen, 1st period..	27.0	2.5	15.0	0.50	18.00	1 : 6.5
" " 2nd "	26.0	3.0	14.8	0.70	18.50	1 : 5.5
" " 3rd "	25.0	2.7	14.8	0.60	18.10	1 : 6.0
7. Fattening sheep, 1st period.	26.0	3.0	15.2	0.50	18.70	1 : 5.5
" " 2nd "	25.0	3.5	14.4	0.60	18.50	1 : 4.5
8. Fattening swine, 1st period.	36.0	5.0	27.5		32.50	1 : 5.5
" " 2nd "	31.0	4.0	24.0		28.00	1 : 6.0
" " 3rd "	23.5	2.7	17.5		20.20	1 : 6.5

FEEDING STANDARDS—*Continued.*

	Total Organic Substance.	Nutritive (digestible) Substances.			Total Nutritive Substance.	Nutritive Ratio.
		Albuminoids.	Carbohydrates.	Fat.		
9. Growing cattle :						
Age, months.	lbs.	lbs.	lbs.	lbs.	lbs.	
2— 3	22.0	4.0	13.8	2.0	19.8	1 : 4.7
3— 6	23.4	3.2	13.5	1.0	17.7	1 : 5.0
6—12	24.0	2.5	13.5	0.6	16.6	1 : 6.0
12—18	24.0	2.0	13.0	0.4	15.4	1 : 7.0
18—24	24.0	1.6	12.0	0.4	13.9	1 : 8.0
10. Growing sheep :						
5— 6	28.0	3.2	15.6	0.8	19.6	1 : 5.5
6— 8	25.0	2.7	13.3	0.6	16.6	1 : 5.5
8—11	23.0	2.1	11.4	0.5	14.0	1 : 6.0
11—15	22.5	1.7	10.9	0.4	13.0	1 : 7.0
15—20	22.0	1.4	10.4	0.3	12.1	1 : 8.0
11. Growing fat pigs :						
2— 3	42.0	7.5	30.0		37.5	1 : 4.0
3— 5	34.0	5.0	25.0		30.0	1 : 5.0
5— 6	31.5	4.3	23.7		28.0	1 : 5.5
6— 8	27.0	3.4	20.4		23.8	1 : 6.0
8—12	21.0	2.5	16.2		18.7	1 : 6.5

B.—Per Day and Per Head.

	Total Organic Substance.	Nutritive (digestible) Substances.			Total Nutritive Substances.	Nutritive Ratio.
		Albuminoids.	Carbohydrates.	Fat.		
Growing cattle :						
Age, months.	lbs.	lbs.	lbs.	lbs.	lbs.	
2— 3 150 lbs.	3.3	0.6	2.1	0.30	3.00	1 : 4.7
3— 6 300 "	7.0	1.0	4.1	0.30	5.40	1 : 5.0
6—12 500 "	12.0	1.5	6.8	0.30	8.40	1 : 6.0
12—18 700 "	16.8	1.4	9.1	0.28	10.78	1 : 7.0
18—24 850 "	20.4	1.4	10.3	0.26	11.96	1 : 8.0
Growing sheep :						
5 — 6 56 lbs.	1.6	0.18	0.87	0.045	1.095	1 : 5.5
6— 8 67 "	1.7	0.17	0.85	0.040	1.060	1 : 5.5
8—11 75 "	1.7	0.16	0.85	0.037	1.047	1 : 6.0
11—15 82 "	1.8	0.14	0.89	0.032	1.062	1 : 7.0
15—20 85 "	1.9	0.12	0.88	0.025	1.047	1 : 8.0
Growing fat swine :						
2— 3 50 lbs.	2.1	0.38	1.50		1.88	1 : 4.0
3— 5 100 "	3.4	0.50	2.50		3.00	1 : 5.0
5— 6 125 "	3.9	0.54	2.96		3.50	1 : 5.5
6— 8 170 "	4.6	0.58	3.47		4.05	1 : 6.0
8—12 250 "	5.2	0.62	4.02		4.67	1 : 6.0

The term "total organic substance" is applied to the amount of the substance fed, less the water and ash. The difference between total organic substance and "total nutritive substance" expresses the quantity of indigestible material.

Another way of representing the food to be given for specific purposes is by expressing it in the form of *daily rations* per 1,000 pounds live weight, made up of so many pounds of feeding-stuffs, and calculated to contain nutritive materials in the proportions given above.

A.—DAILY RATIONS FOR MAINTENANCE FODDER FOR FULL-GROWN OXEN.

(1). lbs.	(2). lbs.	(3). lbs.	(4). lbs.
1½ Clover hay.	3 Clover hay.	10 Barley straw.	5 Timothy.
13 Barley straw.	13 Oat straw.	5 Wheat chaff.	7 Oat straw.
25 Mangolds.	20 Mangolds.	25 Mangolds.	5 Wheat chaff.
½ Rape cake.		½ Rape cake.	5 Potatoes.

B.—MILK COWS.

(1). lbs.	(2). lbs.	(3). lbs.
12 Timothy.	10 Clover hay.	6 Timothy.
11 Barley straw.	10 Barley straw.	8 Clover.
15 Potatoes.	23 Potatoes.	10 Oat straw.
3 Rape cake.	3 Wheat bran.	16 Potatoes.
		1½ Rape cake.

C.—FATTENING CATTLE.

(1). lbs.	(2). lbs.
7 Timothy.	6 Clover.
6 Wheat straw.	7 Barley straw.
62 Mangolds.	70 Mangolds.
4 Bean meal.	2 Linseed.
2 Linseed.	3 Bean meal.
2½ Rye bran.	2 Unbolted rye.

The foregoing tables are given in explanation of the scientific principles involved in cattle-feeding. Other systems are followed which differ from these standards, but these are the results of many years' arduous labour by German investigators, during which thousands of analyses and hundreds of laborious feeding trials have been made.

I will now proceed to give the analyses of the principal feeding-stuffs in use. From a consideration of these, it is expected that the application of the principles already discussed will be readily made.

In the analysis of a feeding-stuff six ingredients are usually sought:

1. *Water.*
2. *Ash.*
3. *Crude fibre* (cellulose).
4. *Albuminoids*—substances rich in nitrogen and sometimes called *flesh formers.* Albumen, gluten, casein, legumen, fibrin, belong to this group.
5. *Carbohydrates*—substances with no nitrogen, and with the hydrogen and oxygen in the same proportions as we find them in water, viz.: twice as much of the former as the latter. Sugar, starch, gum, etc., belong here.
6. *Fats* or *oils* also contain no nitrogen. In these the oxygen and hydrogen are not in the proportions in which they occur in water: the hydrogen being in excess.

II.—Analysis of Feeding Stuffs.

A Table showing the Average Composition of various kinds of Food.

Variety of Food One Hundred Pounds Contains.	Inorganic substance.	Water.	Ash.	Organic substance.	Albuminoids.	Crude fibre.	Carbohydrates.	Fat.	Indigestible organic substance.	Digestible organic substance.	Digestible organic substance consists of.			Ratio of digestible Albuminoids to digestible Carbohydrates.
											Albuminoids.	Carbohydrates.	Fat.	
HAY.														
Meadow hay, poor	9.3	14.3	5.0	80.7	7.5	33.5	38.2	1.5	41.9	38.8	3.4	34.9	.5	1:10.6
" " average	20.5	14.3	6.2	79.5	9.7	26.3	41.6	2.3	32.1	47.4	5.4	41.1	.9	1:7.9
" " good	22.	15.0	7.0	78.0	11.7	21.9	42.3	2.2	27.5	50.5	7.4	42.1	1.0	1:6.0
Red clover, poor	20.1	15.0	5.1	79.9	11.1	28.9	37.7	2.1	55.3	44.6	5.7	37.9	1.0	1:7.1
" " average	21.3	16.0	5.3	78.7	12.3	26.0	38.2	2.2	32.4	66.3	7.0	38.1	1.2	1:5.9
" " good	22.5	16.5	6.0	77.5	13.5	24.0	37.1	2 9	29.1	48.4	8.5	38.2	1.7	1:5.0
White clover, average	22.5	16.5	6.0	77.5	14.5	25.6	33.9	3.5	31.5	46.0	8.1	35.9	2.0	1:5.0
Lucerne, average	22.2	16.0	6.2	77.8	14.4	33.0	27.9	2.5	39.1	38.7	9.4	28.3	1.0	1:3.3
" good	23.3	16.5	6.8	76.7	16.0	26 6	31.8	2.3	32.1	44.6	12.3	31.4	.9	1:2.7
Sainfoin, average	22.9	16.7	6.2	77.1	13.3	27.1	34.2	2.5	32.3	44.8	7.6	35.8	1.4	1:5.2
Alsike clover, average	22.	16 0	6.0	78.0	15.0	27.0	32.7	3.3	32.8	45.2	8.6	34.8	1.8	1:4.6
Yellow " "	22.1	16.7	6.0	77.3	14.6	26.2	33.2	3.3	29.7	47.6	9.2	36.4	2.0	1:4.5
Bokhara " "	22.3	14.3	8.0	77.7	16.7	30.3	27.9	2.8	34.9	42.8	8.5	31.7	1.6	1:4.2
Vetches, in flower	25.	16.7	8.3	75.0	14.2	25.5	32.8	2.5	21.6	43.4	9.4	32.5	1.5	1:3,9
Peas, in flower	23.7	16.7	7.0	76.3	14 3	25.2	34.2	2.6	32.2	44.1	9.4	33.1	1.6	1:4.0
Timothy grass, flowering	18.8	14.3	4.5	81.2	9.7	22.7	45.8	3.0	30.6	50.6	5.8	43 4	1.4	1:8.1
Italian rye-grass, "	22.1	14.3	7.8	77.9	11.2	22.9	40.6	3.2	27.9	50 0	7.1	41.5	1.4	1:6.3
Perennial " "	20.8	14.3	6.5	79.2	10.2	30 2	36.1	2.7	38.0	41.2	5.1	35.3	.8	1:7.3
Millet, flowering	19.1	13.4	5.7	80.9	10.8	29.4	38.5	2.2	32.9	48.0	6.1	41.0	.9	1:7.1
STRAW.														
Wheat	18.9	14.3	4.6	81.1	3.0	44.0	32.6	1.5	48.0	33.1	.8	31.9	.4	1:41.1
Barley	18.4	14.3	4.1	81.6	4.0	40.0	36.2	1.4	42.9	38.7	1.4	36.9	.4	1:27.1
Oat	18.3	14.3	4.0	81.7	3.5	42.0	34.2	2.0	42.4	39.3	1.3	37.4	.6	1:29.9
Rye	18 4	14.3	4.1	81.6	2.5	48 0	29.8	1.3	47.7	33.9	.7	32.8	.4	1:48.3
Vetch	20.5	16.0	4.5	79.5	7.5	42.0	29.0	1.0	43.7	35.8	3.4	31.9	.5	1:9.8
Pea	22 5	16.0	4.5	79.5	6.5	38.0	34.0	1.0	42.7	36.8	2.9	33.4	.5	1:12
Seed clover	21.6	16.0	5.6	78.4	9.4	42.0	25.0	2.0	44.7	33.7	4.2	28.5	1.0	1:7.4
Cornstalk	19.2	15.0	4.2	80.8	3.0	40.0	36.7	1.1	42.4	38.4	1.1	37.0	.3	1:34.4
CHAFF AND COBS.														
Wheat	26.3	14.3	9.2	73.7	4.5	36.0	35.6	1.4	39.1	34.6	1.4	32.8	.4	1:24.1
Oat	24.3	14.3	10.0	75.7	4.0	34.0	36.2	1.5	36.9	38.8	1.6	36.6	.6	1:23.8
Rye	21.8	14.3	7.5	78 2	3.6	43.5	29.9	1.2	41.8	36.4	1.1	34.9	.4	1:32.6
Barley	27.3	14.3	10.0	72.7	3.0	30.0	38.2	1.5	35.9	36.8	1.2	35.0	.6	1:30.4
Pea	21.	15.0	6.0	79.0	8.1	32.0	36.9	2.0	37.6	41.4	4.0	36.2	1.2	1:9.8
Beans	20.5	15.0	5.5	79.5	10.5	33.0	34.0	2.0	38.5	41.0	5.1	34.7	1.2	1:7.4
Corn cobs	16.8	14.0	2.8	83.2	1.4	37.8	42.6	1.4	40.5	42.7	.6	41.7	.4	1:71.2
GREEN FODDER.														
Pasture grass	82.0	80.0	2.0	18.0	3.5	4.5	9.2	.8	5.3	12.7	2.4	9.9	.4	1:4.5
Italian rye-grass, flowering	76.2	73.4	2.8	23.8	3.6	7.1	12.1	1.0	8.5	15.3	2.3	12.6	.4	1:5.9
Perennial, "	72.	70.0	2.0	28.0	3.6	10.6	12.8	1.0	13.7	14.3	1.8	12.2	.3	1:7.2
Timothy, "	73.1	70.0	2.1	27.9	3.4	10.1	13.4	1.0	11.3	16.6	1.9	14.2	.5	1:8.1
Green rye, "	71.6	76.0	1.6	22.4	3.3	7.9	10.4	.8	9.1	13.3	1.9	11.0	.4	1:6.3
Green oats, "	82.4	81.0	1.4	17.6	2.3	6.5	8.3	.5	7.2	10.4	1.3	8.9	.2	1:7.2
Oats and vetches mixed, flowering	85.4	84.0	1.4	14 6	2.4	5 4	6.4	.4	6.1	8.5	1.4	5.9	.2	1:5.4
Sorghum saccharatum, "	83.3	82.2	1.1	16.7	1.2	4.7	10.3	.5	5.8	10.9	.8	9.0	.2	1:9
Indian corn, "	78.4	77.3	1.1	21.6	2.5	6.7	11.7	.7	7.9	13.7	1.6	11.9	.3	1:7.4

ANALYSIS OF FEEDING STUFFS—*Continued.*

VARIETY OF FOOD ONE HUNDRED POUNDS CONTAINS.	Inorganic substance.	Water.	Ash.	Organic substance.	Albuminoids.	Crude-fibre.	Carbohydrates.	Fat.	Indigestible organic substance.	Digestible organic substance.	Digestible organic substance consists of.			Ratio of digestible Albuminoids to digestible Carbohydrates.
											Albuminoids.	Carbohydrates.	Fat.	
GREEN FODDER.														
Millet, flowering	71.9	70.0	1.9	28.1	3.7	10.2	13.4	.8	11.5	16.6	2.1	14.2	.3	1:7.1
Red clover, before flowering	84.3	83.0	1.5	15.5	3.3	4.5	7.0	.7	5.3	10.2	2.3	7.4	.5	1:3.8
White clover, in flower	82.5	80.5	2.0	17.5	3.5	6.0	7.2	.8	6.9	10 6	2.2	7.9	.5	1:4.2
Alsike clover, in blossom	86.5	86.0	1.5	13.5	3.3	4.5	5.1	.6	5.2	8.3	2.1	5.8	.4	1:3.2
Lucerne, young	82.7	81.0	1.7	17.3	4.5	5.0	7.2	.6	6.2	11.1	3.5	7.3	.3	1:2.3
Sainfoin, in flower	81.5	80.0	1.5	18.5	3.2	6.5	8.2	.6	8.1	10.4	2.1	8.0	.3	1:4.1
Bokhara clover, in flower	89.6	87.5	2.1	10.4	2.9	3.6	3.5	.4	4.7	5.7	1.6	3.9	.2	1:2.7
Vetches, "	83.8	82.0	1.8	16.2	3.5	5.5	6.6	.6	6.7	9.5	2.5	6.7	.3	1:3.0
Peas, "	83.0	81.5	1.5	17.0	3.2	5.6	7.6	.6	7.1	9.9	2.2	7.4	.3	1:3.7
Young thistles	88.7	86.7	2.0	11.3	2.8	1.4	6.1	.9	2.5	8.8	2.2	6.0	.6	1:3.4
Carrot leaves	85.6	82.0	3.6	14.2	3.2	3.0	7.2	1.0	4.5	9.7	2.2	7.0	.5	1:3.8
Mangold "	92.3	90.5	1.8	7.7	2.9	1.3	4.0	.5	2.3	5.4	1.2	4.0	.2	1:3.7
Turnip "	90.7	88.4	2.3	9.3	2.1	1.6	5.2	.5	2.4	6.9	1.5	5.1	.3	1:3.9
ROOTS AND TUBERS.														
Potatoes, good	75.9	75.0	.9	24.1	2.1	1 1	20.6	.3	1.1	23.0	2.1	20.6	.3	1:10.2
Mangolds, "	88.8	88.9	.8	12.2	1.1	.9	9.1	.1	1.9	10.3	1.1	9.1	.1	1:8.5
Sugar beet, "	82.2	81.5	.7	17 8	1.0	1.3	15.4	.1	1.3	16.5	1.0	15.4	.1	1:15.7
Carrot, "	85.9	85.0	.9	14.1	1.4	1.7	19.8	.2	1.7	12.4	1.4	10.8	.2	1:8.1
Turnip, "	92.7	92.0	.7	7.3	1.1	.8	5.3	.1	.8	6.5	1.1	5.3	.1	1:5.1
GRAINS AND SEEDS.														
Wheat, good	16.1	14.4	1.7	83.9	13.0	3.0	66.4	1.5	7.9	76.0	11.7	63.1	1.2	1:5.6
Rye, "	16.1	14.3	1.8	83.9	11.0	3.5	67.4	2.0	8.4	75.5	9.9	64.0	1.6	1:6.9
Barley, "	16.5	14.3	2.2	83.5	10.0	7.1	63.9	2.5	6.3	67.2	8.0	57.5	1.7	1:7.7
Oats, "	17.0	14.3	2.7	83.0	12.0	9.3	55.7	6.0	27.5	55.5	9.0	41.8	4.7	1:6.0
Maize, "	15.9	14.4	1.5	84.1	10.0	5.5	62.1	6.5	13.1	71.0	8.4	57.8	4.8	1:8.3
Buckwheat, "	15.8	14.0	1.8	84.2	9.0	15.0	58.7	1.5	32.2	52.0	6.8	44.0	1.2	1:6.9
Peas, "	16.7	14.3	2.4	84.3	22.4	6.4	52.5	2.0	12.5	71.8	20.2	49.9	1.7	1:2.7
Beans, "	17.6	14.5	3.1	82.4	25.5	9.4	45.9	1.6	14.4	68.0	23.0	43.6	1.4	1:2.1
Flax-seed, "	15.7	12.3	3.4	84.3	20.5	7.2	19.5	37.0	16.6	67.7	17.2	15.3	35.2	.....
Cotton, "	15.5	7.7	7.8	84.5	22.8	16.0	15.4	30.3	28.5	56.0	17.1	11.6	27.3	.....
Poppy, "	20.0	14.7	5.3	80.0	17.5	6.1	15.1	41.0	14.0	66.0	14.7	12.3	39.0	.....
MISCELLANEOUS.														
Sugar beet pulp	73.4	70.0	3.4	26.6	1.8	6.3	18.3	.2	6.3	20.3	1.8	18.3	.2	1:10.4
Brewers' grains	77.8	76.6	1.2	22.2	4.9	6.2	10.6	.5	8.4	13.8	3.9	9.5	.4	1:2.7
Wheat bran	18.5	13.1	3.4	81.5	14.0	17.8	45.9	3.8	29.6	51.9	10.9	37.6	3.4	1:4.2
Barley meal	16.8	12.1	5.4	83.2	14.8	19.4	45.6	4.1	30.7	52.5	11.5	37.4	3.6	1:4
Rape cake	22.4	15.0	7.4	77.6	30.3	13.8	23.8	9.5	27.4	50.2	24.2	18.3	7 7	1:1.6
Linseed cake	19.4	11.5	7.9	80.6	28.3	11.0	37.3	10.0	18.9	61.7	23 8	29.0	8.9	1:2.2
Linseed meal (pressed)	17.	9.7	7.3	83.0	34.2	6.6	37.7	4.5	20.9	62.1	28.7	29.4	4.0	1:1.4
Palmnut meal (pressed)	12.9	9.0	3.9	87.1	18.5	28.6	36.7	3.3	31.5	55.6	18.5	33.8	3.3	1:2.3
Palmnut cake	12.1	9.1	3.8	87.3	16.3	21.5	36.4	13.1	24.4	62.9	16.3	33.5	13.1	1:4.1
Cotton seed cake, undecorticated	17.8	11.5	6.3	82.2	24.6	20.8	30.6	6.2	44.4	37.8	18.1	14.1	5.6	1:1.61
Cotton seed cake, decorticated	17.8	10.1	7.7	82.2	34.3	9.6	27.4	10.9	26.5	55.7	28.8	17.0	9.9	1:1.5
Cow milk	88.2	87.5	.7	11.8	3.2	....	5.0	3.6	44.3	11.8	3.2	5.0	3.6	1:4.4
Skim milk	90.8	90.0	.8	9.2	3.0	....	5.6	.6	00.	9.2	3.0	5.6	.6	1:2.4
Buttermilk	90.6	90.1	.5	9.4	3.0	....	5.4	1.	00.	9.4	3.	5.4	1.	1:2.6
Whey	93.9	93.3	.6	6.1	.8	....	.5	.3	00.	6.1	.8	5.	.3	1:7.2
Cream	62.6	62.0	.6	37.3	2.7	....	2.9	31.8	62.6	37.4	2.7	2.9	31.8	1:30.5

Fat.	Ratio of digestible Albuminoids in digestible Carbohydrates.
.3	1:7.1
.5	1:3.8
.5	1:4.2
.4	1:3.2
.3	1:2.3
.3	1:4.1
.2	1:2.7
.3	1:3.0
.3	1:3.7
.6	1:3.4
.5	1:3.8
.2	1:3.7
.3	1:3.9
.3	1:10.2
.1	1:8.5
.1	1:15.7
.2	1:8.1
.1	1:5.1
1.2	1:5.6
1.6	1:6.9
1.7	1:7.7
4.7	1:6.0
4.8	1:8.3
1.2	1:6.9
1.7	1:2.7
1.4	1:2.1
5.2	.....
7.3	.....
9.0	.....
.2	1:10.4
.4	1:2.7
3.4	1:4.2
5.6	1:4
7 7	1:1.6
3.9	1:2.2
4.0	1:1.4
3.3	1:2.3
3.1	1:4.1
5.6	1:1.61
9.9	1:1.5
5.6	1:4.4
.6	1:2.4
..	1:2.6
.3	1:7.2
1.8	1:30.5

In the preceding tables the "organic substance" represents the sum of the *Albuminoids*, *Crude fibre*, *Carbohydrates*, and *Fat*; while the "inorganic substance" represents the sum of the *Water* and *Ash*.

The sum of the digestible carbohydrates and the fat reduced to its "starch equivalent," divided by the amount representing the digestible *Albuminoids*, gives the *nutritive ratios* of the last column.

The "indigestible organic substance" is found by subtracting the sum of the digestible substances from the amount of "organic substance."

In analysis where the percentage of digestible substance is given, further calculation is not necessary in compounding a *ration* based on a particular *feeding standard*; but in cases where the analysis of a fodder is given without the proportion of digestible substance in each ingredient, it becomes necessary to make use of the so-called "digestion co-efficients."

Albuminoids,	56 per cent
Crude fibre,	57 "
Carbohydrates,	63 "
Fat,	48 "

and calculate the percentage of digestible substance according to the method already given, page 57.

III.—Valuation of Fertilizers.

The valuation of a fertilizer signifies ascertaining its worth in money, or its trade value—a value which is not necessarily proportional to its fertilizing effects.

Plaster, lime, stable manure, and nearly all of the less expensive fertilizers, have quite variable prices, which bear no close relation to their chemical composition, but superphosphates and some other fertilizers depend chiefly for their trade value on the three substances, *nitrogen*, *phosphoric acid* and *potash*, which are comparatively costly and quite steady in price.

Experience has settled the general principle that these are absolutely essential to the growth and maturity of all crops; that they are the only expensive substances that are essential, and consequently are the only ingredients on which an estimated value is placed. The prices attached to these substances may vary with the market, and thus we may expect them to change from time to time. Below is given the prices at which the various forms in which these substances are sold were rated at, 1880.

Nitrogen is commercially the most fertilizing element. It occurs in various forms. *Organic nitrogen*, as the nitrogen of animal and vegetable matters generally existing in the albumen and fibrin of meat and blood, in the uric acid of bird excrement, and in the urea of urine. Some forms of *organic nitrogen*, as that of blood and meat, are very active as fertilizers; others, as that of hair, slow in their effect on vegetation. *Ammonia* and *nitric acid* are results from the decay of *organic nitrogen* in the soil and manure heap, and are the most active forms of nitrogen. The former occurs in commerce as sulphate of ammonia, and the latter as nitrate of soda.

Phosphoric acid occurs as *soluble*, *reverted* and *insoluble*.

Soluble phosphoric acid implies phosphoric acid or phosphates that are freely soluble in water. It is the characteristic ingredient of *superphosphates*, in which it is produced by acting on insoluble phosphate with *sulphuric acid*. It is not only readily taken up by plants, but is distributed through the soil by rain.

Reverted phosphoric acid is phosphoric acid that was freely soluble in water, but has undergone a chemical change and become insoluble, but is soluble in a strong solution of ammonia citrate. It can be assimilated by crops, but has less value than soluble phosphoric acid, as it does not distribute so freely by rain.

Insoluble phosphoric acid implies various phosphates not freely soluble in water or ammonium citrate.

Potash is the valuable fertilizing ingredient of "potashes" and "potash salts." It is usually sold in the form of a sulphate or chloride.

The average trade values or cost in market, per pound, of the ordinary forms of *nitrogen*, *phosphoric acid* and *potash* for 1880, was :—

Nitrogen in nitrates	26	cts. per lb.
" " ammonia salts	22½	" "
" " fine ground bone	18	" "
" " medium bone	16½	" "
" " coarse bone	15	" "
" " organic matter, blood, fish, etc	20	" "
Phosphoric acid soluble in water	12½	" "
" " "reverted"	9	" "
" " insoluble fine bone	7	" "
" " " coarse	5½	" "
" " " fine ground rock	3½	" "
Potash in high grade sulphate	7½	" "
" " low grade "	6	" "
" " muriate or potassium chloride	4½	" "

To estimate the value of a fertilizer from this table of prices, it is necessary to have an analysis of the fertilizer, which should always be supplied by the vendor. It is hoped that the time is not far distant when our Government will require an analysis of every fertilizer offered for sale. With this information the farmer will readily be able to estimate its value as follows: Multiply the pounds per hundred of nitrogen, etc., by the trade values per pound. This gives the values of the several ingredients, which added together is the value per hundred pounds of the fertilizer. Multiplying this sum by 20 gives the price per ton.

e.g.—Suppose the analysis of a certain fertilizer gives

Nitrogen in organic matter	2 per cent.		
Soluble phosphoric acid	3 "		
Reverted	4 "		
Insoluble	5 "		
Potash as sulphur	2 "		
2 lbs. nitrogen or organic matter	@ .20	=	.40
3 " soluble phosphoric acid	@ .12½	=	.37½
4 " reverted	@ .09	=	.36
5 " insoluble	@ .07	=	.35
2 " potash sulphate	@ .07½		.15
Total value of one hundred pounds fertilizer			1.63½

Then $1.63\frac{1}{2} \times 20 = 32.70$, the estimated value of a ton.

Further examples of analyses of superphosphates, with estimated and cost prices compared :—

———	No. 1.	No. 2.	No. 3.	No. 4.
Nitrogen	1.68	2.59	3.92	1.67
Soluble phosphoric acid	1.98	4.57	6.03	3.83
Reverted " "	3.66	1.70	4.96	5.99
Insoluble " "	4.77	3.77	1.70	6.01
Potash (as Chloride)	.....	7.31	.....	.60
Estimated value of a ton	$24 94	$36 70	$42 06	$35 99
Cost value or selling price	$24 00	$38 00	$60 00	$40 50

In furnishing the analyses of a fertilizer, it is usual to give the percentage of the ingredients as above and not the combinations in which they occur, such as phosphate of lime, organic matter, and ammonia.

If the *estimated* value is much below the selling price, the fertilizer is likely to be adulterated. *See* No. 3.

In many parts of the United States this method of estimating the value of the fertilizer has been followed for some time with most satisfactory results, in placing a check on the tendency of some manufacturers to practise adulterations.

This will be better understood by the following instance :—A certain fertilizer was sold as "a composition for grass" with considerable success, at the rate of $32 per ton. On an analysis being made, its value was estimated at $1.03 per ton. The publication of this fraud caused the vendor to shift his operations to another State, where his dishonesty was less known.

IV.—ANALYSIS OF THE ASH OF PLANTS.

In the analysis of a plant, two classes of substances are considered; the analysis of the organic substance of the plant, and the analysis of the inorganic. The foregoing analyses refer principally to the organic constituents, while the following has reference to the inorganic compounds which enter into the composition of plants. The former are of special importance in feeding, and are elaborated by the plant itself; the latter are chiefly taken up by the plant from the soil, and are of importance in considering the question of soil exhaustion.

The percentage of ash in the dry matter of plants (that obtained by drying the plants at a temperature of 212°, until they cease to lose weight), is usually from 3 to 6 per cent. of the entire plant. In the seeds the amount of ash is small, but in the leaves it sometimes reaches 20 per cent.

The average percentage of ash is usually given as follows :—

Wheat grain	1.9	Buckwheat straw	6.1
Oat "	2.9	Flax "	3.7
Barley "	2.2	Potato	4.3
Rye "	2.6	Mangold	8.5
Corn "	1.5	Turnip	9.0
Beans "	3.6	Carrot	8.0
Peas "	2.7	White Turnip	6.0
Wheat straw	5.0	Sugar Beet	4.35
Oat "	5.4	Red Clover, whole plant	6.8
Barley "	6.7	White Clover	7.3
Rye "	5.2	Timothy	7.0
Corn "	5.5	Lucerne	7.14
Pea "	6.2		

The composition of the ash of plants, per one hundred parts, is given in the following table, compiled from the results of many analyses (excluding Carbonic Dioxide) :—

Substance.	Potash.	Soda.	Magnesia.	Lime.	Ferric oxide.	Phosphoric Acid.	Sulphuric Acid	Silica.	Chlorine.
1. Wheat (grain)	31.54	2.66	12.10	3.14	Trace.	48.5	1.08	1.83	.10
2. Rye "	30.9	1.8	10.9	2.7	.....	47.5	2.3	1.9	.....
3. Barley "	21.28	4.0	9.10	2.40	.15	33.17	2.10	27.5	.30
4. Oat "	37.48	2.4	7.8	3.0	.6	20.8	1.8	25.9	.22
5. Corn "	37.95	3.0	7.5	3.4	.4	44.8	1.5	1.45	Trace.
6. Beans "	40.5	1.2	6.7	5.2	.2	37.0	5.1	1.0	2.9
7. Peas "	40.4	3.7	8.0	4.7	.6	36.3	3.13	.9	2.3
8. Flax "	30.4	2.61	16.23	9.45	.38	35.9	1.43	1.76	1.70
9. Buckwheat	23.1	6.2	34.4	3.3	.....	48.0	2.1	.....	1.7
10. Potatoes	61.6	1.0	5.0	2.4	.85	18.67	6.25	2.0	2.23
11. Mangolds (yellow)	35.09	28.9	2.5	2.5	.66	6.16	3.19	3.0	18.0
12. Mangolds (red)	25.18	32.10	2.6	2.2	.50	2.16	4.0	1.6	30.0
13. Beets, sugar	49.4	9.6	8.9	6.6	.....	14.3	4.7	3.7	2.0
14. Carrot	41.46	17.6	5.36	8.86	.32	12.68	6.93	2.0	4.79
15. Carrot (tops)	16.0	23.1	4.6	33.0	.....	4.7	7.9	5.6	7.1
16. Turnips	39.3	11.8	3.9	10.4	.....	13.3	14.3	2.4	4.2
17. Turnips (tops)	23.9	7.9	4.7	32.4	.....	8.9	9.9	3.8	8.4
18. Maize	32.3	1.2	5.5	10.5	.8	8.1	5.2	38.0	.....
19. Wheat (straw)	12.16	1.0	4.9	6.82	1.02	3.2	5.78	65.34	.6
20. Oat "	21.6	6.0	3.66	8.1	.83	4.16	3.32	50.8	3.25
21. Flax "	37.9	5.6	7.1	22.3	.....	11.5	5.3	6.0	4.0
22. Buckwheat (straw)	46.6	2.2	3.6	18.4	.....	11.9	5.3	5.5	7.7
23. Barley "	19.32	4.5	2.7	7.0	.26	4.83	3.78	56.8	.76
24. Pea "	22.0	6.0	7.34	39.0	1.08	6.84	6.30	6.18	5.26
25. Lucerne	25.3	2.0	5.8	48.4	.....	8.5	6.1	2.0	1.9
26. Timothy	28.8	2.7	3.7	9.4	.....	10.4	3.9	36.2	4.9
27. Red Clover	31.86	2.16	12.16	31.09	.66	9.0	3.03	6.71	3.3
28. White Clover	17.5	7.8	10.8	33.2	.....	14.1	8.8	4.5	3.2
29. Hops	37.3	2.8	5.5	16.9	.....	15.1	2.6	16.4	3.4
30. Tobacco	27.4	3.7	10.5	37.0	.....	3.6	3.9	9.6	4.5

The following table is frequently used for calculating the exhaustion of soils by certain crops. As the figures are taken from European sources, they may be considered as a close approximation to the true analysis of the substances mentioned :—

VEGETABLE MATERIALS. 1,000 pounds contain :	Composition of the Mineral Matter.
	derived from the soil.
	derived from the atmosphere.
	derived from the soil.
	derived from the atmosphere.

The following table is frequently used for calculating the exhaustion of soils by certain crops. As the figures are taken from European sources, they may be considered as a close approximation to the true analysis of the substances mentioned :—

VEGETABLE MATERIALS. 1,000 pounds contain:	Water, derived through soil from the air.	Organic matter mostly from the atmosphere.	Mineral matter derived from the soil.	Nitrogen in organic matter, mostly from the soil.	Composition of the Mineral Matter.						
					Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Sulphuric Acid.	Silica.
Grain and Straw.											
Wheat, grain	14.3	840.1	16.9	20.8	5.3	0.4	0.6	2.0	7.9	0.1	0.4
Wheat, straw	14.1	812.9	46.1	4.8	6.3	0.6	2.7	1.1	2.2	1.1	31.2
Rye, grain	14.3	839.1	17.9	17.6	5.6	0.3	0.5	2·1	8.4	0.2	0.4
Rye, straw	14.3	816.5	40.5	4.0	7.8	0.9	3.5	1.1	2.1	1.1	22.9
Oats, grain	14.3	830.0	27.0	19.2	4.4	0.6	1.0	1.9	6.2	0.4	12.0
Oats, straw	14.3	816.6	40.4	5.6	8.9	1.2	3.6	1.6	1.9	1.3	19.6
Corn, grain	14.4	843.0	13.0	16.0	3.7	0.2	0.3	2.0	5.9	0.2	0.2
Corn, stalks and leaves	15.0	808.1	41.9	4.8	9.6	6.1	4.0	2.6	5.3	1.2	11.7
Buckwheat, grain	14.0	848.2	11.8	14.4	2.7	0.7	0.5	1.5	5.7	0.2	0.1
Buckwheat, straw	16.0	788.3	51.7	13.0	24.2	1.1	9.5	1.9	6.1	2.7	2.9
Beans, grain	14.5	824.3	30.7	40.8	13.1	0.4	1.5	2.2	11.9	0.8	0.2
Beans, straw	16.0	796.1	43.9	16.3	18.5	1.1	9.8	3.3	3.2	1.6	3.2
Peas, grain	14.3	833.5	23.5	35.8	9.8	0.2	1.2	1.9	8.9	0.8	0.2
Peas, straw	16.0	796.0	44.0	10.4	10.1	1.8	16.2	3.5	3.5	2.7	3.0
Hay.											
Meadow Hay	14.3	805.5	51.5	15.5	13.2	2.3	8.6	3.3	4.1	2.4	13.9
Timothy Hay	14.3	784.9	62.1	15.5	20.4	1.5	4.5	1.9	7.2	1.8	22.1
Red Clover Hay	16.0	783.1	56.9	19.7	18.3	1.2	20.0	6.1	5.6	1.7	1.4
Lucerne	16.0	777.9	62.1	23.0	15.3	1.3	26.2	3.3	5.5	3.7	3.8
Green Crops.											
Timothy, grass	70.0	278.4	21.6	5.4	7.4	0.5	1.6	0.7	2.5	0.6	7.7
Rye, fodder	76.0	223.7	16.3	5.3	6.3	0.1	1.3	0.5	2.4	0.2	5.2
Corn, fodder	82.2	166.0	12.0	1.9	4.3	0.5	1.6	1.4	1.3	0.4	1.7
Red Clover in blossom	78.0	206.3	13.7	5.1	4.4	0.3	4.8	1.5	1.4	0.4	0.3
Roots.											
Potatoes, tubers	75.0	240.6	9.4	3.4	5.7	0.2	0.2	0.4	1.6	0.6	0.2
Potatoes, vines	77.0	210.3	19.7	4.9	4.3	0.4	6.4	3.3	1.6	1.3	0.9
Turnips, tops	89.8	90.1	11.9	3.0	2.8	1.1	3.9	0.5	0.9	1.1	0.5
Turnips, roots	92.0	72.7	7.3	1.8	3.3	0.7	0.8	0.3	0.9	0.8	0.1
Sugar Beets, roots	81.5	177.9	7.1	1.6	3.9	0.7	0.4	0.5	0.8	0.3	0.1
Sugar Beets, tops	89.7	84.9	18.1	3.0	6.5	2.7	2.7	2.7	1.3	0.9	0.7
Carrot, roots	85.0	142.2	7.8	2.2	2.8	1,7	0.9	0.4	1.0	0.5	0.2
Carrot, tops	82.2	152.0	26.0	5.1	2.9	5.2	8.5	0.9	1.2	2.0	2.9

The following are some calculations based upon the foregoing table, showing the materials and the amount removed from the soil by our most common crops:—

CROP.	Sulphuric Acid.	Phosphoric Acid.	Lime.	Magnesia.	Potash.	Nitrogen.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
OATS—						
Grain, 30 bushels=960 lbs.	.4	6.	1.0	1.8	4.2	18.4
Straw, 2,000 lbs.	2.6	3.8	7.2	3.2	17.8	11.2
Total	3.0	9.8	8.2	5.0	22.0	29.6
WHEAT—						
Grain, 20 bushels=1,200 lbs.	.1	9.5	.7	2.4	6.4	25.
Straw, 3,000 lbs.	3.3	6.6	8.1	3.3	18.9	14.4
Total	3.4	16.1	8.8	5.7	25.3	39.4
CORN—						
Grain, 50 bushels=2,800 lbs.	.6	16.5	.8	5.6	10.4	44.8
Straw, 6,500 lbs.	7.8	34.5	26.0	16.9	62.4	31.2
Total	8.4	51.0	26.8	22.5	72.8	76.0
RYE—						
Grain, 25 bushels=1,400 lbs.	.3	11.8	.7	2.9	7.8	24.6
Straw, 3,500 lbs.	3.8	7.3	12.2	3.9	27.3	14.0
Total	4.1	19.1	12.9	6.8	35.1	38.6
MEADOW HAY—						
1½ tons=3,000 lbs	7.2	12.3	25.8	9.9	39.6	46.5
POTATOES—						
Tubers, 150 bushels=9,000 lbs.	5.4	1.44	1.8	3.6	51.3	30.6
TURNIPS—						
Roots, 4,000 lbs	3.2	3.6	3.2	.9	9.9	5.4

An examination of the preceding tables will enable you to understand how some plants are much more exhaustive upon soils than others, and how continual cropping removes from the soil mineral ingredients which must be returned or impoverishment takes place. It will also show that many plants abstract a large amount of potash from the soil, others much lime, while some carry off phosphoric acid. Hence we find such terms as *potash* and *lime* plants in use.

A great deal could be said on what is suggested by a comparison of the figures in the preceding tables; but, as the limit of my work is reached, I leave what has been said to be carefully considered by those for whom it has been written. If the remarks on cattle-feeding and a compilation of useful analyses prove interesting and instructive to the students of the Ontario Agricultural College, I shall feel amply repaid for any time spent in the collection of data required, or trouble experienced in preparing this paper for their perusal.

Your obedient servant,

J. HOYES PANTON,

Professor of Chemistry and Lecturer on Geology and Meteorology.

REPORT

OF

THE PHYSICIAN.

ONTARIO AGRICULTURAL COLLEGE,

GUELPH, 27TH DECEMBER, 1881.

To the Honourable the Commissioner of Agriculture:

SIR,—I have the honour to present my Annual Report as Medical Officer of the Ontario Agricultural College.

During last winter we had more than the average amount of sickness, influenza being epidemic in the city and neighbourhood; many of the students were attacked with the disease. During the prevalence of influenza many of the young men suffered from sore throat, the result of cold.

Following the influenza we had an epidemic of measles, but owing to the great care taken by the officers of the Institution, there were only ten of the young men and three of the servants who contracted the disease.

This is the first time in the history of the College that we have been visited by an epidemic, and we are glad to be able to report that we had not a single death. About this time we had four cases of erysipelas, but only one of them was of a bad type, and he ultimately made a good recovery.

The other ailments have been just such as we meet with in every-day practice.

Owing to the large increase of students, we, as a matter of course, have had more requiring medical aid this year than any previous year.

I am ever ably assisted by the President and those under him whose duty it is to look after the comfort of the students, whether in sickness or in health.

I cannot close this Report without saying that the great difficulty we had to contend with during the prevalence of the epidemic was that we had not a properly isolated sick room into which the patients could at once be removed, and thus prevent the spreading of the disease.

I have the honour to be, Sir,

Your obedient servant,

E. W. MCGUIRE.

APPENDIX 1.

1.—COLLEGE ROLL FOR THE YEAR 1881.

2.—COLLEGE ROLL FOR THE SESSION 1881-'82 (1st Oct. to 31st March).

1.—COLLEGE ROLL FOR THE YEAR 1881.

Name.	P. O. Address.	County, &c.
Anderson, Harry F	London	Middlesex (London City).
Anderson, John P	Guelph	Wellington.
Armstrong, Christian	Knowlton	Quebec.
Armstrong, Francis	Knowlton	Quebec.
Ballantyne, William	Stratford	Perth.
Barclay, Edmund H	St. Andrews	Scotland.
Bansley, John	Toronto	York (Toronto City).
Batty, Jonathan	Meaford	Grey.
Begg, Robert H	Bracebridge	Victoria.
Bell, James	Montreal	Montreal.
Beaudet, George	Quebec	Quebec.
Bethune, Kenneth	Ottawa	Carleton (Ottawa City).
Bignell, Edward	Claude	Peel.
Blake, Oliver C	Waterford	Norfolk.
Blanchard, Monson	Windsor	Nova Scotia.
Bowes, James B	Pinkerton	Bruce.
Bowes, James C	Halifax	Nova Scotia.
Bowman, Byron	West Montrose	Waterloo.
Broughton, Charles J	Hamilton	Wentworth (Hamilton City).
Brown, William	Guelph	Wellington.
Cameron, Henry H	Ottawa	Carleton.
Carnegie, John	Peterboro'	Peterboro'.
Carpenter, Charles	Simcoe	Norfolk.
Chase, Oscar	Cornwallis	Nova Scotia.
Charleton, George H	St. George	Brant.
Chipman, Percy H	Montreal	Montreal.
Clark, Charles	Parkdale	York.
Clark, Frank	Parkdale	York.
Clarke, Harry	Ottawa	Carleton (Ottawa City).
Clutton, John G	Milburn	Huron.
Cowley, Ernest A. E	Windsor	England.
Creelman, James H	Collingwood	Grey.
Cross, Alfred E	Montreal	Montreal.
Cunningham, C. G	Ottawa	Carleton (Ottawa City).
Cuppage, Alexander	Orillia	Simcoe.
Cutting, Aubrey N	Gayton Lynn	England.
Davis, Robert A	Cayuga	Haldimand.
Dawson, John	South Zorra	Oxford.
Day, Forshaw	Kingston	Frontenac (Kingston City).
Dennis, James F	Weston	York.
De Koerber, Victor	Toronto	York (Toronto City).

1.—COLLEGE ROLL FOR THE YEAR 1881—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, &c.
De Veber, William H	St. John	New Brunswick.
Dewar, John	Tiverton	Bruce.
Dickenson, Charles S.	Seaforth	Huron.
Dickenson, Samuel	Zion	Durham.
Dickinson, George A.	Zion	Durham.
Duthie, James	Guelph	Wellington.
Donaldson, John	Wolfeville	Nova Scotia.
Douglas, Joseph	Blake	Huron.
Dunlop, John	Woodstock	Oxford.
Eddington, Dugald	Glencreggan	Scotland.
Elworthy, Robert	Norwich	Oxford.
Edmondson, James A.	Utopia	Simcoe.
Egleston, George	Ancaster	Wentworth.
Eidt, William	Philipsburg, West	Waterloo.
Ffolkes, Edward	Hillington Lynn	England.
Ffolkes, Robert	Hillington Lynn	England.
Ferguson, George A.	Kingston	Frontenac (Kingston City).
File, John J	Brantford	Brant.
Fotheringham, James	St. Mary's	Perth.
Fotheringham, William	St. Mary's	Perth.
Forbes, Edward R.	Toronto	York (Toronto City).
Fraser, Thomas H.	Kinburn	Carleton.
Frith, Henry M.	St. John	New Brunswick.
Garland, Collins S.	Montreal	Montreal.
Gaw, William W.	Leadville	Colorado, U.S.
George, Alexander	Keith	Scotland.
Gibb, J. Gordon	Ottawa	Carleton.
Gibson, William J.	Ottawa	Carleton (Ottawa City).
Gibson, Robert	Glen Allen	Wellington.
Gillespie, Joseph H.	Innerkip	Oxford.
Gilpin, Randolph	Halifax	Nova Scotia.
Gilpin, William	Ottawa	Carleton.
Glass, William	East Zorra	Oxford.
Goold, George Ernest	Kingston	Frontenac (Kingston City).
Grant, William M.	Woodville	Victoria.
Green, E. Herbert	Toronto	York (Toronto City).
Green, Henry	Waterford	Norfolk.
Greenlaw, Fred. William	Plymouth	England.
Gregory, John	Fredericton	New Brunswick.
Grindley, Arthur W.	Wolfe's Island	Frontenac.
Horne, William H.	North Keppel	Grey.
Hill, James L.	Ottawa	Carleton (Ottawa City).
Howitt, William	Guelph	Wellington.
Holtermann, Richard	Toronto	York.
Hallesy, Frederick	Merthyr Tydfil	Wales.
Henderson, Daniel	Loch Winnoch	Renfrew.
Holcroft, Harry S.	Orillia	Simcoe.
Hutton, John R.	St. Catharines	Lincoln.
Hutton, William E.	St. Catharines	Lincoln.
Havard, Benjamin	Merthyr Tydfil	Wales.
Hopkins, John A.	Holt	York.
Holden, Walter L.	Hamilton	Wentworth (Hamilton City).
Job, John	Waterdown	Wentworth.
Jones, George B.	Guelph	Wellington.
Jones, William S.	Halifax	Nova Scotia.
Jones, William H.	Merthyr Tydfil	Wales.
Jeffs, Herbert B.	Bond Head	Simcoe.
Joseph, Stewart S.	Quebec	Quebec.
Kippen, Horace B.	Lennoxville	Quebec.
Kestell, Robert H.	Simcoe	Norfolk.
Knott, Edgar	Portsmouth	England.
King, John E.	Middlemarch	Elgin.
Law, F. E.	Stratford	Perth.
Landsborough, John	Clinton	Huron.
Leask, John	Pinkerton	Bruce.
Lindsay, William David	Woodstock	Oxford.
Lindsay, Samuel George	Woodstock	Oxford.
Lewis, William	Montreal	Montreal.
Lough, William H.	Clinton	Huron.

1.—COLLEGE ROLL FOR THE YEAR 1881—*Continued.*

Name.	P. O. Address.	County, &c.
Luton, Edward E.	New Sarum	Elgin.
Lowry, Charles E. C.	London	England.
McNaughton, James	Laggan	Glengarry.
Motherwell, William R.	Perth	Lanark.
McIlquham, John	Lanark	Lanark.
McIlquham, William	Lanark	Lanark.
Mylne, Robert C.	Smith's Falls	Lanark.
Macaulay, Herbert	Hamilton	Wentworth.
McFarlane, David	Montreal	Montreal.
McArthur, John	Ailsa Craig	Middlesex.
McLeod, Martin D.	Oak Ridges	York.
Myers, William	Guelph	Wellington.
Moore, Charles J.	Toronto	York (Toronto City).
Matthewman, Ernest	Ottawa	Carleton (Ottawa City).
Mahony, E. C.	Hamilton	Wentworth (Hamilton City
Major, Charles	Croydon	England.
Magor, John	Montreal	Montreal.
McPhail, Ernest	Toronto	York (Toronto City).
McLaren, Peter	Perth	Lanark.
McPherson, Duncan	Glanworth	Middlesex.
McDonald, John	Petrolia	Lambton.
McNish, Charles H.	Lyn	Leeds.
McKercher, William	Wroxeter	Huron.
McLennan, Daniel	Camerontown	Glengarry.
Morton, Francis G.	Barrie	Simcoe.
Maunsell, George S.	Ottawa	Carleton (Ottawa City).
Messecar, Charles L.	Scotland	Brant.
Minard, William F.	St. Thomas	Elgin.
Monteith, William	Exeter	Huron.
Millson, Matthew	Glanworth	Middlesex.
Maughan, Walter E.	Owen Sound	Grey.
Nicol, George	Cataraqui	Frontenac.
Newton, John	Weston	York.
Noble, Frederick	Toronto	York.
Newport, Edward F.	St. George	Bermudas.
Neilson, James	Lyn	Leeds.
Ord, William	Toronto	York (Toronto City).
Pope, Edward	Sarawak	Grey.
Pope, Herbert	Sarawak	Grey.
Phin, William E.	Hespeler	Waterloo.
Phin, Richard J.	Hespeler	Waterloo.
Patton, William	Montreal	Montreal.
Philbin, Thomas R.	Ottawa	Carleton.
Poe, James P.	Callan	Ireland.
Pettapiece, William	Manotick	Carleton.
Pope, Alfred H.	London	England.
Perry, Donald E.	Ottawa	Carleton (Ottawa City).
Patterson, William	Merritton	Lincoln.
Ross, James G.	Montreal	Montreal.
Robins, William	Beamsville	Lincoln.
Ross, William J.	Smith's Falls	Lanark.
Rae, William B.	London	England.
Ramsay, Robert	Eden Mills	Wellington.
Rogers, Frederick	Deans	Haldimand.
Roblin, Adelbert G.	Rednersville	Prince Edward.
Redmond, Samuel	Peterboro'	Peterboro'.
Raines, G. R.	Côte St. Antoine	Montreal.
Ryall, Frank	Paris	Brant.
Raikes, Harry	Barrie	Simcoe.
Riddell, Alfred	Kinburn	Carleton.
Rennie, Ernest	Hamilton	Wentworth (Hamilton City)
Robinson, Jesse D.	Middlemarch	Elgin.
Robertson, William	Hanstead	Lambton.
Routh, Rudolph	Montreal	Montreal.
Rose, George M.	Toronto	York (Toronto City).
Surtees, William S.	Ottawa	Carleton (Ottawa City).
Small, Alexander T	Ottawa	Carleton (Ottawa City).
Silverthorn, Newman	Sommerville	Peel.
Scott, Archie	Hastings	Northumberland.

1.—COLLEGE ROLL FOR THE YEAR 1881—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, &c.
Segsworth, Frederick	Monck	Wellington.
Skaife, John	Montreal	Montreal.
Stover, William John	Norwich	Oxford.
Shaver, Charles B.	Stratford	Perth.
Schüll, Charles B.	Guelph	Wellington.
Stonehouse, Marshall	Shirley	Ontario.
Smith, Miles H.	Oakville	Halton.
Shuttleworth, Arthur	Mount Albert	York.
Shearer, Edward	Ottawa	Carleton (Ottawa City).
Skinner, Andrew	Woodstock	Oxford.
Smith, John A.	Martintown	Glengarry.
Smith, J. Lloyd	Ottawa	Carleton (Ottawa City).
Smith, Frank W	Scotland	Brant.
Strange, Alexander W.	Kingston	Frontenac (Kingston City).
Stephenson, Charles	Fingal	Elgin.
Schwartz, Yohann	Quebec	Quebec.
Torrance, W. Percy	Guelph	Wellington (Guelph City).
Templar, William	Jerseyville	Wentworth.
Tronson, Harold	Oakville	Halton.
Terhune, Frederick	Brantford	Brant.
Tourangeau, Adolphus	Quebec	Quebec.
Townsend, Kirkley	Aldershot	Wentworth.
Torrance, Wilfred J.	Ottawa	Carleton (Ottawa City).
Thomas, Frank J	Oxford	England.
Willis, Thomas	Whitby	Ontario.
Woodley, Francis	Quebec	Quebec.
Wilson, William A.	Ottawa	Carleton (Ottawa City).
Watt, James M	Montreal	Montreal.
Watt, D. A	Montreal	Montreal.
Ward, Thomas M	Stanhope	Quebec.
White, William G.	Lanark	Lanark.
White, Charles	Lanark	Lanark.
Wyndham, Walter	Roach's Point	York.
Wettlaufer, Frederick	Tavistock	Perth.
Williams, Albert W.	Culloden	Oxford.
Walker, Robert B.	Diamond	Carleton.
Wilcocks, Frederick H.	Richmond	Quebec.
Willis, William B.	Whitby	Ontario.
Total		217

2.—COLLEGE ROLL FOR THE SESSION 1881-'82 (1ST OCT. TO 31ST MARCH).

NAME.	P. O. ADDRESS.	COUNTY, &c.
Anderson, Harry F.	London	Middlesex (London City).
Barclay, Edmund H.	St. Andrews	Scotland.
Begg, Robert A	Bracebridge	Victoria.
Bethune, Kenneth	Ottawa	Carleton (Ottawa City).
Bignell, Edward	Claude	Peel.
Blanchard, Monson	Windsor	Nova Scotia.
Bowes, James B.	Pinkerton	Bruce.
Bowes, James C.	Halifax	Nova Scotia.
Bowman, Byron	West Montrose	Waterloo.
Broughton, Charles J.	Hamilton	Wentworth (Hamilton City)
Brown, William	Guelph	Wellington.
Cameron, Henry H.	Ottawa	Carleton.
Carnegie, John	Peterboro'	Peterboro'.
Carpenter, Charles	Simcoe	Norfolk.

2.—COLLEGE ROLL FOR THE SESSION 1881-'82—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, &c.
Chase, Oscar	Cornwallis	Nova Scotia.
Clark, Charles	Parkdale	York.
Clark, Frank	Parkdale	York.
Cowley, Ernest H. E	Windsor Castle	England.
Creelman, James	Collingwood	Grey.
Cunningham, C. G	Ottawa	Carleton (Ottawa City).
Cutting, Aubrey A	Gayton Lynn	England.
Davis, Robert A	York	Haldimand.
Dawson, John J	South Zorra	Oxford.
Day, Forshaw	Kingston	Frontenac (Kingston City).
Dennis, James F	Weston	York.
De Veber, William H	St. John	New Brunswick.
Dewar, John D	Tiverton	Bruce.
Duthie, James	Guelph	Wellington.
Dickenson, George H	Zion	Durham.
Donaldson, John	Wolfville	Nova Scotia.
Eddington, Dugald	Glencreggan	Scotland.
Elworthy, Robert	Norwich	Oxford.
Edmondson, James A	Utopia	Simcoe.
Eidt, William	Philipsburg, West	Waterloo.
Ffolkes, Robert W. E	Hillington Lynn	England.
Ferguson, George A	Kingston	Frontenac (Kingston City).
Fotheringham, William	St. Mary's	Perth.
Fraser, Thomas	Kinburn	Carleton.
Frith, Henry M	St. John	New Brunswick.
Garland, Collins S	Montreal	Montreal.
Gillespie, Joseph H	Innerkip	Oxford.
Gilpin, Randolph	Halifax	Nova Scotia.
Gilpin, William	Ottawa	Carleton.
Goold, G. Ernest	Kingston	Frontenac.
Greenlaw, Frederick William	Plymouth	England.
Gregory, John	Fredericton	New Brunswick.
Grindley, Arthur W	Wolfe Island	Frontenac.
Howitt, William	Guelph	Wellington.
Hallesy, Frederick	Merthyr Tydfil	Wales.
Holcroft, Harry S	Orillia	Simcoe.
Hutton, John R	St. Catharines	Lincoln.
Hutton, William E	St. Catharines	Lincoln.
Harvard, Benjamin	Merthyr Tydfil	Wales.
Hopkins, John H	Holt	York.
Holden, Walter L	Hamilton	Wentworth.
Jones, George B	Guelph	Wellington (Guelph City).
Jones, William S	Halifax	Nova Scotia.
Jeffs, Herbert B	Bond Head	Simcoe.
Joseph, Stewart S	Quebec	Quebec.
Kestell, Robert H	Simcoe	Norfolk.
King, John Ezra	Middlemarch	Elgin.
Law, Frank E	Stratford	Perth.
Lindsay, William David	Woodstock	Oxford.
Lindsay, Samuel George	Woodstock	Oxford.
Lough, William H	Clinton	Huron.
Luton, Edward E	New Sarum	Elgin.
Lowry, Charles E. C	London	England.
McKim, James A	Parker	Wellington.
McLeod, Martin D	Oak Ridges	York.
McPhail, Ernest	Toronto	York.
McPherson, Duncan	Glanworth	Middlesex.
McDonald, John	Petrolia	Lambton.
McNish, Charles H	Lyn	Leeds.
McKercher, William	Wroxeter	Huron.
McClennan, Daniel	Camerontown	Glengarry.
Mahony, E. C	Hamilton	Wentworth.
Major, Charles H. F	Croydon	England.
Magor, John F	Montreal	Montreal.
Morton, Francis G	Barrie	Simcoe.
Maunsell, George S	Ottawa	Carleton (Ottawa City).
Messecar, Charles L	Scotland	Brant.
Minard, William F	St. Thomas	Elgin.
Monteith, William	Exeter	Huron.

2.—COLLEGE ROLL FOR THE SESSION 1881-'82—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, &c.
Millson, Matthew	Glanworth	Middlesex.
Maughan, Walter	Owen Sound	Grey.
Newport, Edward	St. George	Bermudas.
Neilson, James	Lyn	Leeds.
Ord, William	Toronto	York (Toronto City).
Pope, Edward	Sarawak	Grey.
Pope, Herbert	Sarawak	Grey.
Philbin, Thomas R.	Ottawa	Carleton.
Pope, Alfred H	London	England.
Perry, Donald E.	Ottawa	Carleton (Ottawa City).
Patterson, William	Merritton	Lincoln.
Ramsay, Robert H.	Eden Mills	Wellington.
Rogers, Frederick	Deans	Haldimand.
Raynes, G. R.	Côte St. Antoine	Montreal.
Ryall, Frank	Paris	Brant.
Raikes, Harry	Barrie	Simcoe.
Riddell, Alfred	Kinburn	Carleton.
Rennie, Ernest	Hamilton	Wentworth (Hamilton City)
Robinson, Jesse D.	Middlemarch	Elgin.
Robertson, William	Wanstead	Lambton.
Routh, Rudolph	Montreal	Quebec.
Rose, George M.	Toronto	York (Toronto City).
Shuttleworth, Arthur	Mount Albert	York.
Silverthorne, Newman	Sommerville	Peel.
Stover, John William	Norwich	Oxford.
Shearer, Edward	Ottawa	Carleton (Ottawa City).
Skinner, Andrew	Woodstock	Oxford.
Smith, John A.	Martintown	Glengarry.
Smith, J. Lloyd	Ottawa	Carleton (Ottawa City).
Smith, Frank W.	Scotland	Brant.
Strange, Alexander W.	Kingston	Frontenac.
Stephenson, Charles R.	Fingal	Elgin.
Schwartz, Yohann A.	Quebec	Quebec.
Tronson, Harold	Oakville	Halton.
Terhune, Frederick	Brantford	Brant.
Tourangeau, Adolphus	Quebec	Quebec.
Townsend, Kirkley	Aldershot	Wentworth.
Torrance, Wilfred	Ottawa	Carleton (Ottawa City).
Thomas, Frank J.	Oxford	England.
White, William G.	Lanark	Lanark.
White, Charles	Lanark	Lanark.
Wyndham, Walter	Roach's Point	York.
Wettlaufer, Frederick	Tavistock	Perth.
Williams, Albert	Culloden	Oxford.
Wilcocks, Frederick H.	Richmond	Quebec.
Willis, William B.	Whitby	Ontario.
Total		129

APPENDIX 2.

TIME TABLES FOR FALL TERM (1st October to Christmas), 1881.

Time Table No. 1 gives the routine of the different years and divisions for the first week; Time Table No. 2, the routine of the same years and divisions for the second week, No. 1 and No. 2 having been followed alternately, for a week each, throughout the term.

TIME TABLE No. 1.—1st WEEK.

2nd Year.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7–12	Work.	Work.	Work.	Work.	Work.	Work.
Afternoon.	2–3	Agricultural Chemistry.	Levelling and Surveying.	Handling and Judging Cattle or Sheep.	Meteorology.	Agricultural Chemistry.	Half Holiday.
	3–4	Veterinary Pathology.	Agriculture.	Agricultural Chemistry.	Agriculture.	English Literature.	
	4–5	Handling and Judging Horses.	English Literature.	Statics.	Levelling and Surveying.	Veterinary Pathology.	

1st Year—Division I.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7–12	Work.	Work.	Work.	Work.	Work.	Work.
Afternoon.	2–3	Arithmetic.	English Composition.	Natural History.	Natural History.	Arithmetic.	Half Holiday.
	3–4	Agriculture.	English Literature.	Agriculture.	Inorganic Chemistry.	Inorganic Chemistry.	
	4–5	Inorganic Chemistry.	Veterinary Anatomy.	Veterinary Anatomy.	English Literature.	Agriculture.	

1st Year—Division II.

	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.	Arithmetic.	Natural History.	English Composition.	English Literature.	
	10–11	Inorganic Chemistry.	Agriculture.	Inorganic Chemistry.	English Literature.	Agriculture.	
	11–12	Natural History.	Inorganic Chemistry.	Veterinary Anatomy.	Agriculture.	Veterinary Anatomy.	
Afternoon.	1.30–5	Work.	Work.	Work.	Work.	Work.	Work.

TIME TABLE No. 2.—2nd WEEK.

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.	Drill.	Drill.	Drill.	Drill.	
	9–10	Agricultural Chemistry.	Levelling and Surveying.	Handling and Judging Cattle or Sheep.	Meteorology.	Agricultural Chemistry.	
	10–11	Veterinary Pathology.	Agriculture.	Agricultural Chemistry.	Agriculture.	English Literature.	
	11–12	Handling and Judging Horses.	English Literature.	Statics.	Levelling and Surveying.	Veterinary Pathology.	
Afternoon.	1.30–5	Work.	Work.	Work.	Work.	Work.	Work.

1st Year.—Division I.

	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.	Natural History.	Natural History.	Arithmetic.	
	10–11	Agriculture.	English Literature.	Agriculture.	Inorganic Chemistry.	Inorganic Chemistry.	
	11–12	Inorganic Chemistry.	Veterinary Anatomy.	Veterinary Anatomy.	English Literature.	Agriculture.	
Afternoon.	1.30–5	Work.	Work.	Work.	Work.	Work.	Work.

1st Year.—Division II.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7–12	Work.	Work.	Work.	Work.	Work.	Half Holiday.
Afternoon.	2–3	Arithmetic.	Arithmetic.	Natural History.	English Composition.	English Literature.	
	3–4	Inorganic Chemistry.	Agriculture.	Inorganic Chemistry.	English Literature.	Agriculture.	
	4–5	Natural History.	Inorganic Chemistry.	Veterinary Anatomy.	Agriculture.	Veterinary Anatomy.	

TIME TABLE No. 3.—SPECIAL COURSE.

1st Year.—Special.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7–8	Work.	Work.	Work.	Work.	Work.	Work.
	9–10	Arithmetic.	Arithmetic.	Natural History.	English Composition.	English Literature.	Holiday.
	10–11	Inorganic Chemistry.	Agriculture.	Inorganic Chemistry.	English Literature.	Agriculture.	
	11–12	Natural History.	Inorganic Chemistry.	Veterinary Anatomy.	Agriculture.	Veterinary Anatomy.	
Afternoon.	2–3	Study.	Study.	Study.	Study.	Study.	
	3–4	Book-keeping.	ology and ys. Geog.	Botany.	Veterinary Mat. Med.	Study.	
	4–5	Mensuration.	Agriculture.	Study.	Agriculture.	Geology and Phys. Geo.	

2nd Year.—Special.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7–8	Work.	Work.	Work.	Work.	Work.	Work.
	9–10	Agricultural Chemistry.	Levelling and Surveying.	Statics.	Meteorology.	Agricultural Chemistry.	Holiday.
	10–11	Veterinary Pathology.	Agriculture.	Agricultural Chemistry.	Agriculture.	English.	
	11–12	Handling and Judging Horses.	English.	Handling and Judging Cattle or Sheep.	Levelling and Surveying.	Veterinary Anatomy.	
Afternoon.	2–3	Study.	Economic Botany.	Agriculture.	English.	Study.	
	3–4	Book-keeping.	Dynamics.	Study.	Study.	Practical Chemistry.	
	4–5	Study.	Veterinary Mat. Medica.	Practical Chemistry.	Economic Botany.	Practical Chemistry.	

APPENDIX 3.

ONTARIO AGRICULTURAL COLLEGE

EXAMINATION PAPERS.

I. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1881.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, JUNE, 1881.

III. PAPERS SET AT THE MATRICULATION EXAMINATIONS, OCTOBER, 1881.

I. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1881.

FIRST YEAR.

AGRICULTURE.

Examiner: WM BROWN.

1. Give a comprehensive sketch of what characterises the different kinds of farming called grazing, dairying and mixed.

2. What guides us in concluding that a soil requires to be drained, and how is drainage in all its details most efficiently conducted under two of the most opposite conditions?

3. State what is meant by "injudicious combination of material" in fence building, and explain the terms "severance damages," "catch water drain," and "gradient" in connection with road making.

FIRST YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. Give brief notes on the history of the Shorthorn and Angus or Aberdeen Polled breeds of cattle.

2. Draft a pedigree to the fifth dam.

3. Compare the Galloway and Angus or Aberdeen Polled breeds in all their similar and dissimilar points and characteristics.

4. Compare points and characteristics of the Southdown and Oxford Down breeds of sheep.

5. How should wool be judged in all respects?

EASTER EXAMINATIONS, 1881—continued.

FIRST YEAR.

PRACTICAL EXAMINATION IN LIVE STOCK.

Examiner: WM. BROWN.

CATTLE—

1. Show the best and the poorest points of the youngest steer, judging by a Shorthorn standard.
2. Describe the whole get-up of the other steer, from any point of comparison.
3. Name the breeding of the cows, and show wherein the one indicates superior milking properties to the other.

FIRST YEAR.

PRACTICAL EXAMINATION IN LIVE STOCK.

Examiner: WM. BROWN.

SHEEP—

1. Point out and name the different breeds, crosses and grades.
2. Which is the best wooled sheep, as regards uniformity and soundness?
3. How would you breed from among these, in order to secure as near as possible the wool of the Merino, with the carcass of the Leicester and constitution of the Southdown—giving reasons in detail?

FIRST YEAR.

INORGANIC CHEMISTRY.

Examiner: J. HOYES PANTON, M.A.

1. Name the different ways in which heat may be transmitted, and give examples of each.
2. Explain the terms base, atom, salt, latent heat.
3. Give the preparation and properties of *choke damp* and *fire damp*.
4. What is meant by a formula in chemistry? Give the formulas for the three *vitriols*, and distinguish these compounds from each other.
5. Name three metals lighter than water, and give their properties.
6. Write notes on the compounds represented by $Ca\ Co_3$, $H\ N\ O_3$, $N\ H_3$, $Na\ H\ C\ O_3$, with reference to their source and utility.
7. Give the preparation and properties of nitrogen.
8. Name the different forms in which *silica* and *alumina* occur, and give their use.
9. Describe a lamp flame, and explain the action of the Bunsen burner.

FIRST YEAR.

ORGANIC CHEMISTRY.

Examiner: J. HOYES PANTON, M.A.

1. Contrast organic compounds with inorganic, and explain the terms carbohydrates, hydrocarbons, alcohols, as applied to chemical compounds.
2. Name the products which can be obtained from petroleum, and the uses for which they are employed. Explain the cause of explosions in kerosene lamps.
3. Give notes on glycerine, cellulose, and the products which can be derived from them.

EASTER EXAMINATIONS, 1881—continued.

4. Distinguish tartaric acid from oxalic. Give the uses of each, and the sources from which these acids are derived.

5. Name some compounds occurring in the group Perpenes, and state a peculiarity existing in the compounds of this group.

6. Write notes on linseed oil, opium, urea and nicotine.

7. Name some of the most important chemical compounds which occur in the juice of the beet, the cane, and the grape.

8. Describe Daniell's battery, and name some of the best conductors of electricity.

9. Upon what chemical principle does the preparation of soap depend?

FIRST YEAR.

ZOOLOGY.

Examiner: JAMES MILLS, M.A.

1. Distinguish organic from inorganic bodies, and state to what extent organization is a condition of life.

2. Explain what is meant by a species. How would you proceed to determine whether *Merino* and *Cotswold* sheep belong to the same species or not?

3. What is taken as the basis of a natural classification of animals? Illustrate.

4. Contrast the two great sections of the animal kingdom—*Vertebrata* and *Invertebrata.*

5. Name the sub-kingdoms of invertebrates, and write as full a description as you can of some two of them.

6. Tell briefly and clearly what you know about frogs, silk-moths, lobsters, and sponges.

7. Describe each of the three stages in the life of a butterfly.

8. Compare an *insect* with a *spider.*

9. Give the classes of vertebrates and the orders of mammals.

10. Name the sub-kingdom, the class and (where you can) the order to which each of the following belong:—Mouse, cat, ox, horse, sheep, pig, oyster, lobster, bee, goose, salmon, leech, star-fish, whale.

FIRST YEAR.

VETERINARY ANATOMY.

Examiner: E. A. A. GRANGE, V.S.

1. Name the various processes of digestion, and state where each process is performed.

2. Name the structures entering into the formation of the foot.

3. Describe the hoof of the horse.

4. Name the structures entering into the formation of a joint.

5. Name the organs of respiration, and state what change takes place in the blood in the lungs.

6. Describe the course of the circulation of the blood through the heart and lungs.

7. Describe the difference between the preparatory organs of digestion of the horse and ox, taking the horse as the standard.

8. Describe the changes which take place in the incisor teeth from birth to eight years old of the horse.

9. Name the compartments which the stomach of the ox is divided into, and describe the appearance of the internal coat of each compartment.

10. Name the bones of the hind extremity of the ox.

EASTER EXAMINATIONS, 1881—continued.

FIRST YEAR.

ENGLISH COMPOSITION.

Examiner: JAMES MILLS, M. A.

1. Explain what is meant by style, and what you consider the essential properties of a good style.
2. State fully what is comprehended under the heads of *accuracy* and *clearness*.
3. Write an article on the peculiarities of poetic diction.
4. Write a composition on one of the following subjects:
   (1.) Climate.
   (2.) Sheep-farming in Canada.
   (3.) System, order and tidiness in farming.
   (4.) "Who o'er the herd would wish to reign,
   Fantastic, fickle, fierce and vain!
   Vain as the leaf upon the stream,
   And fickle as a changeful dream;
   Fantastic as a woman's mood,
   And fierce as Frenzy's fevered blood."

FIRST YEAR.

ENGLISH LITERATURE: SCOTT'S "LADY OF THE LAKE."

Examiner: JAMES MILLS, M.A.

1. Write an article on the leading peculiarities of the literature of the first half of the present century.
2. State when Scott was born, where he lived, and when he died; also name six of his most noted contemporaries.
3. Write a short composition on the "Lady of the Lake,"—the plot, incidents, style, metre, etc.
4. Write a summary of Canto V.
5. Give the meaning and derivation of *sullen, caitiff, pallet, bugle, bulwark, atone.*
6. "The chief in silence strode before,
   And reached the torrent's sounding shore,
   Which, *daughter* of three mighty lakes,
   From Vennachar in silver breaks,
   Sweeps through the plain, and ceaseless *mines,*
   On Bochastle the mouldering lines,
   Where Rome, the Empress of the world,
   Of *yore* her eagle wings unfurled:
   And here his course the Chieftain staid,
   Threw down his target and his plaid,
   And to the Lowland warrior said:—
   'Bold Saxon! to his promise *just,*
   Vich-Alpine has discharged his trust.
   This murderous Chief, this ruthless man,
   This head of a rebellious clan,
   Hath led thee safe through watch and ward,
   Far past Clan-Alpine's outmost guard.
   Now, *man* to man, and steel to steel,
   A Chieftain's vengeance thou shalt feel.'"

EASTER EXAMINATIONS, 1881—continued.

(*a*) Comment on the description.
(*b*) Explain the construction of the italicised words.
(*c*) "*Three mighty lakes*"—name the lakes, and draw a map showing the position of *Katrine*, *Achray*, *Vennachar*, *Benledi*, *Forth*, *Teith* and *Stirling*.
(*d*) "*Eagle wings*"—what is referred to?
(*e*) "*Has discharged his trust*"—explain the allusion.
(*f*) Point out the figures in the above extract.

7. Scan the following:

"O, Alice Brand, my native land
Is lost for love of you;
And we must hold by wood and wold,
As outlaws wont to do."

8. "He rights such wrongs," etc.
"I'll listen till my fancy hears," etc.
"Sad was thy lot on mortal stage," etc.
Complete the quotations.

FIRST YEAR.

ARITHMETIC.

Examiner: A. A. MACTAVISH.

1. Determine the profits from Field No. 10 (10 acres) from the following Ledger account:

(*See next page.*)

DR. FIELD No. 10 (10 acres). CR.

Month.	Day.	——	$	cts.	Month.	Day.	——	$	cts.
1879.					1879.				
October	15	To 150 loads B. Y. manure, at $1.55 per load			December	20	By 220 bushels, at $1.05		
"	28	" 10 days' ploughing, at $2.00					" 18 tons straw, at $3.25		
1880.							Four-fifths manure (unexhausted)		
April	18	" 3 " gang ploughing, at 1.50							
"	19	" 15 bushels spring wheat, at $1.25							
"	19	" 1 day's seeding, at $1.00							
"	20	" 2 " harrowing, at $1.25							
August	10	" 1 " reaping, at $5.00							
"	10	" 3 " binding, at $1.50							
"	14	" 1 " drawing in grain, at $6.00							
October	23	" threshing 220 bushels, at 7 cts							
December	20	" marketing 220 bushels, at 3 cts							

showing the
Teith and

ing Ledger

EASTER EXAMINATIONS, 1881—continued.

2. Find the length in perches of a square field containing 40 acres.

3. James Wilson and John Hunter buy a sawing machine, for which they pay $300 and $200 respectively. It works five months for each of them. Determine what one must pay the other, if they would have made 30 per cent. on the money by letting the machine.

4. A farmer bought a horse for a bill of $150, due in one month, and sold him for a bill of $175, due in four months. What did he gain per cent., money being worth 10 per cent.?

5. Bought at the Bow Park sale, one Shorthorn heifer calf for $75, five Leicester ewes at $35 each, and three Southdown ewes at $30 each. Terms of sale, eight months' credit, or discount for cash at the rate of 6 per cent. per annum. What cash was paid?

6. Bought from William Lyons, Philadelphia, a Percheron stallion, and sold him to James Lowell, Toronto, at a loss of 5 per cent. Had I sold him for $125 more I would have gained 5 per cent. Find how much was paid for him in Philadelphia, duty on horses being 25 per cent.

7. *A*, *B* and *C* were employed to hoe a corn-field for $6.70. *A* could hoe a row in four-fifths of an hour, *B* in three-sevenths of an hour, and *C* in half an hour. It so happened that when all first came to the end of a row at the same instant the work was completed. Divide the money fairly among them, and find the number of rows hoed by each.

8. A merchant in London is indebted to one at St. Petersburg 15,000 roubles. The exchange between St. Petersburg and England is 50 pence per rouble, between St. Petersburg and Amsterdam 91 pence per rouble, and between Amsterdam and London 36 shillings and 3 pence per sterling. Which will be the most advantageous way for the London merchant to be drawn upon?

9. I invest $1,000 of Imperial Bank stock quoted at 105 in Toronto Bank stock quoted at 136. What amount of the latter do I receive?

FIRST YEAR.

BOOK-KEEPING.

Examiner: A. A. MACTAVISH.

1. Put in their proper place, in your Farm Book, the following memoranda, and close the two individual accounts:—January 8, bought of William McGregor, blacksmith, 1 lumber sleigh, $28, and he also shod my horses for $1. February 8, John Lyoll has cut for me 8 cords of wood, at 38c. per cord. Same day I sold him 2 bushels of wheat, at $1.12 per bushel, and 20½ pounds of pork, at 8c. per pound. February 9, blacksmith set 1 shoe, 13c. March 1, Lyoll has sawed for me 3 days, ended this day, at 75c. per day. April 1, I sold him 1 bushel of corn, at 63c.; also ½ bushel of beans, at $1 per bushel. April 8, he has worked 4 days, drawing manure, ending to-day, at 75c. per day. April 15, blacksmith made me 1 large clevis for $1. May 1, he made 2 hoes for me, at 50c. each. May 8, sold Lyoll a pig for $75, and ploughed his garden for 75c. May 29, he has worked for me 2 days, hoeing corn, at 75c. per day. June 7, sold him 3 yards gray cloth, at 75c. per yard, and paid him $3 in cash. June 8, blacksmith shod my horses for $1.75, sharpened a colter for 13c., and mended a chain for 13c. July 24, Lyoll has worked for me 3 days, haying, at $1 per day. August 5, blacksmith set waggon tire for me, $1; sold him 1 ton of hay, $8. August 12, Lyoll has worked for me 5 days, harvesting, at $1.50 per day. September 9, I have pastured Lyoll's cow for 4 weeks, ending to-day, at 25c. per week. Blacksmith ironed whiffletrees for me to-day, $1.50. October 9, sold him 5 cords of wood, at $2 per cord. Lyoll has worked for me 2 days, threshing, at 88c. per day. November 11, Lyoll has husked corn for me 2 days, at 75c. per day. Sold the blacksmith 4 bushels of wheat at $1.12 per bushel, 16 bushels

EASTER EXAMINATIONS, 1881—continued.

of oats at 38c. per bushel, and 3 bushels of corn at 62c. per bushel. November 18, bought of him 14 pounds of gate hinges at 13c. per pound; worked for him this day with team, $1.50. November 19, sold Lyoll 4 pounds of butter at 13c. per pound.

2. Sold James Holmes stock to the amount of $650. Received in payment P. Almy's note for $300, and cash for the balance. Show what ledger accounts are affected, and in what manner, by the above transaction. Give a practical form of P. Almy's note.

3. Write a time draft; a joint note; a receipt for rent.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Give a complete summary of the manner in which natural and artificial permanent pastures may be improved and maintained, with the kinds and quantities of grasses and clovers per acre that can be relied upon in the latter case in Ontario.

2. Draft a diary from 1st October, 1879, to 1st July, 1881, showing the principal events that occur in the management of 100 ewes, with the names, ages, and probable number at end of the period.

3. Show, in concise tabular form, what items usually go to make the cost of 60 lbs. of wheat and 100 lbs. of beef.

SECOND YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. Make a "general purpose cow," naming every possible detail, and specify to what particular breed or combination of breeds she would be comparable. Use the following form:—

POINTS.	Description of Points.	Similar to average breed or breeds called—

2. Make a model ram, having medium length of wool, and all the detail points of carcass and wool best calculated to ensure success:—

POINTS.	Description of Carcass Points.	Description of Wool Points.	Similar to average breed or breeds called—

EASTER EXAMINATIONS, 1881—continued.

SECOND YEAR.

PRACTICAL EXAMINATION IN LIVE STOCK.

Examiner: WM. BROWN.

CATTLE—

1. Show wherein the steer is defective as, and wherein equal to, a standard Shorthorn.

2. Judge the cows, and decide upon their comparative merits as regards beefing and milking indications, without reference to breed.

3. In order to secure as much quantity and quality of milk as possible, and afterwards have the best possible stamp of animal for rapid beef making, in quantity and quality, which bull and cow would you mate for these purposes, having regard to the known characteristics of breed as well as the individual points of each animal? Give your reasons in detail.

SECOND YEAR.

PRACTICAL EXAMINATION IN LIVE STOCK.

Examiner: WM. BROWN.

SHEEP—

1. Which is the most even-fleshed wether, and wherein does it differ from the Leicester standard in carcass points?

2. Which is the best wooled ewe as regards uniformity and lustre?

3. Having regard to the known characteristics of kinds, with what would you breed, from among this lot, in order to secure the greatest amount of the best quality of flesh and wool in the shortest time? Explain reasons for your decision.

SECOND YEAR.

ARBORICULTURE.

Examiner: WM. BROWN.

The object of conserving our present forests and replanting other parts of the country being—

1. To afford shelter for crops.
2. Shelter for grazing animals.
3. Shelter for dwellings.
4. Regulation of temperature.
5. Regulation of rainfall.
6. Securing ornament.
7. A direct cropping investment.

Write short comprehensive notes on each, showing by practical facts what we want and how we should meet these wants.

SECOND YEAR.

AGRICULTURAL CHEMISTRY.

Examiner: J. HOYES PANTON, M.A.

1. Name the principal compounds which afford food for plants, and state what changes they undergo before they are taken up by the plants.

EASTER EXAMINATIONS, 1881—continued.

2. Describe clay, sand and swamp earth, with reference to chemical composition, physical characters and origin.

3. Contrast the soil of Western Ontario with that of Muskoka, and account for the difference in chemical composition.

4. Under what circumstances would you recommend the application of sodic nitrate, superphosphate of lime and quicklime to land? Give the composition of each of these compounds.

5. State the changes which vegetable matter undergoes during decomposition, and give the chemical uses of the *muck* of swamps.

6. How are manures valued? Give an example illustrating your answer.

7. State what ingredients may be expected from an analysis of the ash of plants? Name the organic constituents which are found in plants.

8. What constituents are sought for in the analysis of foods? Give their use in the animal economy.

9. By what means can the feeding properties of foods be largely increased? Illustrate by an example.

10. By what reagents are sugar and fat acted upon in the bodies of animals?

SECOND YEAR.

ENTOMOLOGY.

Examiner: J. HOYES PANTON, M.A.

1. Define an insect, and describe the circulatory and respiratory organs of insects.

2. Compare the Hessian fly with the wheat midge.

3. Give notes on the Ichneumonidæ, and Phylloxera Vastatrix.

4. What plants are affected by Anisopteryx vernata, Eudryas grata, Selandria cerasi, Haltica chalybea, Telea polyphemus, Ægeria tipuliformis, Pieris rapæ, Caloptenus spretus, Agrotis messoreia, Leucania unipuncta?

Give the names commonly applied to these insects, and name the orders to which they respectively belong.

5. Name the families to which some of the most beneficial insects belong.

6. Give the remedies for the prevention of ravages by the plant-louse, the borer, the currant-worm, and the joint worm.

7. Name the insects injurious to the apple, and give the orders to which they respectively belong.

8. Name the insects belonging to the order Hemiptera injurious to vegetation.

9. Identify the specimens before you, and name the plants affected by them. Give remedies for the first.

SECOND YEAR.

METEOROLOGY.

Examiner: J. HOYES PANTON, M.A.

1. Explain what is meant by atmospheric pressure. How is this ascertained? What changes would require to be made in a barometer if glycerine was used instead of mercury?

2, Describe the following instruments, and state the uses for which they are employed:—Pluviameter, Aneroid Barometer, and Minimum Thermometer.

3. Explain what is meant by the correction in the Barometer for gravitation. What is a weather map? How is it constructed?

EASTER EXAMINATIONS, 1881—continued.

4. What effect has a large swamp on the temperature of places in the vicinity? State conditions which affect the moisture of the air.
5. How do you account for the fact that plants and trees situated in the bottom of a valley suffer much more from cold and frost than those in a higher situation?
6. What are *obscure heat rays?* "The mean temperature of a place gives little or no idea of its climate, or of the forms of life for which it is fitted." Explain this remark.
7. What effect has the Rocky Mountains on the climate and vegetation of America?
8. What is meant by the rainfall of a place? How is it affected, and in what way can it be ascertained?
9. Read the instruments before you.

SECOND YEAR.

HORTICULTURE.

Examiner: JAMES FORSYTH.

1. Describe how hybridizing takes place naturally, how it may be accomplished artificially, and how hybridized varieties are perpetuated.
2. Describe the usual mode of propagating greenhouse plants, the material necessary, and the temperature required.
3. In the collection of plants before you, name—
   (*a*) The monœcious plants.
   (*b*) Those with perfect flowers.
   (*c*) Those with endogenous stems.
4. Describe a soil suitable for potting a large number of greenhouse plants.
5. What is a double flower, and wherein does it differ from a single flower of the same species?
6. Make a selection of six plants suitable for window culture, giving the common and the scientific name of each.
7. Name four insects which commonly attack greenhouse plants, and state how they may be destroyed.
8. Identify the plants before you, giving the common and the scientific name of each—
   (*a*) Name the orders to which they respectively belong.
   (*b*) Describe fully plants 2 and 5.

SECOND YEAR.

HORSE PATHOLOGY.

Examiner: E. A. A. GRANGE, V.S.

1. Name the terminations and symptoms of Inflammation.
2. Name all the diseases in connection with the Hock.
3. " " " " " Foot.
4. Describe the difference in symptoms of Ringbone in the front and hind foot.
5. Describe the causes, symptoms and treatment of Azoturia.
6. Name the various kinds of Fracture.
7. Describe the various ways for testing a horse for Bone Spavin.
8. Describe the nature, causes, symptoms and treatment of Catarrh.
9. " " " " " " Laminitis.
10. " " " " " " Enteritis.

EASTER EXAMINATIONS, 1881—continued.

SECOND YEAR.

CATTLE PATHOLOGY.

Examiner: E. A. A. GRANGE, V.S.

1. Name the diseases peculiar to the bones of the ox.
2. Describe the symptoms and causes of a disease termed dentition fever.
3. Describe the nature, causes and symptoms of flukes in sheep.
4. " " " " sturdy in sheep.
5. Name the diseases peculiar to the digestive organs.
6. Describe the causes, symptoms and treatment of Tuberculosis.
7. Describe the nature, causes, symptoms and treatment of Hoven.
8. " " " " " Impaction of Rumen.
9. " " " " " Parturient Apoplexy.
10. " " " " " Foot and Mouth Disease.

SECOND YEAR.

ENGLISH COMPOSITION.

Examiner: JAMES MILLS, M.A.

Write a composition on one of the following subjects:—

1. Canada as a field for stock-raising.
2. The effects of climate on the productions, industries, and inhabitants of a country.
4. "There is a tide in the affairs of men,
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries."

SECOND YEAR.

SHAKSPEARE'S JULIUS CÆSAR.

Examiner: JAMES MILLS, M.A.

1. Name Shakspeare's Roman plays, and give briefly the argument of *Julius Cæsar*.
2. Name the members of the second triumvirate, and write a short account of each.
3. Explain the connection and meaning of the following:—

(*a*) "———————————Vexed I am
Of late, with passions of some difference,
Conceptions only proper to myself,
Which give some soil, perhaps, to my behaviors."

(*b*) "Be factious for redress of all these griefs."

(*c*) "And nature must obey necessity,
Which we will niggard with a little rest."

(*d*) "Why I will see thee at Philippi, then ——
Now I have taken heart thou vanishest."

(*e*) "His life was gentle; and the elements
So mixed in him, that nature might stand up,
And say to all the world, 'This was a man.'"

EASTER EXAMINATIONS, 1881—continued.

4. Derive *rheumy, lief, brooked, fantasies, fain, alchemy.*

5. What is peculiar in Shakspeare's use of the words *temper, his, jealous, an* and *proper?*

6. Write an article on the Elizabethan period of English Literature.

(*a*) In speaking of the Elizabethan English, Todd says that "every variety of apparent grammatical inaccuracy meets us."

Account for this fact, and illustrate by quotations from *Julius Cæsar.*

7. Criticise the following, illustrating at length by quotations and comments:—

(*a*) "Then to the well-trod stage anon,
If Jonson's learned sock be on;
Or sweetest Shakspeare, Fancy's child,
Warble his native wood-notes wild."—*Milton.*

(*b*) "Apart altogether from his dramatic power, he [Shakspeare] is the greatest poet that ever lived. His sympathy is the most universal, his imagination the most plastic, his diction the most expressive ever given to any writer.—*Craik.*

(*c*) "The contrast between the weakness of Cæsar's bodily presence in the first half of the play, and the might of his spiritual presence in the latter half of the play, is emphasized, and perhaps over-emphasized by Shakspeare."—*Dowden.*

8. Quote what you consider the finest passages in the play.

SECOND YEAR.

POLITICAL ECONOMY.

Examiner: JAMES MILLS, M.A.

1. Discuss and illustrate the nature of wealth, and the several agents of production.

2. State fully the advantages and disadvantages said to result from the division of labour.

3. Summarize Professor Jevons' chapter on the "Distribution of Wealth."

4. Investigate the relation between wages and labour, so as to discover the causes of high and low wages.

(*a*) Examine the various methods adopted to regulate the rate of wages and show their economic effects.

5. Compare the Irish and the Canadian system of land tenure, enumerating the advantages and disadvantages of each.

6. Why are gold and silver so much used for money in preference to other materials?

7. "*The market price will be such that the demand at that price will equal the supply at that price.*" Explain and illustrate the meaning of this statement.

8. Discuss—

(1) The question of temporary protection in a new country.
(2) Adam Smith's maxims of taxation.
(3) The influence of credit on the prosperity of a community.
(4) Nihilism and Socialism.

EASTER EXAMINATIONS, 1881—continued.

SECOND YEAR.

APPLIED MECHANICS.

Examiner: A. A. MACTAVISH.

1. A barn door is 12 ft. long, 6 ft. wide, and weighs 160 pounds. If the hinges be 9 ft. apart, determine the stress on the upper hinge, and also the thrust against the lower one. Give a diagram of a barn door properly braced?

2. To a beam A B 8 ft. long, a system of five movable pulleys (where each pulley hangs by a separate cord) is attached. With such a system what power will raise 12 bushels of wheat?

3. (*See Q.* 2.) A B is 8 ft. long and weighs 40 pounds. The cords of the system are attached to it at intervals of 1 foot; the one suspending the fixed pulley being 2 ft. from end B. The power and weight are in equilibrium. How far from the end A must a fulcrum be placed that A B may come to rest in a horizontal position?

4. Show by a diagram how you would determine the draft of a field roller. What objection is there to increasing its weight by piling stone on the frame work? Contrast the merits of a large diametered with that of a small diametered roller of equal weight.

5. Write very brief notes on the following:—

(*a*) Testing a swing plough, properly adjusted.
(*b*) The position of coulter in a sod plough.
(*c*) The width of shear in a sod plough.
(*d*) Adjusting a plough which tends to run inland.
(*e*) Adjusting a plough which tends to run deeper.
(*f*) The ratio of width of furrow to depth of furrow, that the sod may ultimately rest at an angle of 45° to the plane.

6. In our ordinary farm carts the length of the shaft (from centre of axle to the back-band chain) is 8 ft. Now, suppose that when the load is one ton, the shafts are horizontal, and the C. of G. of load is vertically over the axle, at a distance of 2 ft. from it; then the pressure on the horse's back is O. But if the horse is descending a hill of 30° inclination, and the load is held back by the breech-band, then the pressure on his back is $\frac{2000 \times 1}{4\sqrt{3}}$ or 389 pounds. Show by a diagram how the numbers in this calculation are obtained. What improvement would you suggest in the form of the axle to prevent a possibility of such a pressure?

7. Which is the greater work, reaping a ten acre field, draft of reaper being 200 lbs. and length of knife being 5 ft.; or ploughing an acre of land when draft of plough is 312 lbs. and width of furrow being 8 inches?

HYDROSTATICS.

8. Draw diagrams to illustrate the following:—(*a*) Hydraulic Press, (*b*) Suction pump, (*c*) Forcing pump, and write brief notes to explain the manner of their working.

9. Explain fully the manner in which the Hydraulic Ram works.

10. How would you find the pressure on one side of a submerged flood-gate?

SECOND YEAR.

LEVELLING.

Examiner: A. A. MACTAVISH.

1. Draw a full-sized one foot division of the levelling staff.
2. Distinguish between the true and apparent level.

JUNE EXAMINATIONS, 1881.

3. Complete the following field book :—

	BACK SIGHT.	FORE SIGHT.			
A	5.36	3.04	Peg 1.	Distance 100	feet.
	7.02	9.35	" 2.	" 100	"
	4.05	6.36	" 3.	" 100	"
	2.12	3.96	" 4.	" 100	"
	4.08	3.00	B	" 50	"

4. A road is made from A to B, find rise in grade per 100 feet.

Drainage.

5. Enumerate the signs exhibited by under-drained lands.
6. Enumerate the benefits arising from thorough drainage.
7. On drained lands the time of seeding is earlier than on undrained lands. Explain fully why this is the case.
8. Write briefly on "Depth and Distance apart of Drains."

Road Making.

9. Draw a transverse section of a properly built meadow road (let your diagram represent a section extending from fence to fence). Write brief notes on the various parts of the section.
10. Explain how you would determine the force with which a team would have to pull, drawing a load of a given weight up a grade of a given rise, and on which the friction is 1-30th of load.
11. Enumerate the causes of injury to roads.
12. Comment briefly on the present road-making laws of Ontario.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, JUNE, 1881.

FIRST YEAR.

AGRICULTURE.

Examiner: Wm. Brown.

1. Classify, and judge in every detail, the accompanying sample of barley.
2. What are the characteristics, special properties, and the usual practice in the use of mineral superphosphates, gypsum, bone dust, and farmyard manure?
3. Give a concise sketch of the usual mode of cultivating: (1) a cereal; (2) a root; (3) a soiling crop; (4) a tuber.
4. What is comprehended under the term "tillage operations," and to what class of crops are their thorough application indispensable?
5. Sketch the history, arrangement, and condition of our No. —— Field.

JUNE EXAMINATIONS, 1881—continued.

FIRST YEAR.

STRUCTURAL BOTANY.

Examiner: J. HOYES PANTON, M.A.

1. Compare the earlier stages of growth in the maple, lily and pine.
2. "Roots may be considered with reference to duration and shape." Illustrate this by giving examples.
3. Contrast the stem of the Indian corn with that of the flax, and give the characteristics of the embryo leaves and flowers of plants represented by these types.
4. Explain the terms tuber, bulb, prickle, monœcious, culm, stolon and rootstock. Give an example of each.
5. Give diagrams illustrating the different forms of inflorescence.
6. What peculiarity is observed in the flowers of the pine, willow and red maple?
7. State the modifications sometimes observed in the stamens of a flower, and name the terms applied to such.
8. Classify dry fruits.
9. "The parts of a flower answer to leaves." Explain this remark.

FIRST YEAR.

GEOLOGY.

Examiner: J. HOYES PANTON, M.A.

1. Name the chief constituents found in the soil of the Farm, and state the sources from which they have been derived. In what period of Geological History were the present physical features of our country largely produced?
2. Give the characteristics of metamorphic rocks, and name localties where they abound. What economic products are usually found in such rocks?
3. Explain the origin of the *shell marl* in swamps.
4. Name the different forms in which fossils are found, and describe two fossils of importance, in reference to coal deposits.
5. What periods are distinguished for economic deposits? Describe what is sometimes termed the "Age of Fishes."
6. Name the geological districts of Manitoba, and describe the third area.
7. Describe the "Coal Measures." Name localities where they occur in the Dominion. How are they supposed to have been formed?
8. Name the principal fossils of the Guelph Formation.
9. The blocks placed before you represent the various periods in Geology; arrange them in their relative positions as part of the earth's crust.
10. Identify the specimens before you.

FIRST YEAR.

MATERIA MEDICA.

Examiner: E. A. A. GRANGE, V.S.

1. What is a purgative?
2. What is the best purgative for the horse?
3. Name the most important varieties of aloes.
4. Give the nature, action and uses of Barbadoes aloes.

JUNE EXAMINATIONS, 1881—continued.

5. What is the dose of Barbadoes aloes as a purgative for the horse?
6. What length of time does it take an ordinary purgative of aloes to act in the horse?
7. Name the best purgative for each of the domestic animals.
8. Name classes Tonics are divided into, and give an example of each class.

FIRST YEAR.

ENGLISH LITERATURE.

GOLDSMITH'S "DESERTED VILLAGE."

Examiner: JAMES MILLS, M.A.

Sweet, smiling village, loveliest of the lawn,
Thy sports are fled, and all thy charms withdrawn.;
Amidst thy bowers the tyrant's hand is seen,
And desolation saddens all the green:
One only master grasps the whole domain,
And half a tillage stints thy smiling plain.
No more thy glassy brook reflects the day,
But choked with sedges, works its weary way;
Along the glades, a solitary guest,
The hollow-sounding bittern guards its nest.

1. Point out the figures of speech in this extract.
2. *Sweet, smiling village.* Was it an English or an Irish village? Give reasons for answer.
3. *Loveliest of the lawn.* Meaning of lawn. Derivation and other meanings.
4. Enumerate the sports and charms alluded to in second line of extract.
5. *The tyrant's hand is seen.* What does the poet refer to?
6. Give the meaning and derivation of *village, domain, stints, sedges, glades, bittern.*
7. Quote from the "Deserted Village" one example each of *metaphor, simile, assonance, metonymy.*
8. "Sunk are thy bowers in shapeless ruin all." Parse all the words in this line.
9. Quote as follows:

(*a*) Goldsmith's eulogy on Retirement in Old Age.

"*O blest retirement, etc.——ere the world be past.*"

(*b*) His description of the village preacher and the village schoolmaster:

"*A man he was, etc.——charity began.*"
"*There, in his noisy mansion, etc.——carry all he knew.*"

10. What is the main argument of the "Deserted Village?" What age was the author when he wrote it? Quote a passage which seems regretfully to hint that his zest for enjoyment was not so great as it had been.
11. "The Deserted Village is one of the most graceful and touching poems in the English language. It is clear bird-singing; but there is a pathetic note in it." Quote and comment on passages illustrating its grace, melody, and pathos.
12. Classify Goldsmith's chief works; and name five of the most noted men of his time—the greatest in poetry, in criticism, in painting, in politics, and in the histrionic art.

JUNE EXAMINATIONS, 1881—continued.

FIRST YEAR.

MENSURATION.

Examiner: A. A. MACTAVISH.

1. Find the areas of the following:—
   (*a*) An equilaterial triangle whose base is 12 chains.
   (*b*) A square whose side is 12 chains.
   (*c*) A circle whose diameter is 12 chains.
   (*d*) A regular hexagon whose side is 12 chains.
2. Find the area of a field from the following notes:—

L. OFF-SET.	C. LINE.	R. OFF-SET.
6	○ A 12 18 25 to B	90 west. 10

3. The width of a barn is 60 feet, the height of the gable 15 feet, the beam is 5 feet below the plate, the purline post is placed under the middle point of rafter and at right angles to it. At what distance from the centre of the beam will the other purline post rest?

4. Which will carry away the greater quantity of water, a four-inch tile or four three-inch tiles?

5. Compare the weights of the following:—An iron cube whose edge is two feet, an iron sphere whose diameter is two feet, and an iron cylinder whose length is two feet and diameter two feet.

6. How many cubic feet in a piece of timber 6 feet long, the large end being 24×36 and the small end 20×30?

SECOND YEAR.

AGRICULTURE.

Examiner: PROF. BUCKLAND (Toronto University).

1. State the origin, composition, and classification of soils.

2. How would you lay out a farm, say of 200 acres:—size of fields, roads, location and disposition of the homestead; planting for ornament and shelter, material for fencing—dead and live, and the percentage derivable of permanent forest?

3. State some of the principal modern improvements effected in farm implements and machines, and the circumstances under which horse, ox and steam could be readily and economically applied as motive powers.

4. What are the principles on which cultivation should be conducted, such as ploughing, subsoiling, trenching, etc., particularly as to depth?

5. The *rationale* of the rotation of crops; the various systems practised, giving details of such as would be practicable and profitable in Canada. Broadcasting and drilling seed grain compared; and the conditions which should determine the amount of seed per acre.

JUNE EXAMINATIONS, 1881—continued.

6. What preliminary steps would you take before commencing to drain a particular field or farm? The principles on which surface and underground drains should be constructed, as to depth, distance, inclination and materials. Illustrate by rough sketch.

7. What are the proper functions of drains, and the mechanical and chemical changes they produce in the soil, affecting the growth and maturity of crops?

8. State the composition and action of the more available mineral manures, particularly of lime, as carbonate, sulphate and phosphate.

SECOND YEAR.

LIVE STOCK.

Examiner: PROF. BUCKLAND (Toronto University).

1. Define the principal systems of breeding the domesticated animals, such as "in-and-in," "close," and "crossing,"—their respective advantages, and the cautions necessary to prevent disappointment.

2. The relative influence of parents on offspring. Conditions necessary to a healthy progeny. The law of "Atavism," or breeding back. "The value of pedigree."

3. Classify the most important breeds of horses, cattle, sheep and swine:—define their respective characteristic points and qualities, especially those best adapted to the various soils, productions, climates and markets of Canada or Britain.

4. What do you consider would be the readiest and generally most practicable way, as Canadian farmers are at present situated, of permanently improving their farm stock?

5. State the most economical, efficient and practicable systems of feeding and management of horses, cattle, sheep and swine throughout the year in this country, including the relative merits of pasturing and soiling.

6. State the readiest methods of collecting and preserving the excrements of farm animals, fluid and solid, and of preventing their fertilizing powers running to waste. Also the practicability and advantages of economising all available manurial substances on the farm by making them into compost heaps, and best methods of management.

7. Why is mixed husbandry generally practised in Canada in preference to purely arable or pastural? The relations between the cultivation of roots and cereals and the breeding and fattening of animals?

8. What do you consider the weak points of Canadian farming, and the most available and economical means of correcting them?

SECOND YEAR.

PRACTICAL HANDLING AND JUDGING OF SHEEP.

Examiners: F. W. STONE and JAMES ANDERSON.

COTSWOLDS AND SOUTHDOWNS.

1. Point out the various defects in this animal [the one indicated by the examiners].
2. Point out the good qualities of this animal [another indicated by the examiners].
3. Explain the breeding properties for the improvement of mutton and wool.
4. Which of the two breeds is the most profitable at the present time? Give reasons for your answer.

JUNE EXAMINATIONS, 1881—continued.

SECOND YEAR.

PRACTICAL HANDLING AND JUDGING OF CATTLE.

Examiners: F. W. STONE and JAMES ANDERSON.

SHORTHORNS AND HEREFORDS.

1. Point out the defects in the Shorthorn.
2. What are the superior qualities in the same animal?
3. Compare the two, stating clearly the points of difference. Which is the better animal to breed from, and why?
4. Name the desirable points and qualities in animals (1) for dairying, (2) for the production of beef.

SECOND YEAR.

PRACTICAL AND ANALYTICAL CHEMISTRY.

Examiner: P. H. BRYCE, M.A., M.D.

1. How is a standard solution of H_2S prepared? What are its most probable impurities, and show why its strength depreciates with time.
2. A powdered mass of mineral, divided into five portions, is laid before you—
   With 1—When $C_2H_4O_2$ being added, an *effervescence* is produced.
   " 2—Blowpipe reaction gives a *garlic* odour.
   " 3—When treated with HCl. a smell of H_2S is given off.
   " 4—After treatment, as in No. 3, Pb 2 NO_3 gives a *white precipitate.*
   " 5—After treatment, as in No. 3, NH_4, HO gives a heavy *bronze-red precipitate.*
   What is the substance?
3. (*a*) How is the free H_3PO_4 of a superphosphate estimated?
   (*b*) In what form is it most probably present in that made from unburnt bones?
   (*c*) What is *reverted* H_3PO_4, and how is its amount calculated?
4. (*a*) What are the objections raised against the lactometer's accuracy in giving the true density and value of milk?
   (*b*) Indicate the successive steps in the quantitative analysis of a specimen of milk.
5. The *grey* mud flats of Truro, N.S., are formed of disintegrated ferruginous sandstone, mixed with marine salts and organic matter, both animal and vegetable. Such soils, when first ploughed and exposed to the air, are fatal to plant life, but by air and CaO become a *red* soil of inexhaustible fertility—(Dawson). Follow out the successive chemical changes by which this soil is improved, supposing its composition to be—
   (*a*) Composition of rock—$Fe_2O_3 + SiO_2$, etc.
   (*b*) Organic matter—C, H, O, N, S, P + $CaCo_3$ of shells.
   (*c*) Marine salts—chlorides, sulphates, etc., of Na, K, Ca, Mg.
   What is most probably the material most hurtful to vegetation?
6. A vessel contains lime-water; through this a current of CO_2 is passed. Explain the changes which take place, and show how this principle is of importance in the preparation of plant food from the soil.

JUNE EXAMINATIONS, 1881—continued.

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

Examiner: P. H. Bryce, M.A., M.D.

1. Taking the Ranunculaceæ as illustrative, show fully by example what essential points are included in a Natural Classification.
2. Place the following under their natural orders:—
   (*a*) Delphinum consolidum, Brassica campestris, Sinapis alba, Podophyllum peltatum, Althea officinalis, Abutilon.
   (*b*) Describe the chief characteristics of Abutilon.
3. Describe the chief characteristics of the Leguminosæ, and name four economic genera of the order.
4. Give the chief characteristics of the Liliaceæ; give three economic examples.
5. (*a*) Point out the peculiarities of the Gramineæ.
   (*b*) Give the chief distinctive points, economic value and natural habitat of Calamagrostis canadensis, Dactylis glomerata, Bromus secalinus, Saccharum officinarum, Phleum pratense.
6. Contrast the structure of a moss with that of a fern, and give the economic uses of the Algæ.
7. Identify the specimens before you, and analyze the plant numbered 10. Give the order, genus, and species to which each belongs.
8. Name the orders and genera to which the plants principally used for *soiling* and pasturage belong.

SECOND YEAR.

MATERIA MEDICA.

Examiner: A. Smith, V.S.

1. Give the action and use of opium.
2. Give the dose of the tincture of opium for horse and ox.
3. How is chlorate of potash prepared?
4. What is a sedative?
5. Give the dose of nitrate of potash as a febrifuge for the horse.
6. Give nature, action, and uses of nux vomica.
7. Give nature, action, and uses of oil of turpentine.
8. When are Diuretics contra indicated?

VETERINARY SCIENCE.

Examiner: A. Smith, V.S.

Oral Examination.

1. What are the causes and treatment of Spasmodic Colic?
2. Define Strangles in the horse, and state how an animal suffering from them should be used.
3. Name some well-marked contagious disease in the horse.
4. Are Canadian cattle subject to many contagious diseases?

JUNE EXAMINATIONS, 1881—continued.

5. Has contagious Pleura Pneumonia ever been known in Canada?
6. In what districts of the United States does Pleura Pneumonia exist?
7. What is the period of gestation in the cow and in the mare?
8. Describe the appearance of the mouth at four years old in the horse.
9. What diseases in the horse and mode of usage tend to produce Purpura Hæmorrhagica?
10. What diseases are liable to occur in hard-worked horses that are well fed and allowed to remain idle for a few days, and still well fed?
11. What are the causes of Laminitis, or Founder, in the horse?
12. What is Parturient Apoplexy in the cow, and how may the disease be prevented?
13. Define Cerebro-spinal Meningitis.

Following the above practical examination questions, a manipulative examination of horses was taken part in by the students.

ENGLISH LITERATURE.

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

Examiner: W. TYTLER, B.A.

And ever, against eating cares,
Lap me in soft Lydian airs;
Married to immortal verse,
Such as the meeting soul may pierce,
In notes with many a winding bout
Of linked sweetness, long drawn out,
With wanton heed and giddy cunning,
The melting voice through mazes running;
Untwisting all the chains that tie
The hidden soul of harmony;
That Orpheus' self may ——

1. Complete the sentence, and quote from Il Penseroso lines referring to the same story as the passage supplied.
2. Explain *lap, Lydian airs, married to immortal verse, meeting soul, winding bout, wanton heed, mazes, hidden soul,* and name any rhetorical figures in these expressions.
3. Meaning and derivation of *buxom, debonair, pied, junkets.*
4. What is the metre of the poem? Scan lines 1 and 6 of the extract.
5. Sketch briefly the plan of L'Allegro.

Or call up him who left half told
The story of Cambuscan bold.

6. Continue the quotation five lines. Who is meant by "him" in line 1?
7. "Virtuous ring and glass." Meaning of "virtuous." How were they virtuous?
8. "The buskin'd stage." Explain the epithet. What word in L'Allegro is equivalent to *buskin?* Quote the line in which that word occurs.
9. Derive *melancholy, glimmer, cypress, curfew, kercheft, hermitage, ecstasy, charm, frounced.*
10. What, according to Milton, are the pleasures of the Pensive Man?
11. Quote the introduction to both poems—twelve lines each.

JUNE EXAMINATIONS, 1881—continued.

12. Write brief notes on "Starred Ethiop Queen,"—"Philomel,"—"her dragon yoke,"—"to bless the doors from nightly harm,"—"thrice great Hermes,"—"day's garish eye,"—"with honied thigh,"—"storied windows."

13. Name and classify Milton's chief poems. In what language other than English did he write poems?

14. Name three great poets before Milton, with one famous poem of each.

15. Mention the principal causes which made the period from the middle of Elizabeth's reign to the Restoration so brilliant in a literary aspect.

N.B.—Marks will be deducted for errors in spelling and syntax; and added for literary excellence in the *style* of the answers.

SECOND YEAR.

SURVEYING.

Examiner: A. MACTAVISH.

1. (Using a pair of compasses) Show how to construct a triangle having its sides equal to three given straight lines.

2. (Using a pair of compasses) Show how to make a triangle equal to a given trapezium.

3. Cut off from a given triangle a given area, by a line drawn from a point in one of its sides.

4. At a certain distance from the College buildings, and on a level with its base, it is found that the angle of elevation of the top of flag-staff is 45°. At a distance of 58.4 feet from the building, the angle of elevation is found to be 30°. To what height does the flag-staff reach?

5. *ABCD* is a rectangular field, of which the side *AB* is 12 chains and the angle *ABD* is 30°. Find

(*a*) The area of the field.
(*b*) The length of the offsets from the diagonal *BD* to the angles at *A* and *C*.
(*c*) Give "Field Book" notes for planning and finishing the area of the above field.

6. Plan and find the area of the field from the following notes:—

L. OFFSET.	CHAIN LINE.	R. OFFSET.
	○ *A* range *E*	
	700	700. *C*
2.0	1300	
D .1350	2650	1000. *E*
	3375	
	to ○ *B*	

Scale, 10 chains to an inch.

III.—PAPERS SET AT THE MATRICULATION EXAMINATIONS, APRIL, 1881.

ENGLISH GRAMMAR.

Examiner: JAMES MILLS, M.A.

1. Define the terms *case*, *person*, *comparison*, *voice*, and give an example of each.

2. State and illustrate the different ways of distinguishing gender in English nouns and pronouns.

3. Compare the adjectives *hot*, *pleasant*, *nigh*, *late*. Distinguish *later* and *latter*, *elder* and *older*, *few* and *a few*.

(*a*) Is there any objection to such forms as *chiefest*, *extremest*, *most universal*?

4. What is the plural of *staff*, *canto*, *fife*, *dwarf*?

5. Give the meaning of the following words in the singular and the plural number: *iron*, *salt*, *spectacle*, *pain*.

6. Change the following sentences so as to use the passive instead of the active voice of the verb in each case:—

(1) James taught me geography when I was a boy.
(2) My first master instructed me in the art of parsing.
(3) I bade him depart.

7. "Sweet Auburn! loveliest village of the plain,
Where health and plenty cheered the labouring swain;
Where smiling spring its earliest visit paid,
And parting summer's lingering blooms delayed:
Dear lovely bowers of innocence and ease,
Seats of my youth, when every sport could please,
How often have I loitered o'er thy green,
Where humble happiness endeared each scene!"

(*a*) Parse all the words in the first two lines of the above extract.
(*b*) Divide the last four lines into simple propositions, stating the kind and connection of each.

8. Give the past tense and perfect participle of *saw*, *sit*, *set*, *see*, *fly*, *lie* and *lay*.

9. Point out the errors in the following, and give reasons for corrections in each case:—

(1) If thou is honest, I love you.
(2) As neither of them are going, let you and I go.
(3) Neither you nor me are invited.
(4) Let each esteem other better than themselves.
(5) Whom do men say that I am?

ARITHMETIC.

Examiner: A. A. MACTAVISH.

1. By what must 17 miles 121 yards 31 feet be divided to give for quotient 37 perches?

2. How many square feet in a plot of ground 3 perches 14 feet long and 5 yards 11 inches wide?

3. A block of stone is 36 feet long, 2 yards wide and $6\frac{3}{4}$ feet deep. How far from the end must it be cut to have 3 cubic yards?

MATRICULATION EXAMINATIONS, 1881—continued.

4. Find the cost of 196 bags of wheat, each (exclusive of bag) weighing 119 pounds, at $1.96 per bushel.

5. John can do a piece of work in $2\frac{1}{3}$ days, James can do it in $5\frac{1}{2}$ days. In how many days can they both do three times the work?

6. From the sum of the two largest of the following fractions take the difference of the two smallest:—

$\frac{2}{3}$, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{7}{36}$, $\frac{5}{16}$, $\frac{11}{12}$, $\frac{8}{9}$.

7. After giving away $\frac{1}{10}$ of my money, then $\frac{3}{8}$ of the remainder, then $17 less than 18 pounds 19 shillings 6 pence, I had still $17 left. How much had I at first?

8. What is the cost of carpeting a floor 26 feet long and 21 feet wide with carpet 2 feet wide and worth $1.20 per yard?

GEOGRAPHY.

Examiner: J. Hoyes Panton, M.A.

1. Name the principal mountain ranges running north and south in the Eastern and Western hemispheres.

2. Where and what are the following:—Genoa, Sumatra, Amoor, Elba, Kamloops, Yucatan, St. Roque, Isandula, Balkan, Chio?

3. Name the counties bordering on Lake Ontario, and give the county town of each.

4. Sketch a map of North America, showing the positions of the following:—Red River, Dakotah, Emerson, New Orleans, New York, Quebec.

5. What railroads run through the following places:—Guelph, Hamilton, Quebec, Barrie, Harrisburg?

6. Explain the following terms:—Tropics, longitude, estuary, pampas, strait.

READING, DICTATION, AND COMPOSITION.

Examiner: J. Hoyes Panton, M.A.

Reading.

1. Fourth Book (page 240). Read the lines marked.

Dictation.

2. Page 261. Write "After—Earth."

Composition.

3. Write a composition on any of the following:—

(*a*) Promptness in the discharge of duty.
(*b*) Science in farming.
(*c*) Honesty is the best policy.

APPENDIX 4.

ONTARIO AGRICULTURAL COLLEGE.

Class Lists.

Easter Examinations, 1881.

FIRST YEAR.

Classes.	Agriculture.	Live Stock.	Practo'l Handling and Judging of Cattle.	Practcal Handling and Judging of Sheep.	Inorganic Chemistry.
Honours. I.	1 MacLeod. 2 Stonehouse. 3 Gibb. 4 Philbin, Williams.	1 McArthur. 2 Stonehouse. 3 Gibson, R. Gibb. 5 Stover. 6 Williams, Ramsay.	1 McArthur.	1 Stover. 2 Shuttleworth. 3 Terhune. 4 Gibson, R. McIlquham, J. 6 Wyndham. Stonehouse. 8 Philbin. Ramsay. 10 Poe. 11 Carpenter. 12 McArthur. Gibb. Lindsay, S. 15 Moore. 16 Wettlaufer. 17 Myers.	1 McArthur. 2 Stover. Barclay. 4 Jones. 5 Poe.
II.	1 McArthur. 2 Stover. Shuttleworth. 4 Gibson, R. 5 Davis. 6 Jones. 7 Job. 8 Poe. 9 Blanchard. Ramsay. McIlquham, J. 12 Elworthy. 13 Myers George. 15 Petapiece. 16 Shearer. Kippen. Ffolkes. 19 Mahony. 20 Lindsay, S. 21 White W.G. Lindsay, S. 23 Schull.	1 Jones. 2 Shuttleworth. 3 Lindsay, S. 4 George. Lindsay, W. 6 White, W.G. Davis. Poe. 9 Petapiece. 10 Philbin. 11 MacLeod. 12 Job. 13 McIlquham, J 14 Dennis. 15 Gilpin. 16 McLaren. 17 Mahony. 18 Silverthorn. 19 Douglas. 20 Hallesy. 21 Dewar. 22 Elworthy. 23 Blanchard. 24 Barclay.	1 Shuttleworth. 2 Hallesy. 3 Gibson, R. 4 McIlquham, J 5 Gibb. 6 Williams. 7 Gaw. 8 Stover. 9 Petapiece. 10 Stonehouse. 11 Silverthorn. 12 Poe. 13 Myers. George. Philbin.	1 Barclay. 2 Brown. Egleston. Bignell. Blanchard. Job. Schull. 8 Petapiece. Shearer. White, C. Henderson. Matthewman. Dewar. White, W. G. MacLeod. Dennis. 17 Bethune. 18 Chase. Jones. 20 Begg. Davis. 22 McKim. 23 Gaw. Watt J.M. Gilpin. Douglas. 27 Silverthorn. George. 29 McLaren. Law. 31 Hallesy. Tronson. Shaver. Grant. McPhail. 36 Redmond. 37 Armstrong. Mahony. Dawson. 40 Williams. Lindsay W 42 Ferguson. Elworthy. Goold. 45 Rogers.	1 Job. 2 Lindsay, S. 3 Blanchard. 4 Petapiece. 5 Stonehouse. 6 Schull. 7 Dewar. 8 McLaren. 9 Tronson. 10 Grant. 11 Silverthorn. White, W.G.

Class Lists—*Continued.*

FIRST YEAR.

Classes.	Agriculture.	Live Stock.	Practical Handling and Judging of Cattle.	Practical Handling and Judging of Sheep.	Inorganic Chemistry.
Pass. III.	1 Wyndham. 2 McLaren. 3 Bethune. Tronson. Bowman. 6 Armstrong. 7 Dawson. 8 Hallesy. Bignell. Dennis. Shaver. 12 Chase. 13 Pope, E. Dewar. Carpenter. 16 White, C. Goold. 18 Henderson. Grant. 20 Terhune. Barclay. Moore. 23 Gaw. Law. Wettlaufer. 26 McKim. Douglas. 28 Redmond. 29 Silverthorn. Gilpin. McPhail. Begg. Rogers. Brown. Egleston. Beaudet. Matthewman. Ferguson.	1 Bethune. 2 Goold. 3 Armstrong. 4 Shaver. 5 Myers. 6 Tronson. 7 Grant. Carpenter. Chase. 10 Bowman. 11 Terhune, Redmond. White, C. 14 Matthewman. Wyndham. Begg. Schull. Moore. McPhail. 20 Dawson. 21 Beaudet. Rogers. Kippen. McKim. Bignell. Shearer. 27 Henderson. Gaw. Law. Wettlaufer. Pope, E. Brown. Egleston.	1 Dewar. Barclay. Blanchard. 4 Mahony. Chase. 6 Pope, E. Carpenter. 8 Brown. 9 McLaren. Ferguson. Henderson. Shaver. Wyndham. Schull. Elworthy. 16 Egleston. White, W. G. MacLeod. 19 Dawson. 20 Wettlaufer. Gilpin. Rogers. 23 Goold. Lindsay, S. Ramsay. 26 Redmond. White, C. 28 Grant. Bignell. 30 Jones. Dennis. Job. McPhail. Douglas. 35 Moore. 36 Armstrong. Shearer. Matthewman. Tronson. 40 Bethune. 41 McKim. 42 Lindsay, W. 43 Terhune. 44 Davis. 45 Law. 46 Begg. Kippen. Watt, J. M.	Kippen.	1 Dawson. Mahony. 3 Bowman. 4 Shuttleworth. 5 Lindsay, W. 6 Bignell. 7 George. 8 Philbin. 9 Davis. 10 Bethune. 11 White, C. 12 Ramsay. 13 Armstrong. Dennis. 15 Gibb. 16 Redmond, Elworthy. 18 Matthewman. 19 Williams. 20 Shearer. 21 MacLeod. 22 Wyndham. 23 Terhune. 24 Hallesy. 25 Gilpin. Carpenter. 27 McPhail. 28 Kippen. 29 Moore. Chase. 31 Goold. 32 Wettlaufer. 33 Brown. 34 Pope, E. Henderson. Douglas. Shaver. McKim. Rogers. Begg. Gaw. Law. Egleston. Ferguson. Gibson. Ffolkes. Knuth.

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

Class Lists—*Continued.*

FIRST YEAR.

Classes.	Organic Chemistry.	Zoology.	Veterinary Anatomy.	English Literature.	English Composition.
Honours. I.	1 McArthur. 2 Stover. 3 Job.	1 Barclay. 2 McArthur. 3 Jones. 4 Job. 5 Stonehouse. 6 Stover. 7 Dewar. 8 Philbin.	1 McArthur. 2 Jones.	1 Barclay. 1 McArthur. 3 George. 4 Job. 5 Bignell.	1 McArthur. 2 Barclay. 3 Poe.
II.	1 Poe. 2 Barclay. 3 Redmond. 3 Blanchard. 5 Gibson. 6 Bowman. 7 Jones. 8 Shuttleworth. 9 Dewar. 9 Silverthorn, J. 11 Stonehouse. 12 Grant. 13 Bethune. 14 Davis. 15 Hallesy. 15 Rogers. 17 Elworthy. 18 McLaren. 19 Ramsay.	1 Shuttleworth. 2 Poe. 3 Lindsay, S. 4 McLaren. 5 Bowman. 6 Blanchard. 6 George. 8 Tronson. 9 Dennis. 10 Williams. 11 MacLeod. 12 Bignell. 13 Chase. 14 Bethune. 15 Silverthorn. 16 Pope, F. 17 McPhail. 18 Hallesy. 19 Goold. 20 Ramsay. 20 Elworthy. 22 Lindsay, W. 23 Schull. 24 Armstrong. 25 White, W. G. 26 Shearer. 26 Wettlaufer.	1 McLaren. 2 Barclay. 3 Dewar. 4 White, W. 4 Shuttleworth. 4 Blanchard. 7 Carpenter. 7 Poe. 9 Lindsay, S. 10 Job. 11 Ramsay. 12 Stonehouse. 13 Ramsay. 14 Chase. 14 MacLeod. 14 Petapiece. 17 Hallesy. 17 Grant. 19 Bowman. 20 Gibson. 20 White, W. G. 22 Philbin. 23 Stover. 23 Bethune. 25 Lindsay, W. 25 Silverthorn. 27 Henderson. 28 Dennis.	1 Stover. 2 Dewar. 3 Shuttleworth. 4 Grant. 5 Poe. 6 White, W. G. 7 Blanchard. 8 MacLeod. 9 Dennis. 10 Ramsay. 11 Silverthorn. 12 Philbin. 13 Wettlaufer. 14 White. 15 Bethune. 16 Gibson, R. 17 Lindsay, W. 18 Petapiece.	1 Jones. 2 Job. 3 Stovsr. 3 Davis. 5 Petapiece. 6 Gibson. 7 Williams. 8 Goold. 9 Stonehouse. 10 Armstrong. 10 Shuttleworth. 12 Ffolkes. 12 MacLeod. 14 Gibb. 14 Grant. 14 Philbin, 17 Dawson. 17 Bethune. 17 Schull. 17 Kippen. 21 Dewar. 21 Gilpin. 23 Blanchard. 23 White, W. G.

Class Lists—*Continued.*

FIRST YEAR.

Classes.	Organic Chemistry.	Zoology.	Veterinary Anatomy.	English Literature.	English Composition.
Pass, III.	1 McPhail. 2 Gilpin. 2 Dawson. 4 Shaver. 5 Armstrong. 6 Tronson. 7 Petapiece. 8 Williams. 9 Chase. 10 Lindsay, S. 10 Bignell. 12 Dennis. 13 Mahony. 14 Matthewman. 15 Moore. 16 Lindsay, W. 17 MacLeod. 18 White, W. G. 19 Terhune. 20 Philbin. 21 Douglas. 22 Carpenter. 23 Goold. 24 White, C. 25 Shearer. 25 Gibb. 27 Schull. 28 Kippen. 28 Wettlaufer. 28 George. 31 Gaw. 31 Henderson. 31 Law. 34 Pope, E. 35 Wyndham. McKim. Brown. Begg. Egleston. Ferguson. Ffolkes. Knuth.	1 Dawson. 2 Gibb. 3 Matthewman. 4 Grant. 5 Beaudet. 6 Wyndham. 7 White, C. 8 Redmond. 9 Davis. 10 Gibson. 11 Rogers. 12 Petapiece. 13 Carpenter. 14 Terhune. 15 Shaver. 16 Gilpin. 16 Moore. 18 Henderson. 19 Mahony. 20 McIlquham. Douglas. Brown. Kippen. Law. McKim. Begg. Ferguson. Gaw. Egleston.	1 Shearer. 1 Williams. 1 Wettlaufer. 4 Gilpin. 5 Goold. 6 McIlquham, J. 6 Moore. 6 Dawson. 6 Pope, E. 6 Redmond. 11 Gaw. 12 Bignell. 13 Mahony. 14 Brown. 14 McPhail. 16 Schull. 16 Elworthy. 18 Davis. 18 Law. 20 George. Wyndham. Rogers. Kippen. Matthewman. Terhune. Gibb. Beaudet. Begg. Douglas. Shaver. McKim. Ffolkes. Egleston. Knuth.	1 McLaren. 2 Bowman. 3 Moore. 4 Law. 5 Elworthy. 6 Stonehouse. 7 Schull. 8 Williams. 9 Gibb. 10 Tronson. 11 Mahony. 12 Shearer. 13 Pope, E. 14 Dawson. 15 Davis. 15 Hallesy. 17 Armstrong. 18 Carpenter. 18 Kippen. 18 Terhune. 18 McKim. 18 Matthewman. 23 Lindsay, S. Wyndham. Chase. Gilpin. Goold. Henderson. McIlquham. Shaver. McPhail. Begg. Gaw. Redmond. Brown. Egleston. Douglas. Watt, J. M. Rogers. Ferguson.	1 Silverthorn. 2 McLaren. 3 Shearer. 4 Wettlaufer. 5 George. 5 Lindsay, S. 7 Bignell. 7 Moore. 9 Dennis. 9 Tronson. 11 Gaw. 12 Carpenter. 13 Matthewman. 13 Lindsay, W. 15 Law. 15 Hallesy. 17 Chase. 18 Henderson. 19 Brown. 20 Shearer. 20 Mahony. 20 Watt, J. 20 McPhail. 24 Elworthy. 24 Douglas. 26 Rogers. 26 Bowman. 26 Begg. 29 Ramsay. 29 White, C. 31 Redmond. 31 McIlquham, J. 33 Terhune. 34 Pope, E. 35 McKim. Ferguson. Egleston. Wyndham. ....

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

CLASS LISTS—*Continued.*

FIRST YEAR.

Classes.	Arithmetic.	Book-Keeping.	General Proficiency.	Departments.	First Class Men in the Departments.
HONOURS. I.	.....	1 McArthur. 2 Williams. Hallesy. Poe. 5 George. 6 Jones. Bignell. 8 McPhail. Shuttleworth. Moore. 11 Petapiece. Stonehouse. 13 Stover. Gibb.	1 McArthur, J. 2 Poe, J. P. 3 Stover, J. W.	I. Agriculture and Live Stock.	1 McArthur, J. 2 Stonehouse, M. 3 Shuttleworth, A. 4 Gibson, R.
HONOURS. II.	1 Bignell. 2 Grant. 3 Poe. 4 McArthur. 5 Blanchard. 6 Moore. 7 Job. Williams. Stover. Dawson. 11 Chase. Stonehouse. 13 Shearer. Philbin.	1 Philbin. 2 Job. 3 Dewar. 4 Blanchard. Mahony. 6 Davis. Dennis. 8 Barclay. 9 Lindsay, S. 10 MacLeod. Wettlaufer. 12 Gaw. McKim. 14 Matthewman. 15 Bethune. Gibson. 17 Law. 18 McLaren. Ramsay.	1 Job, J. 2 Jones, G. B. 3 Barclay, E. H. 4 Shuttleworth, A. 5 Stonehouse, M. 6 Blanchard, M. G. 7 Dewar, J. A. 8 Macleod, M. 9 Philbin, F. R. 10 Petapiece, W. 11 McLaren, P. Lindsay, S. 13 Williams, A. 14 Ramsay, R. A. 15 George, A. J. 16 White, W. G. 17 Grant, W. M. 18 Gibson, R. 19 Bignell, E. 20 Bethune, K. 21 Hallesy, F.	II. Natural Science.	1 McArthur, J. 2 Stover, J. W. 3 Barclay, E. H.
PASS. III.	1 McLaren. Shuttleworth. George. Jones. 5 Henderson. Brown. Bethune. Wettlaufer. Petapiece. Silverthorn. Mahony. 15 Ramsay. Tronson. Lindsay, S. 18 Terhune. MacLeod. 20 Dennis. Dewar. Matthewman. Douglas.	1 Chase. Shearer. Dawson. Silverthorn. Henderson. 6 Armstrong. 7 Grant. Begg. Lindsay, W. Elworthy. Brown. Bowman. 13 White, C. Gilpin. 15 Goold. Carpenter. 17 Tronson. Rogers. 19 Terhune. 20 Douglas.	1 Dennis, J. 2 Lindsay, W. 3 Mahony, E. C. Chase, O. 5 Silverthorn, N. 6 Bowman, B. 7 Armstrong, C. 8 Elworthy, R. 9 Davis, R. A. Moore, C. J. 11 Dawson, J. 12 Shearer, E. 13 Schull, C. 14 Wettlaufer, F. 15 Gibb, G. 16 White, C. D. 17 Gilpin, W. 18 Carpenter, C. 19 Tronson, H. 20 Goold, G. E.	III. Veterinary Science.	1 McArthur, J. 2 Jones, G. B.

Class Lists—*Continued.*

FIRST YEAR.

Classes.	Arithmetic.	Book-Keeping.	General Proficiency.	Depart-ments.	First Class Men in the Departments.
PASS. III.	20 Shaver.	Egleston.	21 Terhune, F.	IV. English.	1 McArthur, J.
	Begg.	White, W. G.	22 Henderson, D.		
	Hallesy.	Wyndham.	23 McPhail, E.		2 Barclay, E. H.
	Law.	Schull.	24 Redmond, S.		
	Schull.	Redmond.	25 Matthewman, E		
	Barclay.	Kippen.	26 Brown, W.		
	White, W. G.	Pope, E.	27 Law, F. E.		
	Armstrong.	Ferguson.	28 Shaver, C. B.		
	Gilpin.	Ffolkes.			
		Shaver.			
		Beaudet.			
		Knuth.	Pope, E.		
	White, C.	.....	Douglas, J.		
	Carpenter.	.....	Gaw, W. W.		
	Goold.	.....	Wyndham, W.		
	Lindsay, W.	.....	Kippen, H. B.		
	Bowman.	.....	McKim, J. A.		
	McPhail.	.....	Rogers, F.	V. Mathematics and Book-Keeping.	
	McKim.	.....	Begg, R. A.		
	Gaw.	.....	Egleston, G.		
	Redmond.	.....	Myers, W.		
	Davis.	.....	Ferguson, G. A.		
	Pope, E.	.....	Beaudet, G.		
	McIlquham, J.	.....	.....		1 McArthur, J.
	Wyndham.	.....	.....		
	Egleston.	.....	.....		2 Bignell, E.
	Kippen.	.....	.....		
	Ferguson.	.....	.....		
	Rogers.	.....	.....		
	Beaudet.	.....	.....		
	Knuth.	.....	.....		

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

CLASS LISTS—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURE.	LIVE STOCK.	PRACTICAL HANDLING AND JUDGING OF CATTLE.	PRACTICAL HANDLING AND JUDGING OF SHEEP.	ARBORICULTURE.
HONOURS. I.	1 Phin, R. J. Ross, J. G. 3 Phin, W. E. 4 Motherwell. Ballantyne. 6 Dickinson, C. S. 7 Leask. 8 Cuppage. 9 Landsborough.	1 Motherwell. Ballantyne. 3 Phin, W. E. Glass. 5 Phin, R. J. 6 McIlquham, W. 7 Dickinson, C. S. Pope, H. 9 File. Landsborough 11 Patton. 12 Leask. 13 Cuppage. Horne. 15 Cross. Grindley. Gordon. 18 Mylne. Ross, J. G. Newton. Segsworth. 22 Nicol. Robins.	1 Leask. 2 Motherwell.	1 Ross, J. G. 2 Cuppage. 3 Phin, W. E.	1 Ross, J. G. 2 Phin, R. J. 3 Phin, W. E. 4 Motherwell. 5 File. 6 Ward. 7 Grindley. Newton. 9 Pope, H. Cuppage. Ballantyne. 12 McFarlane. Dickinson, S. Dickinson, C. S. 15 Horne. 16 Gordon. 17 Leask. 18 Mylne. Ross, W. J. 20 Fotheringham. 21 Segsworth. 22 Noble. Landsborough. 24 Chipman. 25 Cross. Nicol. 27 Patton.
II.	1 McFarlane. Ward. Pope, H. 4 McIlquham, W. File. 6 Horne. 7 Chipman. Clutton. 9 Fotheringham. Grindley. 11 Mylne. 12 Anderson, H.F. 13 Patton. Gordon. Cross. 16 Ross, W. J. McNaughton. 18 Noble. 19 Dickinson, S. 20 Glass. Nicol. 22 Segsworth. 23 Newton. 24 Torrance.	1 Ross, W. J. 2 McNaughton. 3 Anderson, H.F. 4 Chipman. Fotheringham 6 Torrance. 7 McFarlane. 8 Noble. 9 Dickinson, S. 10 Charlton.	1 Phin, R. J. 2 Fotheringham. 3 Dickinson, C.S. 4 Grindley. 5 Chipman. 6 Dickinson, S. 7 Phin, W. E. 8 Ward. 9 File. 10 Robins. 11 Gordon. 12 Ross, J. G. 13 Glass. 14 Anderson, H.F. 15 Landsborough. 16 Ballantyne. Patton. 18 McIlquham, W.	1 Chipman.. 2 Dickinson, C.S. 3 Phin, R. J. Leask. 5 Motherwell. 6 Nicol. 7 Ballantyne. 8 Clutton. Newton. Grindley. 11 Glass. Anderson, H.F 13 Fotheringham Horne. 15 McIlquham, W. Charlton File. 18 Gordon.	1 Glass. 2 Anderson, H. F. 3 Torrance. Clutton. 5 Charlton. 6 McIlquham, W. Robins. 8 McNaughton. 9 Woodley.

Class Lists—*Continued.*

SECOND YEAR.

Classes.	Agriculture.	Live Stock.	Practical Handling and Judging of Cattle.	Practical Handling and Judging of Sheep.	Arboriculture.
PASS. III.	1 Charlton. 2 Robins. 2 Woodley.	1 Ward. 2 Woodley.	1 Clutton. 2 Horne. 2 Woodley. 2 Cross. 5 Cuppage. 5 Newton. 5 Noble. 8 Pope, H. 8 Nicol. 10 Charlton. 10 Mylne. 12 Skaife. 13 Segsworth. 14 McFarlane. 14 McNaughton. Ross, W. J. Torrance.	1 McFarlane. 2 Cross. 3 Landsborough. 4 McNaughton. 4 Noble. 6 Torrance. 7 Ward. 8 Dickinson, S. 9 Patton. 10 Ross, W. J. 11 Mylne. 12 Pope, H. 12 Robins. Segsworth. Woodley.	

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

Class Lists—*Continued.*

SECOND YEAR.

Classes.		Agricultural Chemistry.	Meteorology.	Entomology.	Hot-house Plants.	Veterinary Pathology (Cattle).
Honours.	I.	1 Phin, R. J. 2 Ross, J. G. Motherwell. 4 Phin, W. E. 5 Charlton. 6 Dickinson, C. S. Ballantyne.	1 Motherwell. 2 Ross, J. G. 3 Phin, R. J. 4 Phin, W. E. 5 Grindley. Dickinson, S.	1 Ross, J. G. 2 Newton. 3 Dickinson, C. S. 4 Phin, W. E. 5 Phin, R. J. Motherwell. 7 Grindley. 8 Nicol.	1 Phin, R. J. 2 Phin, W. E. 3 Motherwell. 4 Grindley. 5 Cuppage.	1 Phin, W. E. 2 Ross, J. G. 3 Phin, R. J. 4 Motherwell.
	II.	1 Horne. 2 Nicol. 3 Dickinson, S. 4 File. 5 Cuppage. Grindley. 7 Landsborough. 8 Ward. 9 Newton. 10 Pope, H. 11 Segsworth. 12 Torrance. 13 Cross. 14 Clutton. 15 Anderson, H. F.	1 File. Landsborough. 3 Ballantyne. 4 Dickinson, C. S. 5 Charlton. 6 Cuppage. 7 Pope, H. 8 Nicol. 9 Horne. 10 Fotheringham. 11 Segsworth. 12 Robins. Cross.	1 Cuppage. 2 Charlton. 3 Ballantyne. 4 Pope, H. 5 File. 6 Landsborough. 7 Fotheringham. 8 Horne. 9 Segsworth.	1 Ross, J. G. Horne. 3 Newton. 4 Landsborough. 5 Pope, H. 6 Robins. 7 Nicol. 8 Ballantyne. 9 Dickinson, C. S. Segsworth. 11 Dickinson, S.	1 Horne. 2 Pope, H. 3 File. 4 Newton. 5 Ross, W. J. Charlton. 7 Cross. Nicol. 9 Grindley. 10 Patton. 11 Ballantyne. 12 Cuppage. 13 Dickinson, C. S. McIlquham, W. McFarlane. Fotheringham. Landsborough.
Pass.	III.	1 Ross, W. J. 2 Robins. 3 Fotheringham. 4 Leask. 5 McIlquham, W. 6 Noble. 7 McFarlane. 8 Patton. 9 McNaughton. 10 Gordon. 11 Mylne. 12 Glass. Chipman. Woodley.	1 Ward. 2 Newton. Patton. 4 Anderson, H. F. 5 Leask. 6 Ross, W. J. 7 Clutton. 8 Mylne. Torrance. 10 McFarlane. 11 Chipman. 12 Glass. 13 Gordon. 14 McIlquham, W. 15 McNaughton. Woodley. Noble.	1 Torrance. 2 Ross, W. J. 3 Gordon. 4 Anderson, H. F. 5 McIlquham, W. 6 Woodley. 7 Robins. 8 Ward. Dickinson, S. 10 Clutton. Cross. Leask. 13 Glass. 14 Patton. 15 McNaughton. Mylne. 17 Chipman. Noble. McFarlane.	1 McNaughton. 2 Clutton. 3 Ross, W. J. 4 Charlton. 5 File. 6 McIlquham, W. 7 Patton. Cross. 9 Glass. Anderson, H. F. Chipman. Fotheringham. Gordon. Leask. Ward. Mylne. Woodley. McFarlane. Noble. Torrance.	1 Anderson. 2 Clutton. Gordon. Segsworth. 5 Leask. 6 Mylne. 7 Dickinson, S. Ward. 9 Glass. 10 Chipman. Robins. McNaughton. Torrance. Noble. Woodley.

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

Class Lists—*Continued.*

SECOND YEAR.

Classes.	Veterinary Pathology (the Horse).	Practical Handling and Judging of Horses.	English Literature.	English Composition.	Political Economy.
HONOURS. I.	1 Phin, R. J. 2 Ross, J. G. 3 Motherwell. 4 Phin, W. E. 5 Ross, W. J. 6 Horne. Ballantyne. Dickinson, C. S. Newton. 10 Pope, H. McFarlane.		1 Motherwell. 2 Ross, J. G. 3 Grindley. 4 Phin, R. J. 5 Newton. 6 Phin, W. E. 7 Dickinson, S. 8 Robins.	1 Dickinson, C. S.	1 Dickinson, C. S. 2 Phin, W. E. 3 Ross, J. G. Motherwell. 5 Phin, R. J. Torrance. 7 Grindley.
HONOURS. II.	1 Leask. 2 Cuppage. McIlquham, W. Dickinson, S. 5 File. Nicol. 7 Glass. 8 Fotheringham. 9 Clutton. 10 Landsborough. 11 Noble. 12 Torrance. McNaughton. 14 Grindley. 15 Patton. 16 Segsworth. Cross. 18 Robins. 19 Gordon.	1 Newton. 2 Ballantyne. 3 Landsborough. Cuppage. Cross.	1 Torrance. 2 Segsworth. 3 Ballantyne. 4 Cuppage. 5 Ross, W. J. 6 Nicol. 7 Horne. Pope, H. 9 File. 10 Anderson, H. F. 11 Clutton.	1 Ballantyne. Ross, J. G. 3 Landsborough. Phin, R. J. 5 Motherwell. 6 Fotheringham. 7 Pope, H. 8 Grindley. 9 Charlton. Mylne. 11 Robins. 12 Horne. Phin, W. E. 14 Anderson, H. F. Nicol. 16 Cuppage. 17 Chipman. 18 Patton. 19 McFarlane. Torrance. Ward. 22 Newton.	1 File. 2 Ballantyne. 3 Robins. 4 Pope, H. 5 Dickinson, S. 6 Newton. Nicol. 8 Ross, W. J. 9 Cuppage. 10 Clutton. 11 Gordon. 12 Charlton. 13 Segsworth. 14 Landsborough. 15 Horne. 16 Leask. 17 Chipman.
PASS. III.	1 Mylne. 2 Charlton. 3 Chipman. 4 Ward. 5 Anderson, H. F. 6 Woodley.	1 Phin, R. J. Charlton. Dickinson. 4 McFarlane. Segsworth. Mylne. Motherwell. Phin, W. E. 9 Grindley. McIlquham, W. Gordon. 12 File. Leask. Nicol.	1 Fotheringham. 2 Leask. Gordon. 4 Charlton. 5 Cross. Glass. 7 Landsborough. Mylne. 9 McNaughton. 10 Chipman. Dickinson, S. 12 McIlquham, W. Patton. McFarlane.	1 Cross. Dickinson, S. 3 File. 4 McNaughton. 5 Leask. 6 Segsworth. 7 Noble. 8 Glass. 9 Gordon. 10 Woodley. 11 Ross, W. J. 12 Clutton. 13 McIlquham, W.	1 McIlquham, W. 2 Anderson, H. F. 3 Fotheringham. 4 Mylne. 5 McFarlane. 6 Skaife. 7 Ward. Noble. Cross. McNaughton. Glass. Patton. Woodley.

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

CLASS LISTS—*Continued.*

SECOND YEAR.

CLASSES.	VETERINARY PATHOLOGY (THE HORSE).	PRACTICAL HANDLING AND JUDGING OF HORSES.	ENGLISH LITERATURE.	ENGLISH COMPOSITION.	POLITICAL ECONOMY.
PASS. III.		Chipman. Anderson, H. F. Clutton. Horne. Noble. Ward. Woodley. 15 Ross, W. J. Patton. Robins. Glass. Dickinson, C. S. Pope, H. Skaife. Ross, J. G. Torrance. McNaughton. Fotheringham.	Ward. Woodley. Noble.		

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

CLASS LISTS—*Continued.*

SECOND YEAR.

Classes.	Applied Mechanics.	Levelling and Surveying.	General Proficiency.
HONOURS. I.	1 Motherwell. 2 Phin, R. J. 3 Ross, J. G. 4 Ballantyne. 5 Phin, W. E.; Ross, W. J.; Nicol.	1 Ross, J. G. 2 Motherwell. 3 Phin, R. J. 4 Ballantyne. 5 Dickinson, C. S. 6 Phin, W. E.	1 Phin, R. J. 2 Motherwell, W. R. 3 Ross, J. G. 4 Phin, W. E. 5 Ballantyne, W. W. 6 Dickinson, S. C. 7 Grindley, A.
HONOURS. II.	1 Horne. 2 Grindley. 3 Cuppage. 4 Charlton; Pope, H. 6 Leask; File; Robins.	1 Ross, W. J. 2 Fotheringham. 3 Cuppage. 4 Pope, H.; Horne. 6 Leask; File. 8 Cross. 9 Landsborough. 10 McIlquham, W.; Dickinson, S. 12 Grindley. 13 Nicol. 14 Charlton. 15 Chipman. 16 Glass; Mylne. 18 McNaughton.	1 Cuppage, A. 2 Horne, W. 3 Nicol, G. 4 Newton, J. 5 File, J. 6 Pope, H. 7 Landsborough, J. 8 Ross, W. J. 9 Charlton, G. 10 Dickinson, S. 11 Leask, J. 12 Fotheringham, J. 13 Robins, W. P. 14 Cross, A. E. 15 Segsworth, F. 16 McIlquham, W. .....
PASS. III.	1 McIlquham, W. 2 Glass. 3 Dickinson, S. 4 Landsborough. 5 Fotheringham; Newton. 7 Dickinson, C. S.; Mylne. 9 Segsworth. 10 McNaughton; Torrance; Clutton. 13 Cross; McFarlane. 15 Anderson, H. F.; Noble. Chipman. Skaife. Patton. Ward. Gordon. Woodley.	1 Robins. 2 Noble. 3 McFarlane. 4 Torrance. 5 Segsworth. 6 Clutton. 7 Newton. 8 Patton. 9 Gordon. 10 Anderson, H.F. Ward. Woodley.	1 Anderson, H.F. 2 Glass, W. 3 Torrance, P 4 Mylne, R. C. 5 Chipman, P. H. 6 Clutton, J. G.; McFarlane, D. 8 Gordon, W. 9 Patton, W. 10 McNaughton, J. 11 Ward, T. M. 12 Noble, F. Woodley, F. E.

Departments.	First Class Men in the Departments.
I. Agriculture and Live Stock.	1 Phin, R. J. 2 Motherwell, W. R. 3 Phin, W. E. 4 Ross, J. G. 5 Dickinson, C. S. 6 Leask, J. 7 Ballantyne, W. W.
II. Natural Science.	1 Phin, R. J. 2 Motherwell, W. R. 3 Phin, W. E. 4 Ross, J. G.
III. Veterinary Science.	1 Phin, R. J. 2 Phin, W. E. 3 Ross, J. G. 4 Newton, J. 5 Motherwell, W. R.
IV. English Literature and Political Economy.	1 Motherwell, W. R.; Ross, J. G. 3 Dickinson, C. S. 4 Phin, R. J. 5 Grindley, A. 6 Phin, W. E.
V. Mathematics.	1 Motherwell, W. R.; Ross, J. G. 3 Phin, R. J. 4 Ballantyne, W. W. 5 Phin, W. E.

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

APPENDIX 5.

FINANCIAL TABLES.

1.—Appropriation Expenditure for 1881.

2.—Statement of Revenue for 1881.

3.—Estimated Expenditure for 1882.

4.—College in account with Farm and Garden.

Ontario Agricultural College.

1. APPROPRIATION EXPENDITURE FOR 1881.

	$ c.	$ c.
A.—*Maintenance Account.*		
I.—*Salaries and Wages*	10,571 52	
II.—*Food.*		
Meat, fish and fowl	3,956 59	
Bread and biscuit	1,267 78	
Groceries, butter and fruit	4,122 67	
III.—*Household Expenses.*		
Fuel	1,983 47	
Light	977 74	
Laundry, soap and cleaning	207 49	
Furniture and furnishings	452 47	
Repairs and alterations	352 75	
Servants' wages (women)	1,786 19	
IV.—*Business Department.*		
Advertising, printing, postage and stationery	616 02	
V.—*Miscellaneous.*		
Maintenance of chemicals	123 78	
Unenumerated	798 63	
VI.—*Payments not provided for in Estimates.*		
Books for library (Cyclopædia Britannic., herd books, books on agriculture, etc.)	356 53	
		27,573 62
B.—*Capital Account.*		
I.—Furniture and Furnishing	2,000 03	2,000 03
		29,573 65

2. COLLEGE REVENUE FOR 1881.

	$ c.	$ c.
January—Tuition fees	75 00	
Balances on board account	139 83	
		214 83
February—Balances on board account		67 19
March—Tuition fees	75 00	
Balances on board account	51 46	
		126 46
April—Tuition fees	1,125 00	
Balances on board account	1,184 62	
		2,309 62
May—Tuition fees	150 00	
Balances on board account	739 42	
		889 42
June—Balances on board account		142 68
July—Balance on board account		10 00
August—Balances on board account		146 23
September—Tuition fees	525 00	
Balances on board account	183 28	
		708 28
October—Tuition fees	1,000 00	
Balances on board account	229 96	
		1,229 96
November—Tuition fees	397 75	
Balances on board account	304 37	
		702 12
December—Tuition fees	175 00	
Balances on board account	548 37	
Fees for Supplemental Examinations	64 00	
Worn-out carriage horse	50 00	
		837 37
		7,384 16

Analysis.

Tuition fees	$3,522 75
Balances on board accounts	3,742 41
Fees for Supplemental Examinations	64 00
Horse	50 00
Lamps	5 00
	$7,384 16

3. ESTIMATED EXPENDITURE FOR 1882.

	Voted for 1881.	Required for 1882.	
I.—College and Boarding-House.	130 Students.	130 Students.	
(a) Salaries and Wages.	$ c.	$ c.	$ c.
President, Resident Master, Professor of English Literature and Political Economy	2,000 00	2,000 00	
Professor of Agriculture and Farm Superintendent	2,000 00	2,000 00	
Professor of Chemistry, Geology and Meteorology, Librarian	1,500 00	1,500 00	
Professor of Veterinary Science	.....	1,000 00	
Professor of Mathematics and Assistant Resident Master	600 00	1,000 00	
Bursar and Storekeeper (formerly boarded and lodged in College)	500 00	1,000 00	
Physician	500 00	800 00	
Instructor in Drill and Gymnastics (gave services gratis for year and a half)	300 00	400 00	
Farm Foreman	.....	150 00	
Foreman of Horticultural Department	600 00		
Foreman of Mechanical Department	600 00		
Matron and Housekeeper	600 00		
Engineer	400 00	400 00	
Assistant Engineer—six months	500 00	600 00	
Stoker and Night Watchman—six months	180 00	198 00	
Janitor and Messenger	.....	120 00	
Temporary assistance	150 00	150 00	
	100 00	100 00	
	10,530 00		11,418 00
(b) Expenses of Boarding-House.			
Meat, fish and fowl	4,000 00	4,000 00	
Bread and biscuit	1,600 00	1,500 00	
Groceries, butter and fruit	4,200 00	4,200 00	
Fuel	2,500 00	2,400 00	
Light	1,000 00	1,000 00	
Laundry, soap, and cleaning	300 00	300 00	
Furniture and furnishing	550 00	550 00	
Women servants for Boarding-house—17 in number	1,750 00	1,750 00	
Repairs and alterations	650 00	650 00	
Advertising, printing, postage and stationery	600 00	600 00	
Maintenance of chemicals	150 00	150 00	
Library (books, papers and periodicals)	.....	200 00	
Unenumerated	700 00	700 00	18,000 00
	28,530 00		29,418 00
Less reveuue (tuition fees and board)	7,384 16		8,500 00
	21,145 84		20,918 00
II.—Experimental Farm.			
Farm Foreman		600 00	
Foreman of Horticultural Department		600 00	
Foreman of Mechanical Department		600 00	
Experiments (labour, seeds, manures, etc.)		1,500 00	3,300 00
	21,145 84		24,218 00

IV. COLLEGE IN ACCOUNT WITH FARM AND GARDEN FOR THE YEAR 1882.

Dr.						
(a) With Farm.						
				$ c.	$ c.	
To Potatoes	130	bags	@	0 50	65 00	
" "	100	"		0 80	80 00	
" Turnips	25	"		0 12½	3 12	
" Wheat	70	"		1 10	77 00	
" "	50	"		1 20	60 00	
" Wood					20 00	
" Milk	3,400	gallons		0 08	272 00	
" Keep of College horse					100 00	
" Carting for College					30 00	
" Carpenter's work					70 00	
						777 [illegible]
(b) With Garden.						
To Apples	30	barrels		1 00	30 00	
" "	30	"		1 50	45 00	
" Asparagus	557	bunches		0 02	11 14	
" Beets	26	bushels		0 40	10 40	
" Beans (in pod)	11½	"		1 00	11 50	
" Capsicum	3	pecks		0 40	1 20	
" Celery	280	bunches		0 07	19 60	
" Carrots	27½	bushels		0 25	6 62	
" Cabbage	86½	dozen		0 40	34 60	
" Currants	1½	bushels			3 50	
" Cauliflower	8½	dozen		0 84	7 14	
" Crab Apples	5½	bushels		0 25	1 37	
" Corn	23½	dozen		0 10	2 35	
" Citron	8	dozen (small)		0 36	2 88	
" Cucumbers	12	"		0 25	3 00	
" Gooseberries	1	bushel			2 50	
" Grapes	6	bushels		2 50	15 00	
" Lettuce	60	dozen		0 20	12 00	
" Melons	2	dozen		1 20	2 40	
" Onions	13	bushels		0 75	9 75	
" Pickling Onions	1½	"		1 25	1 87	
" Parsnips	54½	"		0 35	19 07	
" Peas (in pods)	19½	"		0 70	13 65	
" Pickling Cucumbers	4½	"		1 50	6 75	
" Plums	1	bushel		3 00	3 00	
" Pears	1	"		1 50	1 50	
" Potatoes	30	bushels		0 60	18 00	
" "	47½	"		0 40	19 00	
" Rhubarb	450	bunches		0 02	9 00	
" Radish	2	bushels		2 00	4 00	
" Raspberries	1	quart		0 10	0 10	
" Squash	11	dozen		0 25	2 75	
" Spinach	5	bushels		0 75	3 75	
" Tomatoes	32	"		0 30	9 60	
" Turnips	43	"		0 12½	5 37	
" Vegetable Marrow	13½	dozen			8 00	
" Winter Radish	½	bushel		3 00	1 50	355 86
						1,132 98
Cr.						
By amount paid for Students' labour, at rates fixed by Farm Superintendent and foremen :						
January					373 00	
February					454 33	
March					226 00	
April and May					787 86	
June					668 94	
July					709 78	
August					666 [illegible]2	
October					386 95	
November					659 49	
December					269 94	5,202 61
By balance					4,069 51	

APPENDIX 6.

DESCRIPTION OF BUILDINGS, ETC.,

PREPARED BY THE ARCHITECT OF THE PUBLIC WORKS DEPARTMENT, JANUARY, 1881.

The Farm, containing 550 acres, was purchased from Mr. F. W. Stone, Guelph, in 1873, for the sum of $75,000, and is situated on the Dundas road, about one mile from the City of Guelph.

The buildings have been erected on an elevated portion of the Farm, on the north side of the Dundas road, commanding an extensive view of the surrounding country and the City of Guelph. The principal entrance is from the Dundas road, at the south-west angle of the grounds in front of the buildings, which have been skilfully planted; the hot-houses and horticultural gardens being in the south-east part of the premises, and having a separate entrance on the Dundas road.

The original building, to which additions have been made according to the requirements of the College, as the number of pupils increased, consisted of a stone dwelling-house, 53 feet by 39 feet, with addition in the rear for kitchen, laundry, etc., 60 feet by 24 feet, the whole being two storeys in height.

Commodious farm buildings of stone and wood, with enclosed yards, also stone, brick, and wood farm houses, were also on the premises when purchased, and the lots were surrounded by good post and rail fences. The greater portions of the lots were cleared and well cultivated, the remaining portions being wooded and retained for ordinary farm requirements.

The following additions were made from time to time to the original dwelling-house:—Dining, reading and class-rooms, also a lavatory, laundry, steam-heating apparatus, and apartments for the domestics were constructed in 1873-74, the College having been opened in the latter year. Apartments for twenty-eight pupils were fitted up in the stone farm house, in the front portion of the grounds. This building was burnt down in February last year, and the walls were so much injured that it has not been reconstructed.

In 1875 a mansard roof was constructed over the front portion, and at a distance of 50 feet on the south-east side, the College authorities erected a building 40 feet by 50 feet, two storeys in height, with mansard roof, for lecture and class-rooms.

An addition, 94 feet in length by 50 feet in width, two storeys in height, with mansard roof, was made on the north-west side in 1877, affording accommodation for thirty additional pupils, with a new dining-room, also apartments for the Professor of Agriculture. A cheese factory was also erected south of the Dundas road. Further additions were made in 1879 and 1880, consisting of store-rooms, Matron's and domestic apartments, also a larger dining-room, 62 feet by 40 feet, and dormitories for sixty additional pupils, making, in all, apartments for 130 pupils, with larger reading-room and library, baths and wash-rooms, all being heated by steam, on the direct low-pressure principle, by means of coils and radiators; a new boiler-house, 38 feet by 24 feet, containing two large steam boilers, with coal-house attached, having been constructed for the purpose.

The water supply at present is from wells and tanks on the premises; and the water is pumped into a large tank in the central tower, from whence it is distributed to the several baths, wash-rooms and sinks, the baths and sinks being also supplied with hot water. Arrangements will probably be made with the City Water Works of Guelph to extend their mains to the buildings during 188[illegible]en water will not only be supplied for the requirements of the College, thereby saving the cost of pumping, according to present arrangements, but the buildings will be protected from fire by means of hydrants in the grounds.

The City Gas Company of Guelph extended their mains to the buildings during 1880, and all the apartments are now supplied with gas-light. The buildings now completed occupy a space of 240 feet in front by 180 feet in depth, and contain a reception-room and office, four large class and lecture-rooms, with dining and reading-rooms, library, dormitories for 130 pupils, bath-rooms and lavatories, and apartments for the President, Professor of Agriculture, Assistant Master and Bursar; also Matron's and servants' rooms.

The perspective view shown on frontispiece, and the accompanying plans, which have been prepared in the Department, will explain the arrangement, dimensions and relative position of the various apartments, also the external appearance of the building, which now presents more of a public character than might have been expected, considering the basis on which the various superstructures were erected.

Further improvements will have to be made in 1881, to complete the furnishing and other internal arrangements, and render the buildings suitable in all respects for the requirements of the College.

The total cost of land and buildings, furniture, live stock, implements, drainage, etc., to the end of 1880, amounts to $198,029.51.

APPENDIX 7.

CIRCULAR OF THE ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM.

Staff.

(a) College.

1. James Mills, M.A., President, *Professor of English Literature and Political Economy.*
2. Wm. Brown, C.E., P.L.S., *Professor of Agriculture.*
3. J. Hoyes Panton, M.A., *Professor of Chemistry.*
4. J. Playfair McMurrich, B.A., *Professor of Biology and Horticulture.*
5. E. A. A. Grange, V.S., *Professor of Veterinary Science.*
6. Wm. Nattress, First Class A Provincial Certificate, *Professor of Mathematics and Assistant Resident Master.*

A. T. Deacon, *Bursar.*

(b) Farm.

1. Wm. Brown, C.E., P.L.S., *Farm Superintendent.*
2. P. J. Woods, *Farm Foreman.*
3. J. S. Forsyth, *Foreman in the Horticultural Department.*
4. James Mackintosh, *Foreman in the Mechanical Department.*

Introduction.

The institution known as the "Ontario Agricultural College and Experimental Farm" is situated about a mile to the south of the City of Guelph, in the centre of an extensive agricultural and noted stock-raising district, readily accessible by rail from all parts of the Province. The Farm consists of 550 acres, about 400 of which are cleared. It is composed of almost every variety of soil, and is therefore well suited to the purposes for which it was selected.

Immediately upon taking possession, the Government appointed a Commission to inquire and report regarding "the manner of adapting the said Farm and management and control thereof to the purpose of a Model and Experimental Farm." A few extracts from the Report of this Provincial Farm Commission will show clearly the basis upon which the institution is at present established:—

"The objects of the institution should be—First, to give a thorough mastery of the practice and theory of husbandry to young men of the Province engaged in Agricultural or Horticultural pursuits, or intending to engage in such; and, second, to conduct experiments tending to the solution of questions of material interest to the Agriculturists of the Province, and publish the results from time to time.

"That the Farm should be separated into five distinct departments, namely:—

"1. Field Department.
"2. Horticultural Department.
"3. Live-Stock Department.
"4. Poultry, Bird, and Bee Department.
"5. Mechanical Department.

"All permanent improvements on the Farm should be carried out on a gradually developed system, and in such a manner as to exhibit and test the comparative values of the most approved methods of executing the several works, and to test the cost, convenience, and durability of the several appliances from time to time recommended for adoption on the farms of the Province."

In order to carry out the suggestions of the Provincial Farm Commission, the Government made such improvements on the residence found on the place as would best utilize it for present purposes. Accommodation was provided for about twenty-five pupils, a Principal and a Rector were appointed, and a Foreman for each of the following departments engaged, viz.:

1. Farm Department.
2. Live Stock Department.
3. Horticultural Department.
4. Mechanical Department.

Work commenced in May, 1874. Since that time considerable progress has been made. There are now ninety-two students in attendance, all boarding in the institution; and it is hoped that our Parliament, at its next session, will make an appropriation, to increase the accommodation at once. Many improvements have been made on the Farm. A considerable portion of it has been well drained, suitable implements have been provided, and a very fair representation of stock secured—seven breeds of cattle, five of sheep, and three of pigs. The Horticultural Department has been thoroughly established, and is now one of the most efficient means of education in connection with the institution.

TERMS OF ADMISSION.

1. Each candidate must be at least fifteen years of age.
2. He must produce satisfactory certificates—
   (1) As to moral character.
   (2) As to physical health and strength.
   (3) As to the assent of his parents or guardians.
   (4) As to his intention to follow Agriculture or Horticulture as an occupation.
3. He must pass the Matriculation Examination.
4. If a ratepayer, or a *bona fide* resident of the Province of Ontario, he must pay a fee of $25 a year in advance; if not, he must pay a fee of $50 a year in advance.

The subjects for matriculation are as follows:

(a) Reading, Writing, and Dictation.
(b) English Grammar—Parsing and Analysis.
(c) Arithmetic—to the end of Simple Proportion.
(d) The outlines of General Geography, and the Geography of Canada.

Candidates for admission are required to present themselves for examination on the 16th of April or the 1st of October, at 9 a.m., in the Lecture Room of the College.

First, Second, and Third Class Teachers, holders of Intermediate Certificates, or Certificates of Entrance into the High Schools or Collegiate Institutes of Ontario, Graduates or Undergraduates of any University in Her Majesty's dominions, will be admitted on presentation of certificates or diplomas. Intending students from Ontario, who do not hold any such certificate or diploma, are advised to pass the examination for admission to High Schools, to save the expense and annoyance of having to return home in case of their failing to pass our Matriculation Examination.

There are no special examinations for those who come late. If candidates present themselves after the regular Matriculation Examinations are over, on *the 1st October* and *the 16th April*, they can not be admitted without certificates.

Farmers' sons, or others following the occupation of farming, will be allowed to attend the Classes during the Winter Session, which shall count as a year, under conditions hereinafter specified.

COURSE OF INSTRUCTION.

The instruction given at the institution is embraced under two heads: a Course of Study and a Course of Apprenticeship.

1.—COURSE OF STUDY.

The regular course of study for matriculated students is one of two years. There is a special course for those attending during the winter session only, whereby, no apprenticeship being undertaken in that time, additional studies are possible, and the whole two years' course is completed in two Winter Sessions.

First Year.

SUBJECTS:

Practical Agriculture.
Veterinary Anatomy.
Veterinary Materia Medica.
Physical Geography.
English.
Chemistry.
Botany.
Zoology.
Geology.
Mathematics.

Second Year

SUBJECTS:

Agriculture.
Veterinary Pathology.
Veterinary Surgery and Practice.
Book-keeping.
Levelling and Surveying.
Agricultural Chemistry.
Economic Botany.
Entomology.
Meteorology.
English Literature.
Political Economy.

DEPARTMENTS OF INSTRUCTION.

1.—Agriculture.

Introduction.—*History of Agriculture*—Ancient, mediæval, modern; *Literature*—standard works, reports of societies, periodicals; *Varieties of Farming*—dairy, stock, ordinary mixed husbandry.

Soils.—Origin, distribution, physical properties, and classification of soils; *Reclamation of lands*—Forest clearing—stumping, stoning, fallowing, etc.

Preparation of the Land for Crops.—Ordinary operations of tillage, ploughing, harrowing, cultivating, rolling, subsoiling, levelling, general cultivation most appropriate for the various kinds of soils.

Succession of Crops.—Importance and necessity of rotation, principles thereof, rotations suitable for various soils; crops—root, forage, cereal—treated with reference thereto.

Cultivation of Crops.—The various crops; *Cereals*—wheat, oats, barley, etc. *Leguminous*—peas, beans, etc.; *Roots*—turnip, carrot, potato, etc.; *Forage or Herbage*—tare, lucerne, clovers, grasses, flax, hemp—cultivation most appropriate for each; *Seeds*—purchasing, testing, preparing, changing; *Sowing*—kind and quantity of seed, method of sowing; *After cultivation—harvesting—consumption*, or preparing for market, cost of production, laying land down to grass, management of grass and pasture land.

Improvement of Soils and Lands.—Improvement by thorough ordinary cultivation subsoiling; *Draining*—its value, principles, various methods of draining, formation, levelling for, materials used in formation, cost and remuneration; *Manuring*—farm-yard manuring; application, uses, and properties of *artificial manures*—lime, plaster, salt, bones, superphosphate, nitrate of soda, etc.

Breeding, Rearing, and Feeding of Animals.—Horses suited for agricultural purposes, various breeds, breeding, feeding, and general management; *Cattle*—characteristics of the various breeds—Shorthorns, Herefords, Devons, Ayrshires, etc.; methods of breeding, cross-breeding, in-and-in breeding, pedigree system, rearing young stock, the fattening process, relation of food to increase, dairy management, butter and cheese management, the factory system, realization; *Sheep*—characteristics of various breeds, long wools, medium wools, short wools, breeding and management of ewe flock, winter and spring feeding, rearing of lambs, relation of food to increase; Wool—texture, quantity and quality, dipping and salving, quantity maintained per acre; *Swine*—characteristics of the various breeds, breeding and management of sows, fattening, relation of food to increase, bacon curing; *Poultry*—characteristics of the various breeds, general management.

Implements of the Farm.—Mechanical principles entering into their construction; ploughs, harrows, cultivators; other tillage implements, sowing machines, grass seed and manure distributors; mowing and reaping machines; hay-making and harvesting machines; threshing and dressing machines; barn implements; waggons, sleighs, carts; straw-cutters, turnip-cutters, and pulpers; implements used in stock-feeding, common, steaming; implements of less general use.

General Economy of the Farm.—Laying out a farm, formation and management of roads and lanes; *Fences*—varieties, position, mode of construction, materials, movable fences, hurdles; *Hedges*—varieties, methods of planting, after cultivation; *Buildings*—dwellings, out-buildings, stables, barns, sheds—principles of construction, plans and specifications.

General Business of the Farm.—Capital necessary, values and prices of land, stock, implements and improvements, value of all kinds of labour, making of inventories, keeping of stock and produce registers; *Markets*—economical laws regulating them, customs affecting them, modes of buying and selling, common laws relating to agriculture, relation of agriculture to the other industries.

Arboriculture.—Application to the American continent, different kinds of trees—occurrence, habits, uses, values—value of timber as a crop, raising of trees from the seed bed, what parts of the country should be planted, planting operations, transplanting large trees, enclosing and draining planted ground, management of trees with a view to shelter and economy.

Miscellaneous Subjects.

2.—Horticulture.

Occasional lectures are all that are yet given in this important department. The course of practical work, however, is extensive.

3.—Science.

I.—*Chemistry.*

Chemical Physics.—Force and matter, correlation of force, properties of matter, gravity, cohesion, heat—light, magnetism—electricity; forms of matter, liquids, solids, gases.

Inorganic Chemistry.—Scope of chemistry, atomic theory, chemical affinity, the *non-metallic* elements—oxygen, hydrogen, water—its nature, occurrence, functions, states and decomposition, nitrogen, the atmosphere, ammonia, its sources and important uses, oxides of nitrogen, nitric acid and its importance to plants, sulphur and its compounds, sulphuric acid, its manufacture and uses, phosphorus, the agricultural importance of phosphoric acid, carbon, silicon, flint, sand, silicates, chlorine, bromine, iodine, etc. *The metals*—the alkalies, sodium, potassium, soda, salt; calcium, lime, plaster; lead and its compounds; iron—its ores and manufactures; arsenic—its compounds and detection—gold, silver, platinum, tin, etc., occurrence and uses, alloys.

Organic Chemistry.—Scope of the divisions of the science, organic compounds derived directly or indirectly from plants and animals, artificial formation of organic

compounds, classification of organic bodies and their complexity, determination of the empirical and rational formulæ of organic bodies. *Wood Spirit* and its derivatives, methyl compounds, chloroform, acetic acid and its compounds, alcohol and the process of fermentation, constitution of oil and fats, manufacture of soap and candles; *starch and sugar*, and the other amyloids and glucoids—manufacture of sugar, tartaric, lactic, citric, and malic acids. The flesh-formers, or albuminoids and their congeners; *Essential oils and resins*—varnishes, petroleum; *Vegetable Alkaloids*—quinine, strychnia; aniline dyes; urea and uric acid. *Animal Chemistry. Vegetable Chemistry.*

Agricultural Chemistry.—History of the connection between agriculture and chemistry, the food of plants, the origin and nature of soils, analysis of soils, relation of different plants to the soil, composition of different crops, chemical changes during the growth of different plants, rotation of crops; manures—special and general, the composition of farm-yard manure, nature and analysis of guanos and superphosphates, other manures, feeding of animals, foods, ingredients of foods, relation of increase to composition of food, economy of food.

Practical Chemistry.—Chemical manipulation—the practical testing of waters, soils, foods, superphosphates and other manures, and the preparation of the common gases and the common acids.

Analytical Chemistry.—Qualitative and quantitative analysis, especially the analysis of soils, manures and farm produce.

(a) Through all the courses, both of laboratory and experimental lectures, a constant endeavour is made to illustrate the principles of the pure science of Chemistry, on which the whole teaching is based, by Agricultural examples.

II.—*Natural History and Entomology.*

Botany.—*Structural and Physiological*—Internal structure of plants, cells, and vessels; construction and development of the external parts of plants, root, stem, leaf, flower, seed, fruit; physiology of cells and vessels, chlorophyll; starch, gum, sugar, crystals, etc., movement of fluids and gases, nutrition and respiration, reproduction, methods of fertilization, hybridization, varieties, propagation, budding, division; diseases of plants, smut, rust, mildew, etc.

Systematic and Economic Botany.—Special morphology and general classification of plants, flowerless plants, mosses, ferns, fungi, etc.; flowering plants, characters of larger divisions. The orders containing important agricultural and economic plants, the cereals, grasses, roots with geographical distribution, agricultural seeds and fruits.

Zoology.—Nature of life, vital force, differences between animals and plants, differences between different animals, morphology and physiology, definition of species, origin of species, classification, characters of the general classes and orders of the *Invertebrates*, with examples. Special study of *Infusoria*, *Scolecida*, *Annelida*, and *Insecta*. General characters of the *Vertebrates*—the various orders, with morphological and physiological distinctions of each, illustrated by common examples. Special study of the families of *Aves*, containing the insectivorous birds, and the families of the *Mammalia*, containing all the various farm animals. Comparative anatomy and physiology of farm animals.

Entomology.—Structure and physiology of insects, metamorphoses of insects, senses of insects, insects injurious to vegetation, to growing plants, to fruits—the apple, plum, pear, peach, small fruits, etc.

III.—*Geology, Physical Geography, and Meteorology.*

Geology.—Geological epochs, classification of rocks, structure, stratification, cleavage, foliation, dip, fault, denudation; elevation and depression of land; disintegration of rocks by aqueous and atmospheric agencies, formation of soils, Canadian geology.

Physical Geography and Meteorology.—Connection between physical geography and geology, distribution of land and water, superficial configuration of Ontario, theory of wells and springs. *History and Scope of Meteorology*—weight of atmosphere, how

ascertained; *barometer*—various kinds, manipulation; *Temperature*—how observed and calculated; *thermometer*—varieties, Fahrenheit, Centigrade, etc., use of each, manipulation; solar and terrestrial radiation, moisture of the atmosphere; mists, fogs, clouds; rain, snow, hail; winds and storms; miscellaneous, causes affecting the climate, influence of climate on vegetation.

4.—Veterinary Science.

Anatomy and Physiology of the Domestic Animals.—Horse, ox, sheep, pig. Osseous system, muscular system, syndesmology, plantar system, odontology, digestive system, circulatory system, respiratory system, urinary system, nervous system, sensitive system, generative system, tegumental system.

Veterinary Pathology.—Osseous system, giving the nature, causes, symptoms, and treatment of the various diseases of bone, as splint, spavin, ringbone, etc.

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

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

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

Odontology—Describing the diseases of the teeth; also the mode of determining the age of the animals by the same.

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—Describing the diseases of the heart and blood vessels.

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

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

Nervous System—Nature, causes, symptoms, and treatment of lockjaw, 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, parturition, milk fever, etc.

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

Materia Medica.—Giving the preparation, actions, uses, doses, of over one hundred of the principal medicines used in Veterinary practice.

General Subjects.—The external form of the horse, thoroughbreds, half-bred hunters, harness animals, draught animals. The external forms of stock, breeding, selection of animals, crosses, transmission of hereditary diseases; spavin, splints, sidebones, ring-bones, grease, blindness, roaring, etc., and their remedies, sterility, abortion, general management to produce successful gestation, parturition, natural and preternatural presentations, their treatment. The management of young stock, weaning, feeding, method of preventing blood disease. The feeding of animals, ventilation, water, stabling. The influence of climate upon animals.

Demonstration of Anatomy in the Dissecting-Room.

5.—English and Political Economy.

English.—*Review of past school work.*—Study of etymological, syntactical, and rhetorical forms of the English language, history of its formation, elements entering into it, its connection with other languages. Analytical study of one of Shakspeare's plays, and of extracts from some of the other English classics each year. *English composition*—the sentence, the paragraph, rhetorical figures, their use and abuse, species of composi-

tion, qualities of style, varieties of style. Essay writing, familiar and business correspondence.

POLITICAL ECONOMY.—Wealth, labour, capital; production, distribution, exchange, government, and the position that agriculture holds in each; relation of agriculture to all the other industries of a nation.

6.—MATHEMATICS.

MATHEMATICS.—*Arithmetic—Review of past work in arithmetic, with special view to farm accounts*—tables of weights and measures, proportion, interest, discount, partnership, square and cube roots; *Mental Arithmetic; Mensuration*—the mensuration of every kind of surface, including the quantity of land cultivated by various machines, the surface occupied by different crops, the measurement of solids, including the contents of tanks, ditches, wells, manure heaps, walls, the material for roads, timber, etc. *Surveying* in its commoner branches, fields surveyed with the chain and cross-staff, heights and distances found by the use of the theodolite, levelling practised. *Mechanics*—methods for calculating the weights of different materials, the units of work performed by various agents in the execution of particular works, the strength of materials, the mechanical powers, friction, the steam engine, etc. Those parts of dynamics which have reference to agricultural machinery, such as centrifugal force, accumulated work.

II.—COURSE OF APPRENTICESHIP.

The pupils are daily distributed to each of the following departments:

1. The Live-Stock Department.
2. The Field Department.
3. The Horticultural Department.
4. The Mechanical Department.
5. The Experimental Department.

They are taught the manner of performing the various operations in each department by the instructor or his assistants in that department; and being distributed alternately to each, it is expected that at the end of two years a thorough apprenticeship will have been served.

The instruction received in the class-room is, as far as possible, illustrated and exemplified in the fields, yards, and shops. The following may be taken as a few of the operations, in the performance of which apprenticeship is served:

FIELD DEPARTMENT.—Cleaning, harnessing, and management of horses, ploughing, harrowing, cultivating, drilling, subsoiling, sowing broadcast and by drill, planting, hoeing and grubbing, haying by scythe and mower, harvesting by cradle and reaper, stoning, threshing, winnowing, marketing, draining, levelling, land measuring, stumping, logging, chopping, etc.

LIVE-STOCK DEPARTMENT.—Cutting, pulping, steaming, mixing, feeding, cleaning, and general management of *cattle*. Feeding, lambing, shearing, castration, dipping, salving, hurdling, and general management of *sheep*. Feeding and general management of other stock.

HORTICULTURAL DEPARTMENT.—Digging, ploughing, raking, seeding, planting, hoeing, mowing, harvesting, storing, and general management of vegetables, flowers, and lawn. Pruning, grafting, budding, mulching, cleaning, harvesting and storing, and general management of an orchard. General management of propagating-houses, greenhouses, vinery, nursery, hedges, walks and roads, etc.

MECHANICAL DEPARTMENT.—Planing, sawing, nailing, grooving, matching, mortising, framing, and general use of commoner mechanical tools. Fencing, hurdle making, gate making, and management of general farm improvements. Repairs of all farm buildings, implements, machines, etc.

SESSIONS AND EXAMINATIONS.

For those taking the regular course there are two Sessions in the year—a Winter and a Summer Session. The former commences on the 1st of October, the latter on the 16th April.

There is a vacation at the end of each Session.

There are three examinations in the year, which every student is required to pass, on the lectures of the class-room and on the practical work in the outside departments:—At Christmas, on the work of the Fall Term; at the end of March, the work of the Fall and Winter Terms; and at the end of June, on the work of the Spring Term.

For those taking the special course there is but one Session—the Winter Session—extending from the 1st October to the end of March. To those who pass the requisite examinations, not only in the regular studies, but in the special ones likewise, this Session counts as a year, and is so designated.

DIPLOMAS.

A diploma is given to each student who completes his course of study, and passes satisfactorily all examinations, both on the subjects contained in the curriculum, and on the work of his apprenticeship.

RESIDENCE, LABOUR, FEES, REMUNERATION, ETC.

1.—Regular Course.

It is desirable that all students taking the regular course should reside in the building. As the city, however, is distant but a mile and a half, students may board in it and attend lectures.

The number of hours of labour for regular students varies with the season of the year, from three and a half to five hours a day. In the months of July and August, when there are no lectures, the number is nine and a half hours a day.

Tuition fees, always paid in advance, $25 a year for ratepayers and *bona fide* residents of the Province of Ontario; for all others, $50 a year.

Board, lodging, and light, with the washing of towels and bed linen, $2.24 to $2.38 a week.

Washing, 30 cents per dozen pieces.

Allowance for labour, four to ten cents an hour, according to its value as estimated by the Farm Superintendent and his foremen.

By this arrangement the cost of education is reduced to a minimum:

(1) The entire cost to an Ontario farmer's son, able and willing, with considerable experience in farm work, is $50 to $65 a year for *board*, *washing*, and *tuition*.

(2) To an Ontario Student without any previous knowledge of farming, $55 to $75 a year for *board*, *washing*, and *tuition*.

(3) To non-residents, $75 to $100 a year for *board*, *washing*, and *tuition*.

2.—Special Course.

The special course, as stated above, commences on the 1st of October and ends 1st of April. It is intended for farmers' sons, or others engaged in that occupation, who desire to attend lectures during the winter, and return home in time for the spring work on their own farms. Such students, doing little or no manual labour, are enabled to take a whole year's lecture in the Winter Session, which counts as a year.

Tuition fees, always in advance, $25 a year for ratepayers and *bona fide* residents of the Province of Ontario; for all others, $50 a year.

Board, lodging and light, with the washing of towels and bed linen, $2.24 to $2.38 a week.

Washing, 30 cents per dozen pieces.

No opportunity of defraying expenses can be promised to students taking this course, but if work be required of them they will be paid at the same rates as regular students.

GENERAL RULES.

I.—Students are Required—

1. To render cheerful and willing obedience to orders.
2. To conduct themselves in a gentlemanly and orderly manner at all times.
3. To avoid all noisy or boisterous conduct in or about the building.
4. To observe neatness of dress at prayers, meals and lectures, and tidiness in their rooms.

II.—The Following Practices are Absolutely Forbidden :—

1. Swearing, improper language, and gambling.
2. Use of intoxicating liquors, cards, or fire-arms.
3. Use of tobacco while on detail, in or about the building, or in any place except in the smoking room.
4. Entering domestic or private apartments without permission.
5. Absence without leave.
6. Cutting, marking, or in any way defacing the College buildings or furniture.

GENERAL REGULATIONS.

1. All students who reside in the building are under the charge of the President.
2. A register is kept of the attendance of students at prayers, work and lectures.
3. All students must attend morning and evening prayers, unless exempted from doing so in consequence of the objection of their parents and guardians.
4. They are required regularly to attend their respective places of worship on Sabbath forenoon.
5. No student is allowed to be absent from the institution after seven o'clock in the evening, except by permission of the President.
6. Students are provided with everything in the shape of furniture, bedding, towels, etc., that may be requisite, but each is accountable for every such article placed at his disposal.
7. Every student damaging or breaking anything is required to report the same, that the value of the repairs may be charged to his account.
8. The morning bell is rung at 6 a.m. ; breakfast, at 6.30 a.m. ; farm bell, at 7 a.m. ; school bell, at 9 a.m. ; farm bell, at 12 noon ; dinner, at 12.30 p.m. ; farm bell at 1.30 p.m. ; school bell, at 2 p.m. ; farm and school bells, at 5 p.m. ; tea, at 5.30 p.m. ; school bell, at 7 p.m. ; bell for evening prayers, at 9 p.m. ; lights out at 10 p.m., and doors locked at 10.30 p.m.
9. The President is authorized to impose fines and other penalties for the infraction of rules and regulations.
10. No student whose moral conduct, industrial or intellectual progress is unsatisfactory to the staff, will be allowed to remain at the institution.

GENERAL REMARKS.

A few general remarks on the appliances and advantages possessed by this institution for training young men for agricultural pursuits may be given in conclusion.

Classes of Students.

There are in our Province, as a general rule, at least three classes of young men whom an institution of this kind can benefit. The first class are those who, from our cities and towns, or from other countries, with or without a small capital at their command, desire to serve an apprenticeship at farm work. The second class is farmers' sons, or the sons of those closely connected with that occupation, who wish to complete their education before commencing their life-work. Both of these are provided for in our regular course. And lastly, there are farmers' sons or others engaged in farming who desire to obtain an agricultural education, but cannot remain with us during the summer months. These are provided for in the special course. By taking that course, they can do a year's work in the winter session, be back on their own farms in time to commence their spring work, and return to College again in the fall.

Teaching Appliances on the Farm.

The farm itself is being gradually laid out, cleaned, and drained, and the students assist in these operations. The best and most approved farm implements and machinery are used. The possession of seven breeds of cattle, six of sheep and three of swine, is in itself an important advantage for the purpose of instruction. Besides this, there are in the immediate neighbourhood several herds which are frequently inspected by the students. In the adjacent city, monthly fairs, fat cattle shows, and a central exhibition are held. All of these are visited by the students, who regularly report on what they have observed.

Experiments.

A portion of the farm has been laid out in experimental fields and plots, and regular systematic experiments with varieties of grasses, cereals and roots, with different manures and different modes of cultivation, are carried on. In these the second year students, as far as practicable, are engaged. Besides these field experiments, others in the feeding of live stock are made during the winter, to test the several breeds and the comparative values of different kinds of food. The benefit of such experiments to the Province need not be pointed out. The discovery of one or two really good varieties of wheat, oats or peas would not only cover all expenses, but pay for the place itself in a couple of years by their value to the country. Without mentioning this, however, it will be seen that second years' students are trained in the modes of carrying out experiments.

Teaching Appliances in the School.

These are constantly being added to, although in the meantime they are not so numerous as might be desired. Especially is the want felt in the department of the Professor of Chemistry, for as yet there is but a small working laboratory in connection with the institution. Appliances in school are usually the growth of years, and with five teachers—masters of their subjects—the College may be said to be fairly equipped.

Veterinary Department.

This most important department has been fully organized and is doing good work. A complete skeleton of a horse and all the principal bones of ordinary farm animals have

been provided for the class-room. When an animal dies from disease or any other ailment, it is dissected, and the cause or causes of death sought for and pointed out in presence of the classes. Thus the work is made as practicable as possible.

Library and Reading-Room.

The library is well selected, and, though small, is being constantly augmented. The reading-room is furnished by the College with daily and weekly newspapers, with some half-dozen general periodicals, and the leading agricultural papers of Canada, the United States and Great Britain. Several papers are likewise provided by the Literary Society.

Advantages of the Course.

Besides becoming fairly skilled in the work of a farm, the student takes part in the cultivation of a garden, and thus increases his knowledge and improves his taste in a very important direction. He also acquires skill in the use of tools, so that afterwards he is not only able to make his own repairs, but knows when such work is properly done. He sees for himself the effects of various rotations and different modes of cultivation, and becomes acquainted, on the experimental ground, and in the class-room, with many varieties of grasses, grains, roots, and manures. The different breeds of cattle, sheep and swine, of common use in Canada, become familiar to him from daily contact with them; and the excellencies and defects of each he learns by lectures in the class-room, and by reference in the yards. He is taught how to keep live stock registers, accounts of field cropping, and regular farm accounts. By personal observation he learns the routine of auction sales, of ordinary fairs and stock markets, and of the common grain market. He becomes acquainted with the prices of stock, implements and produce, with the cost of building and improvements—in a word, he is prepared to transact the *business* of a farm. He obtains in the Veterinary Department a knowledge of the structure and functions of farm animals, and the most approved methods of treating and preventing the ordinary diseases to which such animals are liable. The study of the relations of the plant, the soil, and the animal to each other, and to his profession, under the heads of Botany, Chemistry, etc., not only shows him the reasons for the rules of the best farm practice, and enables him afterwards to discover other such rules, but likewise forms in him habits of reasoning closely, systematically and correctly, which cannot fail in after-life to make him a better citizen. And lastly, by this as well as by the teaching in the class-room, by reading the standard works in the library, and the newspapers and periodicals in the reading-room, by contact with his fellow-students, and by discussions carried on with them in their Literary Society, his mind is sharpened and strengthened, his views widened, and his power of thinking and his ability to express his thoughts greatly increased.

If the student be careless, thoughtless, or lazy, few of those advantages will be reaped; but if he be attentive, energetic and diligent, the majority of them will undoubtedly be secured.

James Mills,
President.

REPORT

OF THE

PROFESSOR OF AGRICULTURE

AND

FARM SUPERINTENDENT.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,
GUELPH, 31st December, 1881.

To the Honourable S. C. Wood,
Commissioner of Agriculture.

SIR,—As every successive report of any progressive concern is expected to be more interesting than its predecessor, and as those from this Institution during the past six years have ranked fairly well in this regard, it becomes a somewhat heavy matter to build up the status of the seventh.

You will allow me first of all to say how little I am able to do well in showing what is being done in several of the departments under my charge. The prolific field of Horticulture, for example, should receive a fuller handling, practically and scientifically, than it can possibly do from me. On the question of Fruits alone, we should already be telling the Province and the world how much can and cannot be expected under various conditions of soil, season, and management, not only from all the established varieties, but also from others that may be strictly experimental outside of ourselves, and those that are, or should be, ours experimentally. I think we are not bright in this line—good and reliable as our practical gardening unquestionably is. It is surely part of our duty to point not only the farmer's son, but the professional man and the deeper botanist, to such aspects and bearings of this the only "model culture" extant, as should elicit the commendation of even our enemies—if we have any. So also in regard to Entomology, which, were it as well reported upon in all its relations to our professions as it is taught by Professor Panton, would unquestionably be of almost incalculable value to the Province, for it ought to exist as a division of our Experimental Department, having all its daily and monthly life minutely, reliably, and plainly told, so that every grower of crops would know what to encourage and what to destroy, according to the guide thus established. Then, again, I think it is our place to be statistically wise, in the sense of being able monthly to prejudge what kinds and quantities of products the Province is likely to offer for home and foreign markets. This, I am aware, is a big thing, involving labour, great care, and the special study of a competent man, but it is one that no progressive country can overlook, and to a large extent Ontario has already committed herself in this regard by the rich issue of the Agricultural Commission. Our valued ex-President Johnston opened the gate of this field some years ago by drafting a line of work which I understand had your approval, and now that our College is in the hands of the farmers themselves, what they are doing should be our special work and their special interest. Thus much suggestive.

SHEEP WASHING AT THE ONTARIO EXPERIMENTAL FARM.
(Gow's Dam on River Speed.)

My introductory subject this year is, Our School in relation to the Cultivation of Trees in the Province; as, although I have in previous reports endeavoured to give some idea of its immense value, no definite suggestions have been made, nor any future work made clear.

The general importance of the subject, and its special application to Canada, is necessarily our first consideration, but it is one that has been so ably handled by evidence before the recent Agricultural Commission, that little more is necessary to impress its political standing upon the Government. The great points of trees or no trees, of retained moisture or rapid evaporation, of irregularly or regularly distributed rainfall, of unchecked storms or amelioration, of more or less temperate temperatures, and of the secondary but telling ones of ornament and cropping revenue—all go to make up a chapter of keen interest in our yet but short history as a nation.

Were evidence needed either to convince or stimulate us to action, the fact of what is being done in the conservation and replanting of forests in other countries should awaken both our pride and deep interest, as such lessons are plentiful in India, Australia, and the neighbouring Republic. There, Forestry is a profession and a Governmental department, systematically conducted by able officers, who are liberally supplied, first, in the item of experiments, and then in the establishment of extensive re-clothing of lands chosen by virtue of judgment based upon these and other known facts acquired by experience, or as shown by Nature herself.

When we desire to bring this matter right home to the farmer and his son here, the story takes seven distinct heads:

1. Shelter for crops.
2. Shelter for grazing animals.
3. Shelter for dwellings.
4. Regulation of temperature.
5. Regulation of rainfall.
6. Ornamental purposes; and
7. As a cropping investment.

The area and value of the forest lands of Canada are still of great magnitude;—indeed, of such magnitude that all the reliable information we possess from the brief notes of surveys stands as evidence of our ignorance of its variety, wealth, and extent, because any survey partakes so much of the character of straight-line testing that whole blocks of hundreds of acres of many kinds of our best timber lie untouched and unknown—at least to Government. It is surely within the scope of a reasonable outlay, and not many years' work, that the country should hold one map showing the principal tree crops on every surveyed lot, as well as on every outlined township, district, and limit. While we know intuitively that we are wealthier than we appear to be, it will give us no better standing in the world's market to make a story about it without actual inspection. Besides, when we talk scientifically, as we must do, in respect of forest influences upon many things ere practice goes afoot, it is most material to be thoroughly familiar with the existing condition of our forests as regards first, second, or any subsequent natural growths, and how far they are likely to subserve the ends in view.

The requisite proportion of tree surface to that under agriculture is another of the studies yet little understood by scientists, and cannot, so to speak, be handled practically with any precise measure of reason until further experiments point to safe data; but, from the extreme of overclearing on the one hand, to that of too much forest on the other, there is safe ground for *no delay* on the part of any Government. Of course this would bring up the allied point of what parts of the country should be conserved and what parts replanted, subject to the regulation of appropriate positions and adaptability of soil and climate in each particular example.

It should be one of the particular duties of the Professor of Arboriculture to educate the students of this Institution in regard to the suitability of certain kinds and *forms* of trees for special purposes—whether for field clumps, shelter belts, road-side shade, neighbourhood of dwellings, or for more extensive planting—in addition to the management

of them in all their detail from the seed-bed, transplanting in the nursery, preparation of land for planting, their annual maintenance, thinnings and their value, enemies to and diseases thereof, to the grazing of replanted lands, and the ultimate realization of the matured crop.

Thus should we be in a position to advise our Legislatures on the great national problem of the special and general conservation and replanting, by which it would be shown that enclosing, draining, regulation of fires, animal trespass, and supervision stood as items of public expenditure of the first class, so that one of the first of their duties is the establishment of Forest Departments, and the appointment and duties of a Conservator of Forests for each Province.

II.—THE FIELD.

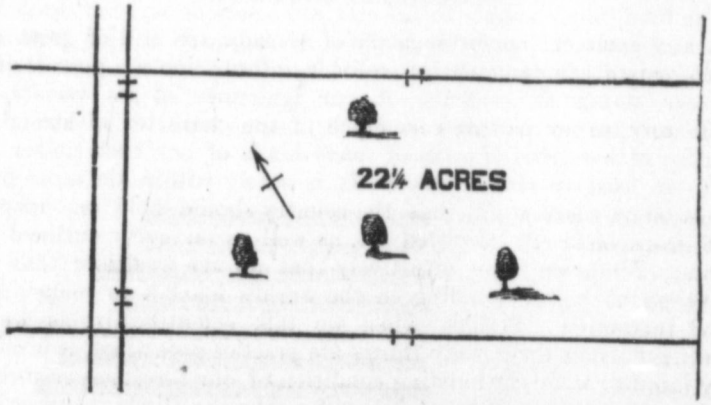
(1) Farm Cropping.

We have had so much of the purely practical in our previous reports under this head, that I am disposed to offer something with a scientific touch, as appropriate to our collegiate position and out of compliment to my fellow-labourers—be he chemist, botanist, entomologist, or practical farmer.

Looking upon a circle of crops by our seven shift as representative of a system that is best adapted to the restoration of an exhausted and dirty clay loam—of which we had so much in 1875—I shall handle Field 8, because of its average position to the whole farm, and of its fairness physically and productively, and because of its having completed the circle referred to.

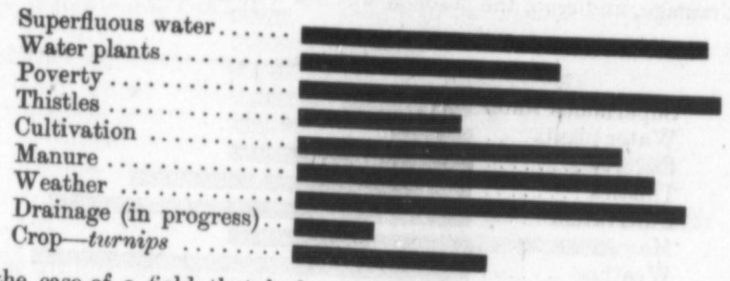
This field has one uniform almost level surface, with sufficient fall to the west for artificial drainage, which was effected in 1874 when in roots. The soil is a clay loam, neither heavy nor light, to an average depth of fifteen inches, resting upon a deep bed of almost pure gravel. It possesses four indifferent shade trees, and is watered from a well on the south-west corner.

Field 8 (1881).



Section of Field 8, showing drains and soils.

CONDITION OF FIELD IN 1874.

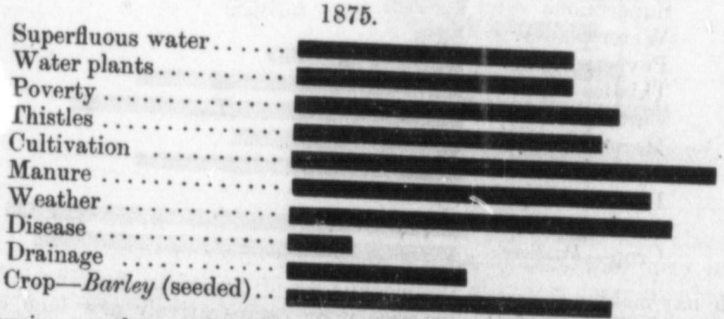


Here is the case of a field that had to be rescued from poverty and dirt by some method that would agree with a succession of crops over 300 other acres, part similarly conditioned and part in good trim. One view would be to thoroughly drain and summer fallow (bare fallow) in 1874, in place of fallowing with a root crop, as was done. In the first case, farm-yard manure would have been turned in with the last ploughing in the fall (probably the fourth or fifth ploughing of that season), when winter wheat might have been sown, or the whole might have been in preparation for spring grain. It was considered best, however, to thoroughly test the reliability of enriching and cleaning land by a religiously-adhered-to rotation based upon considerable practical experience, and upon the true principle that the best farming should always aim at obtaining at least one crop per annum—bare summer fallowing to be avoided if possible.

The condition diagram of 1874 shows a very deplorable state of things: a soil practically dead, though probably not so poor in plant food as may have been imagined, as the evidence of a non-productive soil by its crop under favourable circumstances, such as weather, freedom from animal and vegetable diseases, as well as cultivation, and even manure applications, is by no means conclusive on this point. Much of the apparent sterility of soils is often as much by reason of unpropitious physical conditions as by want of food—the food being simply in uncomatable, poisonous, or at least unpalatable forms. The great quantity of superfluous water in conjunction with previous management, and the necessary accompaniment of weeds, presented a fine subject for experiment, if nothing else.

My cropping story, so far as I am responsible, begins with 1875, thus:

1875.

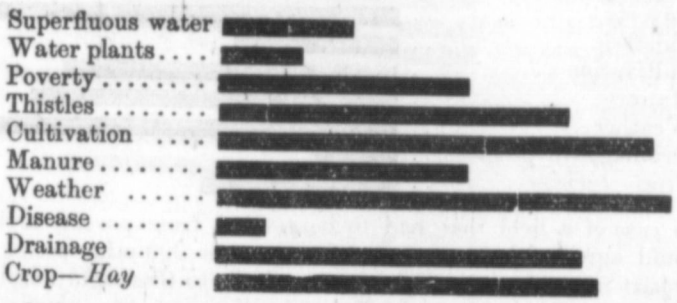


After a turnip crop, that, with its assumed thorough manuring and cultivation, backed by drainage, is considered to be one of the best restorers of fertility and the holder of a rich surface, we laid down to grass (timothy and clovers), stealing a crop of barley as usual—barley, because less exhaustive and less destructive by shade than other cereals. There are various opinions on this important question of what, if any, crop should be taken the year of grass seeding. The best theory says no crop; but all the best practice steps in and shows results fully justifying this sort of double annual production.

It is worth while at this stage to glance forward and compare this card with the six others, as no one of them exhibits such an even agreement of the ten things as 1875 does—a fact telling at once of bad agreement, because when we have superfluous water,

water plants, poverty, and thistles, averaging nearly as much as cultivation, manure, weather, drainage, and crop, the position was not a model one.

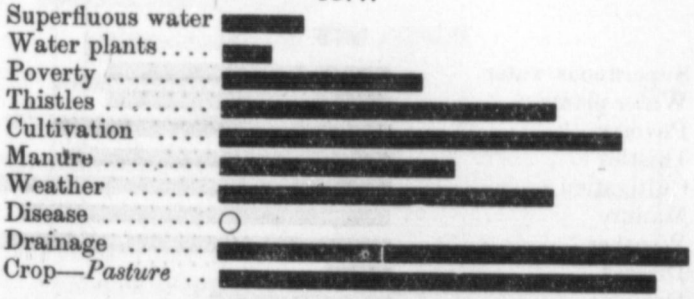
1876.



It is one of the curious things of farming in a country with extremes of climate that many good crops are got under conditions adverse to all notions of propriety in cultivated plant life, and it is because of this prominent fact that permanent improvements and thorough cultivation are yet so scarce in new countries—making so many men lazy, being "too well off," or living well upon the average of things. Depending upon peculiar conditions of climate, which affect both soil and immediate atmosphere favourably for the time being, four crops in ten will be safe to build upon. But then, there is no reliance; there is liability to a four years' bursting of barns and a six years' famine. However, this striking climatic circumstance points to another most important one in the present heat of special manures. Much as we do value and practise the association of mineral superphosphate, gypsum, and bone-dust, with thorough cultivation, systematic rotation, and farm-yard manure, there is no denying that a very great deal of the help of these specials is delayed or lost by, to them, unpropitious weather. So then, after all, the physical condition of things is probably as much or more important than food supply to crops.

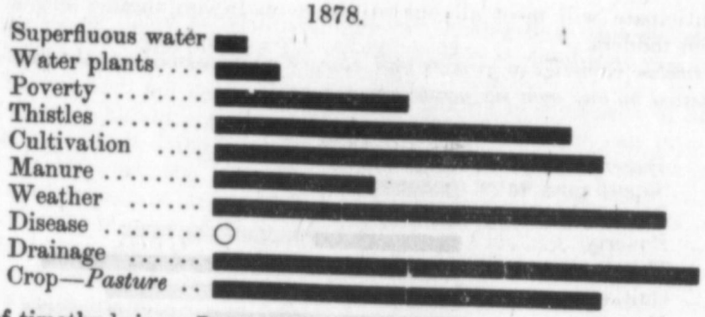
There was a good catch of grass and clover in 1876 amongst all the evils, though of course we could already speak about a comparatively rich surface and some drainage effects, with good cultivation.

1877.

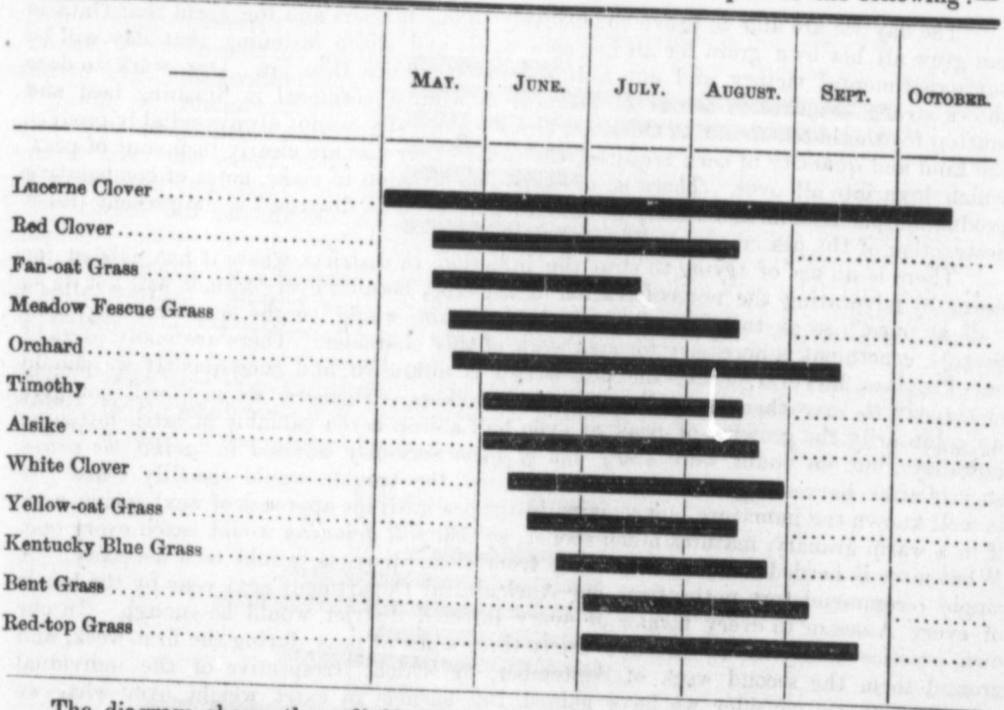


Much hay-making is one of the weaknesses of American farming. We can understand the reasonableness of the practice upon comparatively new land, where richness has to be, as it were, roughly handled in order to proper subjection; but when land is under regular drill there is no excuse whatever for taking three and four years' crops successively of *grain*. Cereals are grasses—grasses are grain producers when they are allowed to mature their seed, and therefore very exhausting upon any soil. In the removal of potash from the soil our form of hay is more hard than that by an equal weight of wheat with its straw, and very much more so in lime. Wheat, however, removes more magnesia, phosphoric acid and silica, and about equal proportions of soda and sulphuric acid. Altogether, then, we trifle with no easily-fed crop when we are tempted by a grand catch of timothy and clover that offers its two tons per acre for half the rotation.

1878.



The fact of timothy being a June plant, and repeating its growth no better than some other first-class grasses, under pasture or elsewhere, should impress the country more than it seems to do. In place of having our animals waiting before June and after July, as well as receiving no *change* of food, upon our valuable cultivated hay, observe the ease with which nearly all farmers could overtake the whole or part of the following :—



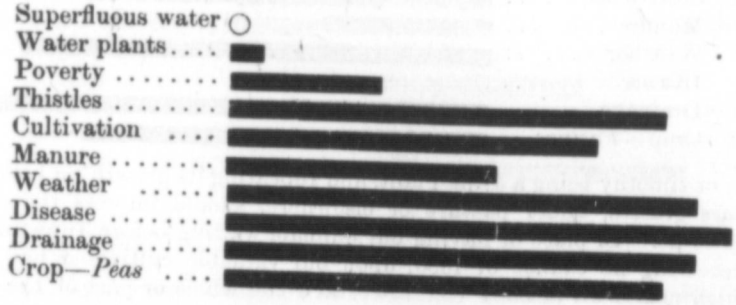
The diagram shows the *reliable* times of each of the grasses and clovers, and, of course, depending upon season and other favourable conditions, they may be extended further into the autumn. Should exception be made to the very large number of grasses and clovers for a rotation of hay and pasture, it is plain that red clover, timothy, orchard, Kentucky Blue and red-top would alone make a rich succession of growths. At the Experimental Farm we are *now* using for a seven course :—

Timothy	6 pounds.
Red-top	2 "
Orchard	4 "
Red Clover	4 "
Alsike Clover	2 "
White Clover	2 "
	20 pounds per acre.

Which we anticipate will meet all our requirements in conjunction with a large number of direct green fodders.

All the twelve varieties of grasses and clovers above-named are thoroughly reliable in Ontario, as tested by our own six years' experience.

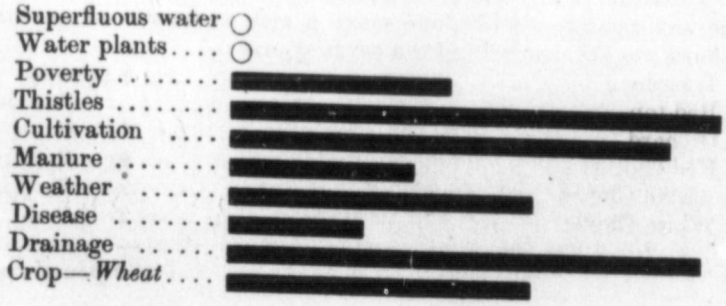
1879.



The day we are able to prove conclusively to our farmers and the world that Ontario can grow all her own grain for all her own cattle and sheep fattening, that day will be our experimental victory, and our national independence thus far. Our work to date shows strong evidence in favour of peameal as against cornmeal in finishing beef and mutton for the butcher, and, as Ontario's climate generally cannot always reliably produce the kind and quantity of corn required, the items otherwise are clearly in favour of peas, which luxuriate all over. There is, of course, no occasion to make notes of comparative production per acre in this example; and all that need be discussed is the present insect destruction of the pea crop.

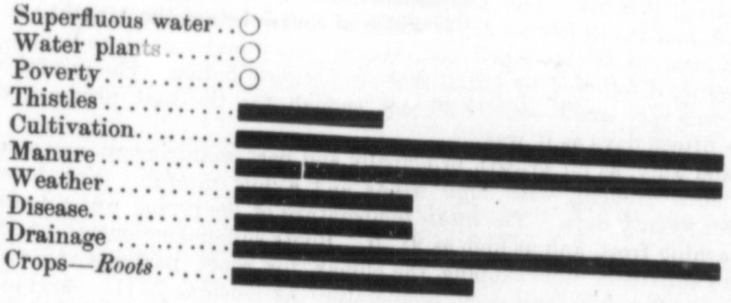
There is no use of trying to stop the infliction, in districts where it has existed for years, by advocating the non-cultivation of the crop, because every farmer will not do so "all at once," so as to stamp-out, which no doubt would be the most certain plan. Statute enactment is necessary for any work of this character. There are many parts of our Province, however, where the pea weevil is unknown, and consequently we should endeavour to save them as well as clean the others. Farmers, we say, will not give up voluntarily the growing of peas, as even half a crop is too valuable in cattle-fattening nowadays, but no doubt were *every one of them* seriously advised to *grind the grain* shortly after harvesting, so as to *kill every insect*, the trouble would speedily cease. It is well known the immature bug remains in the pea until the approach of next spring, and, if in a warm granary, matures much sooner, so that *fall grinding* would catch every one. What more is needed? Thus, new seed, from clean districts, would be a necessity. A single recommendatory notice from our Agricultural Department next year by the hands of every Assessor to every farmer of every infected district would be enough. In our own practice this year we threshed thirty-three acres of peas during the first week, and ground them the second week of September, by which, irrespective of the individual stamping-out, we consider we have gained 150 bushels in extra weight over what we would have realized had grinding been delayed until the bugs had matured themselves by using more grain.

1880.



I am clearly of opinion that there are very few examples in this country of what is usually understood as exhausted or worn-out land—that is, land that will not grow any sort of crops profitably under ordinary cultivation. Practically we have no such land in Canada, because we have not been in the habit of taking a succession of different crops unaided by manure, whereby complete exhaustion of plant foods can only be effected. What we have really been doing in the way of exhaustion was a successive cropping with one sort, and therefore but the removal, very much only, of what was needed by it and them, which, while certainly large and in variety, did not leave a fruitless soil for other crops widely differing in most of their requirements. I do not mean to infer that no damage was done, but that an actual wearing out was not done—leaving nothing for others after such mismanagement. In place of saying exhausted and worn out, it would be more appropriate to say miscropped and impoverished.

1881.



I am unable to understand how any soil can be maintained in the highest state of fertility without a division under root cultivation. We know the value and importance of a division under cultivated corn; what a bare fallow, or rest, means, and what clover can do; but no form of thorough cultivation, cleaning, manuring and surface rest, is so reliable as by turnips and mangolds. This is certainly no new statement to the Canadian farmer, but in many cases it is a doubted one, and entirely denied in others. What is usually implied in the raising of a root crop?

Fall manuring (farm-yard).
Fall ploughing.
Spring ploughing.
Grubbing.
Harrowing.
Rolling.
Harrowing.
Rolling.
Special manures.
Drilling.
Horse hoeing.
Hand hoeing.
Horse hoeing.
Hand hoeing.

This appears formidable, and it certainly means no play. It means a first-class fallow and the securing of twenty tons per acre of a material that converts the winter months into a soiling with green fodder,—freshening all animal life, enabling the farmer to use up much roughness of other materials that would otherwise become less valuable, adding immensely to the manure pile and cheapening keep sixty per cent. I do not go the length of those who argue that were no crops obtained—that is, in the event of turnips being a failure—all the attendant operations as above specified more than repay the cost;

but I do affirm, after twenty-two years' practical experience, that a stock farm is a bare, miserable affair without roots.

Thus, then, from the unpropitious conditions of 1875, our field has become, with one exception, a cropping subject of high value. That exception is *thistles*. I have to confess to being unable, in every example, to eradicate this enemy by root cultivation. Much has been said about thistles on this farm. Do I not say enough for the management when I now affirm that comparatively no thistle has been allowed to mature its seed during the past six years, and that they are cut over three and four times a season? We have had to take to bare summer fallowing in the worst cases.

2.—Cropping Results, 1881.

From April to September inclusive make up all our season of seeding, growth, and of the maturing and harvesting of crops. April and May for seeding; June and July for growth and maturing of cereals, hay and peas; August for harvesting these, and September for maturing of roots. The temperature of our seeding season was very high—as high as 84°.5, and yet as low as 22°.7, which of course brings the monthly mean down to 48°. But a mean of 48° for April and May *is* really high: good, therefore, for cultivation and seeding if followed by genial showers for germination. The rainfall of the seeding months was very small—only 1.39, not enough for the best progress, even though spread over fifteen days as it was.

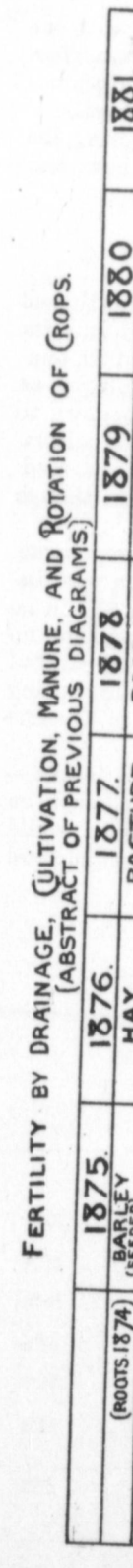
June and July, as for growth principally and part maturing of crops, were characterized by much drought, with high winds and a low rainfall. Yet the rain was distributed over twenty days. The mean temperature of the period was actually 63°, in no instance reaching frost, and as high as 91°.5. Roots suffered seriously. August kept up the heat and sultriness, thus capping the climax for roots, pastures and water; rainfall only 2'.15" over five days, and mean temperature as much as 72°.7. A grand harvesting month for all kinds of grain nevertheless. September was the warmest in Ontario records, also with little rainfall.

Looking at the whole record for the six months, it is plain that had the 8½ inches—half only of our usual quantity—of rain been evenly distributed over the 49 days on which it fell, and those days regularly placed over the whole, the cropping results would have been very much more favourable; so it is the irregular distribution and not the total quantity so much that affects vegetation.

Observe the abstract of weather as follows:

WEATHER—SEASON OF GROWTH AND MATURING, 1881.

Month.	Rainfall.		Temperature.		
	Days.	Quantity.	Highest.	Lowest.	Monthly Mean.
		Inches.			
April	2	.03	79°8	14°5	39°8
May	13	1.36	81°6	31°	56°4
June	12	2.85	81°5	37°4	58°4
July	8	1.01	91°5	52°4	67°5
August	5	2.15	97°	49°	72°7
September	9	1.07	98°	45°	68°4
	49	8.47			60°5



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	72°7
	68°4
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FERTILITY BY DRAINAGE, CULTIVATION, MANURE, AND ROTATION OF CROPS.
(ABSTRACT OF PREVIOUS DIAGRAMS)

THE DOTTED LINE SHOWS THE AVERAGE CONDITION OF THINGS.

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CHARACTERISTICS OF MONTHS:

April.—Very high temperature; small rainfall.
May.—Mean temperature above an average, and very high during fourth week.
June.—Rainfall below an average; high winds.
July.—Great heat during first week; rainfall much below an average.
August.—Temperature very high during fourth week; sultry weather.
September.—Warmest on record; little rainfall.

In fall wheat (Clawson) we had the high average of 38 bushels per acre on an unsheltered field of doubtful previous richness, that had had a crop of oats, but which got an average application of farm-yard manure in fall of 1880. Spring wheat (principally White Russian) was below our average both in quantity and quality, only 17½ bushels per acre from soil in good heart. Barley was under the mean, producing 33 bushels from good, sharp land, previously well done to. Oats fully 45 bushels per acre.

Considering the season, hay stood fairly well with us—or 1¼ ton per acre. We had a great bulk of straw from the variety of peas called Prince Albert, and the very moderate quantity of 23 bushels grain; the average length of straw was six feet, with corresponding strength.

Our highest yield of turnips was 400 bushels per acre, and as low as 170 bushels on different fields. Mangolds were *over* our average upon comparatively new and deep soil in No. 15 field—1,006 bushels per acre by accurate weighings. Potatoes gave 190 bushels, and are good in quality, with few smalls.

For cropping abstract of each field take following table:

Abstract of Cropping Results, 1881.

Field.	Area.	Extent of each crop.	Nature of Crop.	Quantity. T., Tons. B., Bushels.	Rates per acre.	REMARKS.
1	20½	10½	Hay	10¼ T.	1 T.	Gravelly hillocks and thistles.
		10	Pasture			
2			Oats, Barley, etc.			Summer Fallow after Hay in 1880; Experimental cereals.
3	22	22	Hay	29 T.	1¼ T.	See Experimental Report.
4	9	9	Barley, seeded	207 B.	23 B.	Half gravelly hillocks.
5			Bare Summer Fallow			Gravelly in parts; drought harmed Timothy and Clover.
6			" " "			Ploughed four times, and sown with Fall Wheat.
7	20¼	12	Spring Wheat	18 B.	216 B.	" " " " "
		8¼	Oats	330 B.	40 B.	
8	20½	20½	Turnips	7700 B.	380 B.	Part high lying and sheltered.
9	21¼	21¼	Hay	32 T.	1½ T.	Very much harmed by five weeks' drought.
10	14	14	Peas	322 B.	23 B.	Very fine patch of Grasses and Clovers.
11	21¼	21¼	Pasture			New orchard on balance of 10¼ acres.
12						
13	23	23	Pasture			Uncultivated pasture.
14	23	23	Hay	34 T.	1½ T.	
		10	Mangolds	10060 B.	1006 B.	Three acres uncultivated.
15	21½	7	Potatoes	1330 B.	190 B.	Three acres in swampy land.
		1½	Carrots			Few smalls.
		3	Turnips	510 B.	170 B.	
		4	Corn and Hungarian Grass			Corn a failure; afterwards Hungarian Grass.
16	22¼	6	Oats	150 B.	25 B.	Very poor; No. 16 is a wet, dirty field.
		2	Tares and Oats, fodder			Very fair crop.
		10¼	Pasture			
17	20	20	Spring Wheat, seeded down	17 B.	340 B.	
18	19	19	Peas	418 B.	22 B.	Fall Wheat sown.
19	30	8	Fall Wheat	304 B.	38 B.	Clawson variety.
		22	Oats	770 B.	35 B.	
20						
21	16½	16½	Pasture			Uncultivated.
	323¾	323¾	under actual farm cropping this	year.		

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3.—Reclamation and Improvement of Land.

It is the impression of many that we cultivate 400 acres, out of 550, of as clean, naturally dry, stone-free, stumpless and well-fenced land, as need be desired. This is not the case. Two views prevail in regard to what should constitute a Model Farm during its initiation, or say its first decade. One is, that every requisite improvement, of whatever nature, should be executed at once, in order that the country and students may have the records and handling of an immediate first-class thing. I do not agree with this view. I take the side that all permanent improvements should be gradually overtaken—scattered over a series of years: 1st, for the educational value to at least two-thirds of the students; 2nd, for their direct experimental connection; and 3rd, because of legislative economy and better performed work—the crowding of extensive improvements being generally insufficiently done.

What we have done up to 1880 may be gathered from the reports of each year. We have done very much more comparatively during 1880-81 than any two years previous. Field No. 2 has been ploughed four times to check thistles. No. 4 was drained to a considerable extent, loose stones and blasted stones removed, and an old snake fence, with its years of accumulated dirt, thoroughly cleaned. No. 5 was bare fallowed by four ploughings, fast stones blasted and removed. No. 6 has been cleaned of stones and stumps, and ploughed four times as a bare fallow. Field 14 has long been in possession of a low-lying three-acre swale, which this year we have dried with an expensive drain that has its outlet eighteen hundred feet distant, and which has also been cleaned up, burned and ploughed over. Field 13 was much of a swamp seven years ago; part of field 14 four years since; and we have just completed the reclamation of 15 from water, stumps and stones. Our new farm foreman, Mr. Woods, has shown an energy and ability in all this work superior to any of our previous experience. Nos. 16 and 17 fields this year, also, have been blasted of fast stones.

In addition to these improvements during 1881, we have overtaken the grading of part of road round farm buildings and of centre lane; the drainage of part of Nos. 16 and 18, and the fencing of south lane across fields 2 and 3 with board; the fencing of lane across the east half of field 17 with iron, sunk in stone; and the fencing of lane along No. 16, bush with wood and wire.

III.—THE LIVE STOCK.

I should like to preface this year's notes on this engrossing branch of our profession with some remarks on the rearing of store cattle by grazing in our own Dominion.

Ontario is not a grazing country. It has no extensive natural or artificial runs for cattle or sheep, where even growth of frame can be systematically relied upon in preparation for stall feeding; there are neither prairies nor uplands, nor valleys nor hill ranges, where nature welcomes to a feast of fat things from May to October. The Province is too rich all over for the ranch patriarch or the strolling shepherd. We are grain growers, and therefore beef growers in this connection.

But it must not be said that Ontario cannot graze her own cattle and sheep—it could be done were we willing to do it. Not yet exactly do we feel the want of it, or rather the value of it, being able to build all our own bone and muscle, along with some flesh and fat, ere topping off during six months of winter and spring for the butcher at home or abroad. It is a pity we are not feeling this grazing want more keenly; most of us are contented with turning out the yearling to the bush, and the hay after-growth, and the Timothy pasture, where, no doubt, progress is often very good—wonderfully good indeed, but there is no *annual and monthly reliability*—no undeviating round of a variety of plants to meet all the wants of animals that should be rushed for the market. While our remarks apply more to beef and mutton, they are not foreign to production of milk. Such, nowadays, in every country bearing up to the times, is the value of a rich piece of meadow on every farm, that were every farm in Ontario in possession of a *properly managed five-acre permanent pasture plot*, the gain to the whole country would exceed $5,000,000 annually. If I cannot overtake in this report a special chapter on the estab-

lishment and management of permanent pasture, as applicable to Ontario, I trust to be able to do so on another occasion.

Many of our finished students and others having in view to test the entirely new line of cattle grazing on our north-western territories, have asked my views on the whole question of probable expense and outcome thereof on a moderate-sized run in a good locality. Let us do so now.

One batch of thoughts is:—

1. Government terms of occupancy or proprietorship.
2. Value of pasturage, annual reliability, feeding properties, winter keep.
3. Kind of cattle most likely to succeed.
4. Extent of investment that would pay.

The second batch would be:—

1. Capital necessary.
2. Annual expenses.
3. Annual revenue.

The Government terms are most liberal, and substantially thus: Lease of twenty-one years; renewal two years previous to termination; area not to exceed 100,000 acres for one concern; rental one cent per acre; must graze one cattle beast to every ten acres, and the allowance of five acres to every hundred on a cattle station in one block as personal property, on payment of $1.25 per acre.

Now, my first conception of the make-up of such an enterprise is *association*—that is, more than one in its practical management on the spot, because of its comparative speculative character, of its hardships in a measure, and of the immense value of personal supervision. I would recommend the agreement of three young practical stockmen in possession of say $5,000 each, making a joint purse of $15,000. Having chosen, by actual inspection, the district in view of future railway communication; the particular 2,000 acres, with its shelter, water supply and rich enduring grasses; the ultimate necessity of fencing cheaply by utilizing any natural advantages, such as rivers; the very model of a choice of 100 acres as a cattle station, and the easy extension of the ranch, should everything smile—the choice of a breeding stock follows.

The sole aim of men under such circumstances would certainly be to raise the largest number of the best store-beefing cattle in the shortest time, and place an annual draft of them on a railway, or at seaboard, at the least possible cost.

Which breed or breeds, crosses or grades of cattle will do these on the south-western part of our north-western territories, adjacent to the Rocky Mountains?

The choice of cows and heifers must necessarily be confined to what can be had in the United States and Canada, from among those grades or native stock that by their whole stamp, as regards roominess, size, form and disposition, would prove the best possible *grazier* by the use of some kind of thoroughbred bull. The character of such a cow should be otherwise: a good ranger—that is, active in searching for the best patches of grass; a good nurse, able to defend herself and charge, not a wanderer; a home comer when required; hardy as regards changes of climate, and keeping up well on indifferent pasture, if necessary.

Such are plentiful all over the continent at prices ranging from $30 to $50 per head. Then there is also the great field of Texan and Montana cows, the better samples of which are, in several respects, superior to the one just sketched, and wants mainly in a roomy, square frame and quieter disposition, at prices from $10 to $20 a head. Indeed it will be a question to solve, whether or no, by the use of the proper bull, the best Texan cows will not secure the most profitable results on an average of things over a lengthened period, as against the more foreign element unaccustomed to prairie conditions. This latter view, however, can but have a short history, because their progeny would gradually acquire the whole grazing status necessary for the district. I think it would be well to possess, in addition to the common breeders, a small number of pure-

bred cows similar to the bull or bulls in use, wherewith to maintain a succession of bulls and cows, and thus lessen expense of having to renew from a distance.

No difficulty exists, therefore, in knowing what kind of cows to use; the trouble, if any, lies in telling exactly what breed of bulls will clearly give us what we want from such cows and their offspring. There is really no experience to build upon, and all that can be advanced in these first steps of the raising of store-beefing cattle in our Northwest, is to experiment with what we know can make the best average of all the requirements in other parts of the world. Take a systematic view of the requirements, and what we know can be done by the leading beefing breeds from common stock.

——	Maximum Value of Points.	Shorthorn.	Hereford.	Galloway.	Aberdeen Poll.
Reliable breeders	5	4	5	5	4
Impressive power	10	10	9	8	8
Giving early maturity	15	15	12	8	15
Giving weight	15	15	10	9	13
Grazing disposition	20	15	20	18	17
Hardiness	15	10	13	15	13
Quality of flesh	5	2	3	5	4
Least offal	10	9	10	10	9
Permanency of character	5	3	5	4	4
	100	83	87	82	87

It is only by such a tabular view as this that strict comparisons can be arranged and criticized—"book-wise" as it may appear to some of our stiffer-necked old school judges. It is not enough nowadays to say, "I know this is the best;" we must give reasons for every step and action of our progress. So then, casting the memory over the world's beefing lords, it is concluded to confine the choice to four kinds.

But more specifically. I bow to no one in admiration of the splendid Shorthorn, the greatest beefing and milking cattle of the world—still their's to make as much history as ever—a breed that never can be anything but grand; yet, when I am calculating, as I now am, to experiment or speculate in a largely unknown land, where conditions of *civilized* animal life are entirely unknown, I must hesitate in making them one of my agents in the enterprise; and why? Not because of their want of impressive power, nor of their early maturity, nor weight, but simply because we can have other breeds wherewith we know we have more chances of success in reliable breeding, and more given to do well on risk of poor fare. If new things ever become old in the new land, the world's beefer will easily find his place. Meantime, what does the Galloway say? No want of hardiness, nor kindly grazing, nor reliability in breeding, nor first-class quality of flesh, but clearly very short in weight and early maturity when close comparisons are entered upon; and thus, for the best average of all our wants under the estimated conditions, the Galloway has to step aside. The other poll is not a Galloway, nor ever had anything to do with Galloways. In all their history the Angus or Aberdeen poll stand clearly on their own merits as a distinct breed; they are essentially the *Shorthorn* of the north of Scotland, and by the comparative table we find them ahead of the English Shorthorn in hardiness, in quality of flesh, in adapting themselves to grazing conditions, but not equal in impressive power—according to comparatively limited experience, no doubt—equal, however, in early maturing properties, yet deficient, on an average, in weight per head.

Because of their white face, the Herefords are often designated "these consumptive-looking things," by some of their non-admirers ; but placed side by side with their rivals, we find that, while back somewhat in early maturing, and considerably so in weight, this breed, that has "breadth and depth without height," is after all second to none in view of the *probabilities* of our North-west grazings; they are so strong in impressive power, in hardiness, and especially in making flesh upon grass, that I am clearly of opinion we should ask them to lead in this great experiment. On the supposition that we can catch every possible virtue and want by the nine points—reliable breeders, impressive power, early maturity, weight, grazing disposition, hardiness, quality of flesh, least offal, and permanency of character—and that the value or importance of these are *relatively and properly valued* at a maximum of 5, 10, 15, 15, 20, 10, 15, 5 and 5 respectively, it will be interesting to any one to analyze the table thus submitted. Practically there is little difference on the *great average of things* between these four breeds, and the difference that does exist may be accounted for by difference of opinion between men. If asked, however, to make a selection from the four, I would not hesitate, *under the circumstances*, to take them in the order of merit as shown, namely: Hereford, Aberdeen poll, Shorthorn and Galloway.

The next consideration is the capital required for the first two years, during which time, it is presumed, all settling down, house building, fencing of cattle station, enclosing corrals, in addition to the necessary number and variety of live stock, household maintenance, and some implements for ordinary cultivation. After this two-year period some revenue should be accruing, though necessarily not so much as the annual average to be afterwards expected, because, in place of selling all heifers along with the steers, the greater number would be retained to increase the breeding stock. First the estimate, and afterwards any comments upon it :—

Personal expenses of one examining ground and securing lease, etc	$400	
Price of four yearling bulls delivered at ranch, at $400 each	1,600	
Price of three thorough-bred heifers	900	
" 250 cows and heifers (mixture of grades, Texan and Montana), at $25 each	6,250	
Price of two yoke oxen	300	
Twelve saddle horses, natives	600	
Total for live stock		$10,050
Cost of dwelling-house, stables and sheds	600	
Fencing 100 acres as cattle station, the home property	500	
Enclosing two corrals	150	
Agricultural implements, tools, etc	1,000	
Unenumerated	300	
Total for building, fencing, etc		2,550
Household maintenance and personal expenses of three Principals during two years	750	
Wages and keep of two lads during two years	2,000	
Incidental expenses	250	
Rent	40	
		3,040
		$15,640
Price of 100 acres of homestead, at $1.25		125
Total capital required		$15,765

It will be obvious at the first glance of this estimate that we are not dreaming of delegating the investment and management of our money to others, as is usually the case in a much larger concern, or where the heavy purse is a party. Our aim is to show that

it does not require a millionaire to start and handle a cattle ranch, but that three practical heads with $5,000 each may safely do so. By putting a high cost upon everything, securing four first-class bulls and three heifers, with 250 common cows and heifers, two yoke of oxen, twelve native horses for the saddle, with high figures also for the erection of buildings and fences of the usual rough but comfortable kind, the purchase of implements such as ploughs, mowers and waggons, in addition to the personal maintenance of themselves and two young men, the three principals would be in possession of a fully equipped ranch of 2,000 acres at the end of two years.

In saying 2,000 acres, it will be evident that we are calculating circumspectly, *pro tem.*, whatever the future may bring about. Until grazing locations become as regular as Ontario farms are to each other, our 2,000 acres may be 20,000, so long as neighbours don't push or *outfeed* us in number of stock. Necessarily this implies more trouble and expense in superintendence, collecting, numbering and branding, but then it also means very much more revenue. A question of some importance presents itself at this stage of our inquiry—how are we to brand *hornless cattle?* The hot iron cannot be used anywhere with them except upon the hoof, and this would always be a very awkward check—in fact, is rarely used; branding on the skin is only of one year's use, and any other form of hair marking soon grows out, and ear labelling would not do, unless everybody was above suspicion. It is evident that a plan of *ear-marking* or hole-punching is wanted, and in order to draw forth something better, I beg to suggest the following:—

The two ears have four distinct sides—two upper and two lower—thus giving four unmistakable base lines, that the commonest cow-herd could not misinterpret: (1) the upper of the right ear; (2) the upper of the left ear; (3) the lower of the right; and (4) the lower of the left—thus:

The average length of an ear being eight inches, and about four inches in breadth, there is space enough for three distinct positions on each base—one near the point, another in the centre, and the third near the head; these, on our four edges, sides or bases, give twelve positions.

The idea now is to arrange such a plan of punch-holes at these twelve places as will represent all the letters of the alphabet excepting I and Z,—therefore twenty-four. My plan is as follows:—

A double punch constructed to cut out a wedge piece, and also a circular hole, will serve the purpose; and now supposing it is desired to mark cattle belonging to William Brown, Guelph, the cuts would take this position:—

W. B., G.—William Brown, Guelph.

But, of course, the G. could be omitted if considered confusing, and to meet the case of *similar initials* with a different name, such as Walter Butler, the last letter of both Christian and surname can be added thus, the cuts being doubled as required:—

Wr. Br., G.—Walter Butler, Goderich.

And so on, in almost any variety. Were some such plan as this registered as the Government standard or index, much trouble would be saved, as it could not possibly be left to individuals to record their own ear-marks, because no possible variety could meet the wants of hundreds of different graziers.

But the most important and difficult part of this grazing question has now to be handled—the estimate of annual revenue after the first two years. In doing this we will assume the non-necessity of much winter keep to breeding stock, all required being an occasional bite of hay at more severe times, the absence of any sweeping epidemic or extensive stealing, but allowing for ordinary proportion of deaths.

Entering upon possession in spring of 1881, the 250 breeding cows and heifers, less deaths and non-breeding, will have dropped 550 calves by August, 1883, one-half of which will be two and a-half years old, and the other half, being yearlings and calves, to be retained for another season's culling. Of these 275 head, 25 heifers would be kept for filling up blanks among breeders, the 250 to be sold. In taking stock, therefore, on 1st September, 1883, there should be about—

250 breeding cows and heifers.
275 yearling steers and heifers and calves.
250 two-year-olds for sale.

775 head in all.

Estimate of Increased Value.

First draft of two-year-old steers and heifers, delivered at railway (average weight 950 pounds), 250 head at $23 ..		$5,750
Value of 275 yearlings and calves, retained, at $12		3,300
Value of seven additional thorough-bred bulls and heifers		1,500
Gross increase from live stock		$10,550
Depreciation in value of older breeding cows, none over five years old	$400	
Depreciation in value of horses, oxen, implements, etc..	300	
Miscellaneous debits	300	
		1,000
Net increase during two and a-half years..		$9,550

It is not necessary to charge or discharge anything more than what has been done in connection with the cultivation of perhaps fifty acres of grain, roots and household stuffs, and ample allowances have been made for "unforeseen and unprovided," so that this net balance of $9,550 gives $3,820 as annual clear revenue from the investment of $15,000.

Finally, I shall suppose that I am *one-fifth* wrong in calculating capital account *too low*, and *one-fifth* wrong in estimating revenue *too high*, which I simply grant for the sake of quashing all argument. By this concession we still have an annual clear revenue of $3,050 from an investment of $18,000, or a return of *17 per cent. per annum.*

From what other agricultural subject can such a return be made year after year? We but need some facts to confirm these estimates, and I think it would be well that the Dominion Government at once employ a practical expert, one clear of all influences whatsoever, to thoroughly examine, during winter and summer, the best sections of our great North-West grazing lands, in order to the issue of a report showing the question in all its possible bearings. The value of such a document would be immense.

2. The Washing of Wool.

There are two opinions on the question of profit to the farmer in washing sheep before shearing. All quotations of prices are by the pound of sixteen ounces, *washed*, and when the farmer takes his wool to the market unwashed he receives *one-third* less. Example: in place of thirty he receives twenty cents, because, as the purchaser says, there is fully a difference of one-third in weight.

We have inquired into this, and have ourselves tested the point of difference in weight between washed and unwashed wool. There is, for all practical purposes, just one-third difference, with a slight tendency in favour of unwashed—that is, as the sheep, after washing, are allowed to dry and re-yolk for about two weeks, the fleeces gather dirt, and are not, properly speaking, clean of all sand and soil, so that the real result on the market is in favour of the seller and against the buyer.

In illustration of the farmer's position, take our current year's sales of wool—all unwashed, of course:—

Long wool—Leicester, Cotswold and Canadian, 1,117 lbs., at 15 cents per lb.....	$167.55
Medium—Oxford Down, 130 lbs., at 18 cents per lb.....	23.40
Short—Southdown, Southdown grade and Shropshire Down, 242 lbs., at 21 cents per lb.....	50.82
Total unwashed price	$241.77

Had this wool been washed it would have weighed only 745, 97 and 162 lbs. respectively, and realized as follows :—

Long	745 lbs., at	23 cents	per lb.	$171.35
Medium	97 "	27 "	"	26.19
Short	162 "	32 "	"	51.84
Total washed price				$249.38

What does the manufacturer say to this? Where is the farmer's profit in washing wool? Where anything to meet his time and expenses, in addition to risk of a death or two among a large number in a river or pond? There can be no desire to discourage the washing of sheep before clipping, but the advantage to the farmer must be evident. If the manufacturer says he won't buy unwashed at any price, then matters would be changed; but so long as the present one-third difference holds, the farmer has clearly the advantage in not washing.

3. Public Sale of Live Stock, 1881.

This, our fifth annual disposal of surplus animals, was marked by several unusual circumstances. The draft of young cattle, sheep and swine was fully over the average in merit, but possibly with fewer examples of individual excellence. Two Shorthorn heifers, neither plain nor grand, brought $90 apiece,—*only*, as some would add,—yet, after all, not such a small only for the average farmer, nor for the breeder as such. A two-year-old Aberdeen Poll heifer fetched $306, and two bulls of the same kind averaged $125. We were privately offered *thirty-five per cent.* more for these. Ayrshires made an average of $65 and Devons of $50 each. The demand for Herefords and Aberdeen Polls has been very keen, $150 to $200 being freely given for bull and heifer calves of either breed; there is no abatement in the extensive demand for Shorthorn yearling bulls. Our own feeders of live stock are rousing up to the want of *blood* for their purpose; and while quietly grudging anything over $150 a head, they believe, nevertheless, in giving more when the pedigree is on the animal's back as well as on paper.

It forms a very instructive study to mark the average prices realized for different breeds of sheep, as evidence, other things being equal, of the turn in the wool and mutton markets.

Average Prices Realized for Sheep.

Aged Cotswold ram	$51 each.
Shearling Cotswold rams	31 "
Cotswold ram lambs	18 "
" ewe lambs	15 "
" ewes	15 "
Leicester shearling rams	48 "
" ram lambs	22 "
" ewe lambs	12 "
Aged Oxford Down ram	56 "
Oxford Down shearling rams	52 "
" ram lambs	30 "
Shropshire Down ram lambs	45 "
Aged Southdown rams	80 "
Southdown shearling rams	40 "
" ram lambs	15 "
" ewe lambs	12 "
" ewes	20 "

General mean :—

Oxford Downs	$46 "
Shropshire Downs	45 "
Southdowns	33 "
Cotswolds	26 "
Leicesters	24 "

Public Sale of Surplus Live Stock, 8th September, 1881.

Lot.	Class.	Purchaser.	Amount.	Total.
	CATTLE.			
	Shorthorns—		$ c.	$ c.
1	Heifer calf	R. Hermiston, Mount Forest	102 00	
2	" "	J. Carter, Guelph	75 00	
3	Bull	A. McGibbon, Milton	122 00	299 00
	Hereford—			
4	Bull	O. Duck, Hannibal, Mo., U.S	175 00	175 00
	Aberdeen Polls—			
5	Bull calf	M. Boyd, Bobcaygeon	116 00	
6	Bull	G. Hood, Guelph	134 00	
6 (A)	Eyebright III.	M. Boyd, Bobcaygeon	306 00	556 00
	Ayrshires—			
9	Bull	E. Keeler, Maitland	70 00	
10	Bull calf	S. Brown, Fordwich, Huron	60 00	130 00
	Devons—			
7	Princess Mary	E. A. Barnard, D.A., Quebec	58 00	
8	Heifer calf	" " "	37 00	95 00
	SHEEP.			
	Cotswolds—			
1	Ram "Duke"	J. C. Snell, Edmonton	51 00	
2	Two shear ram	E. A. Barnard, D.A., Quebec	35 00	
3	Shearling "	" " "	31 00	
4	" "	P. McGregor, Mimosa	31 00	
5	" "	J. Giffen, Edmonton	20 00	
6	" "	E. A. Barnard, D.A., Quebec	34 00	
7	" "	H. Ferguson, Avon Bank	35 00	
8	Ram lamb	E. A. Barnard, D.A., Quebec	13 00	
9	" "	D. T. Wilson, Teeswater	25 00	
10	" "	J. C. Snell, Edmonton	23 00	
11	" "	J. F. Davis, Glanworth	13 00	
12	" "	E. A. Barnard, D.A., Quebec	12 00	
13	" "	J. Lowden, Montreal	30 00	
14	" "	J. C. Snell, Edmonton	23 00	
15	" "	" "	16 00	
16	" "	" "	15 00	
17	" "	J. Anderson, Arthur	17 00	
18	" "	R. Worth, Petherton	17 00	
19	" "	W. H. Stubbs, Bosworth	14 00	
20	" "	W. Early, Norval	17 00	
21	" "	O. Duck, Hannibal, Mo., U.S	10 00	
22	One pair ewes	W. J. Rudd, Arkell	24 00	
23	" "	E. A. Barnard, D.A., Quebec	24 00	
24	" "	" " "	30 00	
25	" "	" " "	26 00	
26	" "	" " "	34 00	
27	" "	W. J. Rudd, Arkell	42 00	
28	" "	O. Duck, Hannibal, Mo., U.S	28 00	
29	One pair ewe lambs	T. McCrae, Guelph	20 00	
30	" "	O. Duck, Hannibal, Mo., U.S	28 00	
31	" "	J. C. Snell, Edmonton	22 00	
33	" "	B. Watson, "	24 00	
34	" "	O. Duck, Hannibal, Mo., U.S	32 00	
35	" "	E. Jeffs, Bond Head	24 00	
36	" "	J. C. Snell, Edmonton	26 00	
37	" "	E. A. Barnard, D.A., Quebec	26 00	
38	" "	J. C. Snell, Edmonton	40 00	
39	" "		30 00	962 00
		Carried forward		2,217 00

PUBLIC SALE OF SURPLUS LIVE STOCK—*Continued.*

Lot.	CLASS.	PURCHASER.	AMOUNT.	TOTAL.
	SHEEP—*Con.*		$ c.	$ c.
	LEICESTERS—	*Brought forward*		2,217
40	Shearling ram	F. Wyatt, St. Catharines	48 00	
41	Ram lamb	J. O. Stewart, Millburn	41 00	
42	" "	J. Knight, Kingston	19 00	
44	" "	T. Bostock, Wyoming	22 00	
45	" "	F. Wyatt, St. Catharines	14 00	
46	" "	J. Drummond, Clifford	15 00	
47	One pair ewe lambs	H. Glazebrooke, Simcoe	28 00	
48	" "	" "	20 00	207 00
	OXFORD DOWNS—			
49	Three shear ram	J. Prain, Harriston	56 00	
50	Shearling ram	J. Little, Blair	52 00	
51	Ram lamb	J. Anderson, Arthur	33 00	
52	" "	J. P. Woods, Guelph	28 00	169 00
	SHROPSHIRE DOWNS—			
53	Ram lamb	H. Watson, Guelph	29 00	
54	" "	E. E. Patterson, Eastwood	60 00	89 00
	SOUTHDOWNS—			
55	Ram	H. Sorby, Guelph	80 00	
56	Shearling ram	E. A. Cross, River Beaudette	36 00	
57	" "	M. A. Dawes, Montreal	45 00	
59	Ram lamb	O. Duck, Hannibal, Mo., U.S.	9 00	
60	" "	J. F. Davis, Glanworth	18 00	
61	" "	H. Sorby, Guelph	20 00	
62	" "	J. Anderson, Arthur	21 00	
63	" "	O. Duck, Hannibal, Mo., U.S.	16 00	
64	" "	P. J. Wilkinson, Cambray	8 00	
65	One pair ewe lambs	O. Duck, Hannibal, Mo., U.S	20 00	
66	" "	A. Nichol, Kingston	18 00	
67	" "	D. Wright, Chesterfield	20 00	
68	" "	L. N. Smith, Ashburn	28 00	
69	" "	R. Rivers, Walkerton	36 00	
70	One pair ewes	A. A. Sanders, Guelph	28 00	
71	" "	L. N. Smith, Ashburn	54 00	
72	" "	W. Mills, Wingham	36 00	
73	One pair shearling ewes	E. J. Yorke, Wardsville	40 00	533 00
	PIGS.			
	BERKSHIRES—			
1	Boar	W. Hull, Erin	27 00	
2	"	" "	27 00	
3	"	R. Rivers, Walkerton	21 00	
4	"	W. Lachnar, Hawkesville	22 00	
5	Sow	M. Boyd, Bobcaygeon	27 00	
6	"	" "	40 00	164 00
		Gross total		$3379 00

	Total.
	$ c.
	2,217
	207 00
	169 00
	89 00
	533 00
	164 00
	$3379 00

4. Increase to Live Stock by own Breeding.

From 1st November, 1880, to 1st November, 1881, we have, by our own breeding, received the following thorough-bred cattle and sheep:—

Cattle.

27th Dec., 1880.—*Princess Mary 4th*, Hereford, out of Princess Mary 2nd, by Duke of Connaught (4528).

22nd Feb., 1881.—*Sir Walter 3rd*, Ayrshire, out of Beauty of Drumlanrig, by Sir Walter.

23rd Feb., " —*Louan of Galt*, Shorthorn, out of Louan of Brant 5th, by Prince Hopewell.

29th April, " —*Princess Mary 3rd*, Devon, out of Nellie, by Prince Albert Victor.

8th May, " —*Lord Macduff*, Aberdeen Poll, out of Leochiel Lass 4th, by Gladiolus (1161).

10th June, " —*Heather Bell 3rd*, Hereford, out of Heather Bell, by Duke of Connaught (4528).

31st July, " —*Sir Walter 3rd*, Ayrshire, out of Flora 3rd of Drumlanrig, by Sir Walter.

19th Aug., " —*Princess Louise 2nd*, Hereford, out of Princess Louise, by Quebec.

28th Oct., " —*Prince Hopewell 2nd*, Shorthorn, out of Rosalie, by Prince Hopewell.

Sheep.

Cotswolds	Ram lambs	21	from 44 ewes.	
	Ewe "	37		
Leicesters	Ram "	9	" 14 "	
	Ewe "	7		
Oxford Downs	Ram "	3	" 5 "	
	Ewe "	3		
Shropshire Downs	Ram "	3	" 4 "	
	Ewe "	4		
Southdowns	Ram "	8	" 19 "	
	Ewe "	13		

In addition to pigs, grade lambs, grade cattle of many varieties, and Scotch Collie dogs.

5. Our New Importations of Live Stock.

We were allowed by the Estimates the sum of $6,250 wherewith to renew some of our breeds of cattle and sheep, as advised by yourself and reported upon by me. Advantage was taken of the agency of Mr. James Hunter, of Alma, Ontario, who had arranged to proceed to Britain to obtain stock for himself and others. After Mr. Hunter's return we secured other animals of recent importation, and one Canadian bred. Through these sources we are now in possession of eight new cattle of six breeds, and nineteen sheep of five breeds.

I beg to submit a full list of these animals, with their original cost, and all attendant charges until delivery here.

As it will be of special value to us in view of revenue, and should be of general interest to the Province, the pedigree of each of the newly-imported male animals is herewith appended:

IMPORTATION OF CATTLE AND SHEEP FROM BRITAIN FOR THE ONTARIO EXPERIMENTAL FARM DURING 1881.

I.—First cost of animals—		
Shorthorn bull "Sir Leonard"	$765 50	
" heifer "Beta"	1,275 80	
Aberdeen Poll bull "Meldrum"	256 30	
" " heifer "Sybil's Darling"	243 00	
Hereford bull "Hope Dale"	204 12	
Ayrshire bull "Stonecalsey"	267 30	
Jersey heifer "Princess Alexandra" ..	300 00	
Devon bull "General Wyndham"	125 00	
Total for cattle		$3,437 02
Leicester ram and two ewes	194 40	
Cotswolds, two rams	252 06	
Oxford Down ram and four ewes.....	233 28	
Shropshire Down ram and three ewes..	243 00	
Southdown ram and four ewes	250 00	
Total for sheep		1,172 74
II.—British railway charges	148 70	
III.—Ship freight	195 00	
IV.—Food previous to quarantine.....	344 65	
V.—Quarantine	121 42	
VI.—Quebec to Guelph	171 10	
VII.—Insurance	191 50	
VIII.—Incidental delay at Liverpool, tools, etc.....	64 05	
IX.—Allowance to agent for making purchases ..	400 00	
		1,636 42
Total discharge.....		$6,246 18
Sum under-expended		3 82
		$6,250 00

PEDIGREES OF NEW BULLS AND RAMS.

SHORTHORN BULL, "*Sir Leonard*," roan; calved 4th January, 1880. Got by "Sir Wilfred" (37484), bred by J. C. Booth.

Dam, "Countess 3rd,"..Got by "High Sheriff" (26392), bred by T. C. Booth.
" "Countess 2nd,".. " "British Crown" (21322), bred by R. Booth.
" "Countess"..... " "Sir Sam" (25171), bred by J. Peel.
" "Calendula" .... " "Majestic" (13279), bred by R. Booth.
" "Calomel" ..... " "Hamlet" (8126), bred by J. Booth.
" "Chalk" ..... " "Leonard" (4210), bred by R. Booth.
" "Bellona" ..... " "Buckingham" (3239), bred by J. Booth.

Dam from the stock of Sir M. W. Ridley, Bart.

"Sir Wilfred" is by "Royal Benedict," for many years the principal sire at Warlaby, from "Lady Fanny, by "Lord Blithe," own brother to the famous Royal prize cow "Lady Fragrant." "High Sheriff," used three seasons at Storrs, was by "Commander-in-Chief" (first prize at the Royal, 1868), from "Blooming Bride," by "Prince of Battersea," first prize bull calf at the Yorkshire Show, 1863.

Weight of "Sir Leonard," 1464 lbs.

AYRSHIRE BULL, "*Stoncalsey*," (309), bred by Alexander Paton, Stoncalsey, Symington, Ayrshire.

Got by "Black Jock 2nd" (122). Dam "Rosie," got by "Prince Charlie."

"Stoncalsey" (309) gained the following prizes:—1st at Symington, Ayrshire; 2nd at Maryhill, Glasgow; 1st at Hamilton; 1st at Lanark, and Medal for best bull of any age; 1st at Biggar, and cup for best animal of Ayrshire breed.

Weight of "Stoncalsey," 1326 lbs.

ABERDEEN POLL BULL, "*Meldrum*" (1759), calved 25th April, 1880. Bred by the Marquis of Huntly. Got by Warrior (1291).

Dam, "Madge" (1217).....Got by "Major of Tillyfour" (509).
" "Ruth of Tillyfour" (1169) ..... " "Black Prince of Tillyfour" (366).
" "Beauty of Tillyfour 2nd" (1180).. " "Young Jock" (4).
" "Favourite" (2) ..... " "Gray-breasted Jock" (2).

Weight of "Meldrum," 1204 lbs.

DEVON BULL, "*General Wyndham*" (802), calved . Bred by G. Rudd. Got by "Hartland" (363). Dam, "Curley 2nd" (577).

Weight of "General Wyndham," 1562 lbs.

HEREFORD BULL, "*Hope Dale*;" calved March 26th, 1880. Bred by W. Horton, Eng. Got by "Nero" (5477).

Dam, "Miss Alice 2nd" .....Got by "Hildebrand" (4646).
" "Miss Alice" ..... " "Sir Roger" (4990).
" "Maximillian (3252).
" "Jersey" (976).
" "Son of Young Ben" (3609).
" "Young Royal" (1469).

Weight of "Hope Dale," 1320 lbs.

OXFORD DOWN RAM, "*Treadwell* 1881." Got by "Prince of the West." Bred by J. Treadwell, of Upper Winchender, Aylesbury, England.

"Prince of the West" was got by "The Snell," which was got by "Freeland," and bred by J. Treadwell.

Weight, 263 lbs.

SHORPSHIRE DOWN RAM, "*Zetland* 1881." Bred by the Earl of Zetland, spring 1880. Got by "Post Captain." Dam by Mr. Nock's prize ram; granddam by Mr. Lythell's prize ram; great granddam descended from the Pitchford Flock.

"Post Captain" was bred by Mr. John Evans; sire, "British Tar," dam by "Union Jack," granddam by "Nonpareil"—Mr. Nocks' prize ram. Sire, a ram of Lord Chesham's, hired at 110 guineas in 1873, and sold for 115 guineas in 1874.

Weight, 195 lbs.

SHORPSHIRE DOWN RAM, "*Nocks* 1880." Bred by Mr. Nocks, England, spring 1879.

Weight 283 lbs.

SOUTHDOWN RAM, "*Colman* 1881." Dropped spring 1880. Bred by Mr. Colman, Norwich, England. Got by Mr. Henry Webb's "No. 6 1879;" dam from Captain Taylor's flock.

"Colman 1881" took 1st prize in a class of twelve ram lambs of various breeds at Norfolk in 1880.

Weight, 206 lbs.

COTSWOLD RAM, "*Aylmer* 1881." Bred by H. Alymer, of Norfolk, England.
Weight, 265 lbs.

COTSWOLD RAM, "*Kilkenny Champion.*" Bred by Stephen Gillett, Oxon, England.
Weight, 243 lbs.

LEICESTER RAM, "*Bosanquit* 1881." Bred by the Rev. Mr. Bosanquit, Scotland.
Weight, 236 lbs.

MERINO RAM. Imported from France.
Weight, 235 lbs.

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6. CARCASS AND WOOL OF WETHER LAMBS PREPARING FOR SHEARLING MUTTON.

We have on hand, experimentally, a score of wether lambs in view for next Easter and Christmas. They are out of common Canadian ewes by our rams of the respective breeds named. The wool and frames of these are an interesting study at the present time, and so, in preparation for next year's finishing, I have pleasure in submitting average weights of each kind, with lists of length of wool, in comparison with the pure breeds of the same age:

AVERAGE WEIGHTS OF GRADE WETHER LAMBS, CHRISTMAS, 1881.

Cotswold Grade	120 lbs.
Leicester Grade	117 "
Oxford Down Grade	131 "
Shropshire Down Grade	125 "
Southdown Grade	116 "
Merino Grade	110 "

LENGTH OF GRADE WETHER LAMBS' WOOL AS AT CHRISTMAS, 1881.

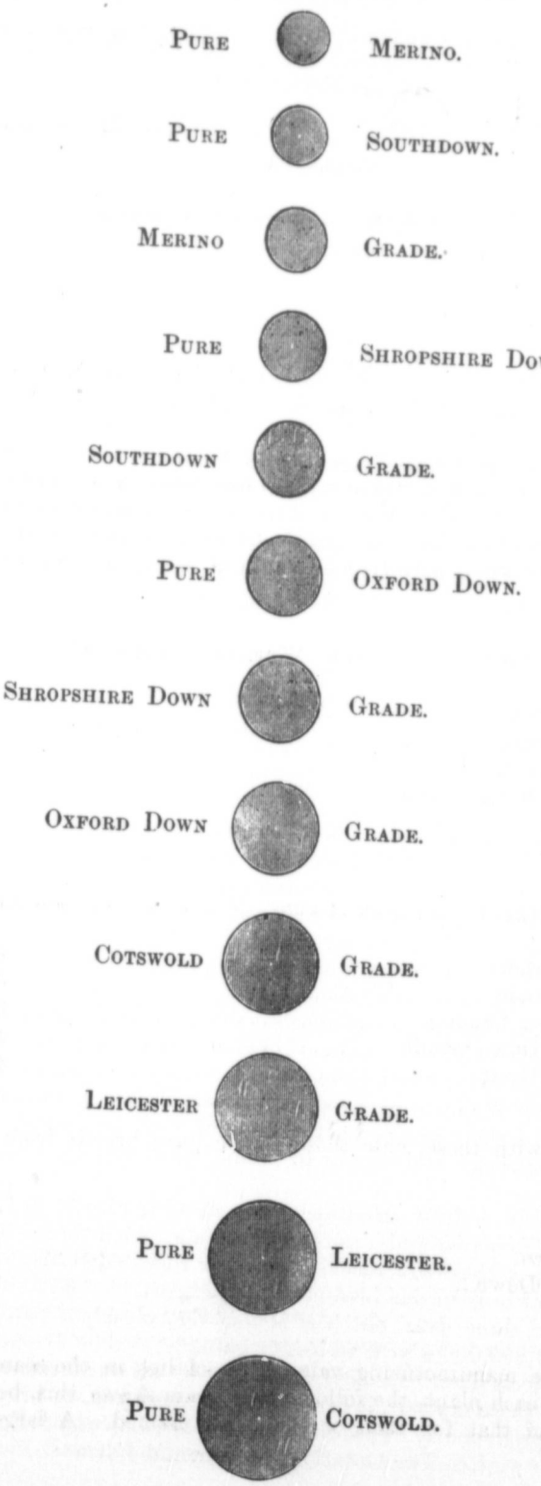
Cotswold Grade	6 inches.
Leicester Grade	6 "
Oxford Down Grade	5 "
Shropshire Down Grade	4½ "
Southdown Grade	4½ "
Merino Grade	3½ "

In comparison with these, note those of the pure breeds from lambs of the same age:—

Cotswold	11 inches.
Leicester	7½ "
Oxford Down	4½ "
Shropshire Down	3¼ "
Southdown	3 "
Merino	2 "

As much of the manufacturing value of wool lies in the coarseness or fineness of fibre, or diameter of each plant, the following diagram shows this, being the average, as nearly as possible, of that for each of the lambs named. A large magnifying power was used:—

7. Comparative Diameter of Fibre of Twelve Kinds of Wool from Lambs now at the Ontario Experimental Farm.



IV.—THE EXPERIMENTAL.

I find a few things are still misunderstood among the general public in regard to some features of our experimental work. For example, in connection with the breeding of cattle and sheep, where so many varieties are obtained from crosses of one kind upon another, there must be not a few *weeds*. Seen among the better ones, they suffer very much by comparison, and, of course, do not look well anywhere, so that it is said they should be culled and placed out of sight. Now, it must be obvious to the larger mind that, as an experimental station, it clearly is part of our duty to allow these weeds, real or apparent—not always real because of appearance—the same place, treatment, and public notice as any of the others, and, if possible, *more publicity*, because of the better lesson that is likely to be conveyed. Seeing a danger is surely better than hiding it. Another example is in connection with field plot experiments, where so many hundreds of kinds are on hand every year; when a set, or individual case, is placed against some other set or individual—whether manures, modes of cultivation, or plant against plant—there must be no interference with the progress of things, unless the same is part of the experiment, and particularly during the growth of what are called uncultivated crops, such as the cereals. Should one plot be more overgrown with weeds than its opponent, it would be wrong to remove these to any material extent, for the simple reason that the experiment might be seriously affected for better or for worse, and in such a case, where damage by weeds is evidently of no small account, it is better to say *nil*, than to prosecute the trial for that season. This will explain why, every year, we have had apparently neglected experimental plots. I may be wrong in some of my views on experimental management, but, right or wrong, the management has been mine, and nobody else is responsible.

A.—*The Animal.*

We have now had five years' experience of systematic field plot and of animal fattening experiments in a great variety of forms, probably too many in the former case, and too few of the latter. All the care and consideration we have been able to devote to soils, plants, manures, modes of cultivation, and kindred field subjects have not, as yet, so far as I am aware, opened up any new road to rapid fortunes in the profession, but they are none the less valuable, and none the less connected with our future work. While we have shown the Province what may and may not be expected from the application of certain fertilizers to certain crops under certain conditions, and particulary their relation and conduct in comparison with farm-yard manure, the range of some of the most interesting of them demands years and years to come.

With regard to the fattening and improvement of animals, much more, comparatively, has been elicited. The eighteen distinct kinds of experiments we have made with swine, sheep, and cattle up to May, 1880, have called forth many criticisms for and against, both at home and abroad. We have received, without exception, unanimous encouragement to further prosecution of the valuable relationships of food to animal life, and now again, therefore, it is my privilege and honour to submit what was done here during the winter of 1880-81.

I beg particularly to draw attention to the striking results in the fattening of cattle with hay and roots, *prepared* and *unprepared*, as also with three kinds of grain—such a difference that, subject to corroboration by further repeated trials, would make 7,200,000 additional pounds of beef in our present annual export, say, $420,000 in value; and the question of two or three year old beef is also very clearly a paramount Canadian one, meaning at least $1,000,000 a year in loss or gain.

The other subjects deserve a careful reading by all our farmers, and as the agent of the Government in these matters, it is my duty, through you, to bring under the notice of the country, thus prominently, what the eminent Dr. Lawes, of England, says in regard to some facts in this work of The Ontario Experimental Farm.

I.—PREPARED AND UNPREPARED HAY AND ROOTS IN THE FATTENING OF CATTLE.

Not a few of our leading breeders and fatteners of live stock, especially those having leanings to Scotch practice, are strong advocates of the use of whole hay and whole turnips; they say it is much more natural, that health is better, and the animals consequently give a better account of such a form of food than when cut and pulped; they argue that a ruminating animal must get its principal sustenance in the rough condition, as without it the chewing of the cud is so far affected as to seriously injure healthy breeding and development. On the other hand some good practical men maintain that many of the unavoidable conditions of management now-a-days are so unnatural, and so full of the high-pressure of the age that we can make the animals to suit our wants as much as any other phase of rural economy; they contend that by partly preparing the food the animal is the better able to meet the extra conditions imposed upon it, particularly in regard to early maturing, or prematuring, for beef. And while the latter cannot gainsay the fact of extra cost in preparation, they are clear in showing that the rougher unpalatable and even unsound kinds of food, can be safely and economically worked up.

Having in view the making of some light on this subject we undertook an experiment with yearling and two-year old steers, from the 13th December, 1880, to the 12th April last. The yearlings, 18 months old, were of our own breedng: two well-bred Shorthorn grades, one a Hereford, (first) cross—Hereford bull upon a Shorthorn grade; and the fourth an Ayrshire, (first) cross—Ayrshire bull upon a Canadian cow. The four two-year olds, then two and one-half year old, were bought from Wm. Whitelaw, of Guelph, being good specimens of the well-bred grade Shorthorn in good condition, neither prime nor low in flesh.

These were very carefully selected and balanced as regards equal qualities for the object in view, and in order to give all an equal chance, each division was allowed two weeks upon its particular form of food previous to actual weighing for the start. They were tied by sliding chain in double stalls in a comfortable, well ventilated, and somewhat dark stable.

It will be obvious to the interested reader that the division of the animals was:

2 two-year olds on unprepared food.
2 " " prepared food.
2 yearlings on unprepared food.
2 " prepared food.

The two-year olds in both examples were offered 90 lbs. of swede turnips, 10 lbs. of hay, 12lbs. of corn meal, and 3 lbs. of bran, per head every day; the yearlings of each example, 60 lbs. turnips, 8 lbs. hay, 6 lbs. corn meal, and 2 lbs. of bran. Everything was weighed at each meal, and the times of feeding were daily at

7 a.m.	turnips and hay.
8.30 a.m.	meal and bran.
11.30 a.m.	turnips and hay.
1.30 p.m.	meal and bran.
4 p.m.	turnips and hay.
8 p.m.	meal and bran.

They were allowed fifteen minutes for exercise, and water at 11 a.m. every day. The prepared food was made by mixing pulped turnips and cut hay, of inch lengths, in the proportions named; all the animals were weighed each week.

Thus then prepared and unprepared turnips and hay continued for fifteen weeks. Nothing occurred to mar the experiment, except perhaps a sort of general indisposition of one of the two-year olds on unprepared food, or rather by not being such a good "thriver" as the others, not evidently any disease or sickness properly speaking, as it always gained in weight except twice, though not proportionately to others every week.

I beg to make particular note of the character of the weather during winter 1880-81 as a great deal of the success or non-success of animal fattening depends on regularity in this as in any other thing. We have in all our experience gathered the important fact that alternations of much frost and many thawings seriously affect the rate of progress, that mild winters are not so good as steady moderate frosty ones, and as the past winter was unusually regular in respect of frost, with very few thawings, the result must have been very favourable to this experiment. During day time the thermometer was rarely over 37° by reason much going and coming of people, and not more than 45° during night when doors were closed.

Our next duty is to record the total quantities of food consumed, *per head*, during 105 days.

Cattle.	Turnips. Lbs.	Hay. Lbs.	Corn-Meal. Lbs.	Bran. Lbs.	Total Quantity of Materials.
Two-year old	8820	980	1029	196	11,025
Yearling	5880	784	735	147	7,546

In this we have evidence of a 1,500 lbs. steer—the average of the two-year-olds during the experiment—being able to consume it own weight of different materials every fourteen days, and the yearlings (average 1,050), very little less. Of course this depends upon large feeding value in small bulk, or small feeding value in large bulk—turnips and hay on the one hand, and meal on the other hand. The two classes of animals were therefore, according to weight, and age it may be, fed alike as regards *quantity*, if not by class to suit growth of bone and muscle in the case of the younger ones, or to lay on flesh and fat in that of the older ones.

What then was the respective increase per head of these animals under such treatment?

———	Weight on Entry.	Weight at Finish.	Increase per Head per day.	Total Increase.
Unprepared Food :	Lbs.	Lbs.	Lbs.	Lbs.
Two-year-olds	1366	1553	1.77	187
Yearlings	1028	1212	1.75	184
Prepared Food :				
Two-year-olds	1477	1705	2.17	228
Yearlings	878	1090	2.02	212

Taking the two-year old cattle, which were finished when 36½ months old, those that entered at an average weight of 1,366 lbs. on *unprepared* food, came out with an average of 1,553, thus gaining 187 lbs. each during 105 days, or a mean daily rate of 1·77 lbs.; the same age of animals on *prepared* food began with 1,477 lbs., and made up to an average of 1,705 lbs. each in the same period, gaining 228 lbs, or a mean rate of 2·17 lbs. per day. It will be noted that, of this class, those on *prepared* food had, on entry, a greater average by 111 lbs. per head, but this, in place of being an advantage, as many may suppose, was pe' ps a disadvantage because of the well-known fact that young light cattle increase in w ght at a greater ratio than older, heavier ones; this fact is not necessarily

illustrated in particular experiments such as this, yet it will be observed that the yearling cattle on *unprepared* food made, practically, as great a daily increase as the two-year-olds by the like management, and a much greater *in proportion to original weight.* In fact, when we look at all the results in this light it will be found, as explained in another chapter, that the yearlings increased on an average over 20 per cent., and the two-year-olds only 14 per cent. upon their original weights. But to return to the subject more immediately on hand: we have a decided advantage by the use of *prepared* hay and roots to the extent of no less than ·40 lbs. per head per day, or nearly one-half pound, in the case of cattle finishing at three years old.

Then again, in the case of the yearling cattle, those upon *unprepared* food entered with an average weight of 1,028 lbs., and came out at 1,212 lbs. each, making 184 lbs., or a daily rate of 1·75, while those of the same age upon *prepared* food, going in at 878, made an average of 1,090 lbs., which is equal to 2·02 lbs. per head per day. Here also we obtain a distinct advantage of ·27 lb. per head per day—say fully $\frac{1}{4}$ of a pound—by the use of prepared hay and roots over that unprepared.

Placing together the two ages of cattle upon the same form of food, we have a mean of 1·76 lbs. per head per day for the *unprepared*, and 2·10 lbs. as that of the *prepared*, or a whole difference of ·34 lb.—being equal to $\frac{1}{3}$ of a pound per head per day in favour of the prepared food all over.

All this is very interesting and valuable, and in order to satisfy any doubts that may arise in regard to the probable sickness of one of the steers already referred to under the unprepared food regime, I beg to show that had this animal done as well as his "mate," which stood as high as 2·20 lbs. per day, the unprepared food results would have made a record higher than the mean of the other; but then, on the other hand, when we do the same thing in the case of the *prepared* food, the result is still a little in favour of the latter position, so that altogether we must meantime stand to our averages and hold according to the figures obtained.

The Province of Ontario has been preparing during the past winter about 100,000 head of three-year-old cattle for the British market, and assuming, for the sake of applying this lesson, that they have all been of the same stamp and treated to rough or unprepared food, similar to our experiment during six months of stall-feeding, the loss will have been 7,200,000 lbs. of beef, or 5,000 head of cattle,—value at least $420,000.

Though not part of the experiment proper, it will nevertheless be interesting to make a memorandum of the debit and credit of these three-year-old steers:

Unprepared Food:

Bought 1,366 lbs. (average steer) @ 5 cents	$68 30
Sold 1,553 lbs. (average steer) @ 7 cents	108 71
	$40 41

Prepared Food:

Bought 1,477 lbs. (average steer) @ 5 cents	73 83
Sold 1,705 lbs. (average steer) @ 7 cents	119 35
	$45 52
Difference in favour of *prepared* food	5 11

The question would now be—for it is a question of numbers—how many cattle would it take to profitably employ extra labour in preparing the food, at the same time remembering the point of working up poor materials, and such others as previously indicated?

II.—THE COST AND PROFIT OF TWO AND THREE-YEAR-OLD STEERS.

In my evidence before the Ontario Agricultural Commission last year, I had occasion to advert to the importance of paying more attention to finishing our beefing cattle at an earlier age than prevails by present practice. As corroborative of this position I beg to

submit some figures upon the relative growth, cost, and value of steers between 18 and 36 months old, as obtained by recent experience here.

Four head, averaging 18 months old, were tied up on 13th October, and withdrawn on 1st May following. They entered at an average weight of 837 lbs. and stood at 1,187 lbs. each at the end of 200 days. The rate of progress here was $1\frac{3}{4}$ lb. per head per day, or just equal to the average of the best three-year old-steers. Now, what does this imply? This: A cattle beast destined for the shambles, having been well done to in nursing and after treatment up to 18 months, is put into the stall in order tc premature with the view of immediate disposal for food. Entering this new stage at a weight, as we have seen, of 837 lbs.—which shows a previous rate of less than $1\frac{1}{2}$ lbs. per day (from birth to eighteen months old), it is served to extra treatment in the shape of 8 lbs. hay, 60 lbs. turnips, $7\frac{1}{2}$ lbs. corn meal and $1\frac{1}{2}$ lbs. bran, until 24 months old. It is then sold for $5\frac{1}{2}$ cents per pound live weight, or $65.28. The same animal put to grass, and carried on through another winter to 37 months old, will weigh, under the best management, 1,648 lbs., and fetch in these times $107. Which pays best?

Two-Year-Old Steer.

Debit.	$ c.	$ c.	Credit.	$ c.
Price of 18 months' old steer,—837 lbs. at 3½c.	29 29		Price of 24 months old steer—1187 lbs. at 5½c.	65 28
Cost of food for six months of winter—			Difference between *cost* price and *market* price of food used (see Chapter III., herewith)	13 08
1600 lbs. hay, at $10 per ton, .. $8 00			Value of manure obtained during six months (see Chapter IV. herewith) .	16 61
200 bus. turnips at 8c. 16 00				
1500 lbs. corn meal 15 00				
300 lbs. bran at ½c. 1 50				
	40 50			
Attendance	5 00			
Bedding	4 00			
Risks (one death in 100)	0 50			
Total debit	79 29			
Credit balance	15 68			
	94 97		Total Credit	94 97

Three-Year Old Steer.

Debit.	$ c.	$ c.	Credit.	$ c.
Total debit from two-year-old	79 29		Value of summer manure	3 50
Summer grazing and attendance, 5 mos. at $1.50	7 50		Difference between *cost* price and *market* price of second winter's food	22 04
Grain allowance while on grass, 500 lbs.	5 00		Value of manure obtained during second winter	31 35
Cost of food in stall, one month of fall and 6 after—				56 89
Mangolds, 6600 lbs. $11 00			Value of three-year-old steer, 1648 lbs. at 6½c	107 12
Turnips, 13,200 lbs. 8 80				
Straw, 806 lbs. 2 02				
Corn fodder, 806 lbs. 2 02				
Hay, 806 lbs. 4 02				
Pea meal, 1210 lbs. 12 10				
Corn meal, 1210 lbs. 12 10				
Bran, 440 lbs. 2 20				
	54 26			
	146 07			
Attendance, bedding and risks	10 00			
Interest on $65.28 for 12 months at 6 p. c.	3 90			
Total debit	159 97			
Clear credit balance	4 04			
	164 01		Total Credit	164 01

There is but one sound way of arriving at the cost of producing beef or flesh of any kind, that is, to charge the animal with everything it consumes, uses, or requires in any form, either as food, bedding, or attendance ; and it is just as plain and reasonable that in whatever way that animal accounts for these things, it must get credit therefor—all according to current market prices or acknowledged value in whatever form. I have hitherto followed this rule very strictly, and see no reason now to change from it except as a means of simplifying or explaining anything. Several explanations are given in other parts of this Advance Report, and the present reference is merely to show that all the items of debit and credit in connection with these two and three-year old steers are correct both in theory and practice.

So then, subject to the quality and firmness of the flesh being equal, it is perfectly plain that there is much more money in getting rid of our beefing steers at two years than by holding them up to three years, under liberal management. I say so upon no estimate or guess work, but solely according to recent experiment, so that no doubt need exist on the subject. Of course, if anybody desires to make heavier beef or to maintain animals as manure manufacturers, the subject of discussion is entirely changed.

But again, it will be obvious to the practical feeder that unless *most liberal* management is carried out from birth to twenty-four months, no cattle beast of that age will be fit for the butcher. And it is just as true that the three-year-old could not be made up to 1,648, or even 1,500 lbs. without similar management, so it would be no argument to say that two-year-olds weighing about 900 or 1,000 lbs. could be bought cheaper than 3½, and brought out more profitably at 36 months than shown by the previous tables.

At the same time I am disposed to give more value to the manure of the three-year-old as against that of the other, and altogether on this important subject, reference should be made to Chapter IV. herewith.

In a stable of 1,000 head of fattening cattle, as for example at Toronto, or at Mr. Wiser's, of Prescott, the difference in favour of two-year-olds would be $11,640, and for the 100,000 of those annually exported from the Province, the handsome sum of $1,168,400.

III.—DOES IT PAY TO FATTEN CATTLE FOR MANURE PRODUCTION ONLY?

There really exists no difficulty in setting this question at rest, and the plainest possible way to illustrate it fully is to purchase a two-and-one-half-year old steer at a price equal to what can be got for it when matured six months afterwards, and give no credit for extra weight of flesh produced ; or, what will amount to the same thing, get the loan of such an animal, feed it with whatever you choose for ordinary good production of beef, and return to its owner six months afterwards,—in short, will it pay to use the animal system as a manure-making machine only?

In regard to what constitutes the actual value of farm-yard manure, it is necessary here to have a distinct understanding with the average farmer, and accordingly I have to draw his earnest attention to the chapter herewith entitled "The Value of a Manure Heap," wherein is clear proof of the facts that must, at the present time at least, guide all men on this valuable subject.

On the 1st October then we are supplied with the use of a thirty-months old steer, and for the succeeding 220 days it consumes :

6½ tons swede turnips,
3¼ " mangolds,
1¼ " of straw, of kinds,
½ ton hay,
½ " pea meal,
⅛ " corn meal, and
¼ " bran.

The *actual cost* of these as produced from the farm amounts to $31.26, thus :

	Actual Cost.	*Market Price.*
Turnips	$8 04	$17 60
Mangolds	3 66	11 00
Straw	2 40	4 04
Hay	1 80	4 04
Pea meal	6 06	12 10
Corn meal	7 10	12 10
Bran	2 20	2 20
	$31 26	$63 08

Now, according to the valuation standard of such materials after passing through the animal system, they are actually worth as fertilizers from one thee-year-old steer, during 220 days, the sum of $32.06, as thus detailed :

Turnips, $1 per ton (of raw materials)	$6 50
Mangolds, $1.25 per ton "	4 06
Straw, $3 per ton "	3 75
Hay, $6 per ton "	3 00
Pea meal, $15 per ton "	7 50
Corn meal, $7.50 per ton "	3 75
Bran, $14 per ton "	3 50
	$32 06

We have then an actual cost of food amounting to $31.26, against what is understood to be as practical a value, anmounting to $32.06, which *under proper management*, lies as so much money to be invested for future cropping. Put in another way, these droppings are equal to one ton of bone dust, or one ton of mineral superphosphate, laid down on the farm from the manufactory, according to present prices ; but, will any experienced farmer assert that he would rather have either of these special fertilizers than the farm-yard manure from this animal ? Would he give seven tons (which the one steer produces), of such first-class home-made manure for one of bone dust, or of mineral superphosphate, valuable as they be ? Long practical experience in the use of these manures says that for the production of grain, roots, and other crops, four tons of first-class farm-yard manure is more active, more permanent, and more suitable than one ton of either of these special fertilizers.

This then is no fanciful valuation or comparison, and I can see no grounds whatever for doubting the affirmative to the question " Does it pay to fatten or feed cattle for manure production only ?" Any one then who asserts that the feeding of cattle does not pay because, on charging all food against the actual increase of weight of flesh and extra price, the account won't balance, is either dead to the value of farm-yard manure, or prejudiced against all such advanced views.

IV.—THE VALUE OF A MANURE HEAP.

Too many opportunities cannot be taken of showing the Province what a large sum annually is thrown from everybody's stable every winter in to the barn court, in the form of what we call farm-yard manure ; that it is actual cash we are thus handling, more so indeed than the beef and mutton being raised at the same time, and as much so as the golden grain that lies so much at the root of man's daily wants. It will be a golden day indeed for this or any country when the manure heap receives as much respect as the bank account ; better a big manure heap than a bank account any day for the farmer—the one he can use at all times, the other is but a source of annoyance at most times.

During the past winter I took particular note of what went to make the manure heap of this farm, and, in the spring, had it properly squared up, measured and weighed. The

story opens on the 12th October, when we housed and began to feed the following animals, and it ends on 1st May, being therefore 200 days. Of course the number of animals varied to some extent, but taken all over, the following were the average on hand during that period:

15	horses.
42	cattle, over two years old.
26	cattle, under two years old.
8	fattening cattle, over two years.
107	sheep, breeding.
33	sheep, under one year.
25	sheep, fattening.
256	head in all.

These ate, or otherwise disposed of, the following materials:

Hay	173,000	lbs.	
Pea straw	27,000	"	
Barley straw	29,000	"	
Oat straw	58,000	"	
Wheat straw	80,000	"	
Corn straw	18,000	"	
Total fodder			385,000 lbs.
Mangolds	270,000	lbs.	
Turnips	800,000	"	
Carrots	6,000	"	
Total roots			1,076,000 lbs.
Oats	29,000	lbs.	
Barley meal	20,000	"	
Corn meal	25,000	"	
Pea meal	33,000	"	
Bran	40,000	"	
Oilcake	3,000	"	
"Thorley's food."	500	"	
Total grain			150,500 lbs.
Gross quantity			1,611,500 lbs.

There was added directly to the manure heap, at various times:

3,000	lbs. of gypsum.
15,000	lbs. of materials from cellars, etc.
18,000	lbs.

So that in accounting for the whole, we have to speak of 1,629,500 lbs.
What became of these 1,611,500 lbs. of food? First we have to credit, or debit:

Extra weight on horses	1,100	lbs.
" " on 42 cattle	2,500	"
Calves produced, as dropped	2,700	"
Extra weight on fattening cattle	2,800	"
" " on breeding sheep	1,600	"
Lambs produced	2,900	"
Extra weight on fattening sheep	1,400	"
Total extra flesh	15,000	"
Milk removed from cows	14,500	"
	29,500	lbs.

For easy calculation it will be best to reduce the 256 animals of all kinds and ages to a representative average; this, as near as possible, is 75 head of three-year old fattening steers, and with these let us now continue the inquiry into this manure heap.

These 75 cattle breathed, perspired, retained, and voided the 1,611,500 lbs. of food enumerated, during 200 days. We have already accounted for the "retained" by the various forms of flesh as above, and have yet to look for 1,582,000 lbs. In doing this it is necessary to explain that the *water*—pure water (which exists in every kind of food in whatever condition)—is usually not reckoned as *food proper* in such calculations, valuable and no doubt indispensable as it is undoubtedly; and as the data by which we have to be guided in these calculations have been established upon the footing of first getting rid of this water, I therefore divide as follows:

		Water.		*Food proper.*
Fodder, 385,000 lbs.	give	57,750	and	327,250
Roots, 1,076,000 "	.....	968,400	"	107,600
Grain, 150,500 "	.....	21,070	"	129,430
1,611,500		1,047,220		564,280

And thirdly, it is found on an average of things, that every such animal as our selected 75 will

Evaporate and breathe	57	per cent. of this	"food proper."
Increase in weight,	6	" from	"
Void, as manure,	37	" of	"
	100		

Which therefore makes the following abstract:

Used in breathing and evaporation, 22 lbs. per head per day	321,600
Increased in weight, 2·25 per head per day	33,850
Voided as manure, 14 lbs. per head per day	208,830
As above	564,280

Allowing the *actual 29,500 lbs.* of flesh and milk to stand against the 33,830 lbs. of *estimated* increase as above, we have to deduct the "vital force" amount—breathing and evaporation—of 321,600 lbs., and manure quantity, 208,830, which leaves 1,051,572 lbs. still to be accounted for. The water of the food equals 1,047,220 lbs., and thus leaves a balance of 4,352 lbs., or just the difference between the two first items, 29,500 and 33,852.

But the manure heap actually weighed	1,065,750	
Deduct gypsum, cellar cleanings, etc., and bedding (75,000) ..	93,000	
	972,750	
Deduct also *dry* manure voided	208,830	
	763,920	
Deduct water voided with manure, *estimated* about 70 per cent. of 691,830, the total weight of animal droppings ..	483,000	
	280,920	

This quantity of 280,920 lbs. extra in the manure heap has to be accounted for by (1) the retention, and (2) the replacement by hand from tanks, of part of its own liquid, water largely, (3) by addition of water from snow, the heap being uncovered, and (4) *less* so much by fermentation and evaporation in the process of decay. This *one-fourth* difference is not large according to old country experience of loss by fermentation and decay, which is usually one-third and even one-half *less* than the original weight, but still probably large

under the circumstances. These circumstances were an even steady winter, as against an open irregular one, either here or in a more temperate climate. In our case, therefore, with continuous frost, the treading of cattle daily, solidifying and excluding air, the application of gypsum to regulate and retard decay and retain gases, together with the addition of snow, there cannot have been much loss by fermentation and evaporation; and indeed the heap itself said so when being cut up, as greenness was common, with the want of that dark cheesy consistency so well known in ripe farm-yard manure.

What then is the Value of this Manure Heap?

How does the ordinary farmer view this part of the subject? He thinks a load, or say a ton, is worth $1, as got from city stables, and as he can haul two loads per day with one team, on an average of distances, the load is therefore worth $2.50. He cannot deny this because he does it, and at the same time many of our readers will agree it is a very common saying among farmers that farm-yard manure at home—home made—is worth $2.50 per ton, because they cannot do without it—they must have it, and from what they know abstractly of its effects upon crops, they judge this figure to be a close estimate of its value.

There is but one other way of valuing this material: Long experience, as obtained by accurate experiments upon many crops, has shown what is the worth of any particular form of manure or fertilizer under a variety of conditions, and thus the practical farmer and the scientist have now laid their heads together and fixed upon a *commercial standard* for most forms of fertilizers—whether superphosphate, gypsum, bone dust, farm-yard manure, or under the more specific titles of nitrogenous, phosphoric, and potash. In the same way we have come to know pretty exactly what certain animals under a variety of conditions do with the food they eat, and thus can tell what the average manure haap consists of. Building upon these facts, I now submit what may be called the "Commercial Value of our 1880-81 Manure Heap"—the materials having passed through the 75 cattle specified, in 200 days:

86 tons	Hay, @ $6	$516
101 "	Straw, of kinds, $3	303
14½ "	Oats, @ $8.50	120
10 "	Barley meal, @ $5.25	52
12½ "	Corn meal, @ $7.50	93
16½ "	Pea meal, @ $15	227
¼ "	Thorley's Food, @ $8 (estimated)	2
20 "	Bran, @ $14	280
1½ "	Oil cake, @ $23	39
3 "	Carrots, @ $1	3
135 "	Mangolds, @ $1.25	169
400 "	Turnips, $1	400
799½		$2,024

(Average $2.55 per ton.)

Assuming that these materials represent the average in all respects of Canadian practice for fattening purposes, it appears that every ton given as food is worth $2.55 after passing through the animal system; that the 1,470 cubic yards of the manure heap weighed 537 tons, which at farmers' valuation of $2.50, gives $1,342 as total value; that the commercial value of $2,204 is $1.60 more per ton than the farmer's; that each animal (of the 75 representatives), made, or was the means of making, seven tons of manure during the winter; that the value of such manure per head amounted to $18 by the farmer's valuation, and $29 according to commercial valuation; and that, under deduction of purchased materials, the 370 cultivated acres of the farm have given about 1¼ ton of manure per acre per annum.

V.—DR. LAWES, OF ROTHAMSTEAD, ENGLAND, ON THE ONTARIO EXPERIMENTAL FARM FEEDING EXPERIMENTS.

It is safe to assert that no other man has done so much in throwing light upon the agricultural profession as Dr. Lawes, of England. Being a practical farmer, and a practical chemist, with a heavy purse, and a thorough, *enduring* enthusiasm as an experimentalist, he has, in conjunction with Dr. Gilbert, given the world, of late years, many most valuable facts, from the inquiries of some forty years, in regard especially to the relationship of food to animal life.

In our report of 1879, upon the cattle-feeding experiment of that year, I had occasion, in explaining the position of the debit and credit sides of the transaction, to quote Dr. Lawes as authority for the fact that no fattening animal whatever pays for the food it consumes by the *direct increase* of its weight from such food. This seemed to be an interesting and perhaps even a new thing to many in England, for on the 11th February the *Live Stock Journal*, of London, published our chapter of 1879, entitled "What it Costs to Make Beef." To this Dr. Lawes made reply in the same journal; and as the opinion of such an authority always takes the highest place in agricultural literature everywhere, the occasion should not be lost by us in showing Canada what her Experimental Farm has done so far, and what the world thinks of certain branches of her work.

As the whole original article of 1879 and Dr. Lawes' letter are not lengthy, it will be best first of all to reproduce them.

From Report of 1879.

What it Costs to Make Beef.

Few of us have any idea, as I have elsewhere remarked, as to the actual cost of feeding, because few of us are in the habit of placing a value upon the produce consumed upon our own farms. Dr. Lawes, of England, recently asserted that in no case would an animal pay for the cost of its food by the direct increase of its weight from such food. What has been our own experience here of late?

1878—To make 1,610 lbs. cost $193.27, or 12 cents per lb.
1879—To make 4,593 lbs. cost $636.00, or 13 cents per lb.

6,203 — Mean 12½ cents per lb.

This is charging every possible item in food, bedding, and attendance; and I have no doubt the figures are in correspondence with the average of the country.

So then it costs 12½ cents per lb. live weight to make good beef that is usually sold at 6 cents per lb. live weight! How is this accounted for?

Debit, as above		$0 12½
Credit actual increase at market price for improved beef.	$0 05½	
Credit also for extra quality given by 6,203 lbs. *new* to 26,139 original lbs. = 4 at 2 cents per lb.	0 08	
Credit manure, according to chemical value, $0 06c. " " ordinary value, 0 02c.	0 04	
		$0 17½

Balance, being credit of $0 05 per lb. over all animals.

This needs explanation. We purchase a steer, or take one of our own breeding, and put it into regular systematic feeding when 1,163 lbs. weight and worth $40.70 at 3½ cents per lb. During six months it is fed upon materials that cost, with attendance and bedding, the sum of $43, which have added 360 lbs. to its weight, thus making the prime

animal 1,523 lbs. But the food has not only added 360 lbs. to weight, *it has improved all the original* 1,163 lbs.—raising them from 3½ to 5½ cents per lb., as a purely marketable subject. It is obvious therefore that the fo[illegible]nd its associations have to be credited with what they have done at the ratio of 4, that is every 1 lb. of new weight improved the quality of 4 of the old, thus making 8 cents, as given in the foregoing statement. The real value of manure not being known, or rather, as the chemist and practical farmer do not agree as to its value, I have adopted a mean, or 4 cents, as resulting from the refuse that goes to make every additional pound of flesh.

Our example steer cost originally	$40 70
And to feed, etc., cost	43 00
	$83 70
It sold for	83 76

Showing no profit or loss when all food, etc., is valued, and no other items credited, as shown in the above example of 17½ cents per lb.

But according to honest book-keeping there is, as we have seen, 5 cents per lb. on 360 lbs., or $18 of clear profit for six months from an investment of $83, which is equal to 43 per cent. per annum.

Letter from Dr. Lawes.

"In the *Live Stock Journal* of February 11th, you publish the result of some experiments in cattle-feeding, made at the Ontario Experimental Farm, which, while they in one sense confirm my views, yet arrive at very different conclusions from mine, owing to the very different estima[illegible] of the value of lean as compared with fat stock in Canada and in Great Britain.

"When I stated, some years ago, that the increase upon a fattening animal was of less value than the cost of the food consumed to produce it, I did not intend my remarks to have a world-wide application.

"The Ontario experiments appear to have been carefully carried out. It is stated in the report that a steer weighing 1,163 lbs. increased 360 lbs. in six months. This is nearly 14 lbs. per week increase, or a little over one per cent. increase per week on the weight of the animal, which I consider to be a fair average. The total cost of producing the 360 lbs. was $43, or £9, which is equivalent to 6d. per lb. As the report puts the case :—'It costs 12½ cents to make good beef, which is usually sold at 6 cents per lb. live weight;' but then the report goes on to show this loss is converted into a profit, because 'the food has not only added 360 lbs. to the weight, it has improved all the original 1,163 lbs., raising them from 3½ cents to 5½ cents per lb.'

"The great distinction between Great Britain and Canada, as regards cattle feeding, is, as I have mentioned above, the very low price of store stock in the latter country. I am now going to make a further statement, which very possibly may be called in question —viz., that we pay more per pound for beef in a lean animal, than we can make of it when fat. I will proceed to give my reasons for holding this opinion, and your readers will thus be able to judge for themselves whether they justify the conclusion to which I have come.

"I will take the case of a bullock of the same weight as that given by way of illustration in the report of the Ontario experiments, and will endeavour to follow out the transaction as it would probably occur in this country.

"A bullock, in good store condition, weighing 1,163 lbs., would give about 53 per cent. carcass; or carcass, 616 lbs., offal, 547 lbs.—1,163 lbs. The increase, 360 lbs., I estimate to contain 70 per cent. carcass; or carcass, 252 lbs., offal, 107 lbs.—359 lbs. By the addition of the two we get in the fat animal, carcass, 868 lbs., offal, 655 lbs.—1,533 lbs.

"This is equal to 57 per cent. of carcass. Now, assuming that the selling price of beef is 8d. per lb., I do not think that a store beast of good quality could be purchased at much under 4½d. per lb. live weight; which would be equal to 8½d. per lb. for the carcass, and make the value of an ox weighing 1,163 lbs. £21 16s. It cost in Canada 6d per lb. to add the 360 lbs. weight to the animal, or £9 altogether.

"I estimate that it takes 12 to 13 lbs. of absolutely dry food of good quality to produce 1 lb. of increased live weight; about two tons of food would therefore be consumed in the production of the 360 lbs. increase; this increase I estimate to contain 252 lbs. of butcher's meat, which at 8d. per lb. amounts to £8 8s.

"Now, it is quite evident that no combination of fattening food which we could use in this country could cost as little as £4 4s. per ton, in an absolutely dry state. Swedes, at the purchasing price of 15s. per ton, would cost £6 6s. per ton in a dry state. Therefore, as beef on a lean animal costs as much per pound, if not more, than beef on a fat animal, it is not with us, as it is in Canada, a question of raising each pound of our store stock from 3½d to 5½d. On the contrary, we may be only too thankful if we can start even, and do not pay more for the meat on our store stock than the price for which we can sell it to the butcher when the animals are fat.

"It will be a happy day for British farmers when they are able to purchase cheap store stock from foreign countries, without risk from disease: but until that day arrives I must still adhere to the opinion I have expressed, that a profit in feeding can only be obtained by charging a certain sum to the manure.—J. B. Lawes."

Presuming upon a careful perusal of our original article, I should like to look into Dr. Lawes' statements somewhat fully: When he says he did not mean the remark that I made use of in 1879 to have a world-wide application, he implies, I think, that at the time he advanced it (address to The Berkshire Agricultural Association, 3rd May, 1879), he thought the much smaller cost of food in America might bring about a result entirely different from British practice, but now, he says, his views are confined by our experiments, though through different causes, the chief of which is, "the very different estimate of the value of the lean as compared with fat stock in Canada and in Great Britain." Herein lies the cream of the point at issue, and Dr. Lawes proceeds by saying—"I am now going to make a further statement, which very possibly may be called in question, viz., that we (in Britain) 'pay more per pound for beef in a lean animal, that we can make of it when fat.'" This will be a startling fact, for it is a fact as fully explained in the foregoing letter, even to old experienced hands in Britain, and it is one upon which we in Canada may congratulate ourselves, for, "as beef on a lean animal costs as much per pound, if not more, than beef on a fat animal, it is not with us, as it is in Canada, a question of raising each pound of our store stock from 3½ to 5½ cents. On the contrary, the British farmer may be only too thankful if he can start even, and has not to pay more for the meat on store stock than the price for which he can sell it to the butcher when the animals are fat." Thus, then, the British farmer can only look for profit in feeding by charging a certain sum to the manure.

The reverting question at this point is, is it a matter of fact in Canada that lean or store cattle cost *less* to produce per pound than they do when matured. We have said so in all our previous reports, and the practice of the country in every instance says so. But all commercial practice is no correct test of the *actual cost* of everything, and thus it will now be interesting to ascertain, as exactly as possible, what is the real cost to the producer of a store cattle beast. In doing this, it will be best to keep to the average steer reported upon by me in 1879, and since handled by Dr. Lawes.

Cost of a Store Steer Weighing 1,163 pounds, alive, at 30 Months Old.

Bull service	$2 00
Half cow's milk during six months	11 25
Extra food to calf during nursing	2 50
Food of calf, from six to twelve months' old, during winter	6 89
Food of yearling steer, twelve months	20 04
Food of two-year-old, during six months of summer	12 50
	$55 18
Attendance and risks	6 50
Total actual debit	$61 68

This is the first time we have publicly attempted to show what it costs to rear a steer from birth to thirty months old. The statement is one which must be most critically examined, and I advance it now for that very purpose, trusting our feeders will spare no pains to thoroughly sift.

A good Shorthorn grade cow is put to the bull on 1st July, and drops a bull calf on 1st April following, which is steered in due course; the calf gets half the mother's milk for six months, along with some grain and green fodder, therefore it is justly chargeable with the one half of the milk—equal, on an average, to 1,500 lbs. at ¾ of a cent. per pound. After weaning, when six months old on 1st October, the calf is treated to a regular diet of hay, roots and grain, which, at lowest, is equal to *one-fourth* of what is required by a two-year-old, as shown in Chapter IX. herewith; then, for the next twelve months, the summer grazing with some grain to keep up the "calf-flesh," will amount to $20.04 as above debited, and during the time from 24 to 30 months, which is on grass with grain to suit, the steer's keep cannot be less than $12.50; these, with a proper allowance for attendance and risks by death, etc., will amount in all to $61.68.

The animal now weighs 1,163 lbs., and has consequently cost 5¼ cents per pound.

But the producer has had an annual revenue from the manufacture of manure; we must credit the steer with the results obtained in this line, as detailed in Chapter III., and according to kinds and quantities of food consumed; this will figure up to $11.60 for the term of 30 months.

We have now obtained the clear sum of $50.08 as the actual *cash cost* to the farmer of producing a 30 months old steer that weighs 1,163 lbs., so that were he to sell to the feeder at 4⅓ cents per pound, he would neither be a gainer nor a loser by that part of the transaction. But it is obvious that were such an animal sold at 3½ cents, as we have put it in 1879, the producer would certainly lose, and the feeder gain, as illustrated. It is well known that steers about 1,000 lbs. live weight did fetch from 3½ to 4 cents, and even now, not more than 4½ cents per pound, or exactly what it costs to produce them, on an average.

The lesson to be drawn from these facts is that no breeder of store stock can be making a safe profit who sells under 4½ cents per pound, and that, as the matured steer at three years, according to present prices, will not fetch over 6½ cents, the feeder cannot safely give more than 4½ cents for the store animal.

VI.—THE COMPARATIVE SIZE, WEIGHT, AND VALUE OF VARIOUS GRADES OF FAT SHEARLING WETHERS.

While we have in previous reports occasionally referred to our farm experience regarding pure breeds, and some grades of sheep, we have never systematically submitted any figures specially upon the size, weight and value of fat shearling wethers as bred and fed here in view as a lesson for the Province.

After all, the great question with the average farmer is not so much what can be got for particular pure breeds of sheep, as which of them will improve his common stock so as to secure the greatest weight and best quality of wool and flesh in the shortest time.

I should hope most of our farmers are now well aware of the important fact that, under the best management, there is always most money in getting rid of fat sheep as shearlings in place of holding them on for another year. It pays best in (1) earlier returns, in (2) greater weight proportionately to time, and (3) in quality of flesh, and (4) in quality of wool. I shall not therefore labour this chapter with any details regarding the conduct of two-shear wethers, except to note that on an average of kinds, the increase to weight during the second year is only at the rate of *one-fifth* pound per head per day—that is, the average shearling of 183 lbs. would not exceed 250 lbs. twelve months afterwards.

We are not able to present the Shropshire Down and Merino so reliably as the others, but will next year, when, from our own breeding and management, more figures should be on hand.

During the last five years we have regularly bred and fattened the first crosses resulting from pure-bred Leicester, Cotswold, Oxford Down, and Southdown rams upon ordinary Canadian ewes; and as all the management and food has been identical in every detail, the results may be relied upon as valuable for comparison.

Lambs are usually dropped about the middle of March and weaned 1st July, getting some grain at all times, and such other management as was fully shown in our 1880 report on "Fattening of Young Sheep."

Under such treatment we have had, on an average, the following sizes:

——	Heart Girth.	Flank Girth.	Length.
	ft. in.	ft. in.	ft. in.
Grade	—	—	—
Cotswold grade	4 3	4 0½	4 2
Leicester grade	4 1	4 1	4 0
Oxford Down grade	4 0½	3 11	4 0
Southdown grade	3 11½	3 11¼	3 10
Merino grade	—	—	—
Shropshire Down grade	—	—	—
Averages	4 1	4 0	4 0

The two first measurements will be easily understood; the third is the length of the animal as it stands, taken from the drop of the tail to the mouth, when the head, or face proper, is held in a *horizontal* position, and the tape line tightened from point to point. By this method we get the nearest test of a well-made animal, as all the measurements should practically agree—as they do in these examples.

The Leicester leads in flank girth, and the so-called small Southdown gives nearly as much as the others, and is but little second to the Oxford Down in heart girth also. Some will expect to find a proportionately better heart girth in the Leicester grade, but then they are the most even all through—that is, of the most perfect form—by having the three things agreeing, the Cotswold being the least so.

Weight of Fat Shearling Wethers.

Grade	150 lbs.
Cotswold grade	199 "
Leicester grade	198 "
Oxford Down grade	177 "
Southdown grade	157 "
Merino grade	145 "
Shropshire Down grade	165 "
Mean	170 "

So, practically, the two long-wools are equal in weight as shearlings, and even to ourselves this result has been somewhat surprising, because we have been accustomed to look upon the Cotswold as a slower and more irregular fattener. That they are so in the latter respect we have already seen; and while they do not want in weight, they certainly do not

give it proportionately to size of bone or length and height of frame. The two Downs are, relatively to weight, very much greater in girth than either of the long-wools; for example, were girth to be regulated by the standard of 4′ 1″ to 198 lbs., then the Oxford Down should heart girth *only* 3′ 8″, and the Southdown 3′ 3″, in place of 4′ 0½″ and 3′ 11½″ respectively.

Cost.

In this it will simplify to state generally that, inclusive of all food, proportion of ewe's keep during nursing, dipping, washing, clipping, proportion of sire's service, management, and casualties, an average shearling wether runs up a debit of $7, presuming that as many are kept as will wholly engage one shepherd's time. Taking this as data, the following is the respective cost of the several grades:

Grade	$5 00
Cotswold grade	9 30
Leicester grade	8 10
Oxford Down grade	7 40
Southdown grade	6 00
Merino grade	5 50
Shropshire Down grade	7 00
Mean	$6 90

It is a point, subject to no dispute, that the great roomy raw Cotswold will eat one-half more than the hardy compact Southdown, and the others very much in proportion to their size.

Wool Weight and Value.

Grade	5 lbs. at	25c.	$1 25
Cotswold grade	9 "	28c.	2 52
Leicester grade	8 "	28c.	2 24
Oxford Down grade	8 "	35c.	2 80
Southdown grade	6 "	40c.	2 40
Merino grade	7 "	42c.	2 94
Shropshire Down grade	9 "	38c.	3 42
Mean			$2 51

Flesh Value.

While over most parts of this country as yet, "mutton is mutton" of whatever weight, quality, or size, there is nevertheless a decidedly growing recognition of the value of certain kinds over others as regards the mixing of fat and lean. The rough patchy stamp is clearly not in favour, even with our export shippers, and so we have now to record a very different value in flesh for these grades.

Grade	150 lbs. at	5c.	$7 50
Cotswold grade	199 "	5c.	9 95
Leicester grade	198 "	5c.	9 90
Oxford Down grade	177 "	6c.	10 62
Southdown grade	157 "	6½c.	10 20
Merino grade	145 "	5c.	7 25
Shropshire Down grade	165 "	6c.	9 90
Mean			$8 05

In conclusion, gather up the items, and make a balance sheet, thus :—

——	Carcass.	Wool.	Cost.	Balance.
	$ c.	$ c.	$ c.	$ c.
Southdown grade	10 20	2 40	6 00	6 60
Shropshire Down grade	9 90	3 42	7 00	6 32
Oxford Down grade	10 62	2 80	7 40	6 02
Merino grade	7 25	2 94	5 50	4 69
Leicester grade	9 90	2 24	8 10	4 04
Grade	7 50	1 25	5 00	3 75
Cotswold grade	9 95	2 52	9 30	3 17
Mean				4 95

From which we obtain very striking evidence in favour of short and medium-wooled sheep—such figures that, in view of the present export trade, no one need hesitate, even supposing they are fifty per cent. in error.

VII.—CORN, OATS, AND PEAS IN THE FATTENING OF CATTLE.

Supposing all faith were placed in the chemical analysis of any kind of food, and it stood as an invariable fact that the fattening animal made most progress in a given time upon that which contains the most fat and flesh-forming materials in the forms of albuminoids and carbohydrates, it would result that corn, oats and pease made beef best in the order given respectively.

Corn possesses a larger percentage of fatty and oily materials, in comparison with oats and pease, pease being considerably less than oats; corn also has one-fourth more starch than either of the others, though less sugar; oats being four times heavier in sugar than corn or pease. Corn is characterized for its albuminoids, and oats for its carbohydrates. As shewn by the accompanying table, the water in each of these foods is practically alike, and the only remarkable difference not yet referred to is the possession by pease of fully one-half more of what are called *flesh*-formers as against corn and oats.

Average Composition of Corn, Oats and Pease.

——	Corn.	Oats.	Pease.
Water	14.50	14.00	14.00
Flesh formers	10.00	11.50	23.50
Fat formers	69.00	64.50	50.00
Woody fibre	5.00	7.00	10.00
Mineral matter (Ash)	1.50	3.00	2.50

The interesting and practical point therefore is, Does experience, in most cases, agree with the chemical facts, especially in regard to the fattening of cattle, and what, so far, has been the test of the Ontario Experimental Farm thereanent?

On 25th June we closed an experiment specially arranged with these grains, having been very carefully carried out for 75 days. The animals were fair, but not extra samples of three-year old Shorthorn and Hereford grade steers, one of each in each of the three batches. We had three animals in each of the classes all throughout, but owing to several causes it was considered best to confine the experiment to the six that stood nearest each other in every respect, such as size, quality and apparent disposition. They were allowed to "settle down" by receiving one week's food similar to their subsequent treatment respectively, all being tied up in a cool open shed away from other cattle. As the experiment began on the 12th April, warm weather was soon experienced, so that during the latter part of the term the thermometer was often at 80° and 85° in the shade; this told heavily against the average daily increase per head in comparison with winter practice, but of course it told equally for corn, oats and pease. All grain was roughly ground, being neither fine nor very rough; turnips pulped, and hay long.

In discussing the results of this experiment, we will refer to the average animal of each division.

FOOD CONSUMED DURING 75 DAYS, BY ONE ANIMAL.

Turnips	3,525 lbs.	For each of the three divisions.
Mangolds	600 "	
Grain	657 "	
Bran	50 "	
Hay	770 "	
Green fodder	252 "	

NOTE.—The cattle receiving oats ate one-sixth less hay, and those on corn one-fifth less than above given. Those on pease drank one-third more water than either of the others. When the hay was "clovery" the animals would not take so much roots as when timothy abounded; the change from hay to green fodders did not scour. It was particularly noticeable that more corn came through the animals undigested than either oats or pease. Feeding was conducted, as regards time of day, etc., similar to that specified in Chapter I. Food was weighed at every meal.

RESULT IN INCREASED WEIGHT.

———	Weight on Entry.	Weight at Finish.	Total Increase.	Daily Increase.
	lbs.	lbs.	lbs.	lbs.
Corn	1,163	1,271	108	1.44
Oats	1,301	1,411	110	1.47
Pease	1,243	1,388	145	1.94
Mean	1,236	1,357	121	1.62

Corn and oats, therefore, gave a similar daily increase per head, while pease record *one-half pound more daily.* What may be the cause of this? It was not by reason of larger animals at the start, nor greater amount of food, nor any difference whatever in conditions, so far as human skill was concerned, and consequently it must be sought for in the properties of the food. I am not prepared to handle this part of the subject at present, but would again simply draw the attention of the feeder to the few facts already

noted, and particularly to the much greater proportion of *flesh*-forming materials existing in pease, which means the making of more muscle and lean as against the lighter oil and fatty matters.

Cost of Production.

Without reference, meantime, to the crediting of any items so as to make a proper balance sheet as exhibited in other parts of this report, it will suffice to note the actual cost of producing the several increased weights. The price of each of the grains will be held at one cent per pound, which they are in the Canadian market on an average at present.

Corn	14¼	cents per pound.
Oats	14⅛	" "
Pease	11⅙	" "

This is no less than 21 per cent. in favour of pease, which is equivalent to $4.50 per head of increased profit during one winter's feeding, or $4,500 in a stable of 1,000 head.

Is there not reflection here for a very important national question with us? Much of our agricultural talk of late has been about the inability of the Province to grow corn and the restriction put upon its importation from the States. But, after all, is corn the cheapest producer of beef—weight for weight and price for price, with other coarse grains easily and cheaply cultivated in Ontario?

VIII.—SUMMARY OF GENERAL CONCLUSIONS.

1. A steady, frosty winter is better than an open one in feeding cattle.
2. An average two or three year old steer will eat its own weight, of different materials, in two weeks.
3. Two and three year old cattle will add one-third of a pound more per head per day to their weight upon prepared hay and roots than upon the same materials unprepared.
4. It is 30 per cent. more profitable to pre-mature and dispose of fattening cattle at two years old than to keep them up to three years.
5. There is no loss in feeding a cattle beast well upon a variety of materials for the sake of the *manure alone.*
6. Farm-yard manure from well-fed cattle, three years old, is worth an average of $3.30 per ton.
7. A three year old cattle beast, well fed, will give at least one ton of manure every month of winter.
8. No cattle beast whatever will pay for the direct increase to its weight from the consumption of any kind or quantity of food.
9. On an average it costs twelve cents for every additional pound of flesh added to the weight of a two or three year old fattening steer.
10. In this country the market value of store cattle can be increased 36 per cent. during six months of finishing by good feeding.
11. In order to secure a safe profit, no store cattle beast, well done to, can be sold at less than 4½ cents per pound (live weight).
12. In the fattening of wethers, to finish as shearlings, the Cotswold and Leicester grades can be made up to 200 pounds, the Oxford Down 180 pounds, and the Southdown (grades) 160 pounds each (live weight).
13. Combining wool and flesh value, the Southdown grade gives the highest returns —as much as double that of the Cotswold grade and 35 per cent. over that of the Leicester grade, as also slightly in advance of the Oxford Down grade.
14. Fattening cattle on oats will eat one-sixth less hay than when receiving corn or pease; those on pea meal will drink one-third more water than those upon corn or oats. Clover lessens the consumption of roots.
15. Apparently about one-fifth of ground corn passes through the cattle beast undigested.
16. Pea meal (rough ground) gives 21 per cent. greater returns in fattening cattle than either corn or oats.

N.B.—In the carrying out of these experiments I have to acknowledge with much pleasure the valuable assistance rendered by all the second year students, and especially on the part of their Committee, Messrs. Leask, Phin and Motherwell; and to Messrs. Leask, Dickinson and Fotheringham as superintendents of the feeding.

All experiments must be repeated again and again ere confidence can be established.

IX.—The Cutting-up of our Experimental Cattle.

From the pease, oat and corn experiment of 1880-81, we retained four steers in view for Christmas—one each of Hereford and Ayrshire grades, and two Shorthorn grades. They were housed all summer, getting green fodder with pea meal. When sold to Messrs. Mallon & Co., of Toronto, we had their kind permission to superintend the killing and cutting-up, so as to obtain correct percentages, now looked upon as valuable points in the make-up of beefing cattle. This subject receives too little attention among breeders, feeders, butchers and exporters. It will be easy to show how a shipload of fattened cattle can be $3,000 more or less in value, according to percentage of offal—whether only sixty to the 100, or as much as sixty-six of clean butchers' meat to every 100 lbs. live weight. Nationally, then, we are highly interested even in this one item, and there are others proportionately valuable, which it is now my duty to submit.

The cutting-up value of a fat cattle beast depends upon four things:

Breed,
Sex,
Food, and
Age.

Breed regulates the whole proportion of offal; sex also affects the amount of waste (so called)—being more in the female and less in the male and steer; food very materially increases and lessens the butchers' profit—on the one hand, pasture gives the greater waste, and dry fodder with grain increasing the proportion of clean meat. Age is no secondary agent in all this work, as youth gives flabbiness with more offal, while the more mature makes things firmer, fills up, and offers more tallow.

In the animals we are about to slaughter, therefore, it is necessary to have knowledge of all these influences, with particular reference to their being housed and grain fed all summer.

A Shorthorn grade, in this example, means the second cross of a pure Shorthorn upon an ordinary Canadian cow; and the Hereford and Ayrshire grades were the first crosses from exactly the like cow. The two Shorthorn steers were twins, and had no other nurse but their mother, so that very much allowance must be considered in making comparisons—this must not be forgotten. Food and management were alike to all.

The cutting-up table that follows shows the respective ages in days, killing weight, home weight, and classification of carcass materials, along with percentages of offal to killing weight, of tallow to the same, and the very important one of percentage of clean flesh or butchers' meat to the gross live weight.

It appears, then, that a Shorthorn grade, the average of twin steers, 970 days old, gave 14⅓ lbs. of offal, 5⅓ lbs. of tallow, and 63.92 lbs. (say 64 lbs.) of clean meat to every 100 lbs. live weight; this was from a rate of increase of 1.41 lbs. per day. A Hereford grade steer, 1,025 days old, gave 13½ lbs. of offal, 6¼ lbs. of tallow, and 64.65 lbs. of clean flesh to every 100 lbs. live weight, from a daily increase of 1½ lbs. during these 1,025 days. And an Ayrshire grade steer, 1,095 days old, gave 15⅜ lbs. offal, 4¾ lbs. tallow, and 63⅓ lbs. of clean meat to every 100 lbs. live weight, from a daily gain of 1.42 lbs. per day. In comparing these, the Hereford grade has the least percentage of offal, the greatest of tallow, and the greatest percentage of butchers' meat; in all these, the Ayrshire is considerably lowest, while the Shorthorn takes as nearly as possible an intermediate position. While not alike for comparison, because of breeding and of much greater age, I have, nevertheless, thought it interesting to place alongside a forty-four months pure bred Devon steer. Note the lower gain per day, the much greater propor-

tion of tallow and less offal that age (and may-be breed) gives, along with no less than 65¾ lbs. of clean meat to every 100 of live weight.

The Market Value of Four Kinds of Beef.

It is not what the butcher wants to "show off" with at Christmas, and for which, as a *business agent*, he gives more than for anything else, but it is what suits the average consumer, who requires the most economical roast or boil at any time. When the farmer feeds, and the butcher cuts up just that stamp of animal from which both the epicure and the uncultivated hungry can be served, we may conclude as having produced the *standard*. Now, what is such a standard, and its application to these under discussion? I purpose to invite examination to this under two heads: 1st, Merit by Appearance; and, 2nd, Merit by Actual Cooking and Consumption.

(1) their merit by appearance.

The standard of what is called "first-class beef," without regard to breed, is said to be:

1. In general appearance a clear cherry-red.
2. Juicy or sappy in appearance.
3. Fine smooth grain to the touch.
4. Fat and lean well mixed, or marbled.
5. Fat of a clear straw colour.
6. Suet to be of a brighter shade than the fat, with little fibre, and to crumble easily.
7. Loin and ribs to be covered with fat more or less in thickness.
8. The sirloin when cut to be about equal thickness at both ends.
9. Little bone anywhere.
10. Thickness of flesh and fat everywhere.

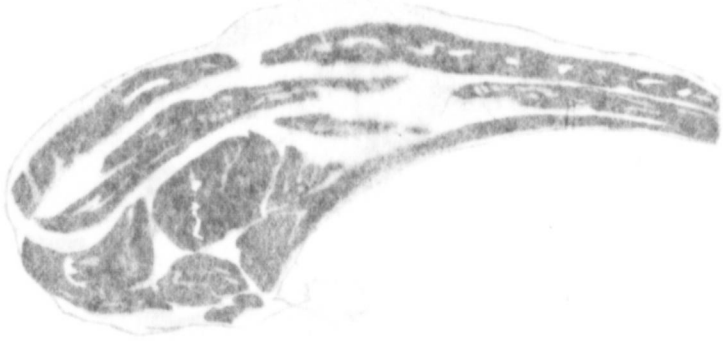
There are many other ways of putting quality, according to national and individual modes of expression, but these will serve our purpose at present.

In order to submit the four kinds named to this standard, I have much pleasure in giving three illustrations of each, as taken by an artist, strictly according to scale, and in every detail they are well and faithfully done. Each set of cuts being exactly from the same parts of each of the breeds, there is necessarily very much here that must interest not only the people of Canada, but every civilized country. Indeed, this inquiry is one of the fields of our profession that has lain too long untilled; and while I do not say that we are the first to cut turf, I trust we will be the first to establish a series of such illustrations over many years' coming experience that can be looked to as reliable for universal reference.

The Cutting-up of Four kinds of Fat Steers.

——	Shorthorn Grades.	Hereford Grades.	Ayrshire Grades.	Pure Devon.
Age in days	970	1025	1095	1325
	lbs.	lbs.	lbs.	lbs.
Offal	180½	194	206	169
Tallow	67½	90	63	125
Blood	66½	70	70	87
Head and Feet	51	60	59	75

SHORTHORN GRADE.



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Tallow	67½	99	63	125
Blood	66½	78	72	87
Head and Feet	51	60	49	75

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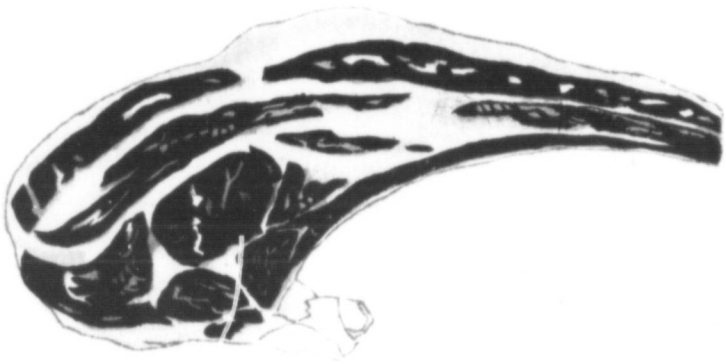

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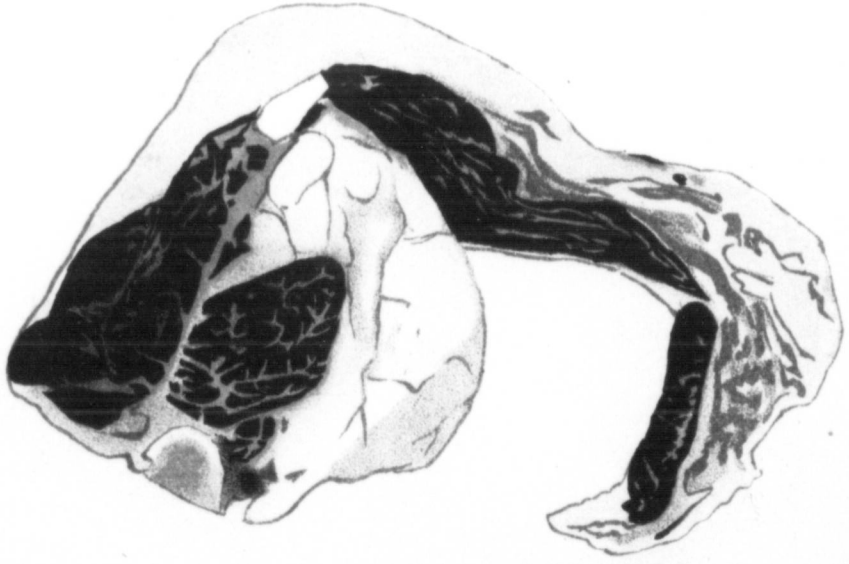

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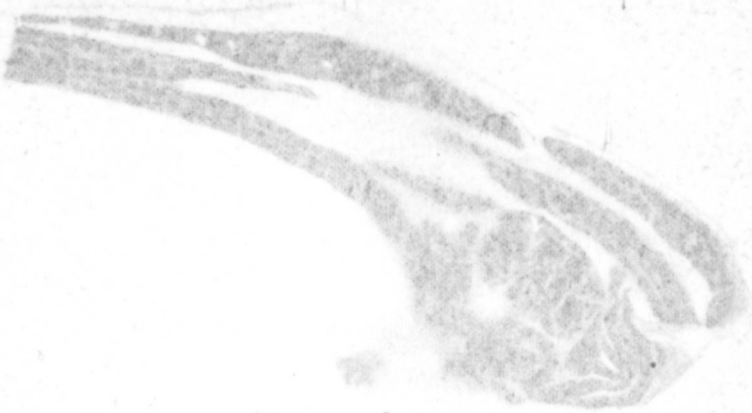
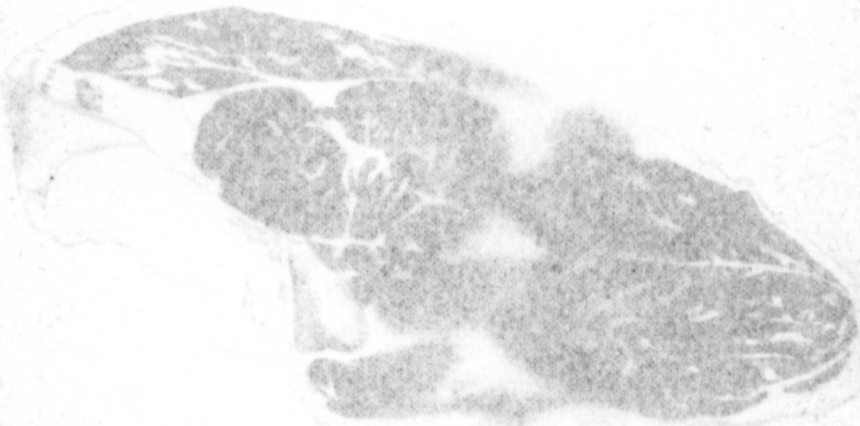
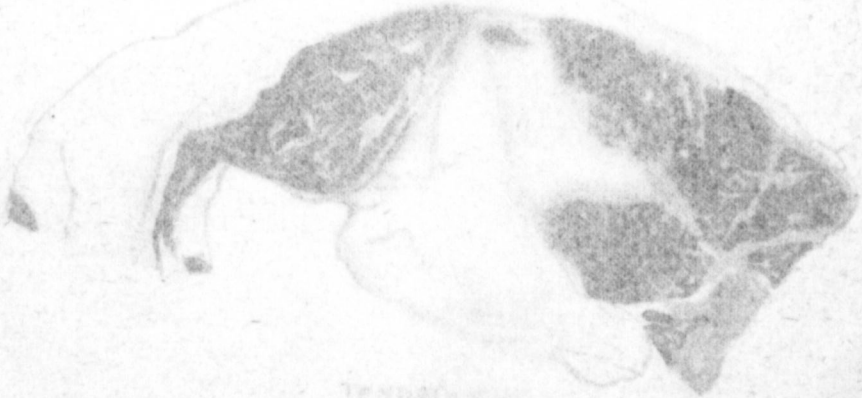
ROLPH SMITH & CO TORONTO

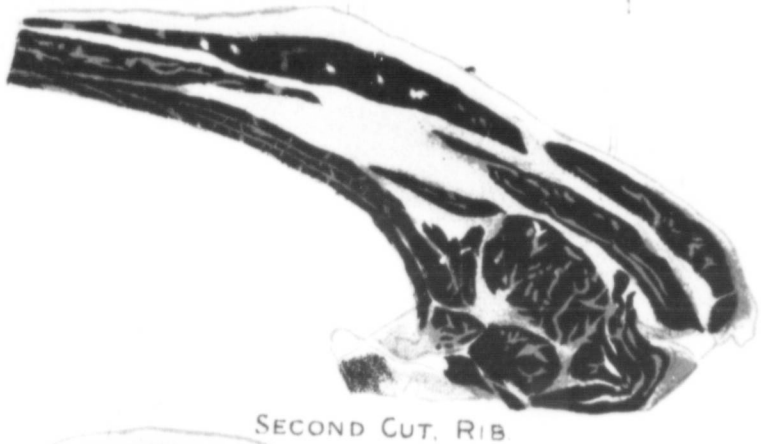
HEREFORD GRADE







HEREFORD GRADE



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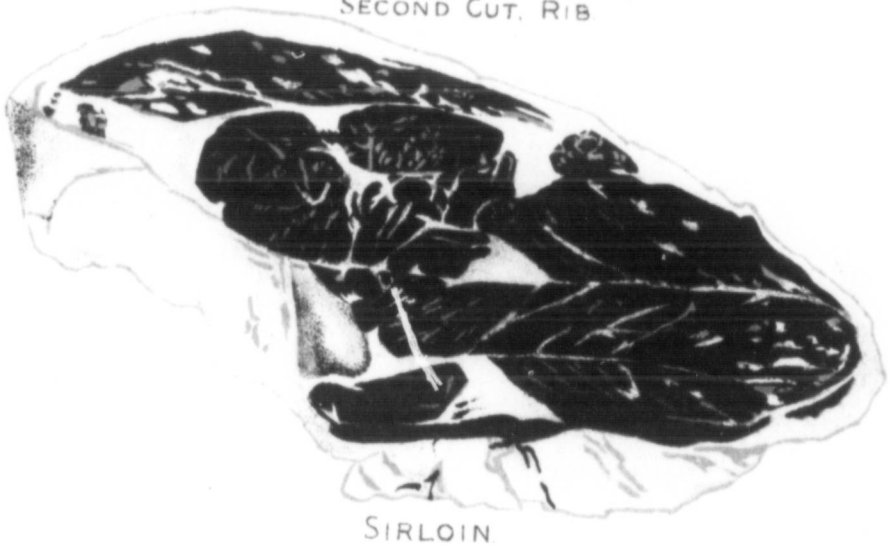

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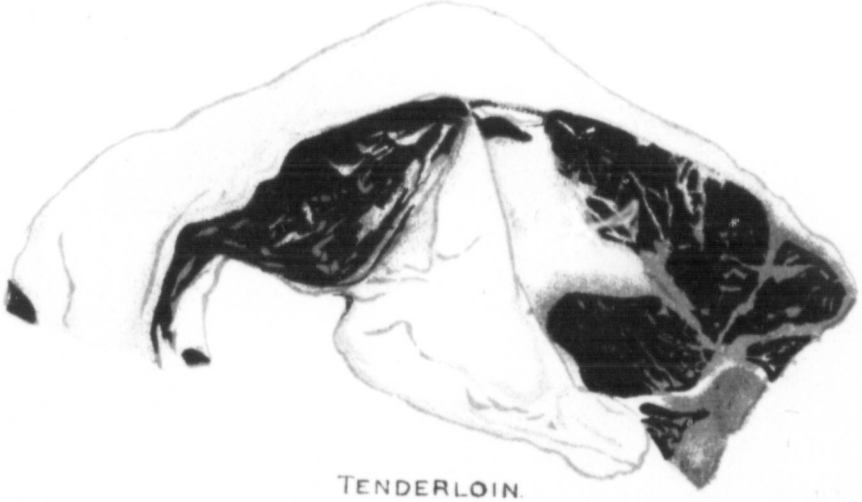
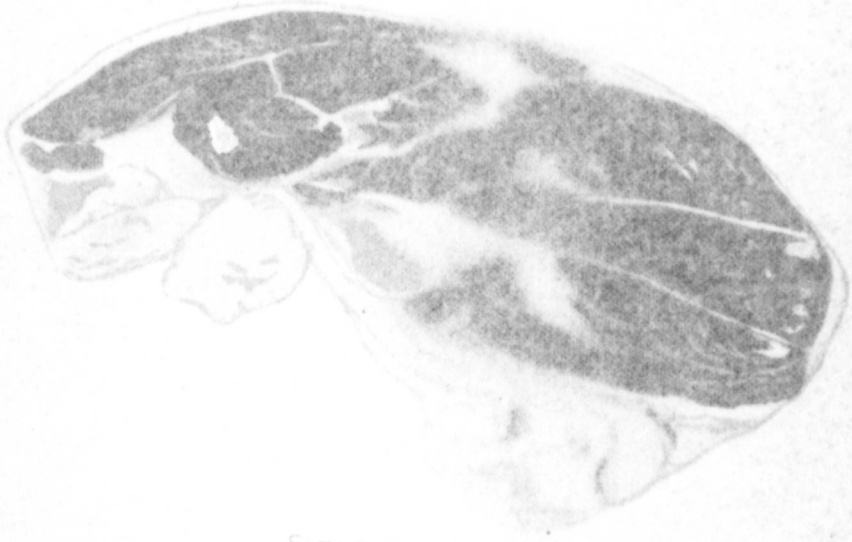


TENDERLOIN.

AYRSHIRE GRADE

SECOND CUT



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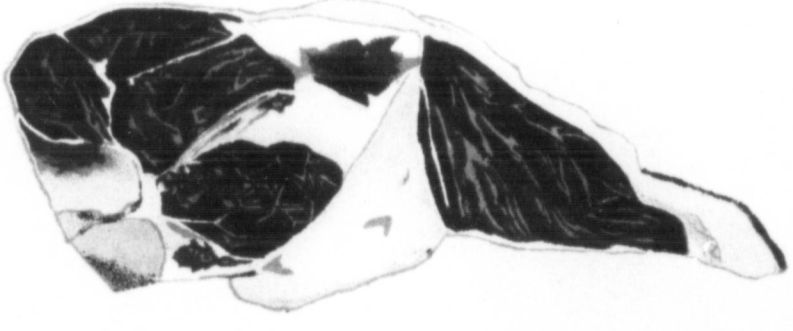

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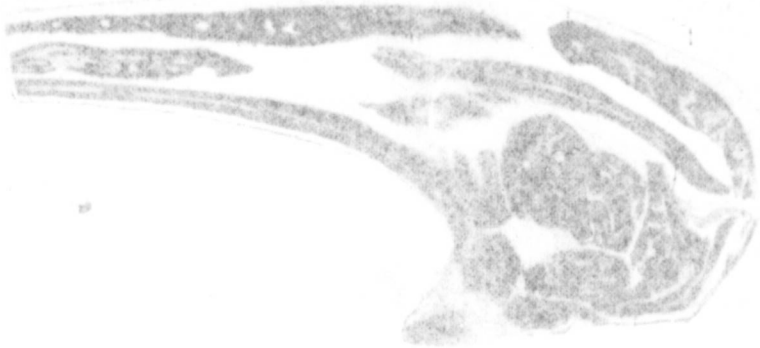
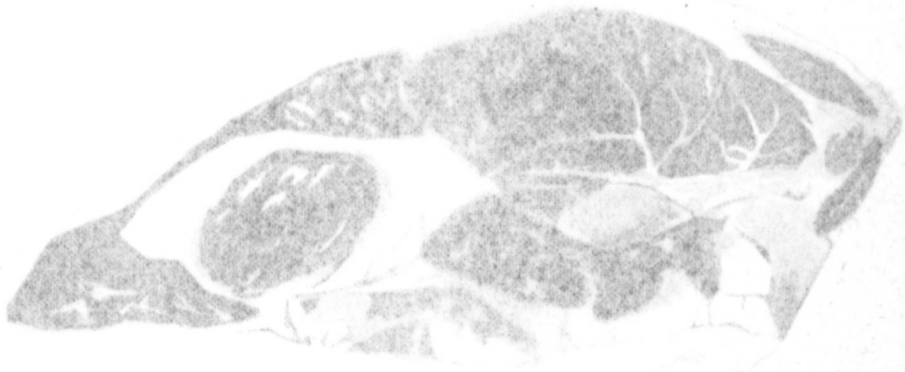
ROLPH, SMITH & CO. TORONTO

PURE DEVON





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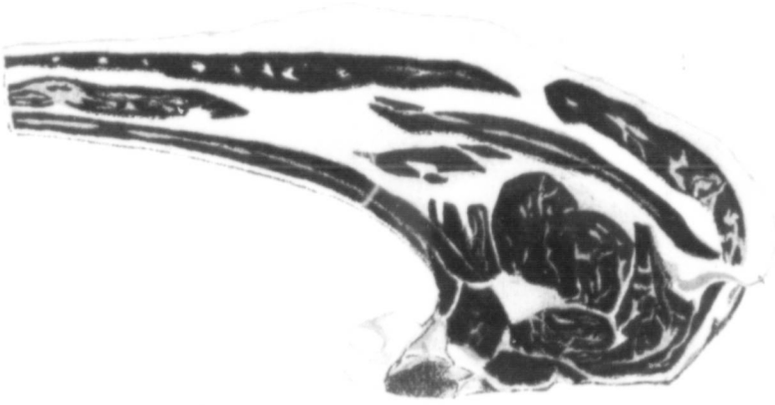

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THE CUTTING-UP OF FOUR KINDS OF FAT STEERS—*continued.*

——	Shorthorn Grades.	Hereford Grades.	Ayrshire Grades.	Pure Devon.
Hide and tail	86½	96	86	103
Carcass	801	933	836	1075
Killing weight	1253	1443	1329	1634
Home weight	1357	1536	1443	1706
Daily gain per head	1.41	1.50	1.42	1.28
Percentage of offal to killing weight	14⅛	13½	15⅝	10⅓
Percentage of tallow to killing weight	5⅛	6¼	4¾	7⅝
Percentage of carcass to killing weight	63.92	64.65	63.33	65.78

(2) THEIR MERIT BY ACTUAL COOKING AND EATING.

Boiling.

———	Weight before.	Weight after.	Difference.	Per cent. of shrinkage.
	lbs.	lbs.	lbs.	
Shorthorn Grade	7¾	6⅛	1⅝	21
Hereford Grade	6¾	4¾	2	29
Ayrshire Grade	8¾	5⅞	2⅞	33
Pure Devon	7	4¾	2¼	32
Mean	.....	.....	.....	29

The Shorthorn loses least by boiling, and the Ayrshire most, the Hereford being an exact mean of the four, with Devon nearly as much as the Ayrshire. Of course, in this, some housewives may desire beef that gives off its virtues freely, while others want both good soup and good beef afterwards. Can both be got?

Roasting.

———	Weight before	Weight after.	Difference.	Per cent. of shrinkage
	lbs.	lbs.	lbs.	
Shorthorn Grade	7	4¼	2¾	39
Hereford Grade	8	6	2	25
Ayrshire Grade	8	5½	2½	32
Pure Devon	6¼	4½	1¾	28
Mean	.....	.....	.....	31

In roasting, the Hereford grade parts with least oil, or other good things; Devon second, Ayrshire grade next, and the Shorthorn seems to be most liberal in parting with these: a very marked contrast to its conduct when boiled.

We submitted the final proof to nine experts, immediately after roasting; opinion, in majority, being given according to last three lines of following table:

12.—ABSTRACT.

Valuation of the flesh of four kinds of fat steers, as bred and fed at the Ontario Experimental Farm.

POINTS.	Value of each point.	Shorthorn. Grade.	Hereford. Grade.	Ayrshire Grade.	Pure Devon.
Clear cherry-red colour	5	5	5	3	3
Juiciness	5	4	5	3	3
Fine smooth grain	5	3	5	3	4
Marbling and mixing	15	15	14	13	11
Clear straw colour of fat	3	2	3	2	1
Suet colour and fibre	2	3	3	2	2
Covering of loin and ribs	7	7	5	4	6
Form of sirloin	10	10	6	8	7
Weight of bone	3	2	3	1	3
Flesh and fat distribution	7	7	6	5	4
Boiling	10	10	8	6	7
Roasting	8	5	8	6	7
Eating	20	17	20	19	18
	100	90	91	75	76

In all the work of this, every item was pronounced upon without regard to what the end might be—for or against either of the breeds—and no checking made during its progress. This final table, therefore, is the unbiased opinion of several good judges.

I have to thank Messrs. Mallon & Co., and Mr. Frankland, of Toronto, for cheerful and able help in this somewhat new line of our profession, and special mention must be accorded Mr. Geo. Hood, of Guelph, as well as Mr. Woods, our Farm Foreman.

B.—*The Plant.*

1.—THE THIRD YEAR OF WHEAT AFTER SEVENTEEN FORMS OF MANURE.

Plots 10, 11, and 12—Field B.

What is it that has most influence in the production of crops during a series of years? Is it soil with its food conditions, or climate with its conditions—cultivation being good?

What are we to say of soil that gives us, three years in succession, 17¾ bushels of wheat on an average, without manure, and 19½ bushels by the use of seventeen forms of fertilizers? Without manure we had, in 1879, 13½ bushels; in 1880, 8¼ bushels of Spring Wheat; and 31¼ bushels of Winter Wheat in 1881. As, necessarily, the effects of climate can best be estimated by the conduct of a crop upon *unmanured* land, we shall gather up figures upon this subject as they have been carefully recorded here, and as exhibited in the annexed chart:

CHART OF TEMPERATURE AND RAINFALL TO ACCOMPANY EXPERIMENT OF SUCCESSIVE CROPS OF WHEAT UPON SEVENTEEN FORMS OF FERTILIZERS THE CROP

CHART OF TEMPERATURE AND RAINFALL TO ACCOMPANY EXPERIMENT OF SUCCESSIVE CROPS OF WHEAT UPON SEVENTEEN FORMS OF FERTILIZERS THE CROP REPRESENTED BEING THAT WHICH RECEIVED NO MANURE.

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On the assumption, then, that temperature and rainfall have more to do with production of crops than the best of soil food conditions, on an average of things, it appears in 1879 the unmanured plot gave 13½ bushels of Spring Wheat, by seeding on 28th April and harvesting on 3rd August; and that was in receipt of a mean temperature of 64° during these 97 days, and of 12 inches of rainfall distributed over 26 days. The same soil with a like crop in 1880 gave 8¼ bushels, by seeding on 26th April and harvesting on 6th August, in a mean temperature, for 100 days thereafter, of 67° 8′, and of 7⅛ inches of rainfall scattered over 48 days; while under a crop of Winter Wheat during 1881, that was harvested on 21st July, the yield was 31¼ bushels of grain under a May, June, and July mean temperature of 61°, and a rainfall of 5⅕ inches scattered over 24 days—thus tabulated:—

Year.	Mean Temperature.	Duration of growth in days.	Rainfall.		Crop.
			in.	days.	
1879	64°	97	12	26	13½ bushels Spring Wheat.
1880	67° 8′	100	7⅛	48	8¼ " "
1881	61°		5⅕	24	31¼ " Winter Wheat.

In the order of amount of grain per acre the following shows the cropping of 1881:—

——	Grain in bushels.	Straw in lbs.	Weight of grain per bushel.
Farm-yard Manure and Nitrate of Soda (*a*)	41	3,690	64¼
" " " "	40	3,390	64
Lime Compost	38¼	2,955	62½
Farm-yard Manure and Salt	35¼	2,940	63½
Farm-yard Manure and Bone Dust (*a*)	35	2,940	63½
Farm-yard Manure and Gypsum	32¼	2,685	63¾
Nitrate of Soda	31½	2,730	63
Farm-yard Manure and Bone Dust	31⅛	2,685	63¼
No Manure	31¼	2,565	64
Farm-yard Manure and Mineral Superphosphate (*a*)	31	2,520	64¼
Farm-yard Manure	30½	2,610	64
Farm-yard Manure and Mineral Superphosphate	30½	2,730	63½
Mineral Superphosphate	29½	2,400	64¼
Farm-yard Manure and Gypsum (*a*)	28½	2,460	63
Farm-yard Manure and Salt (*a*)	28½	2,370	63
Salt	28	2,130	64
Gypsum	28	2,355	63
Bone Dust	26	2,040	62½
Mean	33½	2,677	63½

It will now be in order to illustrate what each form of fertilizer has done for the three year period just terminated.

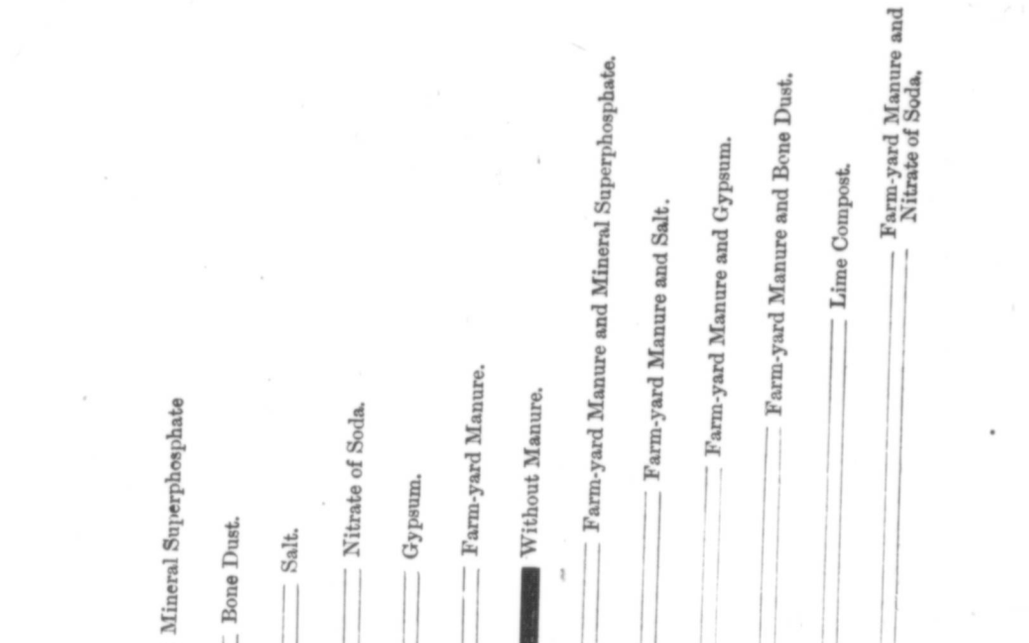


Diagram showing average annual produce of Wheat, during three years, since application of twelve forms of fertilizers.

At the present stage of this experiment, therefore, four facts stand boldly out:

1st.—That all the *mineral* fertilizers range below the produce that has been received from land *unmanured*.

2nd.—That farm-yard manure alone has given no more than that unmanured.

3rd.—That everything giving a produce greater than that unmanured is from an association of farm-yard manure and mineral fertilizers, lime compost excepted; and

4th.—That a compost of earth (decayed vegetable matter and lime) is second only to one in all the contest.

Take the first fact, and consider why it is that neither gypsum, nitrate of soda, salt, bone dust, nor mineral superphosphate have, on an average of three years, done nothing in producing extra crops. During the first season they gave conjointly 16⅓ bushels, as against the 13½ from the unmanured plot; for the second season they gave 5$\frac{1}{10}$ bushels, to the 8¼ for that unmanured; and 28½ for the third year, in comparison with 31⅓ from unmanured land.

Consider, also, what conditions have so nullified farm-yard manure during three years, which in no single instance gave an indication of its existence.

Also note the very striking results comparatively, when any of these special manures are associated with farm-yard—in every instance making a produce superior to those from farm-yard alone and the unmanured.

And a very valuable lesson is certainly deducible from the position taken by lime compost as a producer of grain.

In criticising these things briefly, we take our stand on two well-known things. We do not know with any measure of certainty, because the country's experience of them is short and limited, what the conduct of special fertilizers is under a variety of conditions—soil, temperature, rainfall and crop; but we know what farm-yard manure is expected to do, and, of course, in addition to this, we have the surer base of comparison with a crop that has not been treated to any form of manure.

In a previous Report we got rid of the question of effects of manurial application, and showed that the land under this experiment was neither in a high state of cultivation nor had been highly manured. It is obvious then that we must fall back upon conditions other than soil ones.

It seems to me, under these circumstances, to be impossible to gainsay the fact that CLIMATE has been the prime regulator of growth for the period named. The conditions of temperature and rainfall have been such as rendered, in all likelihood, soil help unnecessary in the case of manures not in association. The case would not be so evident were farm-yard manure out of this non-producing list, because the special fertilizers are special—unusual, so to speak—and certainly not so natural. It is a strong ground to take, that as farm-yard manure failed to act, there must have been such a combination of temperature and rainfall as made its usual fertilizing effects inoperative.

On the other hand, we have evidence of fertilizing action on the part of all those specials and farm-yard manure when they are placed together. In 1879 they gave, in every instance, much superior crops to the farm-yard and unmanured portions; in 1880 they did not give, in any one example, anything over those two standards; while in 1881 they again overreached them.

Here again, therefore, is clear proof of an overruling influence of climate, especially referable to the year 1880. By the chart and abstract thereof we observe an unusually high mean temperature, and a moderate rainfall, extending over no fewer than 48 days out of the 100—such a small amount of moisture per day as must have seldom reached the roots of plants, when the rapid evaporation is considered.

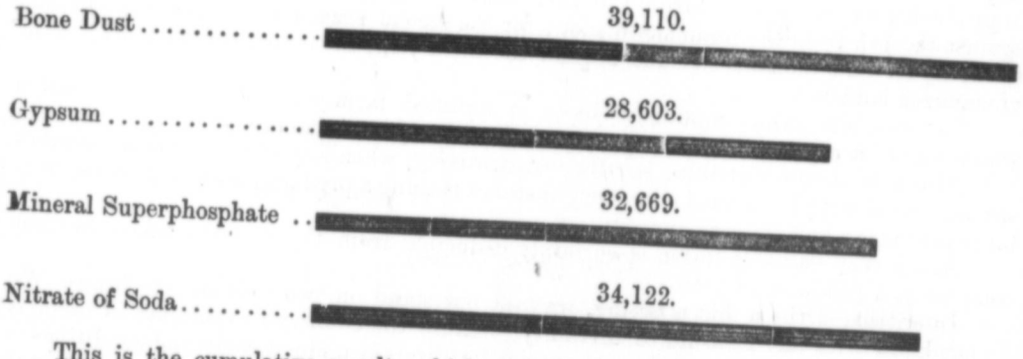
But why did the manures act when in combination? The chemist can best tell. Meantime we gather the interesting and highly valuable fact for the Canadian farmer, that one of the reasons of the permanent fertility of their soils, in comparison with Britain, is owing apparently to the more propitious character of climate to the growth of plants—wheat especially.

2.—The Effects of Bone Dust, Mineral Superphosphate, Gypsum, and Nitrate of Soda, applied in 1878.

Plot 29, Field C.

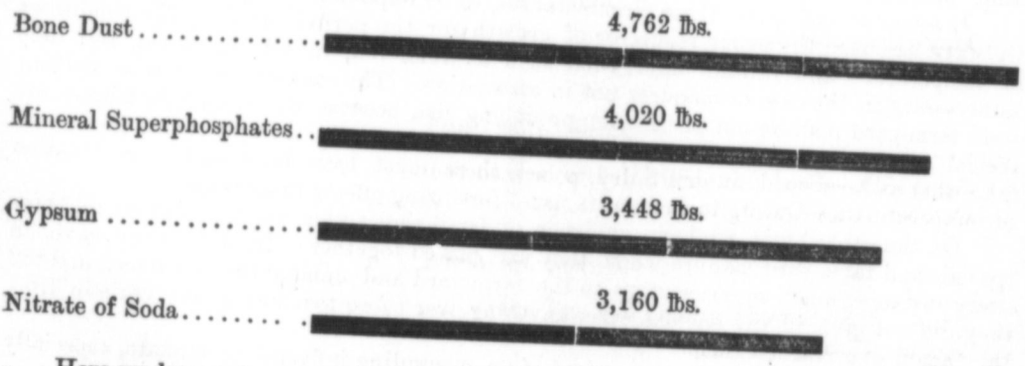
As a variety in the representation of this, one of our oldest and most reliable experiments, I beg to submit diagram, showing the four years' results from these four important fertilizers, in the production of *Oats, Barley, Wheat, Carrots, Sugar-Beet, Turnips* and *Mangolds.*

Average produce in lbs. per annum, from use of Fertilizers applied in 1878.



This is the cumulative result, which does not necessarily indicate the reliable or most permanent character of either of these special manures. If 1881 crop (Winter Wheat) has been influenced more by soil food than by atmospheric conditions, then the following should tell which holds out best:

1881 Cropping.



Here we have a true representation of the usually understood permanent character of these fertilizers, and it remains for coming years to verify.

3.—Green Fodder Crops, 1881.

As usual, we have a large variety of these, and as the season was particularly severe on all kinds of vegetation, by reason of protracted drought, it is important to note the conduct of what is expected to make up for scant pastures.

Prickly Comfrey.

Planted in 1879; cultivated, sets four feet apart each way.

May 27th	cut	$9\frac{1}{2}$ tons per acre.
July 13th	"	$2\frac{1}{2}$ "
September 1st	"	$2\frac{1}{2}$ "
October 7th	"	$1\frac{1}{4}$ "
		$15\frac{3}{4}$ tons per acre.

Red Clover.

Sown spring, 1880; ploughed for corn fodder on 1st June.
Plot 2.—May 30th—Cut $6\frac{1}{2}$ tons per acre.
Plot 3.—June 6th.—1st cut..... 8 tons per acre.
July 23rd.—2nd cut..... 3 "
September..... third growth left uncut
11 tons per acre.

Corn (after Clover).

June 4th.—Drilled, but a failure.
July 2nd.—Drilled second time.
September 4th.—Cut 8 tons per acre.

Rye (Winter).

Sown 3rd October, 1880. Late, thin, and winter-killed
June 6th.—Cut $4\frac{1}{4}$ tons per acre.

Rye (Spring).

May 7th.—Sowed.
July 2nd.—Cut 3 tons 20 lbs. per acre.

Rape (after Rye).

June 18th.—Seeded in drill; dry, poor seed bed.
October 7th.—Cut $3\frac{1}{4}$ tons.

Hungarian Grass.

June 10th.—Sowed; ground dry and lumpy.
August 17th.—Cut $4\frac{1}{2}$ tons per acre.

Sainfoin.

Sown spring, 1880; half covered with plants.
June 11th.—Cut 3 tons per acre.

Tares and Oats.

May 7th.—Sowed equal parts by measure—2 bushels per acre.
July 25th—Cut 9 tons 180 lbs. per acre.

Lucerne.

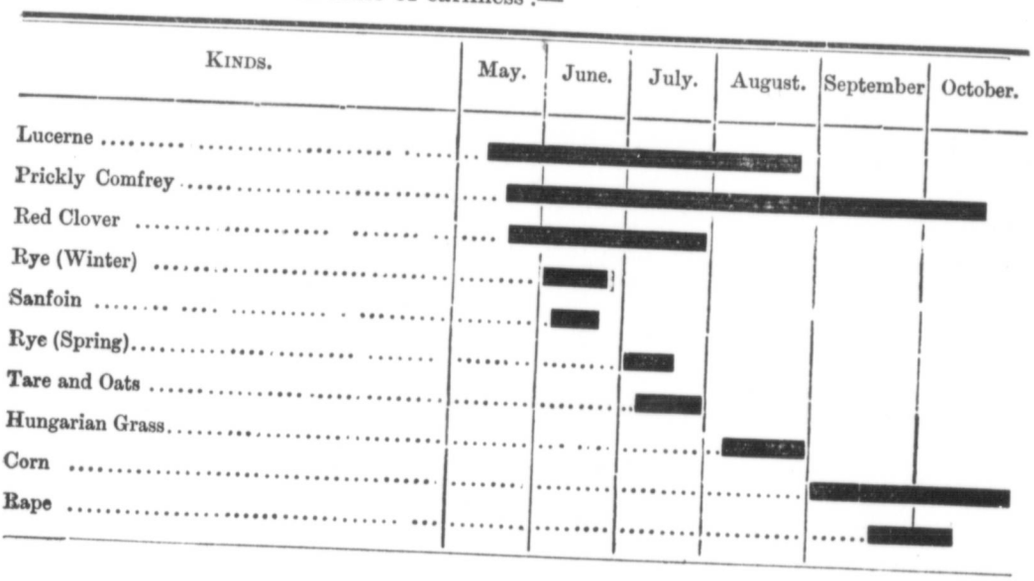
(*Seeded in 1876 and 1880.*)

May 19th, 1st cut	4	tons, 830 lbs.	per acre.
June 29th, 2nd "	5½	"	"
July 21st, 3rd "	5¼	"	"
August 11th, 4th cut	2	" 700 lbs.	"
Total	17½	"	"

By monthly produce we had, therefore, of green fodders to help in stables or on fields :—

May	20½	tons	per acre.
June	20¾	"	"
July	22¾	"	"
August	6½	"	"
September	10½	"	"
October	4½	"	"
Monthly mean	14	"	"

Or thus illustrated in order of earliness :—



3.—Permanent Pasture.

We cannot too often impress upon the Province that, in connection with mixed farming, root cultivation and so much permanent pasture are the building up of our best agriculture—they are the surest foundation of our future success. A big chapter could be written on this subject, but all that can be looked for in this report is to abstract its important features, and hint at some of its advantages :—

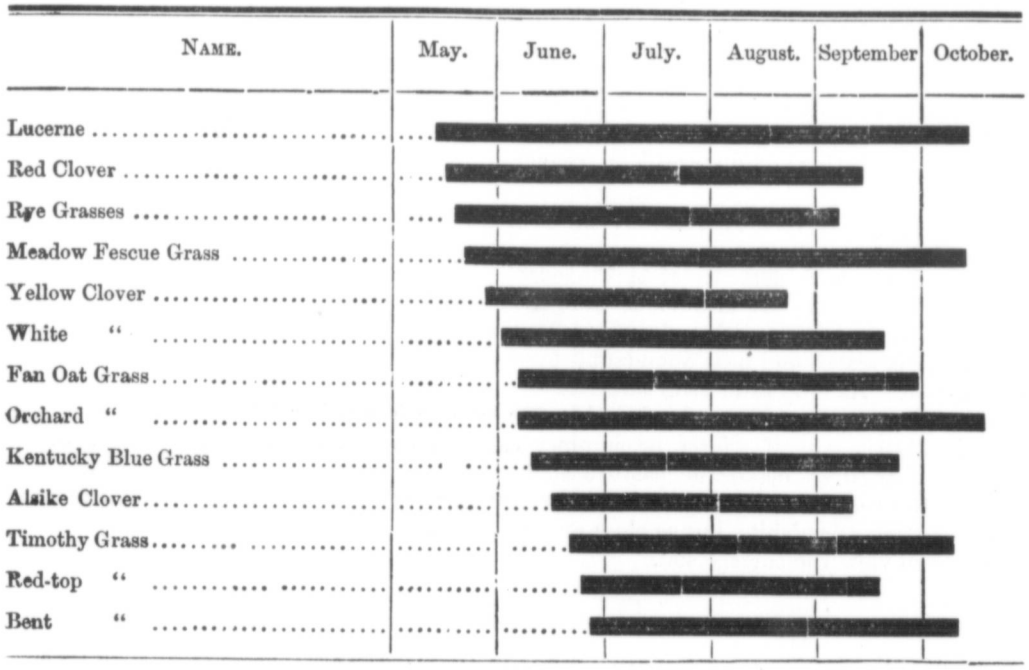
(1) It gives several crops per annum.

When a variety of grasses and clovers are established in association, the case is one much similar to what nature, under the best of circumstances, offers to animal life—a change every week from May to October. It is then a point to be studied in choosing

the kinds, that they do not all, or even many of them, come during one month or leave off altogether at the same time of the year, but come and mature and go off, if possible, in regular succession from spring to autumn. Thus every week, or every month at least, is equal to a change of field, and secures the value so much desired through such conditions.

Beginning in 1878, we have had great satisfaction in handling nine grasses and five clovers in connection with this subject, as thus illustrated, showing the order in which they come, and their duration each season. Of course the red clover generally leaves us after two years, but it is well to have a little at the start in order to get all we possibly can.

Grasses and Clovers for permanent pasture as found reliable in Ontario.



The quantity of each may be as follows :—

Grasses.		*Clovers.*	
Timothy	7 lbs.	Lucerne	4 lbs.
Orchard	4 "	White	3 "
Italian Rye	2 "	Red	1 "
Perennial Rye	2 "	Alsike	1 "
Fan Oat	2 "	Yellow	1 "
Red-top	2 "		10 "
Meadow Fescue	3 "	Grasses	25 "
Bent	1 "		
Kentucky Blue	2 "	Per acre	35 "
	25 "		

Note.—The Rye grasses will hold in the most favourable positions in Ontario, in association with others, but rarely alone: they are the best English fodder plants, and should be encouraged with us.

(2) IT OFFERS AN EARLIER AND LATER BITE THAN OTHER PASTURES.

It is a well-known fact in the growth of pastures where a number of different plants exist, that by such an association there is mutual support, nursing, and shelter, which give early and late growth. In our own experience we have much earlier offers than what are represented in the foregoing diagram, many of the grasses and clovers coming in middle and end of May. The value of this early bite is something incalculable after a long, close winter, and particularly, it meets the heavy "back-going" of which we see so much in ordinary practice among cattle and sheep. So also, the rich "foggage" sends on deep into winter.

(3) ANIMALS ARE MORE HEALTHY AND LESS LIABLE TO DISEASE UPON IT.

All experience goes to show that browsing animals more than others require change of food often, not only in the form of soft succulent growth, but harder and woody matters at the same time. Some of the grasses and clovers are also directly medicinal to cattle and sheep, so that altogether, with a choice of ten or twelve throughout the season, health is better and diseases less frequent.

(4) IT CANNOT POSSIBLY BE DESTROYED BY DROUGHT OR FROST.

The immense importance of this needs little comment—it comes strongly home to us in this country. It is obvious that as association of plants and roots gives mutual support and protection with a close surface, there is necessarily much less risk of damage when rain is scarce and heat abundant—much less evaporation and less "cracking" of the surface. As crop after crop succeeds each other week by week and month by month, the soil is not exposed to the burning sun, and moisture is retained to nourish at all times. Then again, if winter or summer excesses do kill two or three kinds, there remains enough to make the pasture still of greater value than anything else. All through the very severe drought of this season our permanent pasture was never bare, never wanting a fresh bite, but so close and strong that we had to separate with the hand in order to view the surface soil.

(5) IT GIVES MORE DAIRY PRODUCE THAN ANY OTHER FORM OF FODDER.

During the last half century the best managed old pastures of England have stood at more value per acre than the richest arable land, partly because of their permanency of crops, and largely because of their being able to graze *three cows per acre.* There seems no reason why Ontario cannot do *one-third as well* as this, and I am convinced it can be done. For three years in succession on our farm, on a small scale, on comparatively old permanent pasture, and on that of two years' standing, we have clearly proved that *seven sheep* per acre can be well done to. This is equivalent to one and one-quarter cow per acre. There is, then, no other form of fodder that can do the same thing.

(6) IT GIVES THREE TIMES MORE BEEF AND MUTTON PER ACRE THAN OUR ORDINARY ROTATION PASTURES.

The average timothy and clover pastures of the Province, in connection with mixed farming, just graze, on an average, one cattle beast to every three acres—taking from 1st May to 1st November on an average of years. This is substantially correct. But we have shown, in the preceding paragraph, that three and three-quarter cows can be kept on three acres of the permanent kind required, and as the proper stamp of two-year-old steers and heifers preparing for the butcher eat more than an ordinary milk cow, we shall say one beefing animal per acre. There are at the present time about 20,000,000 arable acres in Ontario, possessing practically no permanent pasture, but 3,500,000

acres of rotation pasture that do or should therefore maintain 1,190,000 head of, say, beefing cattle. Were only *one-tenth* of this rotation pasture under the permanent form of it, the annual gain to the Province would exceed $11,000,000. The magnitude and national value of a few acres, per farm, of first-class permanent pasture is thus apparent.

(7) IT CAN BE USED AS A SOILING CROP ANNUALLY.

When everything is most propitious and grass abundant, and where a number of bulls and calves are housed during summer, and a reliable cut of green fodder is most important, this can always be had from well-managed permanent pasture, early and late, at the rate of ten tons per acre, green weight, where no systematic soiling crops are upheld.

(8) IT IS LESS EXPENSIVE TO PRODUCE AND MAINTAIN THAN ANY OTHER CROP.

While it cannot be maintained that there is no trouble, time, and expense incurred in establishing successfully all that we desire in this connection, nor that its permanency and value can be upheld without top-dressing materials, it is not difficult to see that once fairly afoot, permanent pasture costs a great deal less per acre per annum proportionately to produce received than any other crop can possibly do.

(9) IT IS A CONTINUAL SOURCE OF RELIANCE AND WEALTH.

Most other things may fail during a particular season, times may be bad, and disease decimate the farm, yet the permanent pasture will smile and invite a share of its wealth.

(10) IT IS PERMANENT.

The successful establishment and maintenance of permanent pasture implies:

1. A soil free of dead water.
2. A rich surface, friable but firm.
3. Depth of soil to allow roots beyond reach of drought.
4. A retentive soil to resist drought and hold moisture.
5. Securing *variety* of grasses and clovers and thick seeding.
6. Easy pasturing for first two seasons.
7. Heavy stocking, to keep down rougher plants.
8. Top-dressing at least every third year.

CHARACTERISTICS OF GRASSES NOW ESTABLISHED SUITABLE FOR PERMANENT PASTURE.

The past season has been one of the very best to test thoroughly the reliability of all pasture plants, and note their conduct in comparison with each other, particularly as regards endurance during drought, which stood very hard on 30th August, when the following observations were made:—

Red-top.—A good tough sod, about equal to Timothy, though presenting no bite.

Perennial Rye.—Looks fresher and better as pasture than Red-top and Timothy.

Meadow Fescue.—Stands drought better than Orchard or Timothy; is now close, rich, green, and vigorous.

Italian Rye.—Not good; few plants; is good at re-seeding itself every season.

Kentucky Blue.—Wiry and dry with a good sward.

Timothy.—Very good, but presents no bite for cattle; dry and somewhat withered; takes a fourth place.

Orchard.—Somewhat behind Meadow Fescue and Fan Oat, but not much.

Fan Oat.—About equal to Meadow Fescue, which is saying a great deal.

PLOT 36, FIELD C.

Four years' Cropping after Farm-yard Manure and three Special Fertilizers. All weights in pounds.

	1878.			1879.				1880.				1881.		Total results in quantities per acre for four years.
	Mangolds.	Turnips.	Carrots.	Wheat.		Barley.		Oats.		Wheat.		Oats.		Wheat.	
				Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	
Farm-yard Manure	48,480	19,440	30,480	2,800	780	5,040	1,584	4,400	1,974	1,040	95	2,400	960	1,970	1,565	123,108
Mineral Superphosphate..	45,600	16,560	31,800	2,560	680	2,800	1,360	3,280	1,622	960	140	2,360	880	1,910	1,362	113,874
Nitrate of Soda	52,200	1,680	33,840	2,640	720	2,960	1,520	4,240	1,785	960	70	2,350	800	2,220	1,371	109,346
Bone Dust	34,800	1,920	32,400	2,560	720	3,040	1,280	3,840	1,360	560	20	2,040	800	2,390	1,331	89,061

4.—Indian Corn.

Six kinds received from S. White, Esq., of Charing Cross, Ontario, all without names except one, the others being numbered, produced under the ordinary mode of cultivation, as follows, per acre:—

———	Grain, in Bushels.	Stalks, in Tons.
No. 1	43	5½
No. 2	34	4⅛
No. 3	18	3⅛
No. 4	18	2¾
No. 5	46	5⅛
Crompton's Early	30	2⅛

5.—Potatoes.

Crop 1881, in order of Quantity per Acre.

Variety.	Bushels per Acre.	Remarks.
Peerless	191	Large; no smalls.
Success	182	Medium size.
Late Rose	176	" "
St. Lawrence	174	All small-sized.
Eureka	173	Fair.
Perfection	171	Small.
Early Ohio	169	Medium.
Extra Early Vermont	169	Very small tubers.
Brownell's Superior	150	Small and poor.
Beauty of Hebron	147	Very small.
Snowflake	144	Small; few large ones.
Compton's Surprise	142	Very small.
Brownell's Vermont Beauty	134	Medium in size.
Average	163	Bushels per acre.

6.—Farm-Yard Manure and Special Fertilizers on Mangolds, Sugar-Beet and Carrots

——	Farm-Yard Manure.	Guelph Superphosphate.	Marcon's Superphosphate.
White Sugar Beet	1,412	960	1,128
Orange Globe Mangold	966	1,045	1,402
White Belgian Carrot	347	233	282
Mean	908	746	937

7.—The Growing of Large Roots in a Dry Season (1881).

Variety.	Average Weight of each Bulb.	Bushels per Acre.
	lbs.	
White Silician Sugar-Beet	7.7	1,167
Fisher Hobbs' Orange Globe Mangold	7.4	1,124
Yellow Globe Mangold	7.1	1,083
Norbiton Giant Long Red Mangold	6.7	1,029
Large White Sugar-Beet	6.2	936
Carter's Warden Prize Mangold	5.4	916
Mammoth Long Red Mangold	5.0	739
Red Globe Mangold	4.7	689
Kilmorin's Sugar-Beet	4.0	658
Scottish Champion Swede	4.0	615
Mean	5.8	896

8.—Continuous Crops of Cereals after Clover, and Fallowing, separately.

The object here is to follow up the effects of (A) a preparation of two years' growth of clover (Lucerne), and (B) of a bare fallowing heavily dressed with farm-yard manure—in preparation for continuous crops of cereals. The facts for two years are already in our hands, and I have much pleasure in submitting the following abstract thereof:

Preparation.	1880. Oats.		1881. Oats.		Total Results thus far.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	B. lbs.	lbs.	B. lbs.	lbs.	B. lbs.	lbs.
Clover	38.10	4,020	50.00	2,210	88.10	6,230
Fallowing	29.24	3,210	33.18	2,060	63.6	5,270

Before commenting upon this, it is of importance to observe that the Province is considerably interested in the question of fallowing or no fallowing, and also of the value of clover as a preparation for other crops. There are those who maintain that advanced farming cannot possibly recognize the want of one crop out of seven or eight, as either sound in principle or at all required by the necessities of any particular circumstances—that having to give a year's rest, or cleaning, or whatever it may be called, is evidence of want of ability, if not of ignorance. They show that under a proper system of rotation, having as its base a thoroughly managed root division, there cannot possibly exist any necessity for allowing one year to go without a crop, which simply means a loss. On the other hand, there are those who contend that summer or bare fallowing is indispensable to the best success in very many cases, particularly on soils of a heavy character, where cleaning and atmospheric influences do more than root cultivation. They argue that it is natural to allow a rest, and altogether there is such a gathering up of good things as more than compensates for the want of a crop throughout a rotation course. Apart from these practices, some others advise that all virtue, permanency and the greater wants of all vegetable life can alone be had from the growth of clover and its application as a direct manure. They point to chemical facts and experience in confirmation, and say they avoid the extremes of no crop and of expensive production of exhaustive roots.

So, then, we take up meantime the question of Clover *versus* Fallowing. The plot is a clay loam of medium physical character, which was neither rich nor poor by previous cropping or manuring; it is very uniform both as regards soil, aspect and management before 1880. In 1878 one-half (A) was spring seeded broadcast with Lucerne, which then, and during 1879, gave fair crops for soiling—roots being traced as deep as two feet. The other half (B) was bare fallowed in 1878 by being repeatedly ploughed during summer, and receiving 20 loads per acre of farm-yard manure covered under with the last ploughing in the fall; in 1879 turnips were sown, but proved a failure—very few plants came, but cultivation was carried out, and thus practically, therefore, it had another year's fallowing.

The foregoing abstract of the two first years' cropping of oats after these preparations shows a most decided result in favour of clover—a result of such a sledge-hammer character as must place clover men in the big chair for some time to come. During the first season clover gave thirty per cent. more grain and twenty-six per cent. more straw, and the second year no less than fifty-two per cent. more grain, though only seven and one half per cent. more straw. Financially, for the two years, we have from—

Clover preparation ..... $23.60 per acre per annum.
Fallowing ..... 16.60 " "

A difference of no less than two rents per annum in favour of clover, without reference to any items, more or less, on either side, in regard to cost of such preparations. What has the farm-yard manure been doing, and where are the gathered virtues from rest and

atmosphere? Is there more in the Lucerne form of clover than in our ordinary Red variety, or does the value lie as much in their being agents in tapping subsoil fertility as well as direct manures? Meantime we must bow to the clover men.

9.—Hay from Nineteen Forms of Fertilizers, as applied in 1879.

MANURES.	Lbs. of Hay per Acre.
Bone Dust and Salt	4,000
Farm-yard Manure	3,440
Bone Dust	3,400
Bone Superphosphate	3,280
Mineral Superphosphate	3,200
Mineral Superphosphate and Gypsum	3,080
Gypsum	3,040
Lime	2,720
Bone Superphosphate and Salt	2,680
Bone Superphosphate and Bone Dust	2,480
Mixture of all	2,480
Unmanured	2,320
Salt	2,080
Mineral Superphosphate and Bone Dust	2,000
Bone Superphosphate and Gypsum	2,000
Mineral Superphosphate and Salt	1,880
Bone Superphosphate and Mineral Superphosphate	1,840
Gypsum and Salt	1,680
Bone Dust and Gypsum	1,670
Nitrate of Soda	1,040
Average	2,515

This is upon part of farm field No. 9, that is under regular rotation. In 1879 the crop was turnips and spring wheat, seeded with grasses and clover in 1880—hence the hay of this year. The manures applied to roots in 1879 were 500 lbs. per acre each when alone, and 250 lbs. when associated; farm-yard manure 20 tons, and lime 3 tons per acre.

The produce of hay was affected by four things: weather, irregularity of surface, kinds of grasses, and clovers that predominated in each plot, and by the fertilizers. Now, there is really more than is at first sight apparent in the influence of weight of crop here by the kinds of plants. We sowed—Timothy 4, Orchard 2, Red Top 2, Red Clover 6, Alsike 3, and White Clover 3 lbs. per acre. Whether owing more to manure influence, or to irregularity of surface, or to weather, it is difficult to say; but there were seven distinct classes of hay crops where one or more of the grasses or clovers predominated,

and thus unquestionably affected the yield by weight. While, therefore, to some extent unreliable, it is very interesting to note the great range of produce from bone dust and salt down to nitrate of soda—from two tons to one-half ton per acre. Using the unmanured as a dividing line, it is impossible to assign the exact reasons why most of the *associated* fertilizers should be below, and most of those acting alone are above this datum.

10.—Sundry Small Experiments.

1. The French poppy matures and bears full seed here. Seed got from Ontario Immigration Agent, Havre, France.

2. The Soja beans obtained from Mr. Bruce, of Hamilton, have done well, half crops producing fifteen bushels per acre. A low-branched bush one foot high, some individual plants had 125 pods, with two and three in each pod.

3. Fertilizers applied to roots at different stages of growth, for the first time this year, have given such a varied result, that a detail report is held over until 1882, when further experiment will make more interesting and reliable.

4. As usual, we grew about 200 varieties of wheat, oats and barley for purposes of comparison, class room instruction, and for the making of sample books for distribution.

5. The heaviest crop of sugar beet or mangold this year was from seed of our own maturing and preparation. White Silician variety of beet.

6. In field No. 8, where apatite was used against farm-yard manure in 1879, the crop of turnips this year was slightly the best from apatite.

7. Again, the sugar cane matured at our high elevation (900 feet above Lake Ontario; 1,120 feet above sea). The Chinese variety is much the earliest, the Early Amber being later.

11.—Experimental Notices.

1. We have 42 different kinds and associations of grasses and clovers by this year's seeding in preparation for further evidence regarding suitability for the Province.

2. We are continuing the test of over 100 varieties of wheat, oats and barley, part evidence of which appeared in 1879 and 1880 Reports.

3. The very important experiment of the feeding of cattle with peas, oats and corn is being continued, with nine yearling steers and heifers in three batches, each batch receiving a change of food every two months.

4. We have in view for winter 1882-3, to place against each other in feeding, the first cross of Shorthorn upon Canadian cow; Aberdeen Poll upon Canadian cow; Shorthorn upon pure bred Ayrshire cow; and Hereford upon Canadian cow.

5. We have on hand, in preparation for next year's fall shows, twelve stamps of mutton and wool, by shearling wethers and ewes.

V.—THE GARDEN.

Our Horticultural work in all its branches was never so full nor so well overtaken as during the past season. Mr. Forsyth's management is unassuming, yet reliable and thorough. The Committee of the Fruit Growers' Association will report to you in regard to fruit and forest tree cultivation here, so that all I need submit at present is the Gardener's report to me on the general work of the year. Following the recent appointment of a Professor of Botany and Horticulture to our College, we look forward with great pleasure to increased interest in this department, and to the more intimate association of its science and practice.

Mr. Brown:—*Sir*,—In briefly reporting to you on the Horticultural work of the past year, I would say that notwithstanding many reverses, arising principally from causes beyond our control, the results as a whole have been encouraging and quite equal to expectation. The unusual severity of the winter (1880-81), extending over the length and breadth of the Province, left its traces on all tender and untried varieties of

fruit trees and shrubs, even killing many that had hitherto stood the test of years and thought to be well established.

The young trees planted here, on the laying out of the Kitchen Garden five or six years ago, have suffered much from the above causes. Forty-four pear, six plum and seven cherry trees were found to be worthless, and had to be consigned to the rubbish pile—although up to this a more healthy, vigorous and promising lot of young trees, just coming into fruit, could seldom be met with. The smaller fruits suffered less: Gooseberries and Currants had their usual attack of caterpillar, but those being kept under, they did as well as usual. The more persistent attack of mildew on the English varieties of Gooseberries is less easily overcome, and I fear will continue to be a drawback to their more extensive cultivation. Grape-vines were vigorous and the fruit abundant. The season may be said to have been exceptionally favourable for the vineyard: having escaped the late spring and early fall frosts, with the unusual drought of August and September, did much to mature doubtful varieties and improve all. Lindley, Delaware, Concord, Rogers' Nos. 4, 19, 33 and 44, with some others, produced largely and ripened well. Adirondac, Iona, and Salem were slightly affected by mildew, but all bore heavily, and the general result was most satisfactory.

The Apple crop, like that generally throughout the Province, was limited in quantity, and the quality of fruit hardly up to the average sample. All through the month of May and first half of June the nights were cool, and vegetation backward: consequently early vegetables were for the time scarce, but after this all culinary vegetables were very plentiful. Many of the staple sorts—Potatoes, Cabbage, Carrots, Beets, Parsnips, Peas, Beans, etc.—were specially abundant in their season--Tomatoes producing at the rate of 500 bushels to the acre.

On account of the long-continued drought and scarcity of water, which had to be obtained in limited quantities from various sources at the cost of much time and labour, the Flower Garden, I regret to say, had not at any time during the summer that fresh and luxuriant appearance which might have been expected, from the increased number as well as the many additional species and varieties of bedding plants which we had taken some interest in collecting. Yet under these adverse conditions they kept growing and blooming, so that when compared with others elsewhere they were pronounced by many to be wonderfully fine.

From the amount of extra labour in this department throughout the season, and especially in the spring months, in laying out and planting nearly twenty acres of a new Orchard, including Apples, Pears, Plums, Cherries, Gooseberries, Currants, Raspberries and Strawberries, as well as nearly two acres of Grape-vines, and an arboretum composed of over 300 different species and varieties of trees and shrubs, under the supervision and direction of the Fruit Growers' Association, and which will no doubt be reported on elsewhere, you are aware that not a great deal could be accomplished in the way of new work or permanent improvements; yet this has by no means been overlooked when time and opportunity permitted. During the summer the dilapidated wooden verges of the Kitchen Garden, which from the first were of a temporary character, and in their decayed state have been an eyesore for years, have been removed and substituted by what we consider a more permanent and less expensive article, namely, small boulders, or the larger-sized pebbles collected from the field, costing only the labour of drawing and laying them, and which now present a neat and rather unique though somewhat rural appearance. Other minor alterations have also been made, and some gravel thrown on to the walks and drives, but in this there is yet much to be done.

Some few additions have been made to our stock of Greenhouse plants, and all continue increasing, and are as healthy as can be; still the list is very limited and incomplete compared with what might reasonably be desired, consisting as they do principally of soft-wooded plants, no money having ever been spent for this purpose; but it may truly be said that we have all in number and perhaps in value that the space will accommodate. The houses and workshops connected therewith, as you well know, are in a very incommodious and unsatisfactory condition. Constructed from the first on a very primitive and contracted plan, especially the system of heating (by flues),

which is very imperfect and defective—even dangerous, requiring the greatest care to avoid the very probable possibility of fire. Indeed the whole structure (workshop included) is not equal to what we see in the possession of many unpretending florists or market-gardeners throughout the country. I may here express a hope that you will use your influence to have the proposed new Greenhouses erected the coming season; and in this event I would suggest that one of the smaller houses should be so constructed in the internal arrangements that it would be suitable for forcing such as Lettuce, Radish, Rhubarb, etc., and thus supply a very pressing and growing demand of the Boarding-house during the spring months, when vegetables are scarce and can hardly be produced in sufficient quantity by any ordinary amount of hot-bed frames.

As you are aware, during the winter months, when outdoor work was impracticable and students' labour could not be so profitably employed, about two hours each day were spent on practical instruction in the Greenhouses.

The various ways of root and top grafting were explained and practised by the students; also, the mode of propagating greenhouse and other plants; the watering, temperature and moisture required; the different systems of heating, and the potting, growing, hybridizing, and selection of plants generally; the composition of desirable soils for potting purposes; the insect pests that usually attack inside plants, with the means of getting and keeping clear of them; also the common and technical names of the plants we have, with the natural orders to which they belong. In all this the students generally manifested considerable interest, and, indeed, passed a very creditable examination at the close of the session; and not a few have so expressed themselves as looking upon these exercises of more real value to the practical man than the more tedious study of systematic Botany or Vegetable Physiology. It seems surprising how little the majority of intelligent young men know of the Pot culture and management of plants. In this I believe that many could profitably take lessons from their elder or younger sisters. It is perhaps to be regretted that these practical lessons cannot be carried out to a greater extent into the Kitchen and Flower Gardens, the Orchard, the Vineyard, and Arboretum. This, however, cannot be done during the spring and summer months, unless more skilled labour is employed. One of the principal difficulties to be contended with in this department is to get the amount of work accomplished by student labour, with advantage to them and justice to what is required of them—that is, to get the work accomplished in a satisfactory and workmanlike style; and with a growing demand for skilled labour, this want is greatly on the increase.

VI.—THE MECHANICAL.

Mr. McIntosh has taken us through a year of unusual activity—in what and how much, his letter to me gives a good idea. I am still dissatisfied that this department remains unacknowledged as technically educational. Of course we are much pleased with what it does for all the others practically, but so many students desire to devote part of their time with us, to the higher lines of mechanics, that unless the foreman's hands are strengthened by systematic help throughout, the most of them leave incomplete even in what pertains to farm work alone. I do not think that anything should be attempted beyond what attaches properly to an Agricultural College, but in this *everything* should be thoroughly well done—time given, and the necessary help given to do it. The foreman should have more leisure to superintend, to advise, to instruct, to describe, to use the blackboard, and should not be tied, as he necessarily is at present, to working with his own hands, running from place to place, and sharping tools.

Mr. Brown:—*Sir*,—In accordance with our usual custom of giving a summary of operations that have engaged our attention in connection with the Mechanical Department for the last twelve months, I find, by referring to the time book, that after the routine of examining the new students, the machinery attaching the engine to drive the root and straw cutters and chopping mill were overhauled and put in trim by the addition of a counter shaft and pulleys, belts, etc. We have obtained a decided advantage over the former way. While this was going on, another part of the students were engaged at repairs about the college, and putting on the winter windows and fitting and glazing new ones for addition

to the buildings. Considerable repairs were also done to the dwelling houses of the farm hands, and all necessary repairs about the farm buildings. Prominent in this line was the fitting up of the instruction stable with iron stalls, feed boxes, hay racks, etc., the walls were likewise lined with tongued and grooved stuff, and now it is a well-finished and comfortable stable.

The want of a proper place to store away the farm implements, when not in use, had long been felt; the erecting of such a house or shed had been kept in view for some time. About the 1st of January it was decided to prepare for such a building by providing timber for the frame-work from the farm bush, and allowing the students to do this and have it ready for raising. We were in a position to put together by the time the frost was out of the ground; the building is 100 feet long by 27 feet wide, one storey divided into eleven compartments, giving ample room for the implements now on hand. The garden department must not be overlooked, as it brings considerable work to the mechanical in the way of repairing implements, tools, glass, hot beds, etc. Perhaps it will give the best idea if I submit one day's proceedings in the distribution of students and their various employments during forenoon and afternoon, and as I have the journal open at page 144, Feb. 23rd, 1881:

Students' Names.	Employment.	Hours.
	A.M.	
Grant	Repairing stable door	4½
Tronson	" "	"
Dewar	Getting out timber in bush, for implement house	"
George	" " "	"
W. McIlquham	Hewing timber, for implement house	"
McLaren	" "	"
McCauly	Making whiffletrees	"
Hill	Repairing locks for stable doors	"
Shaver	Clerk	"
Wyndham	Agent, taking orders from other departments	"
	P.M.	
Ballantyne	Repairing hay-rack	3½
W. Phin	Filing saws	"
Chipman	Clerk	"
Surtees	Framing timber for implement house	"
Nicol	" "	"
Clutton	" "	"
J. McIlquham	" "	"

About the 1st of March we got some shafting, pulleys, etc., in order to have a circular saw rig in the shop to be driven by the engine, at a cost of about $150. In this we have also an edging table, with 24-inch circular saw and one for small saws; with these we not only do the work quicker, but as a point of education they are a success, and in this connection there are some things required for the department, viz., a turning lathe at say from $60 to $80, and a surface planing machine at $200, all to be drawn by the engine.

During the same month all the farm implements were examined and the necessary repairs completed ready for spring operations.

April 5th.—Commenced erection of tool house; this building is 84 feet x 26, frame, with brick foundation, lean-to roof, one part 20x26 feet used for farm foreman's office, the remaining 64x26 feet, required for storing farm tools, such as forks, spades, hoes, rakes, scythes, etc. There were now sixteen students given to this department at each distribution and to find employment for that number we began to erect the implement house at the same time as this building, and to a large extent they were under the control and direction of the more advanced students. Both these buildings are nearly

complete; the exception being some doors, shelving, etc., which are now being attended to.

About the 1st of May you handed me a plan for shed and airing-yards for bulls; this building, 40 feet 6 inches x 55 feet, 13 feet 4 inches in height to plate, is likewise frame, having six loose stalls 14x14 feet, with airing yards for each 14x20 feet, and compartments for straw, roots, and grain, all on the ground floor, and a large granary overhead. This building stands upon 58 cedar posts sunk 4 feet into the ground; commenced to build 1st day of June, but owing to some delay in getting material forward, it was not pushed on until near the end of the month, and completed so far as to receive the animals by the 1st of August,—students doing the greater part of the work.

In the matter of field-fences we did not accomplish quite all that was intended; there was, however, about 20 rods of board fence run along what is known as the south lane, enclosing one side of fields 2 and 3, and about as much of wire fence enclosing one side of fields 17 and 18, with all repairs of existing fences, shifting gates to more convenient places in fields, also making and putting on new ones where required.

With regard to instruction, I have not been able to give explanations so thoroughly as desirable, and this is partly owing to the intricate nature of the work, the want of experience on the part of a great number of the students, and the limited time they are in the department. I feel it to be my duty to suggest through you to the Government that there be an assistant in this department, and that each student be taught not only the use of tools and how to apply them properly, but also be able for himself to put them in proper order.

VII.—The Ontario Experimental Farm Balance Sheet, Year 1881.

REVENUE.	$ cts.	$ cts.
Grain sold	584 85	
Wool sold	238 35	
Animal service fees	248 50	
Live stock sold	4,536 15	
Miscellaneous receipts	7 75	
Gross cash receipts	5,615 60	
Allowance for keep of ten cows for College use	350 00	
Keep of six cows for farm hands (now withdrawn)	210 00	
Keep of Garden, College and Superintendent's horses	305 00	
Half cost of keep of two instruction teams	100 00	
Allowance for maintenance of three breeds of cattle (Ayrshire, Galloway and Devon), nine head, as educational—less value received from sales thereof	195 00	
Allowance for maintenance of three breeds of sheep (Merino, part Cotswold and part Leicester), as educational—less value received from produce thereof	55 00	
Keep of one breed of swine, as educational—less value received from produce thereof	25 00	
Horse labour supplied to Experimental Department	180 00	
" " College	45 00	
" " permanent improvements	75 00	
Wages of extra farm hand to assist in superintending student labour during summer	180 00	
Wages of Instructor on Farm Practice	396 00	
Manure supplied to Garden	65 00	
" " Experimental Department	103 00	
Loss of crop from land occupied by Experimental Department, new orchard and tree clumps	110 00	
Extra labour in maintaining "appearance" over Farm, half time of one man	180 00	
Labour on tree clumps and shelter-belts	85 00	
Value of farm produce (potatoes, wheat, etc.) supplied to College	560 00	
Carpenter work (College), permanent improvements, etc.	90 00	
Fuel supplied to College	90 00	
" " farm hands (now withdrawn)	210 00	
Extra expenditure in purchase of implements, and repair of same	185 00	
Extra expenditure in harness, horse-shoeing, etc.	95 00	
Rents paid for Farm and Garden Foremen	208 00	
Labour in making roads—thirty days of three teams, with four extra men	390 00	
Garden produce supplied to College		

EXPENDITURE.	$ cts.	cts.
Farm.		
Labour paid for, including ploughmen, instructors, harvest help, public sale, etc	3,533 63	
Manures other than farm-yard	275 86	
Seed bought	292 95	
Implements	326 50	
Live stock bought—horses, cows, sheep, pigs	749 62	
Feed purchased this year during fall being cheaper, in place of doing so in spring and summer of 1882—principally oats, bran, middlings, and peas	2,202 55	
Repairs and alterations on buildings, machinery, implements	1,204 45	
Medicines to live stock	68 25	
Printing and advertising	190 95	
Public sale expenses, other than regular labour	190 19	
Rents of houses for Farm and Garden Foremen	208 00	
Permanent improvements—buildings, machinery, etc.	100 00	
Unenumerated	287 37	
Gross Farm expenditure		9,630 32
Garden.		
Labour, including Fruit Grower's man	1,064 40	
Seeds	46 25	
Implements	118 40	
Repairs	60 71	
Unenumerated	31 64	
Gross Garden expenditure		1,321 40
Grand total cash expenditure		10,951 72
Students' labour in Farm, Garden, and Carpenter Departments for twelve months	5,130 68	
Less half allowed as educational encouragement		2,565 34
Balance to credit		13,517 06

Fuel supplied to College		50 00				
" " farm hands (now withdrawn)		90 00				
Extra expenditure in purchase of implements, and repair of same		210 00				
		185 00				
Grand total cash expenditure						10,951 72
Students' labour in Farm, Garden, and Carpenter Departments for twelve months			5,130 68			

Extra expenditure in harness, horse-shoeing, etc		95 00				
Rents paid for Farm and Garden Foremen		208 00				
Labour in making roads—thirty days of three teams, with four extra men		390 00				
Garden produce supplied to College		350 00				
One man attending to Fruit Grower's work, pleasure grounds, etc.		324 00				
			10,776 60			
Farm produce on hand 1st November, 1881—						
Wheat	150 bushels at $1.26	189 00				
Oats	900 " 0.40	360 00				
Barley	207 " 0.70	145 00				
Peas	100 " 0.75	75 00				
Turnips	8,000 " 0.08	640 00				
Mangolds	4,600 " 0.10	460 00				
Carrots	200 " 0.15	30 00				
Hay and straw	100 tons	700 00				
Increase to live stock by own produce, on hand—						
Cattle	$625 00					
Sheep	845 00					
		1,470 00				
Manure on hand, 60 tons		120 00				
			4,189 00			
Total Revenue			14,965 60			

Less half allowed as educational encouragement			2,565 34
			13,517 06
Balance to credit			1,448 54

NOTE.—The extra expenditure of 1881 over previous years consisted in (1) purchase of feed in preparation for 1882, (2) extra instruction team of horses, (3) rents of houses, and (4) large permanent improvements executed by farm hands, amounting in all to about $2,100; and of course live stock purchases and house rents should be on capital account.

Taking the area under cultivation as 375 acres, there results:

Cash sales revenue per acre	15 00	
Revenue from produce on hand per acre	11 50	
	26 50	
Credit from other sources per acre	12 00	
Cost of regular labour per acre	7 60	
Cost of student labour per acre, as reduced	5 10	

Showing that one-half the expense of the Farm is not connected with ordinary management.

Total Expenditure		14,965 60

VIII.—CONCLUDING REMARKS.

Seven years' work of the Ontario Agricultural College and Experimental Farm are now finished. The experience gained by the Government and their officers in regard to the value of such an institution must be almost full. If not nearly full, then weakness exists somewhere—where, it should be the duty of the public to enquire. But, as Ontario records already tell, our success in securing home patronage and the world's patronage during this comparatively short period has been quite a feature in school history—for we are essentially a school, and the unusualness of this bids me draw your attention to some points that may ere long tend to mar this comfortable popularity. I am not one whit apprehensive of evil, but rather jealous of the status already attained, and of the value of its being made more permanent.

I must preface by stating that too much is expected of us—entirely too much. I do not refer to those ignorant of the modern idea of scientific and practical farming, because their opinion is not worth anything; but to the expectations of the over-anxious father and of the un-self-reliant student. This is no doubt a weak point in more lines of life than ours, yet it has been more ours of late than older institutions, by reason of our short life. With very many of the young men who have come through our hands during these seven years, the expectation has been that they came to gather, without the necessity of much effort on their part, that they could be made farmers in two years, as against the life experience of the past generation. That this is purely ridiculous we need not delay to inquire, but it must be held up to the country that no possible amount or value of instruction on our part will ever make the farmer unless he is himself in love with it. Let it be clearly understood that the two years with us means only an introduction to such a measure of principles, science, and practice as but whets the appetite for more, and that we are as unable to fledge a young man for this profession as the Toronto University is in turning out a lawyer, a doctor, or a clergyman.

We have it in our experience that no volume of brain activity and practice is able to farm unless accompanied by that measure of madness called enthusiasm. Those thus constituted have always done well here—thankful of the advantages, never complaining of want of appliances—and altogether stand out in strong relief to others whose minds may be above clods and cattle. We have never yet had an example of keenness accompanied with dissatisfaction. And now for a weakness or two:

I should like to see more opportunities in the hands of the Professor of Agriculture, whereby with his classes he should visit such works and objects on the Farm in their monthly and weekly progress as may be required to supplement, verify, and impress lectures, as well as being separately and immediately practical in their aim. Many important things are necessarily missed by a certain number of the students, who, while at study, cannot be with those others who are finishing a certain job on a certain day; and all the explanatory talk by the teacher in the class-room cannot possibly make up for the same thing *on the spot*. In the same way the Professor of Botany and Horticulture should have an open card for the many important references in the kitchen, flower, and fruit gardens, as well as the arboretum. Even the Chemist should go a-field occasionally; and why not the Entomologist? As being more immediately interesting to myself, I beg that the Veterinary Professor be also permitted to take his classes out whenever he deems it desirable. I consider "class-room-out-door" lessons of the highest value.

But the most prominent weakness in my departments is one that I have more than once adverted to in previous Reports—the being unable to give *repeated* lessons to every student in every practical detail of the Farm. The Government has met us very liberally in regard to part of this by allowing an extra team of horses for the use of Second-year Students, and more they cannot be asked to do until some practicable and thorough scheme is matured. Ploughing and management of reapers and mowers come more closely under this list, for in most other things we do a great deal.

Indeed, in place of crying "More—more," we ought to refrain by calling "Less—much less." We cannot blink the fact that education is being pressed too hard here; the

students do not say much about this, because the admission might be a reflection upon their capacity, though it would be only so in appearance. No young man, or old either, is able to do well to himself and others by attempting in two years all that is offered by our curriculum. That some have taken every year First Class Honours is no conclusive evidence whatever of well-appropriated materials. The best evidence to us is the inability of the average student to acquit himself to his own satisfaction, and it is the average man who should guide.

Along with these critical remarks, I think it is also mine officially to say something on our progress, though undoubtedly well done in another form in this issue. President Mills has taken us through a year of unusual activity in the College and lecture-rooms. There are not half-a-dozen men in the Province able by experience or by intuition to weigh what it is to have the care, in all its variety, domestically, morally, and educationally, hour by hour daily for months in succession, of one hundred and thirty young men, in one house, one-half of whom are neither boys nor men; it is a position few are able to fill, and few need covet. The fact then of so few troubles having occurred during this our first year of a roll of over six score speaks much for the President and for the students.

I could make you up another report, nearly as lengthy as this one, of communications from ex-students, now in many parts of the world, telling their experiences—failures and successes—but all delighted to hear from the "O. A. C.," and expressing warm gratitude for their connection with it. Indeed, the present year is one marked by the return of three or four of these, of the most practical stamp, who, after leaving us, and having to fight life's battle in a new form, found out where they were weak, and had the manliness to acknowledge and to renew their connection. I consider this one of the highest compliments the Institution has received. Another phase of our growth requires careful handling; that is, recommending students as managers of farms. My correspondence in this regard is steadily increasing, especially from the United States; and so sure as beef and mutton production is on the increase in all parts of the American continent, so sure will the demand increase for first-class managers of live-stock. We filled two such applications during the past year.

In my long connection here I have never expressed an opinion regarding the future of the "Farmers' College." Let me respectfully do so now. The maintenance of a new thing like ours, in the view of some people, requires disconnection with politics, endowment, and affiliation with an University. I see no practical necessity for either of them. It is enough for us that the Institution has steadily made progress, and has never gone back. I have known no serious political jarrings over us, and what have been have been for our good. Comparative independence by endowment would likely mean less progress by reason of less life. We all need stirring up by people, press, and Parliament, and any proposed association with an University could not make us better farmers nor better men. In one word, so long as our halls are well filled, no one has a right to grumble; there are no better critics than the students themselves, and with this always keen, and your own open and firm supervision, the country may say, "Let well alone."

In conclusion, permit me to acknowledge the obligations I feel to all the officers, men, and students, for help and kindness under many forms, through many difficulties, thus made lighter and easier surmounted by such agreeable union.

I have the honour to be, Sir,

Your obedient servant,

W. Brown,

Professor of Agriculture and Farm Superintendent.

APPENDIX.

INVENTORY AND VALUATION OF OUTSIDE DEPARTMENTS.

FARM—LIVE STOCK.

HORSES.

14 Working horses	$1,940 00	
		$1,940 00

CATTLE.

Herefords:		
1 One-year-old bull	400 00	
3 Cows	900 00	
		1,300 00
Shorthorns:		
1 One-year-old bull	800 00	
1 Heifer	1,450 00	
5 Cows	850 00	
2 Heifers	300 00	
		3,400 00
Devons:		
1 Three-year-old bull	160 00	
1 Cow	100 00	
1 Heifer	70 00	
		330 00
Aberdeen Polls:		
1 One-year-old bull	400 00	
1 Heifer (imported)	400 00	
2 Cows	400 00	
1 Heifer	350 00	
		1,550 00
Ayrshires:		
1 Two-year-old bull	250 00	
4 Cows	400 00	
1 Heifer	100 00	
1 Calf	25 00	
		775 00
Jerseys:		
1 Two-year-old heifer	300 00	
		300 00
Grades:		
13 Cows	520 00	
3 Heifers	90 00	
		610 00
Fattening Stock:		
11 Steers and heifers	536 00	
		536 00

Sheep.

Cotswolds:		
2 Shearling rams		
32 Breeding ewes		
5 Ram lambs	125 00	
13 Ewe lambs	260 00	
		$1,595 00
Leicesters:		
1 Shearling ram	100 00	
13 Breeding ewes	390 00	
2 Breeding ewes	100 00	
1 Ram lamb	25 00	
1 Ewe lamb	20 00	
		635 00
Oxford Downs:		
1 Shearling ram	150 00	
10 Breeding ewes	500 00	
1 Ram lamb	35 00	
2 Ewe lambs	40 00	
		725 00
South Downs:		
1 Ram (aged)	40 00	
1 Shearling ram	200 00	
23 Breeding ewes	690 00	
1 Ram lamb	30 00	
2 Ewe lambs	40 00	
		1,000 00
Shropshire Downs:		
1 Three-shear ram	150 00	
1 Shearling ram	150 00	
8 Breeding ewes	400 00	
4 Ewe lambs	120 00	
		820 00
Merino:		
1 Three-shear ram	100 00	
		100 00
Grades:		
15 Breeding ewes	105 00	
		105 00
Feeding Wethers, Grades:		
26 Feeding wethers	150 00	
		150 00

Pigs.

Berkshires:		
1 Imported boar	90 00	
3 Sows	120 00	
2 Small boars	30 00	
1 Small sow	10 00	
		250 00
Prince Albert, Windsor:		
2 Brood sows	90 00	
		90 00
Feeding Pigs:		
Thirty-four	115 00	
		115 00

Essex:		
1 Boar	$30 00	
		$30 00
Poland China:		
1 Boar	25 00	
		25 00
Dogs.		
Scotch collies	50 00	
		50 00
Total for Live Stock		$16,562 00

FARM DEPARTMENT.

1 Vertical 6 horse-power boiler	189 00	
1 Portable steam engine	725 00	
1 Vibrator	445 00	
2 Feed boilers	25 00	
5 Farm waggons	200 00	
1 Democrat	20 00	
2 Carts	45 00	
10 Sets of double-trees	19 00	
5 Neck-yokes	5 00	
3 Pair of bob-sleighs	65 00	
1 Long sleigh	15 00	
1 Pleasure sleigh	30 00	
3 Seed drills	180 00	
2 Reapers	120 00	
2 Mowers	110 00	
2 Pea-harvesters	36 00	
2 Horse rakes	60 00	
2 Cultivators	30 00	
1 Jack	12 00	
1 Drag sawing machine	50 00	
3 Fanning mills	65 00	
1 Circular saw	30 00	
		2,426 00
Wheel-barrows, combs, brushes, oil cans, wrenches, saws, hammers	20 00	
Axes	50 00	
1 Horse-power	35 00	
1 Separator	70 00	
4 Iron ploughs	65 00	
6 Metal beam ploughs	100 00	
1 Wooden beam plough	8 00	
1 Double mould-board plough	28 00	
2 Gang ploughs	35 00	
1 Sub-soil plough	20 00	
6 Ploughs, with wheel and skimmer	70 00	
1 Turnip drill	10 00	
5 Set iron harrows	75 00	
		586 00
2 Sets of wooden harrows	10 00	
1 Wooden roller	25 00	
Shovels, spades, forks, hoes, and draining tools		
Scythes, cradles, reaping-hooks, rakes, barley-forks, etc	100 00	
1 Stone-boat	5 00	

6 [illegible] team harness	$130 00	
5 Plough harness	60 00	
2 Sets cart harness	18 00	
1 Barn truck	4 00	
2 Weigh scales	35 00	
1 Platform scale	90 00	
		$477 00
Measures, horse-blankets, bags, chains, picks and baskets	75 00	
5 Hay racks	35 00	
1 Water cart	60 00	
1 Straw-cutter and belts	35 00	
2 Grain crushers	75 00	
1 Cake crusher	20 00	
4 Root pulpers and slicers	120 00	
90 Cattle chains	86 00	
1 Bull leader	1 00	
Sheep racks and troughs	75 00	
2 Cross cut saws	6 00	
1 Desk in office	8 00	
1 Medicine chest and medicine	20 00	
10 Stable lamps	8 00	
5 Gravel boxes	10 00	
1 Stove	10 00	
1 Spring tooth harrow	16 00	
1 Road scraper	10 00	
4 Horse hoes	40 00	
1 Blacksmith's forge and tools	80 00	
Tarpaulin, waggon dks. and ox yoke	24 00	
		764 00
Total for Farm		$3,853 00

GARDEN.

2,500 Flower pots	75 00	
500 Greenhouse plants	450 00	
3,000 Mixed bedding plants	250 00	
6 Watering cans	7 50	
1 Syringe and set of roses	5 00	
8 Hot-bed frames and sashes	45 00	
4 Hand glasses	4 00	
100 Seed boxes	7 50	
1 Cart horse	100 00	
1 Set cart harness	8 00	
1 Single sleigh	30 00	
1 Set single harness	12 00	
2 Ploughs and double-trees	23 00	
1 Set harrows and cultivators	14 00	
1 Garden roller	8 00	
1 Metal horse roller	40 00	
2 Wheel-barrows and 1 hand-barrow	6 00	
1 Gravel screen and 5 hand-screens	15 00	
5 Garden rakes	4 00	
15 Garden spades	20 00	
7 Shovels	10 00	
15 Draw hoes	7 00	
6 Dutch hoes	3 50	

6 Snow shovels and 1 snow plough	$6 00	
4 Scythes and snaiths	5 00	
3 Planting trowels and 3 spades	3 50	
5 Pruning saws and 1 buck-saw	7 50	
3 Manure forks	2 00	
8 Potato forks	6 00	
2 Garden lines and reels	3 00	
2 Tree scrapers	1 00	
4 Hammers	3 00	
2 Pair edging shears	4 00	
2 Pair hedge shears	4 00	
2 Pair pruning shears	4 50	
1 Pair vine pruning shears	3 00	
2 Edging knives	2 00	
9 Pruning knives	6 00	
6 Grafting knives	2 00	
2 Picks and 1 crowbar	3 00	
2 Axes and 1 set iron wedges	4 50	
1 Seed drill and 3 potato dusters	9 00	
1 Framing square, compass and knives	4 00	
1 Hedge bill and hand axe	1 50	
6 Baskets and 2 brooms	1 50	
18 Bass mats and 2 hay rakes	9 50	
3 Wire baskets and 3 thermometers	3 00	
10 Branding irons	8 00	
1 Monkey-wrench	1 50	
1 Waggon jack	2 00	
1 Stable lantern and 2 oil cans	2 00	
1 Step ladder	1 00	
16 Hyacinth glasses	4 00	
2 Sickles and 3 garden markers	2 00	
2 Lawn mowers	20 00	
150 Zinc tree-labels	60 00	
1 Stove	1 00	
1 Office desk	1 50	
6 Rustic chairs	4 00	
1 Tape line and sundries	5 00	
Total for Garden		$1,354 00

CARPENTER SHOP.

12 Hand cross-cut saws	16 00
4 Hand rip saws	7 00
1 Compass	1 00
4 Draw-knives	4 00
4 B. Braces	10 00
1 Set auger bits	10 00
1 B. Machine	6 00
20 Gimlet bits	2 50
5 Oil-stones	3 75
6 L. Planes	5 40
2 Jointer planes	5 00
6 Try "	9 00
7 Jack "	7 00
1 Jorn Compass	4 50
1 Set hollows and rounds	1 00

2 Sets match planes	$3 00	
5 Bend planes	3 00	
2 Rabbit planes	1 60	
11 Nail hammers	11 00	
3 Hand axes	6 00	
2 Broad axes	7 00	
1 Monkey-wrench	2 00	
2 Cold chisels	0 50	
5 Try squares	2 00	
3 Framing squares	7 00	
1 Panel square	1 25	
4 Mallets	1 00	
2 Spirit levels	2 50	
2 Framing saws	6 00	
3 Trowels	3 00	
5 Screw drivers	2 00	
Chalk and lines	2 00	
2 Tool bags	0 80	
1 Wire strainer and operator	10 00	
Bench brushes	0 40	
5 Carpenter benches	35 00	
6 Ladders	6 00	
2 Scratch-awls	0 30	
4 Paint brushes	3 00	
4 Oil cans	4 50	
1 Glue pot	1 50	
Gimlets and gimlet bit	2 00	
1 and jorns	5 00	
1 Stove	6 00	
Fencing tools, spades, spoons, picks and mauls	10 00	
1 Ralshet drill and bits	8 00	
1 Block and tackle	12 00	
1 Small anvil	5 00	
2 Adzes	4 00	
2 Four-inch chucks	6 00	
4 Framing chisels	4 00	
1 Set firmer chisels	5 00	
2 Office desks	5 00	
4 Hand screws	2 00	
12 Brad-awls	1 00	
Office books	4 00	
1 Edging circular saw table, $40; small saw table, $20	60 00	
1 Counter shaft, pulleys, hangers, etc	95 00	
1 Leather belt	10 00	
1 Wheel-barrow	6 00	
1 Two-wheeled truck	16 00	
1 Pair snips	3 00	
Saw piles	5 00	
		$488 50

Experimental Department.

Horse hoe, coffee mill, thermometer, barometer	40 00	
Grain tester, 1 set scales and weights (table), 1 spring scale	27 00	
2 Hand scoops, 1 dust pan, 1 varnish brush, 9 screws	5 00	
2 Funnels, 1 set rubber printing type, 1 half-bushel measure	4 00	
1 Peck measure, 1 half-peck measure, 2 wire baskets	4 00	

6 Turnip baskets, 1 mouse trap, 1 Paris green sprinkler	$3 00	
1 Broom, 2 canvas sheets, 1 fanning mill, set harness	25 00	
1 Tarpaulin sheet, 1 threshing machine, 190 peck bags	45 00	
1 Desk, 2 sample cases, 2 sets grain bins.....	13 00	
1 Table, 1 stove, 4 wooden rakes, 1 mallet	10 00	
4 Manure forks, 3 cattle brushes, 1 lantern, 1 stable broom ..	4 00	
1 Pair cattle shears, 1 zinc pail, 2 cattle leaders.....	2 00	
1 Sponge, 1 pair shears, 1 letter file, 1 box paper fasteners ..	2 70	
1 Memorandum file, 2 corn planters, lettering brushes and paint.	4 55	
1 Microscope, 1 band knife, 1 cradle, 1 scythe.....	7 00	
1 Grain scoop, 3 shovels, 3 spades, 2 manure forks.....	6 00	
1 Potato scoop, 1 potato grape, 1 garden hoe	3 00	
1 Large hoe, 4 turnip hoes, 2 Dutch hoes, 4 spuds	6 00	
1 Rake, 1 pick, 1 flail, 1 pair bellows	3 00	
		$214 25

ABSTRACT.

Farm—Live Stock	$16,562 00	
" Implements, etc	3,853 00	
		$20,415 00
Garden		1,354 00
Carpenter		488 50
Experimental.....		214 25
		$22,471 75