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NINTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM.

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FOR THE YEAR ENDING 31ST DECEMBER,

1883.

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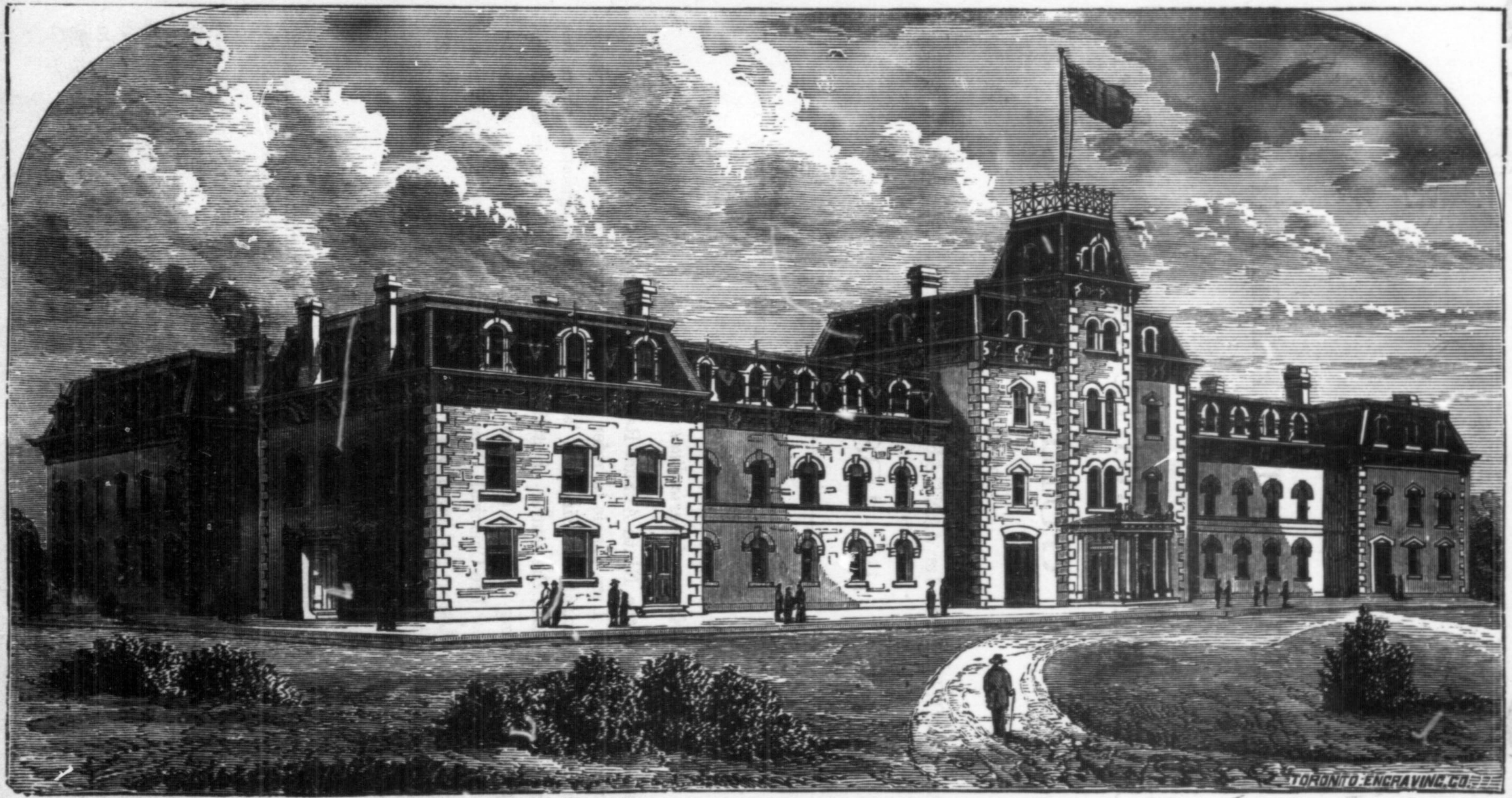
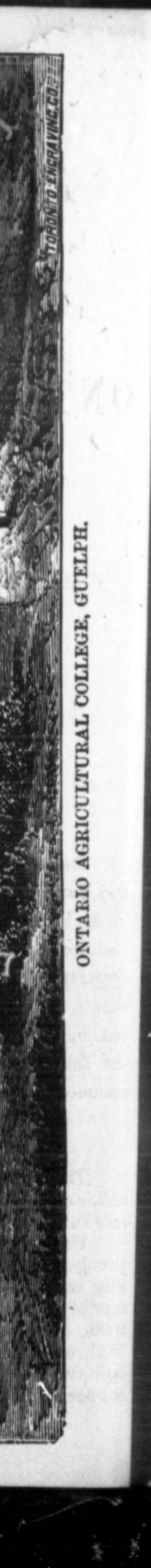


ONTARIO AGRICULTURAL COLLEGE, GUELPH.



REPORT OF THE PRESIDENT

OF THE

ONTARIO AGRICULTURAL COLLEGE, GUELPH,

FOR THE

YEAR COMMENCING 1st JANUARY AND ENDING 31st DECEMBER, 1883.

GUELPH, 2nd January, 1884.

To the Honourable A. M. ROSS,

Commissioner of Agriculture:

SIR,—In presenting the Ninth Annual Report of the Ontario Agricultural College and Experimental Farm, I am unable to refer to anything striking or at all remarkable in the history of the Institution. Since the last meeting of the Legislature there has been no change in the Staff, the course of study, or the routine of work in the several Departments. Everything has gone on as usual; and only one or two items need more than a passing reference. The Chemical Department is better equipped than it was a year ago; the Natural History section of the Museum is much larger and more varied; the Library is more complete; and the Grounds in front and rear of the College have assumed an entirely new aspect.

THE ATTENDANCE.

The most important matter to which I can here refer is, perhaps, the attendance; and, under this head, I scarcely know what to say, in order to present the facts of the case in such a way as not to be misunderstood.

For some time past there has been a growing feeling that we are admitting too many young men from Great Britain and other places outside of Ontario. It has been repeatedly said that the College is filled with English, Irish, Scotch, and everything but the sons of our Ontario farmers. Now, such statements, I wish to say, are very far from the truth, as the records clearly show; for the percentage of non-residents was only $24\frac{1}{2}$ in 1881, and $29\frac{3}{4}$ in 1882, including, in both cases, all students from places outside of Ontario, whether from Quebec, New Brunswick, Nova Scotia, Prince Edward Island, or the old country.

We do not forget that the College is maintained by the people of this Province; and in our management we seek constantly to meet their wants and wishes. Nevertheless, some think that we injure the College by the admission of so many English boys; and for that reason I beg to explain the course which I have hitherto pursued.

Our tuition fee is $20 a year for residents, and $50 for non-residents. Applications from the Province of Ontario, if satisfactory, are accepted without delay; and those from other provinces and countries are generally held in abeyance till a short time before our Matriculation Examination, at which time—if the candidates from home are not sufficient to fill all vacancies—some of the applications from abroad are accepted. In this way Ontario always gets the preference, and non-residents are admitted only to fill the vacancies which are not required by our own people. During the year 1883, however, I pursued a somewhat different course. I endeavoured more fully to comply with the wishes of those who so earnestly and persistently maintain that the legitimate, and the *only* legitimate, work of the College is to educate Ontario boys in the principles of Agriculture, Stock-raising, and the other subjects embraced in our curriculum. I wisely or foolishly decided to admit a smaller number from the old country; and consequently the attendance is a little less than it was a year ago. Within the last six months, I have refused nearly forty applications from Great Britain; and it remains to be seen whether our farmers' sons will fill all vacancies in the course of a year or two.

Course of Study.

I need scarcely add that our course of study is specially designed for farmers' sons as we find them in this country. A course making some provision for Classics or Modern Languages would be preferred by those who are still in doubt as to the occupation which they may ultimately decide to follow; and a purely technical course would be more acceptable to old country boys, who generally have a very fair English education before they leave home. But with our Canadian farmers' sons the case is different. Their early education, if they decide to remain on the farm, is very generally neglected; and a course of study intended to meet their wants should not be so narrow in its range as to embrace only a few technical subjects, nor so wide as to include Classics and Modern Languages. It should be both special and general to a limited extent—the former, to assist them in making a living; and the latter, to fit them for the discharge of their duties as citizens. Recognizing this fact, we have all along given prominence to Agriculture, Chemistry, Veterinary Science, and other branches that have a direct bearing on the work of an agriculturist as such; and, at the same time, we have insisted on the study of English Literature, Composition, and Political Economy, to assist in fitting our students for taking their part in the municipal, political, and religious work of the country to which they belong.

Management.

The general management of the Ontario Agricultural College and Experimental Farm is divided between the President and the Farm Superintendent, who are, to a large extent independent of each other. The former has full control of the College, and the latter of the Farm. Each is required to work for the other; but neither is responsible for the discharge of his duties to anyone but the Commissioner of Agriculture.

THE FARM.

The work under this head is divided into three departments:—

I. The Farm Department.
II. The Live Stock Department.
III. The Experimental Department.

For the revenue, expenditure, and entire management of these, and of the Mechanical Department also, my colleague, Professor Brown, is responsible. He buys, sells, hires the men, directs the foremen, and does whatever else he thinks necessary for the accomplishment of the objects aimed at; and his report, in Part VI. of this volume, contains an able and exhaustive statement of the work done in these departments during the past year.

THE HORTICULTURAL DEPARTMENT.

The management of this departmnt, which is fast becoming one of the heaviest and most important departments of the Institution, has lately been transferred to our gardener, Mr. Forsyth, who has thereby become directly responsible to the Commissioner of Agriculture for the Lawn, Gardens, Orchards, and Arboretum. In the matter of revenue and expenditure, Mr. Forsyth is amenable to the Commissioner alone; but, in the work of the department, he is guided to some extent by a Special Committee of the Fruit Growers' Association, whose account of the year's operations will be found with Mr. Forsyth's report at the end of this volume.

THE COLLEGE.

For convenience and systematic treatment, the work in the College may also be considered under three heads:—

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

The routine in each of these varies very little from year to year. There are no experiments to be described; no important results to be announced; nothing new to tell: consequently, when called on to give an account of my stewardship for another year, I feel very much like a man undertaking to preach for the fourth time on the same text, every point of which was exhausted in his first discourse. Be that as it may, I beg to report as follows:—

I.—THE COURSE OF INSTRUCTION IN THE COLLEGE.

Before proceeding to the work of 1883, I may give the sessions and terms into which the year is divided, a list of the subjects taught, and the names of the professors and lecturers, with the work allotted to each; after which I shall speak of the year's operations as a whole, and then of each term separately.

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

Sessions.

Winter Session, embracing the Fall and Winter Terms—1st October to 31st March.

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

Terms.

Fall Term—1st October to 22nd December.
Winter Term—5th January to 31st March.
Spring Term—16th April to 30th June.
Summer Term—1st July to 31st August.

Subjects Taught.

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

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

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

Method of Instruction.

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

THE STAFF.

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

English Literature and Political Economy.

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

Agriculture, Live Stock, and Arboriculture.

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

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

4. J. Playfair McMurrich, M.A.

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

5. Frederick Grenside, V.S.

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

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

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

THE YEAR 1883.

As already intimated, the history of the College during the year 1883 is little else than a record of ordinary exercises and incidents, such as have been reported from year to year. The work in the several departments has gone on as usual, and the progress made has been no less substantial and satisfactory. We have made very considerable additions to the museum, especially in the department of Natural History. The Professor of Chemistry has been provided with new apparatus for the analysis of soils, milk, and manures; and we have, for the first time, got a complete catalogue of our library made out and printed.

Hitherto we have admitted students twice a year—in October and April; but this practice has led to some irregularity and trouble that ought to be avoided; and I hope ere long to be in a position to adopt the rule which prevails in all other colleges of admitting only once a year.

There is no falling off in the number of applicants for admission ; but the attendance is a little less than it was in 1881 and 1882, owing to the fact already stated, that is, the determination on our part to be guided to some extent by the views of those who insist that the admission of so many wealthy men's sons from England and elsewhere, has a tendency to prevent the plain, unsophisticated youth of our own Province from entering the College.

Attendance.

The number on the roll in 1883 was 202, representing several foreign countries, twenty-nine Counties of Ontario, and five other Provinces of the Dominion, as follows : from India, 1 ; the United States, 2 ; Wales, 2 ; Manitoba, 3 ; Ireland, 4 ; Scotland, 4 ; New Brunswick, 6 ; Nova Scotia, 7 ; the Province of Quebec, 16 ; England, 20 ; and Ontario, 134 ; —67 per cent. of residents, and 33 of non-residents. See College Roll, appendix 1.

Counties, etc.	*Students.*	*Counties, etc.*	*Students.*
Brant	3	Montreal	6
Bruce	4	New Brunswick	6
Carleton	4	Northumberland	5
Durham	2	Nova Scotia	7
Elgin	6	Ohio, U. S.	1
England	20	Ontario	2
Frontenac	1	Ottawa	10
Grey	4	Oxford	3
Glengarry	4	Peel	1
Hamilton	2	Perth	7
Hastings	2	Peterborough	4
Huron	1	Prince Edward County,	2
India	1	Prince Edward Island	3
Ireland	4	Quebec (City)	3
Kent	2	Quebec (Province)	6
Kingston	3	Simcoe	15
Lambton	3	Scotland	4
Lanark	1	Toronto	10
Leeds	4	Victoria	1
Lincoln	1	Wales	2
London	1	Welland	1
Manitoba	3	Wellington	10
Massachusetts, U.S.	1	Wentworth	3
Middlesex	3	York	9

Total number of students in 1883 202
Number of Ontario counties represented 29

In 1882 the County of Simcoe sent the largest number of students ; and in 1883 t had a representation of 15, which is one-half larger than that of any other county Wellington sent 10 ; the cities of Toronto and Ottawa, 10 each ; York, 9 ; Perth, 7 Elgin, 6 ; Northumberland, 5 ; Bruce, Carleton, Grey, Glengarry, Leeds and Peter orough, 4 each ; Brant, Lambton, Middlesex, Oxford, Wentworth, and the City o ingston, 3 each ; Durham, Hastings, Kent, Ontario, Prince Edward, and the City o amilton, 2 each ; and several other counties and cities, 1 each.

Religious Denominations.

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

Episcopalians	90	Lutherans	2
Presbyterians	49	Plymouth Brethren	2
Methodists	36	Universalists	1
Baptists	8	Unitarians	1
Roman Catholics	7	Swedenborgians	1
Congregationalists	5		
		Total	202

Lectures.

Lectures commenced on the 1st October and continued throughout the first three terms of the scholastic year 1882-83—from the 1st October to the 30th June; during which time all our regular students were engaged in class-room work and manual labour alternately—three hours a day having been spent at the former, and from three and a half to five at the latter. To this were added five hours in two weeks for set-up drill and gymnastics, under Adjutant Clarke, the very efficient drill instructor of the Ontario and Wellington Field Batteries; so that the daily routine of every student in the regular course, for nine months of the year, was—

Lectures in the College, three hours a day (excepting Saturdays).

Manual Labour, outside, three and a half to five hours a day, according to the season of the year.

Study in room, two hours a day.

Drill and gymnastics, one hour a day (for five days of every alternate week).

While the first year students were at lectures in the College, the second year students were employed outside. Those who went out to work in the forenoon, came in for lectures in the afternoon, and *vice versa*. Thus the theoretical work inside and the practical work outside went on simultaneously during the Fall, Winter and Spring Terms. The Summer Term (1st July to 31st August) was devoted entirely to work in the outside departments—the farm, the live stock, the garden, the carpenter-shop and 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 beg to submit the following syllabus of lectures delivered by the professors in the several departments and sub-departments of study during the scholastic year, commencing on the 1st October, 1882, and ending on the 31st August, 1883:—

Outline of Class-room Work.

Scholastic Year 1882-83.

(*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; exami nation 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 and basicity; oxygen and hydrogen; water—its nature, functions, decomposition and impurities; nitrogen; the atmosphere—its composition, uses and impurities; ammonia—its sources and uses; nitric acid and its connection with plants; carbon; combustion; carbonic acid and its relation to the animal and vegetable kingdom; sulphur and its compounds; manufacture and uses of sulphuric acid; phosphorus; phosphoric acid and its importance in agriculture; chlorine—its bleaching properties; bromine; iodine; silicon; potassium; calcium; magnesium; iron, etc.

Zoology.—Definition of terms morphology, physiology, embryology, etc.; distinctions between animate and inanimate objects; life distinctions between plants and animals; definition of general terms; development; basis of classification; characters of the various classes, with a more detailed and special account of the porifera or sponges; actinozoa, including the formation of coral islands; trematoda, including the "liver-fluke"; cestoda, with a description of the life-history of the common tape-worm, and of the form causing "staggers" in sheep; nematoda, including thread worms, trichina wheat anguillula, cause of gapes in chickens, etc.; acanthocephala; oligochæta—formation of mould by earth-worms; hirudinea lamellibranchiata, including edible molluscs and pearl fisheries; gasteropoda; cephalopoda.

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 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.

FIRST YEAR—(Continued)

Spring 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.—Study of various classes continued; arthropoda, with special attention to structure and habits of the arachnida, acarina and insecta; general structure of the vertebrata; distinctions between vertebrata and invertebrata; pisces; amphibia; reptilia—treating especially of the snakes and turtles; aves—habits and appearance of the more important insectivorous birds; mammalia, with special attention to the orders containing useful and domestic animals; antropomorpha; man.

Lectures illustrated by specimens, diagrams, and drawings on the black-board.

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 "Marmion," Cantos V. & VI.

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, sanfoin, prickly comfrey, clovers, grasses; the cultivation and management most appropriate for each.

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

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

Department 3.—Veterinary Science.

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

Department 4.—English.

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

English Classics.—Committing to memory and critical study of Washington Irving's "Sketch Book."

Department 5.—Mathematics.

Mensuration.—Mensuration of surfaces—the square, rectangle, triangle, trapezoid, regular polegon, circle, sector, segment, etc. Special application to the measurement of lumber. Mensuration of solids—tetrahedron, cube, prism, cylinder, spherical segment, spherical zone, parabolid, frustum 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, 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.—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 terrestial 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, syntatical, 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 distances 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.—Importance of the study to agriculturists; natural checks to insect ravages; system of nomenclature; anatomy of insects—appendages, respiration, nutritive and nervous systems; metamorphosis; classification; beneficial and injurious insects—their habits and the best means of checking the ravages of the latter—lectures illustrated by specimens.

Department 3.—Veterinary Science.

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

Circulatory System.—Description of the diseases of the heart and blood 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 Literature 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 "King Richard the Second."

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

Department 5.—Mathematics.

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.

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

Quantitative analysis of soils, manures and farm produce.

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

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

Department 3.—Veterinary Science.

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

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

Department 4.—English.

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, 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.

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

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

The scholastic year began on the 1st October, 1882, and ended on the 31st August, 1883. The first term of the year, i.e., the Fall Term, having been treated of in our report of 1882, I shall begin with the

Winter Term, 1883.

5th January to 31st March.

The students in attendance were those who had entered at the beginning of the Fall Term in October, 1882, or previous to that date—112 in number; and the work was to a large extent a continuation of the subjects begun at that time.

Class-Room Work.

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

First Year—31	lectures, one hour each, on			Agriculture and Live Stock.
32	"	"	"	Chemistry.
21	"	"	"	Zoology.
21	"	"	"	Veterinary Anatomy.
21	"	"	"	English Literature.
11	"	"	"	English Composition.
21	"	"	"	Arithemetic.
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Second Year—16	lectures, one hour each, on			Agriculture and Live Stock.
5	"	"	"	Arboriculture.
31	"	"	"	Agricultural Chemistry.
11	"	"	"	Entomology.
21	"	"	"	Political Economy.
11	"	"	"	English Literature.
10	"	"	"	English Composition.
21	"	"	"	Veterinary Pathology.
21	"	"	"	Dynamics, Hydrostatics, and Road-making.
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Also one hour a week was spent by the second year students in the practical handling and judging of horses, under the supervision of Dr. Grenside, our Veterinary Surgeon.

Department 1.—Agriculture and Live Stock.

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

A specimen of some kind, say a Shorthorn steer, is brought into the lecture-room, which is so arranged with galleried seats that every student while in his place taking notes has a full view of the lecturer and all his movements. The different parts of the animal are first pointed out and named, such for example, as the brisket, crops, loins, twist, etc. After this has been several times repeated, the students are called on to point out and name the several parts in presence of their class-mates. The lecturer then criticises the animal more closely, indicating the strong and the weak points, and giving his estimate of it as a whole. Afterwards several animals of different breeds are brought in together, and he proceeds to describe and illustrate what are considered the good points of the 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.

Department 2.—Natural Science.

The work of the Winter Term in this department embraces Inorganic Chemistry, Organic Chemistry, and Zoology, with the first year students; Agricultural Chemistry, and Entomology with the second year.

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

The second year students were at the same time engaged in the study of Agricultural Chemistry and Entomology. During the previous term they had learned the relation of Chemistry to Agriculture and stock-raising; and with this knowledge they now proceeded to study the nature and sources of plant food, the origin and properties of the different kinds of soil, their preservation and renovation, the causes of unproductiveness, the properties and uses of various manures, the chemical composition of a number of fodders, and the nutritive value of each. On subjects such as these, they spent three hours a week; and at the same time took a course of lectures delivered by the Professor of Biology, on the marks, habits, and depredations of the various insects that infest our crops and fruits, seeking especially to learn the best means of checking and preventing their ravages.

A more detailed account of the work in the several sub-departments under this head will be found in the reports of Dr. Hare and Professor McMurrich, in parts II. and III. of this volume.

Department 3.—Veterinary Science.

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

The work of the year in this department embraced not merely the lectures in the College, but also the medical treatment of all the stock kept on the farm. This, of course, gave the Professor of Veterinary Science a good deal of extra work; but it afforded him an opportunity of observing carefully the action of one or two diseases, to which stock in this country is more or less liable. On the whole, I may say our stock is healthy, and has hitherto suffered very little from ailments of any kind. Some of our cattle have now and then been troubled with what is commonly called "foul in the foot," and very young lambs occasionally with goitre; but nothing serious has resulted from these causes. Not so, however, with tuberculosis and tape-worm. The former has caused the death of three or four of our best cows in the course of a few years, and the latter made sad havoc of our lambs last spring. I beg, therefore, to refer you, Sir, and all our readers to Dr. Grenside's valuable report in Part III. of this volume, in which you will find a full discussion of the causes, symptoms, and treatment of these diseases. Allow me also to ask your favorable consideration to what is there said by Dr. Grenside regarding the work, wants, and claims of the Veterinary Department.

Department 4.—English Literature and Political Economy.

Regarding this department, I have to say as I did last year, that our course of study is still the same, and the same subjects are emphasized. We spend no time on any foreign language; 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 classic authors; and for this reason we devote all the time we can spare to exercises of that kind.

During the Winter Term of 1883 the first year students spent one hour a week on exercises in composition, and two hours in the critical study of the fifth and sixth Cantos of Scott's "Marmion." The second year men read Shakespeare's "Julius Cæsar," and a part of "King Richard the Second," and committed to memory the best passages in each. They also devoted two hours a week to the discussion of such questions as are usually considered under the head of Political Economy—land, labor, capital, the production and distribution of wealth, strikes, lock-outs, etc.

Department 5.—Mathematics and Book-keeping.

The work under this head, as I said once before, presents certain difficulties, which are likely to remain for some time to come. First of all, we cannot devote much time to the department; and in the next place, most of our students have only a very imperfect knowledge of the elementary principles of Mathematics, when they come to us. Consequently, we have not as yet undertaken anything beyond Arithmetic, Mensuration, elementary Mechanics, and the less difficult operations in Levelling and surveying. Even in these few branches, we find it necessary to lay most stress on what is likely to have frequent application in the ordinary business of a farming community. The Book-keeping also is of a special kind. It might be called Farm Book-keeping—farm, garden, field, and dairy accounts.

The work of last winter differed very little from that of the winter before; hence I shall not spend time in describing it, but simply refer to the examination papers on Arithmetic, Statics, and Book-keeping in Appendix 3, and to the Class-Lists in Appendix 4, for evidence of the work done in this department.

Course of Apprenticeship.

Last year, as usual, our students were sent regularly to work in the outside departments. There were no exceptions, nor any choice of employment. All were placed on the same level, and had to take their share of such work as ordinary Canadian farmers have to do; and, owing to this fact, we are pleased to be in a position to say that no one has yet been able to point to a single instance of a farmer's son having acquired a dislike to farm work by attendance at the Ontario Agricultural College; and this we look upon as a matter of very considerable importance, in view of the fact that the weak point in a general system of theoretical instruction, such as we have in this Province, is its tendency to unfit a large number of young men for making a living at any occupation that requires them to soil their hands in the performance of manual labour.

So far as we can judge, our system of combining out-door work with study is productive of good results; for not only are city boys prepared for farming, but farmers' sons are educated without losing their taste for farm work, and are trained up in the belief that manual labor is not at all incompatible with intelligence, refinement, and respectability—that a farmer may be a well-informed gentleman of the highest type.

1.—Farm and Live Stock Departments.

In January, February and March there is not much work to do on the farm; and if we had to rely entirely upon that department for employment for the students, we should be involved in serious difficulty. But live stock of all kinds requires more attention in winter than at any other season of the year. Cattle, sheep, pigs, and horses, all need special care in cold weather. Consequently, our young men devote a good deal of time to that department during the Winter Term, and have ample opportunity for getting a thoroughly practical knowledge of Professor Brown's methods of rearing, feeding and fattening all the kinds, grades, and ages of animals kept on our farm.

Last winter, in addition to the regular work of looking after the different breeds of cattle, sheep, and pigs, there was an extensive series of experiments in cattle and sheep feeding, which furnished a good deal of very instructive work to all who were interested enough to take part in it.

2.—Mechanical Department.

The work in this department furnished a variety of useful employment, as in former years. The students were instructed in the use of such tools as are required in plain carpenter work, and were regularly employed in repairing implements, barns, and college buildings; in making gates, waggon-tongues, etc.; and in doing a variety of odd jobs such as receive constant attention on every well-managed farm.

As this department comes under the report of the Farm Manager, it does not devolve on me to go into any of the details of the year's operations; but I may observe in passing that there is no department of the Institution in which the students take a greater interest, and none in which they are more profitably employed during the winter months.

3.—Horticultural Department.

As already intimated, this department is rapidly growing in extent and importance. The theoretical instruction in Botany, Entomology, and Horticulture is given by Professor McMurrich; and the practical work of the department is managed by Mr. James Forsyth, our gardener, assisted by a special committee of the Fruit Growers' Association.

The department now embraces a large lawn and arboretum, three green-houses, a four-acre kitchen-garden, a sixteen-acre orchard, a vinery, and several experimental clumps of young forest trees.

During the past year, a great deal of work has been done in laying out, grading, and planting the lawn, according to the accompanying plan, drawn by Mr. Miller, of Fairmount Park, Philadelphia. The surface soil was thoroughly pulverized; new roads were made; some of the ground was re-seeded; and a portion of it re-planted according to the plan recommended by Mr. Miller: so that the surroundings of the College have undergone a complete transformation; and no one will deny that the appearance of things is very much improved. See accompanying plans of grounds and proposed new green-houses, etc.

In the early part of last winter, the second year students were sent to the gardener for instruction in grafting, budding, layering, etc.; about the middle of February, they commenced a special examination and study of our green-house plants; and, at the end of March, most of them passed a creditable examination on the paper headed Horticulture, in the first part of Appendix 3.

Special Live Stock Class.

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

The members of this class, not to exceed twenty in number, were to spend the half of each day in handling and looking after cattle, sheep, pigs, and horses, and the remainder of the time in studying lectures and books which treat of these animals in health and disease.

By this arrangement over twenty young men were employed in looking after animals which, under other circumstances, would have been attended to by six or seven of the regular students. Consequently, the work of the specialists, being confined to the one department, was really for their own benefit, rather than for the performance of remunerative labour; and, for that reason, the Institution did not pay them for their work.

The class began on the 1st October, and was to continue till the end of March. As might be expected in any new departure, certain difficulties were encountered from time to time; but none of them proved at all serious, except one: that was the temptation to idleness, which arose from the fact that the time of the class was not fully occupied with lectures and recitations. They were placed on their honour, and directed to spend a few hours every day in reading text-books on Live Stock and veterinary Science. Some did as they were expected to do, and others might be said to have wasted the greater part of the time that was set apart for reading. The former were orderly and well-behaved; the latter were more or less troublesome.

Students who neglect their work during the term, generally find some excuse for shirking examinations at the end; and the idlers amongst our Specials last year were no exception to the rule. Sixteen out of the twenty left just before the Easter Examinations; and the effect of their leaving was, to say the least, very undesirable. It created amongst the regular students a restlessness which was difficult to control, and ultimately resulted in the premature departure of several who should, and under other circumstances would, have remained to the end of the term.

The class was an experiment; and, while the results were not altogether satisfactory, we are giving it another trial this winter, and are endeavouring to guard carefully against the difficulties which arose last year. So far we have been much pleased with the work and conduct of the new class.

Easter Examinations.

The Easter Examinations were, as usual, on the class-room work of the Winter Session (1st October to the 31st March). They commenced on the 19th, and ended on the 28th of March. The questions set in the different subjects will be found in the first part of Appendix 3. Most of them are difficult enough to differentiate the best students, while they 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 obtained by each.

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, as follows:—

FIRST CLASS MEN IN THE DEPARTMENTS AT EASTER, 1883.

Departments.		FIRST YEAR MEN.	Departments.		SECOND YEAR MEN.
I.	Agriculture and Live Stock.	None.	I.	Agriculture and Live Stock.	None.
II.	Natural Science.	1. Slater, H. 2. Lehmann, A. 3. Macdonald, W. A.	II.	Natural Science.	1. Torrance, W. J. 2. Robertson, W. 3. { Fotheringham, W. { Perry, D. E. 5. Jeffs, H. B. 6. Willis, W. B.
III.	Veterinary Science.	1. Carpenter, P. A. 2. Lehmann, A. 3. Hubbard, W. W. 4. Saxton, E. A. 5. Powys, P. C.	III.	Veterinary Science.	None.
IV.	English Literature and Composition.	1. Slater, H. 2. Powys, P. C. 3. Tucker, H. V. 4. { Carpenter, P. A. { Macdonald, W. C.	IV.	English Literature and Political Economy.	None.
V.	Mathematics and Book-Keeping.	1. Westlake, G. 2. Sharman, H. B. 3. Lehmann, A. 4. Carpenter, P. A. 5. Black, C. H. 6. Little, W. 7. Macdonald, W. A. 8. { Ballantyne, A. W. { McGregor, H. 10. Wark, A. E.	V.	Mathematics.	1. Willis, W. B. 2. Robertson, W. 3. Torrance, W. J. 4. Fotheringham, W.

As there are several blanks in these lists, it is perhaps right that I should add a word of explanation. Some may wonder how it is that, in the first year, there are no first-class men in Agriculture and Live stock; and, in the second year, none in Agriculture, Veterinary Science, or English Literature and Political Economy.

In the first place, it may be observed that no one is ranked first-class in any department, unless he obtains 75 per cent. of the total number of marks allotted to the subjects in that department. If a candidate falls in any degree below this standard he is ranked as a second-class man. In the next place, although theory and practice go hand in hand with us, it takes some time to become thoroughly proficient in the practice. Young men may, even in six months, acquire a good deal of theoretical knowledge about cattle, sheep, horses, and English Literature; but they cannot, in so short a time, become proficient in judging animals, writing English, or solving original problems in Political

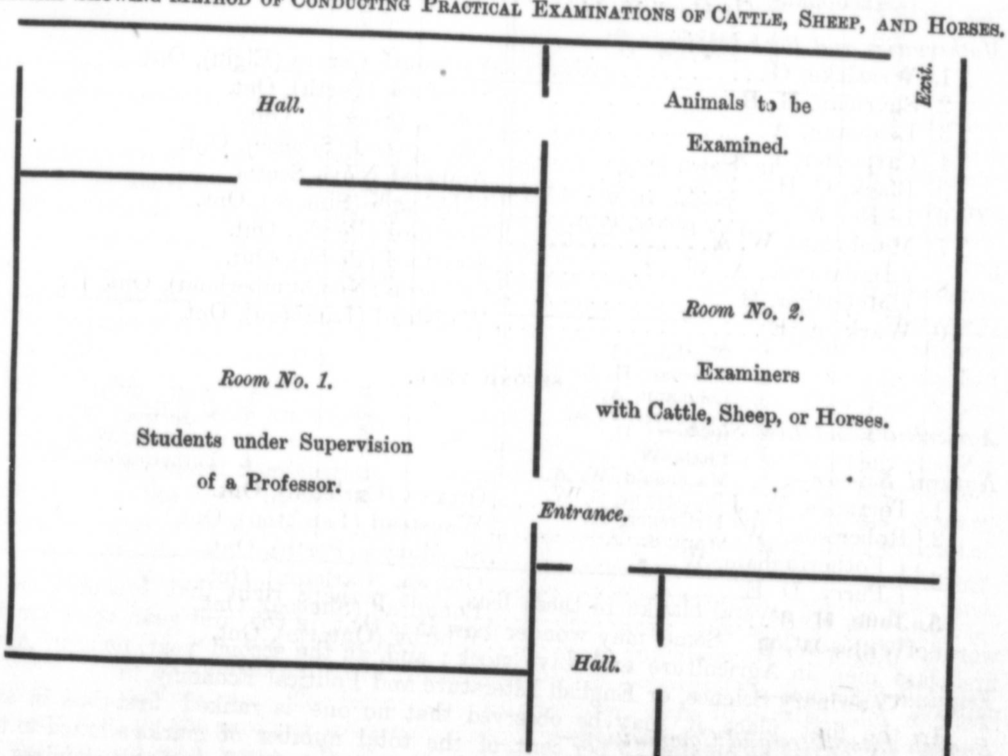
Economy. So it was with our students last Easter. Some of them were marked A1 in the theory; but, nevertheless, they failed to get the aggregate of marks necessary for a first-class rank in Agriculture, Veterinary Science, and English Literature; and a glance at the Class-Lists in Appendix 4, will show that the practical examinations were the cause of the failure in almost every instance.

Oral Examination of Live Stock.

In a previous report I called attention to the fact that we had instituted a practical examination of cattle, sheep, and horses, to be held twice a year—at Easter and Midsummer. We did so because we had discovered that it was quite 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, according to the standard which he found in his books or notes. The result has been all that we could have wished. The anticipation of these half-yearly examinations has led the students to go more frequently into the yards and stables, with note books in hand, to handle, judge, and compare various specimens of the several breeds of animals kept by the Institution.

In speaking more particularly of last Easter, I may say that the animals to be examined were taken into the Veterinary Class-room. The students were admitted one at a time; and when each had spent the allotted number of minutes in examining the animals and answering questions, he passed out, and another from an adjoining class-room took his place. The following diagram shows the relative position of the rooms used, and indicates more clearly than words how the examination was conducted:—

Diagram Showing Method of Conducting Practical Examinations of Cattle, Sheep, and Horses.



The class to be examined each day was sent early in the morning to room No. 1 in charge of a Professor; and at the hour for commencing the examination, the first student on the list went from room No. 1 to room No. 2, to meet the examiners. When his time was up, he passed out of the building. Another from No. 1 took his place; and so on, till the whole list was gone through.

HONOUR CERTIFICATES,

Granted on the Results of the Easter Examinations, 1883.

FIRST YEAR.

Agriculture—

Natural Science—

1.	Slater, H.	Taunton, England.
2.	Lehmann, A	Orillia (Simcoe), Ont.
3.	Macdonald, W. A	Stratford (Perth), Ont.

Veterinary Science—

1.	Carpenter, P. A.	Collingwood (Simcoe), Ont.
2.	Lehmann, A	Orillia (Simcoe), Ont.
3.	Hubbard, W. W	Burton, New Brunswick.
4.	Saxton, E. A	Nantwich, England.
5.	Powys, P. C	Fredericton, New Brunswick.

English Literature and Composition—

1.	Slater, H	Taunton, England.
2.	Powys, P. C	Fredericton, New Brunswick.
3.	Tucker, H. V	Toronto (York), Ontario.
4	Carpenter, P. A	Collingwood (Simcoe), Ont.
	Macdonald, W. A	Stratford (Perth), Ont.

Mathematics and Book-keeping—

1.	Westlake, G	Yarmouth Centre (Elgin), Ont.
2.	Sharman, H. B	Stratford (Perth), Ont.
3.	Lehmann, A	Orillia, (Simcoe), Ont.
4.	Carpenter, P. A.	Collingwood (Simcoe), Ont.
5.	Black, C. H	Amherst, Nova Scotia.
6.	Little, W.	Killyleagh (Simcoe), Ont.
7.	Macdonald, W. A	Stratford (Perth), Ont.
8	Ballantyne, A. W	Stratford (Perth), Ont.
	McGregor, H.	Colborne (Northumberland), Ont.
10.	Wark, A. E	Wanstead (Lambton), Ont.

SECOND YEAR.

Agriculture and Live Stock—

Natural Science—

1.	Torrance, W. J	Ottawa (Carleton), Ont.
2.	Robertson, W.	Wanstead (Lambton), Ont.
3	Fotheringham, W	St. Mary's (Perth), Ont.
	Perry, D. E.	Ottawa, (Carleton), Ont.
5.	Jeffs, H. B	Bondhead (Simcoe), Ont.
6.	Willis, W. B	Whitby (Ontario), Ont.

Veterinary Science—

English Literature and Composition—

Mathematics and Book-keeping—

1.	Willis, W. B.	Whitby (Ontario), Ont.
2.	Robertson, W	Wanstead (Lambton), Ont.
3.	Torrance, W. J	Ottawa (Carleton), Ont.
4.	Fotheringham, W.	St. Mary's (Perth), Ont.

Spring Term.

(16th April to 30th June.)

All specialists, and generally some others, leave at Easter; hence we have been accustomed to hold two entrance examinations in the year—one on the 1st of October, and the other on the 16th of April. The number admitted in April last year was 18. They were examined on the 17th and 18th; and lectures commenced on the 19th.

Work in Outside Departments.

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 charge of farms on their own responsibility; such as harnessing and driving horses, ploughing, sowing, harrowing, rolling, mowing with the scythe, driving a mower, and such like. The young men are sent to him in rotation, according to our knowledge of what they require; and while under his instruction they get no wages. Hence they are generally anxious to learn as quickly as possible, so that they may be in a position to claim the promised pay for their work.

Class-room Work.

While particular prominence was given to practical work outside, the theoretical work inside was by no means neglected. In the department of Agriculture the cultivation of the various crops was taken up; seeds were examined and judged; the different modes of sowing discussed and exemplified; the principles underlying rotation, and the rotations suitable to different soils, climates, and circumstances were explained; also the improvement of land by ordinary cultivation, subsoiling, fallowing, manuring, and laying down to grass. At the same time, under the head of Practical and Analytical Chemistry, the second year men were employed from three to four hours a week in the laboratory, examining and testing waters, soils, foods, manures, etc., so far as our limited appliances would allow. In that way they were led to see the practical value of what they had already learned in Inorganic, Organic, and Agricultural Chemistry. They had opportunities for putting their knowledge to a practical test. Hence most of them entered cheerfully and heartily into the work. In systematic and Economic Botany they received lectures on the general classification of plants, and studied more particularly those orders which contain the most important agricultural and economic plants—cereals, grasses, roots, and plants used in the manufacture of fabrics, oils, medicines, and other articles of commerce. At the same time the first year students were attending lectures on Geology and Botany. In the former they learned something of the formation, composition, and character of the soils found in the country; in the latter they studied the plant in relation to the soil and the atmosphere—its form, food, functions, and diseases, giving special attention to hybridization, the different modes of propagation, and such diseases as smut, rust, mildew, etc. The lectures of the class-room were illustrated and applied to some extent by the gardener while the students were at work with him in the 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 Washington Irving's "Sketch Book;" wrote impromptu compositions; began the study of Mensuration; and continued that of Book-keeping from the previous term. During the same time, the second year men had lectures on Veterinary Science, twenty-five or thirty important medicines, and the therapeutics of the veterinary art; read critically and committed to memory Milton's "L'Allegro," and "Il Penseroso;" gave some attention to Farm Book-keeping; and went twice a week into the fields with a master to apply, as far as possible, what had previously been taught them under the heads of Levelling, Draining, and Elementary Surveying.

Examiners and Examinations.

Hitherto we have found difficulty in getting suitable persons to act as examiners in Agriculture and Live Stock. Many have the knowledge, but very few have the experience necessary for that kind of work. Some have both the knowledge and the experience, but cannot spare the time. In order, therefore to make our honours and diplomas worth as much as possible to the recipients, I think it would be advisable, before long, to ask for a small annual vote to pay examiners in all the departments; we should then find less difficulty in getting competent men to undertake the work; the students would not confine themselves so closely to the lecture-room notes—they would read more extensively; and, I have no doubt, it would have an excellent effect on both professors and students.

Last Easter the examinations were all conducted by the professors of the College, except Practical Cattle, Practical Sheep, English Literature, and Political Economy; and at midsummer the only subject in which we had an outside examiner was English Literature.

The List of Examiners is as Follows:—

Wm. Brown, Esq., College	Agriculture and Live Stock.
John Hobson, Esq., Mosboro' (Wellington)	Handling and Judging Cattle and Sheep.
Charles Drury, M.P.P., Crown Hill (Simcoe)	Handling and Judging Cattle and Sheep.
R. B. Hare, Ph. Dr., College	Chemistry, Meteorology, and Geology.
J. Playfair McMurrich, M.A., College	Biology, Horticulture and English Literature.
F. Grenside, V.S.	Veterinary Science.
S. C. Smoke, M.A., Toronto	English Literature.
Wm. Douglas, B.A., Toronto	Political Economy.
E. L. Hunt, Esq., College	Mathematics, Book-keeping, and English Literature.

These gentlemen prepared the questions, examined the answers, and ranked the candidates according to the standard laid down on a previous page. The work was satisfactorily done; and I beg to return my most sincere thanks to all, but especially to those outside of our own staff—*i.e.*, to Messrs. Drury, Hobson, Smoke, and Douglas for their generous and efficient assistance in the departments which they represent.

The results of the Midsummer Examinations are given fully in the second part of Appendix 4; from which it will be seen that a few in each year gained the rank of first-class men in one or more of the departments, and received honour certificates as follows:—

HONOUR CERTIFICATES.

Midsummer Examinations, 1883.

First Year.

Agriculture—

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

Natural Science—

1. Carpenter, P. A. .... Collingwood (Simcoe), Ont.
2. Lehmann, A. .... Orillia (Simcoe), Ont.
3. Macdonald, W. A. .... Stratford (Perth), Ont.
4. Wark, A. E. .... Stratford (Perth), Ont.
5. McKay, J. B. .... Wanstead (Lambton), Ont.
6. Ballantyne, A. W. .... Stellarton, Nova Scotia.

Stratford (Perth), Ont.

Veterinary Science—

1. Miller, J. P. .... Norwich, England.
2. Carpenter, P. A. .... Collingwood (Simcoe), Ont.
3. Hubbard, W. W .... Burton, New Brunswick.
4. Wark, A. E. .... Wanstead (Lambton), Ont.
5. Macdonald, W. A. .... Stratford (Perth), Ont.
6. Butler, G. C. .... London, England.
7. Ballantyne, A. W. .... Stratford (Perth), Ont.
8. Shaw, A. G. .... Wolverhampton, England.
9. Black, P. C. .... Windsor, Nova Scotia.

English Literature and Composition—

1. Black, P. C. .... Windsor, Nova Scotia.
2. Miller, J. P. .... Norwich, England.
3. Carpenter, P. A. .... Collingwood (Simcoe), Ont.
4. Macdonald, W. A. .... Stratford (Perth), Ont.

Mathematics—

1. Wark, A. E. .... Wanstead (Lambton), Ont.
2. Little, W. .... Killyleagh (Simcoe), Ont.
3. Sharman, H. B. .... Stratford (Perth), Ont.
4. Carpenter, P. A. .... Collingwood (Simcoe), Ont.
5. McKay, J. B. .... Stellarton, Nova Scotia.
6. Ballantyne, A. W. .... Stratford (Perth), Ont.
7. Wroughton, T. .... India.
8. Macdonald, W. A. .... Stratford (Perth), Ont.

Second Year.

Agriculture and Live Stock—

1. Robertson W. .... Wanstead (Lambton), Ont.
2. { Willis, W. B. .... Whitby (Ontario), Ont.
   { Jeffs, H. B. .... Bond Head (Simcoe), Ont.

Natural Science—

1. Slater, H. .... Taunton, England.
2. Robertson, W. .... Wanstead (Lambton), Ont.
3. Jeffs, H. B. .... Bond Head (Simcoe), Ont.
4. Willis, W. B. .... Whitby (Ontario), Ont.

Veterinary Science—

1. Robertson, W. .... Wanstead (Lambton), Ont.
2. Fotheringham, W. .... St. Mary's (Perth), Ont.
3. Jeffs, H. B. .... Bond Head (Simcoe), Ont.
4. Slater, H. .... Taunton, England.

English Literature—

1. Robertson, W. .... Wanstead (Lambton), Ont.
2. Slater, H. .... Taunton, England.
3. Fotheringham, W. .... St. Mary's (Perth), Ont.
4. Willis, W. B. .... Whitby (Ontario), Ont.

Mathematics—

1. Willis, W. B. .... Whitby (Ontario), Ont.
2. Jeffs, H. B. .... Bond Head (Simcoe) Ont.

Visitors.

It is, I believe, still correct to say that the Ontario Agricultural College and Experimental Farm has a larger number of visitors, from home and abroad, than any other public institution in the country—visitors of every class and calling, but especially farmers. The only agricultural college in the Province; the only institution in the British Dominions that has systematically attempted to combine study and manual labour; an institution that has been keenly criticised and soundly abused—all this has given us more or less notoriety, and has excited a curiosity to see and know exactly what we are doing.

Last year we had not only the usual number of daily visitors, but several large excursions of farmers in the month of June, from Brant, Oxford, Wentworth, Huron, Bruce, Grey, Simcoe, York, and Peel, with smaller companies from Wellington, Halton, and other places. Everything passed off pleasantly. Short addresses were delivered by leading excursionists, and resolutions passed at the close of each day's proceedings.

In Camp at London.

By the kindness of Lieutenant-Colonel Macdonald, commander of the First Provisional Brigade of Field Artillery, we have had for the last three years the very efficient and valuable services of Adjutant Clark, as instructor in artillery, rifle drill, and gymnastics. Adjutant Clark is undoubtedly one of the best instructors in the Dominion; and he has spared no pains to do the college work efficiently and in such a way as to interest the students, and meet the wishes of the officers as regards study, work, and discipline; without a gymnasium, or a suitable room to drill in, he has given our young men not only the ordinary military drill, but also a great variety of valuable exercises with bar-bells, parallel bars, Indian clubs, etc.; all of which has a direct bearing on the much neglected, but all important subject of physical education.

Then, a number of the students, being members of the Ontario Field Battery, were called out to camp on the 20th June, but could not be spared from the College till the 23rd. Twenty-five of them went into camp at London on the 24th, and returned to the College on the 3rd July, just in time for the closing exercises of the session.

CLOSING EXERCISES.

Granting of Diplomas: Presentation of Medals and Prizes.

The usual public exercises at the close of the year's lectures and examinations took place on the 3rd July. A number of visitors from Guelph, and elsewhere, came to show their interest in the Institution, and to witness the presentation of the diplomas, medals, and prizes. After a short address by the President of the College, the Hon. James Young, Commissioner of Agriculture, granted diplomas to the following young gentlemen, and, before doing so, alluded to the fact that the College had decided at the outset not to cheapen its diplomas by granting them to any but those who reached the required standard in every department of study and work prescribed in the curriculum. Consequently, only nine out of a class of twenty-four were presented to receive at his hands the parchment admitting them to the status of associates of the Ontario Agricultural College.

Associates.—Fotheringham, W.; Garland, C. S.; Jeffs, H. B.; McPherson, D.; Perry, D. E.; Robertson, W.; Schwartz, J. A.; Torrance, W. J.; Willis, W. B.

The Gold Medal was presented to W. Robertson, of Wanstead, County of Lambton, by the Hon. James Young; the First Silver Medal to W. B. Willis, of Whitby, by James Innes, M.P.; and the Second Silver Medal to Wm. Fotheringham, of St. Mary's, by

James Laidlaw, M.P.P. The prizes and honour certificates were presented by members of the Faculty, clergymen, and other visitors; after which the students and a number of tbeir friends met in the college dining hall for tea.

Associates of the College.

1881.

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

1882.

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

1883.

Fotheringham, W.	St Mary's (Perth), Ont.
Garland, C. S.	Montreal.
Jeffs, H. B.	Bond Head (Simcoe), Ont.
McPherson, D.	Glanworth (Middlesex), Ont.
Perry, D. E	Ottawa (Carleton), Ont.
Robertson, W	Wanstead (Lambton), Ont.
Shewartz, J. A	Quebec.
Torrance, W. J	Ottawa (Carleton), Ont.
Willis, W. B.	Whitby (Ontario), Ont.

Prizes Awarded on the Results of the Easter Examinations.

First Year.

Agriculture and Live Stock—
1st. Little, W.
2nd. Ballantyne, A. W.

Natural Science—
1st. Slater, H.
2nd. Lehmann, A.

Veterinary Science—
1st. Carpenter, P. A.
2nd. Lehmann, A.

English Literature and Composition—
1st. Slater, H.
2nd. Powys, P. C.

Mathematics and Bookkeeping—
1st. Lehmann, A.
2nd. Westlake, G.

General Proficiency—
1st. Macdonald, W. A.
2nd. Lehmann, A.
3rd. Carpenter, P. A.

Second Year.

Agriculture and Live Stock—
1st. Jeffs, H. B.
2nd. Torrance, W. J.

Natural Science—
1st. Torrance, W. J.
2nd. Robertson, W.

Veterinary Science—
1st. Fotheringham, W.
2nd. Torrance, W. J.

Eng. Lit. and Political Economy—
1st. Fotheringham, W.
2nd. Willis, W. B.

Mathematics and Bookkeeping—
1st. Willis, W. B.
2nd. Robertson, W.

General Proficiency—
1st. Torrance, W. J.
2nd. Robertson, W.
3rd. Fotheringham, W.

Medals.

The competition for the College Medals is—

(1) By written examinations at Easter on the class-room work of the Fall and Winter Terms.

(2) By written examinations at the end of June on 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.

The minimum standard for the Gold Medal is 50 per cent. of the marks in each subject, and an aggregate of 75 per cent. of the total number of marks in all the subjects; for the Silver Medals, 50 per cent. in each subject, and an aggregate of 67 per cent. in all the subjects.

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

(1) Written Examinations at Easter.	(2) Written Examinations at Midsummer.	(3) Practical Examinations, Midsummer.
1. Robertson, W.	1. Robertson.	1. Robertson.
2. Fotheringham, W.	2. Willis.	2. Jeffs.
3. Willis, W. B.	3. Jeffs.	3. Willis.
4. Jeffs.	4. Fotheringham.	4. Fotheringham.

GENERAL PROFICIENCY.

1. Robertson, W. (Gold Medallist) .... Wanstead, Lambton, Ont.
2. Willis, W. B. (First Silver Medallist)...... Whitby, Ontario, Ont.
3. Fotheringham, W. (Second Silver Medallist). St. Mary's, Perth, Ont.
4. Jeffs, H. B. .... Bond Head, Simcoe, Ont.

Medallists.

Eight medals have hitherto been awarded, two by His Excellency the Marquis of Lorne, and six by the College. The winners have all been non-drinkers and non-smokers. Six of them are farmers' sons, and all but one from the Province of Ontario.

1880.

J. L. Webster, Nova Scotia, banker's son.. Winner of Governor-General's Medal.

1881.

R. J. Phin, Hespeler, Ont., farmer's son.. Winner of Governor-General's Medal.

1882.

F. Wettlaufer, County of Oxford, Ont., farmer's son.... Gold Medallist.
A. Shuttleworth, County of York, Ont., farmer's son.... First Silver Medallist.
R. A. Ramsay, County of Halton, Ont., farmer's son.... Second Silver Medallist.

1883.

W. Robertson, County of Lambton, Ont., farmer's son .... Gold Medallist.
W. B. Willis, County of Ontario, Ont., farmer's son.... First Silver Medallist.
W. Fotheringham, County of Perth, Ont., clergyman's son.. Second Silver Medallist.

Summer Term.

(1st July to 31st August.)

At the close of the Spring Term (30th June), when the year's lectures were ended, most of the farmer's sons went home for haying and harvest, and some of the other students hired out with farmers for the summer months; so that only thirty remained with us during the Summer Term (July and August). These worked nine and a half hours a day, giving more or less attention to all the departments, but spending the greater part of their time where it was most needed, *i.e.*, on the farm. I shall not attempt to give a detailed account of the routine in each department, but simply say that the young men received more or less instruction in the fields, the yards, the gardens, and the shop. They spent a portion of their time in a special class for the purpose of learning how to dig, plough, harrow, sow, shear sheep, mow, cradle, drive a reaper, bind, shock, etc.; and did all there was to do in the summer months, on a four hundred-acre grain and stock farm, and in the management of a large vegetable garden, flower garden, orchard and lawn.

Fall Term.

COMMENCEMENT OF A NEW SCHOLASTIC YEAR—1st October, 1883.

Forty-seven old students returned at the beginning of the Fall Term, and sixty-two new ones were admitted, making a total of 109. Twenty-three had to pass our Matriculation Examination, and thirty-nine were admitted on presentation of certificates. The names and addresses will be found in the second part of Appendix 1; and the following lists contain the names of the counties, countries, and religious denominations which they represent:—

Counties, etc.	No. of Students.	Counties, etc.	No. of Students.
Brant	1	Middlesex	3
Bruce	2	Montreal	5
Carleton	4	New Brunswick	3
Durham	2	Norfolk	1
Elgin	1	Northumberland	5
England	10	Nova Scotia	5
Frontenac	1	Oxford	1
Glengarry	1	Perth	5
Grey	2	Prince Edward	1
Hastings	1	Prince Edward Island	2
Huron	1	Peterboro	2
India	1	Province of Quebec	4
Ireland	1	Simcoe	9
Kent	2	Scotland	2
Lambton	1	Toronto	10
Lanark	1	Victoria	1
Leeds	1	Wales	1
Lincoln	1	Wellington	6
Manitoba	3	Wentworth	2
Massachusetts, U. S.	1	York	3

Total number in attendance during Fall Term, 1883...... 109
Number of Counties in Ontario represented.............. 27

RELIGIOUS DENOMINATIONS OF STUDENTS IN ATTENDANCE DURING FALL TERM.

Episcopalians	47
Presbyterians	29
Methodists	20
Congregationalists	4
Baptists	3
Roman Catholics	3
Plymouth Brethren	1
Lutherans	1
Unitarians	1
Total	109

Ages of Students.

Candidates for admission must be at least sixteen years of age. The ages of those now in attendance range from 16 to 32, as follows:

18	at the age of	16 years.
19	"	17 "
30	"	18 "
13	"	19 "
14	"	20 "
8	"	21 "
3	"	22 "
1	"	23 "
1	"	24 "
1	"	25 "
1	"	32 "
Average Age..		...18½ years.

Classroom Work.

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 Wednesday, the 3rd of October, and continued without interruption till 19th December.

Regular Students.

The first-year students received three lectures a week on the characteristic points and peculiarities of the different breeds of cattle; had a full course of lectures with experiments on Chemical Physics and Inorganic Chemistry; devoted an hour and a-half a week to Human Physiology; and spent some time in studying the Anatomy and Physiology of the Horse. Under the head of English and Mathematics, they read a portion of Washington Irving's "Sketch Book," 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 pastures and green fodder; results from the different kinds of seed, soil, and manures; and the previous season's experiments with wheat, oats and grasses. They had one lecture a week on Meteorology, and a full course on Agricultural Chemistry—the composition of different plants in relation to the soils on which they grow; the preservation and renovation of soils, the chemical composition and value of different manures, the superphosphates, double silicates, and other substances which furnish plant food. They spent two hours a week at lectures on Veterinary Pathology, and one in handling and examining horses for spavin, ring-bone, splint, founder, and other diseases, all under the eye and direction of our veterinary surgeon, Dr. Grenside; they also read the greater part of Shakespeare's "Julius Cæsar," and devoted some time to the study of statics and drainage.

Special Students.

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

In addition to this, I had almost forgotten to say, the Specials got a course of practical and, so far as I can learn, very popular lectures on stock, from P. J. Woods, our Farm Foreman; which lectures were delivered sometimes in the classroom, but generally in the stables with the cattle. Mr. Woods took the class from stall to stall examining, comparing, and judging the various animals from the standpoints of breeding, feeding, and immediate slaughter, and in that way made the young men thoroughly familiar with the strong and the weak points of all the animals kept on the farm. On certain days of the week also, Mr. Woods, being a practical butcher as well as stock-man, showed them how to cut up carcasses of pork, beef, and mutton for use in the College, pointing out the prime cuts and practically demonstrating how to prepare the different parts of a carcass for the table.

Fat Stock Show.

On the 13th and 14th December, the Guelph Fat Stock Club held its annual show in the city, and kindly arranged matters so that all our students were afforded special opportunities for examining, comparing, and judging the animals on exhibition. Every one had to take notes on the show as a whole, and on the best animals in each class, and write out a special report for Professor Brown. The work was heartily entered into and very much enjoyed by all the classes.

Terminal Examinations.

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

First Year—

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

Second Year—

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

The questions were not difficult, because they were intended only to show who were making a right use of their time, and to prepare the candidates for a severer test at Easter. The results, as published in the daily papers, indicate very clearly that patient, plodding industry, here as elsewhere, almost invariably wins the race.

II.—BOARDING HOUSE AND COLLEGE BUILDINGS.

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

College Buildings.

The College building, as shown on frontispiece, is a plain substantial structure, without much claim to architectural beauty. Like the Institution itself, it was built little by little without any very definite idea of the shape it might ultimately assume. When the Government first bought land and determined to establish an agricultural college, the

Architect drew plans for a building which would have suited the purpose exactly, but the cost seemed too great and the country was not prepared for it; consequently it was decided nine years ago to commence work with a few students in Mr. Stone's farmhouse. Additions and alterations were made from time to time as the number of students increased, till the result is a large and peculiarly arranged building, altogether different from what was originally intended—not what we would like—but affording considerable accommodation and serving the purpose fairly well.

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

Repairs Needed.

Some of the woodwork inside has become so dingy from seven or eight years' wear that there is need of an immediate expenditure of several hundred dollars for repairs. The old pine floors in three or four of the students' halls are almost worn out and should be at once replaced by new ones of well-seasoned oak or maple.

Repairs Done Last Year.

In June last Professor Brown moved out of the College into one of the new houses recently built on the lawn; and the rooms which he had previously occupied in the College were painted, papered, and overhauled generally by the Public Works Department, for the use of the President's family. At the same time about $200 of our maintenance appropriation was expended in painting and papering the Bursar's office and two rooms for the Matron in the front of the main building, and in graining and varnishing certain portions of the College halls, including twenty doors, fourteen windows, and a long stretch of wainscoting.

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 have been satisfactory. The Matron has superintended the work in the culinary department, and the Assistant Resident Master has taken charge of the students at meals and assisted me in looking after them in the halls and dormitories.

Daily Routine.

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

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

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

Discipline.

In the matter of discipline, the year 1883 was not at all exceptional. Of course, where there are so many young men boarding in the same building, it may be set down as a certainty that there will arise, now and then, cases which need to be dealt with promptly and vigorously, especially among the sons of the wealthier classes. As regards our own Institution, I think I am correct in saying that the uniform testimony of those who have come to us from the old country, is that the order maintained here is much better than they had been accustomed to in English schools and colleges; and, considering the fact that I have only one master to assist me in looking after the students at all times, in the dining-room, halls, and dormitories, I think we may congratulate ourselves on the quiet which generally prevails in the College, and on the fact that so few difficulties have arisen.

When a new master comes, an effort is generally made by the more daring spirits, to test his mettle in some way or other, and occasionally by means that are very improper. To this development of youthful depravity is to be attributed the fracas of one evening last winter, which resulted in the kicking-in of the new master's door, the dismissal of five students, and the publication of a false and misleading article in one of the Toronto papers. In reference to which case, I have only to say, that if editors of papers had each a few months' experience in the management of a large boarding-house in connection with a College, they would wait to hear both sides before giving publicity to the statements of dismissed students or their sympathizers.

III.—THE BUSINESS DEPARTMENT.

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

Correspondence.

Most of the correspondence falls to the lot of the President, and consists chiefly in sending out circulars, distributing reports, and answering inquiries about terms of admission, course of study, duties of students, cost of board and tuition, books used, books recommended, etc. Last year I distributed 1,800 copies of our last Annual Report, sent out about 1,000 circulars, and wrote, on an average, from five to six letters a day. Reports were sent to the leading Agricultural Colleges in Britain and the United States, to the subordinate granges in Ontario, and to all farmers and others who made application for copies.

Books and Accounts.

Our Bursar, Mr. A. T. Deacon, 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 Farm Superintendent for approval, and then to forward both to the Treasury for payment. He receives and accounts for all moneys from the College, the Farm, and the Treasury Department, and pays all accounts that have been approved of by the President or the Farm Superintendent, and passed by the Auditor. He also keeps three sets of books :—

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

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

No. 3, showing the account of each student from the day he enters the College till he leaves it—tuition fees, board and washing, amounts allowed for labour, and cash balances paid the College for board and washing.

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

General Business.

In addition to his duties as bookkeeper, the Bursar has to provide supplies for the boarding-house and take charge of the storeroom. 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 management, but for the discipline of the inside departments, as regards both officers and students.

Finances.

The financial tables in Appendix 5 contain a brief statement of the College and Boarding-house accounts for the year 1883, and the estimated expenditure for 1884. Table No 1 shows the expenditure under the various heads; No. 2, the revenue from all sources; No. 3, the College account with the Farm and the Garden, for 1883; and No. 4, the estimated expenditure in 1884.

The total expenditure in 1883, on the regular maintenance account, was $33,040 86, and on capital account, $719 76. It may be observed, however, that a number of items amounting to more than $600 under the head of maintenance might with more propriety have been charged to capital, had there been any vote for that purpose; such, for instance, as a carriage shed, $75; plumber's tools, $160; iron tie-posts, $26; etc., etc.

A few facts regarding the revenue and expenditure of the College may be stated as follows—bearing in mind that the figures have no reference whatever to the Farm or any of the outside departments, except the amount paid by the College for farm salaries and student labour on the Farm, and the charges against the College for milk, flour, vegetables, etc., supplied by the Farm, as per table No. 3 :—

(1) College expenditure on maintenance account (including payments for student labour on Farm, &c.)		$33,040 86
College revenue from fees and board balances		7,242 47
Net expenditure (including payments for student labour, &c.)		$25,798 39

(2) Expenditure in 1883		$33,040 86
Voted for 1883		31,848 00
Over expended		$ 1,192 86

In this over-expenditure, the chief item is under the head of fuel, which exceeded the appropriation by $618 25; and the remainder is accounted for almost entirely by a number of items which should have been provided for by a vote on capital account; but, as no such vote was taken and the purchases were necessary, they had to be made and charged to maintenance.

(3) Net expenditure in 1883 (including payments for student labour on Farm, &c.)		$25,798 39
Salaries of Foremen and part salaries of Superintendents of Farm and Garden	$3,000 00	
Paid for student labour on Farm and Garden	4,000 42	7,000 42
Net expenditure of College in 1883 (exclusive of payments for student labour on Farm, &c.)		$18,797 97

In table No. 4, Appendix 5, will be found the estimated expenditure for 1884, along side of the sums voted for various purposes in 1883. It is unnecessary for me to dwell on the items separately, any further than to request your favourable consideration of the claims urged for an increase in the salaries and wages of several professors and other officers of the institution. The increase asked in each case will be found in table 4, Appendix 5.

Last year I did my best to get a steward appointed to assist me in the boarding house, but failed to accomplish my purpose. I put down $500 for such a man as I require, but it was struck out; so I have decided to let the matter drop for the present, in the hope that before long the Government may recognize the necessity for such an officer in the institution.

MISCELLANEOUS ITEMS.

Library.

A very important factor, in the education given at the College, is our Library of about 4,000 volumes, selected and added to from time to time, with reference to the present work and future wants of our students. We have not only a good representation of the best books which treat of the several branches taught in the Institution, but also a large number of volumes on history, biography, travels, poetry, and general literature, as well as the latest and best dictionaries and encyclopædias.

About a year ago, at the suggestion of the Hon. S. C. Wood, I commenced the work of making a catalogue for publication in our last annual report; but finding it impossible to get it printed in time for presentation to the House, I decided to revise the list carefully and have it printed separately for the use of the students. In the work of revision, I was assisted by Mr. Rodger, a gentleman of leisure in Guelph, who kindly offered his services in arranging and checking the books, correcting proofs, &c.; and I wish here to tender my most sincere thanks to that gentleman for his disinterested efforts to lighten my labors during the months of July and August. We worked together till the middle of September, at which time we had the pleasure of presenting the students the first printed catalogue of our Library.

Reading Room.

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

Papers and Magazines.

(a) Sent Free by the Publishers.

Journal of Commerce, Montreal
Journal of Agriculture, Montreal.
Weekly Herald, Stratford.
Advertiser, Elmira.
Christian Guardian, Toronto.
Canadian Entomologist, London.
Monthly Weather Review, Toronto.
Canada Presbyterian, Toronto.
Christian Herald and Signs of our Times, New York.

(b) Furnished by the College.

Daily Globe.
Daily Mail.
Weekly Globe.
Weekly Mail.
Guelph Mercury.
Guelph Herald.
Canadian Farmer and Grange Record, Welland.
Farmer's Advocate, London.
Rural Canadian, Toronto.
Grip, Toronto.
Canadian Lumberman, Peterboro'.
North British Agriculturist, Edinburgh.
Irish Farmer's Gazette, Dublin, Ireland.
Mark Lane Express, London, England.
Canadian Stock-Raiser's Journal, Hamilton.
National Live-Stock Journal, Chicago.
Live-Stock Journal and Fancier's Gazette, London, England.
Popular Science News and Boston Journal of Science.
Scientific American.
Scientific American Supplement.
Boston Journal of Chemistry.
American Agriculturist.
Cultivator and Country Gentleman.
City and Country.
Country Gentleman's Magazine,
Gardener's Monthly.
Veterinarian.
Veterinary Journal.
Aberdeen Free Press.
St. John Telegraph.
Good Words.
Sunday Magazine.
Quiver.

(c) Furnished by the Literary Society.

Contemporary Review.
Century Magazine.
Nineteenth Century.
Fortnightly Review.

Museum.

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

Under several of these heads we have already a very fair collection; and a portion of it has been arranged and classified by the Professor of Biology, who acts as Curator of the Museum. For a list of the specimens now on hand, see appendix to Professor McMurrich's report in the third part of this volume.

Literary Society.

The Literary Society in connection with the College, was never more active, vigorous, and useful than at the present time. The members of this society meet every

Friday evening in one of the class-rooms, to practice reading, debating, and declamation. The discussions are often quite spirited; and the work done is, undoubtedly, a very valuable addition to the educational appliances of the Institution. In the performance of such work, the young men have an opportunity of testing their ability before they assume the responsibilities of life on the broader scale. They learn to speak in public, and gradually become acquainted with the rules of order according to which public meetings are conducted. Their wits are sharpened, their reasoning powers developed, and their manners improved. Last year the funds of the society were spent in the purchase of papers, magazines, reviews, and prizes for reading, essay-writing, and public speaking.

Changes in the Staff.

In the beginning of this report, I stated that no changes in the staff had taken place during the year 1883, forgetting to say that at the close of 1882, Dr. Nattress, who had been my Assistant Resident and Mathematical Master, resigned his position and went to Europe to complete his medical education. He was succeeded by E. L. Hunt, a third-year undergraduate of the University of Toronto, who is still with us.

There is no doubt that the frequent changing of masters or professors in any school or college is productive of bad results; and for that reason, I hope the Government of this Province may ere long judge it expedient to pay such salaries as will secure the longest possible tenure of office by the several members of our staff.

E. A. A. Grange, V.S., who was one of the first professors appointed to lecture in the Ontario Agricultural College, remained at his post for a little over seven years, but never succeeded in getting a higher salary than $600 per annum. He did his work well and faithfully, hoping that in the course of time his efforts would meet with something like adequate remuneration. In this, however, he was disappointed from time to time; and, not seeing any very good grounds to hope for more liberal treatment in the future, he at length resigned his position with us and went to Lansing, Michigan, where they where glad to get him to lecture in their Agricultural College for more than twice the salary that we paid him.

Dr. Grenside is our Professor of Veterinary Science at the present time; and I am pleased to say that he is giving entire satisfaction as a lecturer and practitioner; but he will not remain long with us for $600 a year. I have asked for an increase in his salary; and I sincerely hope the Government may judge it expedient to comply with my request so far as to prevent us from losing his services also.

Under New Auspices.

At the beginning of last year we were disappointed to hear that our old Chief, the Hon. S. C. Wood, under whose control and guidance we had worked so long, had decided to retire from public life and leave us in charge of some one else. After a few months' suspense, we were reassured by the very acceptable appointment of the Hon. James Young, who at once acquainted himself with all the departments of the Institution, and took a most earnest and active interest in everything pertaining to the College and the Farm. All seemed fair for another term of successful work, when we were again surprised by the unexpected and much regretted resignation of Mr. Young; and now, Sir, we have the honour to look to you for counsel and guidance, and we do so in the hope that we may be able to work in such a way as to secure your approval, and promote the best interests of the Ontario Agricultural College and Experimental Farm.

Wants and Recommendations.

As usual, our wants are numerous, but may be stated very briefly:—

(1) The renewal of worn-out floors in the College.
(2) A hot-water boiler in the College.
(3) Additions to our coal houses.
(4) An ice-house.

(5) The removal of all our old barns and stables, and the erection of suitable farm buildings a little farther away from the College.

(6) A new Conservatory and Greenhouses with Botanical Laboratory and Lecture-room.

(7) A Laboratory for practical work in the department of Chemistry.

(8) A good analyst, who, under the direction of the Professor of Chemistry, would spend most of his time in analysing soils, manures, foods, feeding-stuffs, etc., for the instruction of our students, and especially for the benefit of farmers throughout the Province, who are constantly sending samples for analysis.

Agricultural Education.

It is gratifying to observe that the question of agricultural education is beginning to excite a good deal of interest throughout this Province, and, I might say, throughout the whole Dominion. The press is waking up to the importance of the subject; and the Council of the Agricultural and Arts Association has lately inaugurated a scheme of annual examinations in branches of study bearing directly upon the work of the farm. On the results of these examinations, certificates will be granted, and no less than ten money prizes, ranging from $15 ot $30 each, awarded annually to the most successful candidates, as follows:—

1st. To the *three* candidates for second-class certificates obtaining the greatest number of marks, $25, $20, and $15, respectively.

2nd. To the *three* candidates for second-class certificates, who have *never attended* any agricultural school or college in Canada or elsewhere, obtaining the greatest number of marks, $25, $20, and $15, respectively.

3rd. To the *four* candidates for *third*-class certificates, who have *never attended* any agricultural school or college in Canada or elsewhere, obtaining the highest number of marks, $30, $25, $20, and $15, respectively.

An outline of the course of reading necessary for these examinations has been prepared, and can be had on application to Henry Wade, Esq., Secretary of the Agricultural and Arts Association, Agricultural Hall, Toronto.

The questions will not be based on any particular book or books, nor are any text-books prescribed; but two lists of books are given, containing a few of the works that may be studied with advantage—No. 1 for all candidates, and No. 2 for those intending to write for second-class certificates:—

1. "First Principles of Agriculture" (Tanner); "Hand Book of Agriculture," embracing soils, manures, rotation of crops, and live stock (Wrightson); "Canadian Farmer's Manual of Agriculture" (Whitecombe); "Soil of the Farm" (Sir J. B. Lawes and others); "Catechism of Agricultural Chemistry and Geology" (Johnston)—new edition by Cameron.

2. "New American Farm Book" (Allen); "Talks on Manures" (Harris); "Chemistry of the Farm" (Warrington); "Elements of Agricultural Chemistry and Geology" (Johnston and Cameron); "Stock-Breeding" (Miles); "The Complete Grazier" (Youatt and Burn); "American Cattle" (Allen); "Feeding of Animals" (Stewart); "Manual of Cattle Feeding" (Armsby); "The Shepherd's own Book" (Youatt, Skinner and Randal); "Treatise on the Pig" (Harris); "Veterinary Adviser" (Law); "Insects Injurious to Vegetation" (Harris); "Insects Injurious to Fruit" (Saunders).

Such a course of study cannot fail to be a great benefit to the farmers' sons of this Province, and, indirectly, to all classes of the population. I need not enlarge on the advantages which are sure to result to the whole community from the reading and study of our agricultural papers and the best works on agriculture, stock-raising, and kindred subjects. I commend this course of reading to the young farmers of Ontario.

When the late Minister of Education authorized "The First Principles of Agriculture," by Professor Tanner, for use in the Public Schools of Ontario, he did a wise thing. He took a step in the right direction, but, in our opinion, did not go far enough. The book is authorized; but its use is optional, and the Normal Schools are doing nothing whatever to qualify the teachers of the Province for giving instruction in it. Something more is needed. The rural constituencies are asking for something more—the young men who wish to prepare for the examinations of the Agricultural and Arts Association, are asking for something more; and I venture to express the hope that the new Minister of Education will give their requests the most favourable consideration.

So far as we can judge, they want three things:—

1. "The First Principles of Agriculture" placed in the fixed, instead of the optional, list of studies in all our rural Public Schools.

2. A course of lectures to all teachers in training at the Normal Schools, on—

(1) Agriculture, Live Stock, and Dairying.
(2) Forestry.
(3) The beautifying of our homes.

3. A course of lectures on these topics, delivered at convenient centres throughout the Province on Saturdays, for Public School teachers who have already passed through the Model and Normal Schools.

So long as Agriculture is on the optional list of studies, nothing will be accomplished by its authorization. Witness the fate of "Christian Morals" as an optional subject in the Public School programme. No doubt, the programme is already crowded; but Agriculture is more important than some of the branches now in the compulsory list. Let our Inspectors demand and our teachers spend a little less time on Geography and on the endless details of Grammatical Analysis, and we shall easily find a place for Agriculture.

One point more. It is utterly useless to pass a law compelling teachers to give instruction in subjects which they know little or nothing about. Consequently, I take the liberty of recommending that a competent man be appointed to lecture on the subjects just named, both in the Normal Schools and throughout the Province, as suggested in 2 and 3 above. Professor Henry Tanner, F.C.S., of the Institute of Agriculture, South Kensington, London, spends a portion of every year in lecturing to the Public School teachers of England on these very topics; and I have no doubt the services of such a man would be invaluable to us at the present time. Hence I take the liberty of asking the Commissioner of Agriculture, and the Council of the Agricultural and Arts Association, in conjunction with the Minister of Education, to give this proposition the early consideration which its importance seems to demand.

I have the honour to be, Sir,

Your obedient servant,

JAMES MILLS,

President.

9. Laboratory.
10. Lecture-Room.
21. Kitchen Garden.
22. Hedge of Norway Fir
M. Ericaceæ ......Heath.

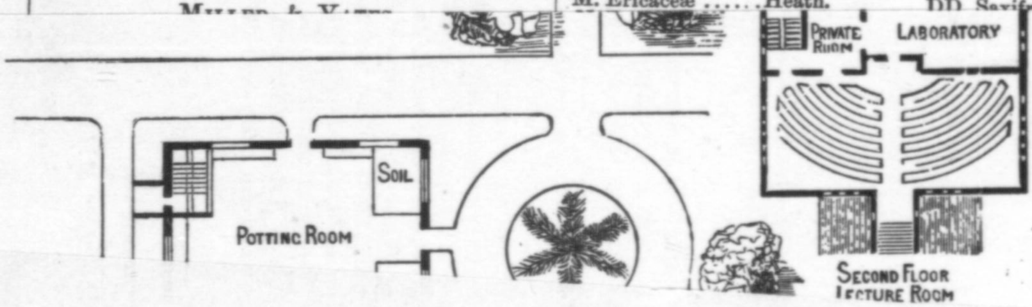
AGRICULTURAL COLLEGE,

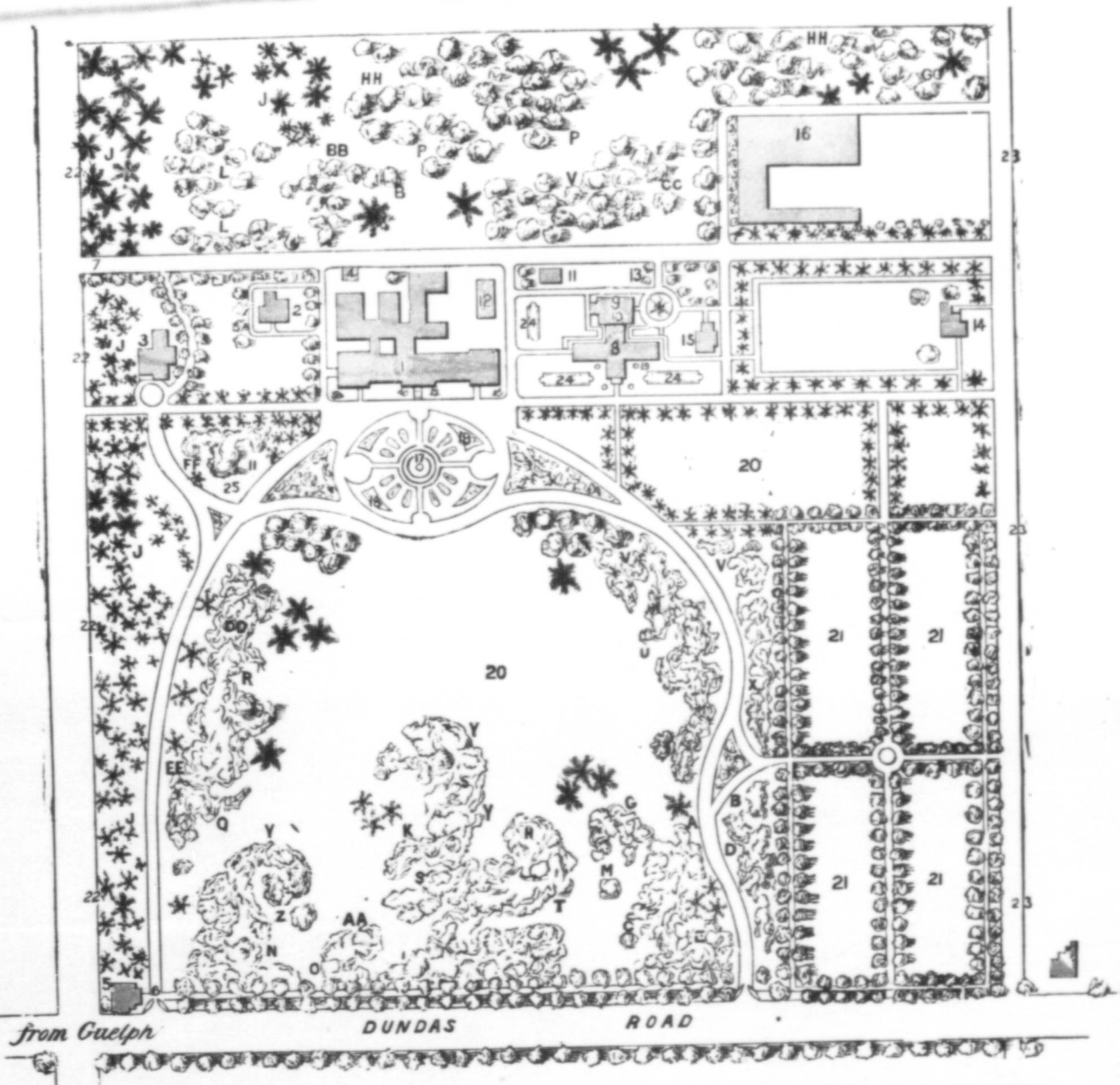
GUELPH.

CONSERVATORY, GREENHOUSE

AND

LECTURE ROOM.





REFERENCES.

1. Main Building.
2. Bursar's House.
3. Professor's House.
4. Ice House.
5. Porter's Lodge.
6. Main Entrance.
7. Back do.
8. Greenhouse, etc.
9. Laboratory.
10. Lecture-Room.
11. Chemical Laboratory.
12. Convocation Hall.
13. Sites for proposed buildings.
14. Cottage for Farmer.
15. do Gardener.
16. Farm Buildings.
17. Fountain.
18. Flower-beds.
19. Vases.
20. Play-ground and Lawn Tennis.
21. Kitchen Garden.
22. Hedge of Norway Fir.
23. do Arbor Vitæ.
24. Sub-tropical Beds.
25. Choice Evergreens.

AGRICULTURAL COLLEGE,
GUELPH.

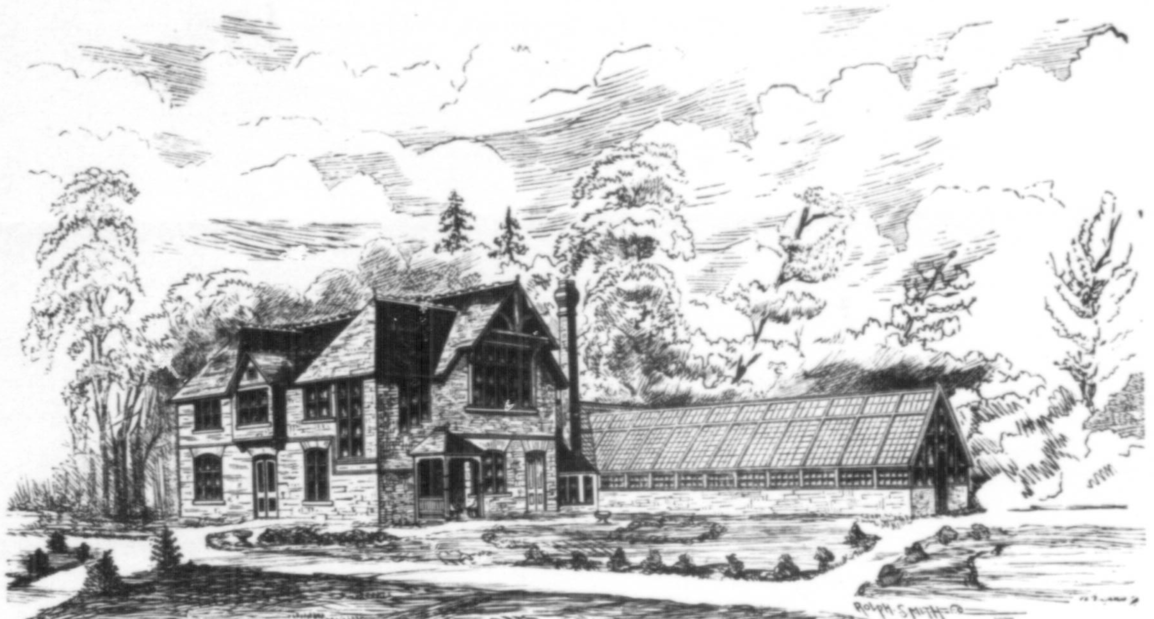
PLAN OF GROUNDS.

Scale, 200 ft. to 1 in.

MILLER & YATES,
Landscape Gardeners,
PHILADELPHIA, PA.

REFERENCES TO ARBORETUM.

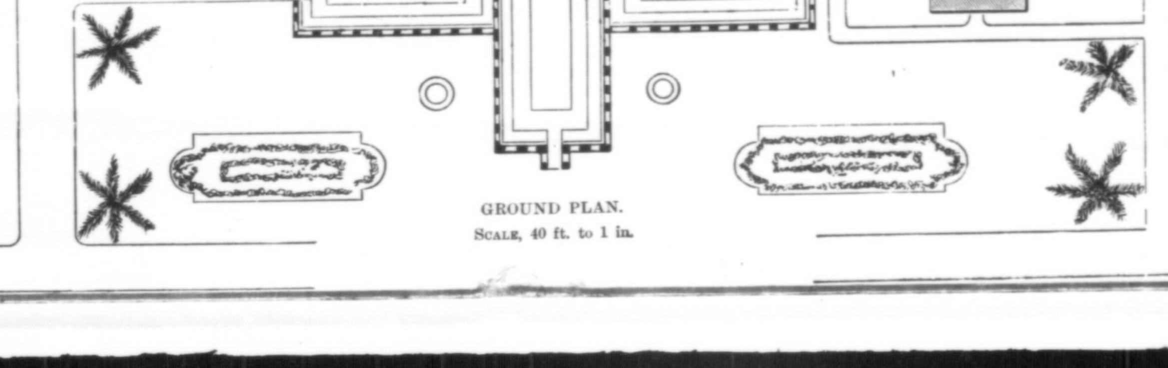
A. Anacardiaceæ ..Sumach.
B. Aquifoliaceæ...Holly.
C. Araliaceæ .....Ginseng.
D. Berberaceæ....Barberry.
E. Betulaceæ ....Birch.
F. Bignoniaceæ ..Bignonia.
G. Calycanthaceæ.Calycanthus.
H. Caprifoliaceæ...Honeysuckle.
I. Celastraceæ ...Staff-tree.
J. Coniferæ ......Pine.
K. Cornaceæ .....Dogwood.
L. Cupuliferæ ....Oak.
M. Ericaceæ ......Heath.
N. Euphorbiaceæ .Spurge.
O. Hamamidaceæ..Witch Hazel.
P. Juglandaceæ...Walnut.
Q. Lauraceæ .....Laurel.
R. Leguminaceæ ..Pulse or Bean.
S. Magnoliaceæ...Magnolia or Holly-hock Family.
T. Malvaceæ ...Mallow.
U. Myricaceæ ..Sweet Cale.
V. Oleaceæ ....Olive.
W. Platanaceæ ..Plane-tree.
X. Rhamnaceæ..Buck-thorn.
Y. Rosaceæ.....Rose.
Z. Rubiaceæ....Madder.
AA. Rutaceæ ....Rue.
BB. Salicaceæ ....Willows and Poplars.
CC. Sapindaceæ..Soapberry.
DD. Saxifrageæ ..Saxifrage.
EE. Styraceæ ....Storax.
FF. Tamaricaceæ.Tamarisk.
GG. Tiliaceæ.....Linden.
HH. Urticaceæ ..Nettle.
II. Verbenaceæ .Verbena or Vervain.



AGRICULTURAL COLLEGE, GUELPH.—PERSPECTIVE VIEW OF CONSERVATORY, GREENHOUSE AND LECTURE-ROOM.

AGRICULTURAL COLLEGE,
GUELPH.

CONSERVATORY, GREENHOUSE
AND
LECTURE ROOM.



GROUND PLAN.
SCALE, 40 ft. to 1 in.

1. COLLEGE

2. COLLEGE

NAMES

Alderson, A. B.
Alexander, R. C
Ashworth, H. L
Annand, F. W. C.
Ardagh, A. E.
Austin, W. E.
Aylsworth, H.
Baldwin, E. H.
Ballantyne, A. W.
Black, C. H
Black, P. C.
Black, D. A.
Beadle, C. D.
Beer, H. H.
Begbie, E. A.
Bent, E.
Brodie, C. J.
Brandon, R. C
Braun, P. E.
Brown, W. J
Boyle, Viscount R.
Boyle, Hon. H. G.
Boyd, J. L.
Bowes, J. C
Buckingham, F. W.
Butler, G. C
Campbell, C. A.
Campbell, J. L.
Campbell, W. W.
Carlaw, C. M.
Carpenter, P. A.
Casswell, A. B.
Clark, C.
Clark, F. R.
Climie, W. J.
Collins, H. J
Corson, G. H.
Cowley, A. E.
Courbarron, F. H.
Creagh, A. H.
Creelman, J. A.
Cream, W. C
Cross, E. L.
Cutting,
Davies, S.
Denton, E.
Denne, T. H. G.
DeChadenèdes,
DeVeber, W. H.
De Winton, W. F.
Erskine, H. R.
Edmondson, J. A.
Eddington, D. C.
Finlayson, H.

APPENDIX 1.

1. COLLEGE ROLL FOR THE YEAR 1883.
2. COLLEGE ROLL FOR THE SESSION 1883-84 (1st Oct. to 31st March).

1. COLLEGE ROLL FOR THE YEAR 1883.

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Alderson, A. B.	Ottawa	Carleton.
Alexander, R. C.	Wendigo	Middlesex.
Ashworth, H. L.	London	England.
Annand, F. W. C.	Halifax	Nova Scotia.
Ardagh, A. E.	Barrie	Simcoe.
Austin, W. E.	Ottawa	Carleton.
Aylsworth, H.	Deseronto	Hastings.
Baldwin, E. H.	Everitt	Mass., U.S.
Ballantyne, A. W.	Stratford	Perth.
Black, C. H.	Amherst	Nova Scotia.
Black, P. C.	Windsor	Nova Scotia.
Black, D. A.	Elora	Wellington.
Beadle, C. D.	St. Catharines	Lincoln.
Beer, H. H.	Charlottetown	Prince Edward Island.
Begbie, E. A.	London	England.
Bent, E.	Belleville	Hastings.
Brodie, C. J.	Bethesda	York.
Brandon, R. C.	Canton	Ontario.
Braun, P. E.	Ottawa	Carleton.
Brown, W. J.	Fergus	Perth.
Boyle, Viscount R. H.	Castle Martyr	Ireland.
Boyle, Hon. H. G.	Castle Martyr	Ireland.
Boyd, J. L.	Toronto	York.
Bowes, J. C.	Halifax	Nova Scotia.
Buckingham, F. W.	Stratford	Perth.
Butler, G. C.	London	England.
Campbell, C. A.	Toronto	York.
Campbell, J. L.	Clarksburg	Grey.
Campbell, W. W.	Clarksburg	Grey.
Carlaw, C. M.	Warkworth	Northumberland.
Carpenter, P. A.	Collingwood	Simcoe.
Casswell, A. B.	Ingersoll	Oxford.
Clark, C.	Parkdale	York.
Clark, F. R.	Parkdale	York.
Climie, W. J.	Listowel	Perth.
Collins, H. J.	York	England.
Corson, G. H.	Hamilton	Wentworth.
Cowley, A. E.	Guelph	Wellington.
Courbarron, F. H.	St. Andrews	Scotland.
Creagh, A. H.	St. Leonards	England.
Creelman, J. A.	Collingwood	Grey.
Cream, W. C.	Paisley	Bruce.
Cross, E. L.	Montreal	Quebec.
Cutting,	Guelph	Wellington.
Davies, S.	Toronto	York.
Denton, E.	London	Middlesex.
Denne, T. H. G.	Peterboro'	Peterborough.
DeChadenèdes,	Guelph	Wellington.
DeVeber, W. H.	St. John	New Brunswick.
De Winton, W. F.	Ottawa	Carleton.
Erskine, H. R.	Ottawa	Carleton.
Edmondson, J. A.	Orillia	Simcoe.
Eddington, D. C.	Glencreggan	Scotland.
Finlayson, H.	Ottawa	Carleton.

1.—COLLEGE ROLL FOR THE YEAR 1883—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Fotheringham, W.	St. Mary's	Perth.
Frith, H. M.	St. John	New Brunswick.
Fuller, S. G.	Stratford	Perth.
Fair, J. L.	South Monaghan	Northumberland.
Furner, G. H.	Toronto	York.
Gregory, J.	Fredericton	New Brunswick.
Garland, C. S.	Montreal	Quebec.
Greenwood, J. T	Peterboro'	Peterborough.
Hannah, J.	Egmondville	Huron.
Hague, J. P	Cobourg	Northumberland.
Henry, J. W.	Thornton	Simcoe.
Herbert, D. L.	St. Andrew's	Scotland.
Holcroft, H. S.	Orillia	Simcoe.
Hubbard, W. W	Burton	New Brunswick.
Hanson, E. T.	Ottawa	Carleton.
Harvey, E. J.	Aylmer	Elgin.
Horsey, E. H.	Cataraqui	Frontenac.
Hamilton, R. M	Brantford	Brant.
Hamilton, J. B	Lennoxville	Quebec.
Harrison, F. W	Owen Sound	Grey.
Ings, F. W.	Charlottetown	Prince Edward Island.
Jemison, W. A.	Thornton	Simcoe.
Jordan, A. W.	Simonds	New Brunswick.
Jeffs, H. B.	Bond Head	Simcoe.
Jones, T. L.	Aberystwith	Wales.
Jones' Williams, A. H	Penpont, Brecon	Wales.
Keil, C. A	Chatham	Kent.
Kemmis, J. H. W	Dublin	Ireland.
Knott, E.	London	Middlesex.
Kelly, S. A. J	Ancaster	Wentworth.
King, J. E	Middlemarch	Elgin.
Laurie, C. A	Quebec	Quebec.
Luton, E. E	New Sarum	Elgin.
Latimer, R. M	Marshville	Welland.
Lehmann, A	Orillia	Simcoe.
Little, W.	Killyleagh	Simcoe.
Lane, H. R.	Surbiton, Surrey	England.
Lang, W.		Manitoba.
Langlois, R. J	Toronto	York.
Leech, L. T.	Guelph	Wellington.
Lobb, E. W. T.	Hamilton	Wentworth.
Morden, T. T.	Walkerton	Bruce.
Moyle, F. T	Paris	Brant.
Merritt, C. L.	Scotland	Simcoe.
McIntosh, G. H.	Mossboro'	Wellington.
McLean, J. R.	Innerkip	Oxford.
Mohr, A.	Cincinnati	Ohio.
Malcolmson, K. G	East Barnet, Herts	England.
McLennan, D.	Camerontown	Glengarry.
McLennan, J. D	Lancaster	Glengarry.
McKim, J.	Parker	Wellington.
McLennan, A.	Ottawa	Carleton.
Morton, F. G.	Barrie	Simcoe.
Maunsell, G. S.	Ottawa	Carleton.
Mcdonald, J	Petrolia	Lambton.
Macdonald, W. A	Stratford	Perth.
Major, C. H	Lyn	Leeds.
Mathewson, G	Lennoxville	Quebec.
Miller, J. P.	Norwich	England.
McNish, C. H	Lyn	Leeds.
McGregor, J.	Colborne	Northumberland.
Macalister, T. G	Kingston	Frontenac.
Malcolm, G. J	Agra	India.
Mavor, H.	Toronto	York.
McCarthy, D. J	Peterboro'	Peterborough.
McIntyre, D.	Paisley	Bruce.
McKay, J. B.	Stellarton	Nova Scotia.
McPherson, D	Glanworth	Middlesex.
McPherson, A	Montreal	Quebec.

1.—COLLEGE ROLL FOR THE YEAR 1883—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, Etc.
McPherson, H. A.	Lancaster	Glengarry.
Meikle, G. W.	Lachute	Quebec.
Morris, D. W.	Montreal	Quebec.
Muir, J. B.	North Bruce	Bruce.
Matson, J. S.	Toronto	York.
Neilson, J.	Lyn	Leeds.
Nairn, J.	Toronto	York.
Ord, W. B.	Toronto	York.
Pearce, J. W.	Aylmer	Elgin.
Pethick, W. H.	Charlottetown	Prince Edward Island.
Poe, J. J. E.	Callan	Ireland.
Perry, D. E.	Ottawa	Carleton.
Paton, G. C.	Langside	Scotland.
Powys, P. C.	Fredericton	New Brunswick.
Pritchard, R. M.	Port Hope	Durham.
Pocock, H. R.	Brockville	Leeds.
Quinn, E.	Orillia	Simcoe.
Reford, F. W.	Toronto	York.
Redmond, W. J.	Peterboro'	Peterborough.
Ruel, F. C.	Southsea	England.
Robinson, J. D.	Middlemarch	Elgin.
Robertson, W.	Wanstead	Lambton.
Rennie, E. A.	Hamilton	Wentworth.
Raynes, G. S.	Montreal	Quebec.
Rose, G. M.	Toronto	York.
Ramsay, A. R.	Montreal	Quebec.
Raynor, T.	Rose Hall	Prince Edward.
Reid, P.	Montreal	Quebec.
Ridings, H. L.	Colborne	Northumberland.
Read, F. Read	Bobcaygeon	Victoria.
Robinson, B.	Wheatley	Kent.
Rowat, J. T.	Hillsdale	Simcoe.
Ross, J. H.	New Glasgow	Nova Scotia.
Saxton, E. A.	Nantwich	England.
Slater, H.	Taunton	England.
Steers, O.	Ottawa	Carleton.
Sharman, G. C.	Stratford	Perth.
Sharman, H. B.	Stratford	Perth.
Skaife, F. W.	Montreal	Quebec.
Schroeder, R.	Toronto	York
Smith, A.	Simcoe	Norfolk.
Smith, E. P.	Port Hope	Durham.
Spalding, F. J.	Perth	Lanark.
Stamer, O. P.	Hubbard's Cove	Nova Scotia.
Sworder, E.	Qu'Appelle	Manitoba.
Sworder, R.	Qu'Appelle	Manitoba.
Shaw, A. G.	Wolverhampton	England.
Shaw, E. E.	Wolverhampton	England.
Spohn, H. B.	Lancaster	Wentworth.
Seden, F. H.	London	England.
Sinclair, Q. P.	Montreal	Quebec.
Sarjeant, E.	Hawkstone	Simcoe.
Smith J. L.	Ottawa	Carleton.
Strange, A. W.	Kingston	Frontenac.
Smith, J. A.	Martintown	Glengarry.
Schwartz, J.	Quebec	Quebec.
Tewson, F. R.	Markham	York.
Thomas, F. J.	Oxford	England.
Torrance, W. J.	Ottawa	Carleton.
Tourangeau	Quebec	Quebec.
Tucker, H. V.	Toronto	York.
Thompson, W. D.	Guelph	Wellington.
Urmston, R. B.	Southsea	England
Vivian, H.	Mohawk	Brant.
Weatherston, N.	Toronto	York.
Wilson, T. G.	Hawkstone	Simcoe.
Walsh, E. F.	Luton, Bedfordshire	England.
White, C. D.	Hereford	England.
Warren, F. F.	Kingston	Frontenac.

1.—COLLEGE ROLL FOR THE YEAR 1883—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, Etc.
Westlake, G.	Yarmouth Centre	Elgin.
Wilmot, E. M	London	England.
Weatherston	Toronto	York.
Willis, W. B.	Whitby	Ontario.
Weston, G. H.	Ottawa	Carleton.
Watterworth, G. E.	Ingersoll	Oxford.
Whitehead, J.	Brampton	Peel.
Whitehead, R.	Broadstairs	England.
Wark, A. E.	Wanstead	Lambton.
Wroughton, T. A.	Montreal	Quebec.
Total		202

2. COLLEGE ROLL FOR THE SESSION 1883-84 (1st Oct. to 31st March).

NAMES.	P. O. ADDRESS.	COUNTY, Etc.
Alderson, A. B.	Ottawa	Carleton.
Alexander, R. C	Wendigo	Middlesex.
Ashworth, H. L.	London	England.
Annand, F. W. C.	Halifax	Nova Scotia.
Austin, W. E.	Ottawa	Carleton.
Baldwin, E. H.	Everitt	Mass., U. S.
Ballantyne, A. W.	Stratford	Perth.
Black, P. C.	Windsor	Nova Scotia.
Beadle, C. D.	St. Catharines	Lincoln.
Beer, H. H	Charlottetown	Prince Edward Island.
Begbie, E. A.	London	England.
Bent, E	Belleville	Hastings.
Brodie, C. J	Bethesda	York.
Brown, W. J.	Fergus	Wellington.
Buckingham, F. W.	Stratford	Perth.
Butler, G. C	London	England.
Campbell, C. A.	Toronto	York.
Campbell, J. L.	Clarksburg	Grey.
Campbell, W. W.	Clarksburg	Grey.
Carlaw, C. M.	Warkworth	Northumberland.
Carpenter, P. A	Collingwood	Simcoe.
Casswell, A. B	Ingersoll	Oxford.
Climie, W. J.	Listowel	Perth.
Collins, H. J.	York	England.
Corson, G. H.	Hamilton	Wentworth.
Cowley, A. E.	Guelph	Wellington.
Courbarron, F. H.	St. Andrews	Scotland.
Creagh, A. H.	St. Leonards	England.
Cross, E. L.	Montreal	Quebec.
Cutting	Guelph	Wellington.
Davies, S.	Toronto	York.
Denton, E.	London	Middlesex.
Erskine, H. R.	Ottawa	Carleton.
Fuller, S. G.	Stratford	Perth.
Fair, J. L.	South Monaghan	Northumberland.
Furner, G. H.	Toronto	York.
Greenwood, J. T	Peterboro'	Peterborough.
Hannah, J.	Egmondville	Huron.
Hague, J. P.	Cobourg	Northumberland.
Henry, J. W.	Thornton	Simcoe.
Herbert, D. L.	St. Andrews	Scotland.
Holcroft, H. S.	Orillia	Simcoe.
Hubbard, W. W	Burton	New Brunswick.
Jemison, W. A.	Thornton	Simcoe.
Jordan, A. W.	Simonds	New Brunswick.

2.—COLLEGE ROLL FOR THE YEAR 1883-84—*Concluded.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Jones, T. L.	Aberystwith	Wales.
Keil, C. A.	Chatham	Kent.
Kemmis, J. H. W.	Dublin	Ireland.
Knott, E.	London	Middlesex.
King, J. E.	Middlemarch	Elgin.
Lehmann, A.	Orillia	Simcoe.
Little, W.	Killyleagh	Simcoe.
Lane, H. R.	Surbiton, Surrey	England.
Lang, W.		Manitoba.
Langlois, R. J.	Toronto	York.
Leech, L. T.	Guelph	Wellington.
Lobb, E. W. T.	Hamilton	Wentworth.
Macdonald, W. A.	Stratford	Perth.
Major, C. H.	Lyn	Leeds.
Mathewson, G.	Lennoxville	Quebec.
Miller, J. T.	Norwich	England.
McGregor, J.	Colborne	Northumberland.
MacAlister, T. G.	Kingston	Frontenac.
Malcolm, G. P.	Agra	India.
Mavor, L.	Toronto	York.
McCarthy, D. J.	Peterboro'	Peterborough.
McIntyre, D.	Paisley	Bruce.
McKay, J. B.	Stellarton	Nova Scotia.
McPherson, A.	Montreal	Quebec.
McPherson, H. A.	Lancaster	Glengarry,
Meikle, G. W.	Lachute	Quebec.
Morris, D. W.	Montreal	Quebec.
Muir, J. B.	North Bruce	Bruce.
Matson, J. S.	Toronto	York.
Nairn, J.	Toronto	York.
Pethick, W. H.	Carlottetown	Prince Edward Island.
Powys, P. C.	Fredricton	New Brunswick.
Pritchard, R. M.	Port Hope	Durham.
Quinn, E.	Orillia	Simcoe.
Rose, G. M.	Toronto	York.
Ramsay, A. R.	Montreal	Quebec.
Raynor, T.	Ross Hall	Prince Edward Island.
Reid, P.	Montreal	Quebec.
Ridings, H. L.	Colborne	Northumberland.
Read, F.	Bobcaygeon	Victoria.
Robinson, B.	Wheatley	Kent.
Rowat, J. T.	Hillsdale	Simcoe.
Ross, J. H.	New Glasgow	Nova Scotia.
Saxton, E. A.	Nantwich	England.
Slater, H.	Taunton	England.
Steers, O.	Ottawa	Carleton.
Sharmon, G. C.	Stratford	Perth.
Skaife, F. W.	Montreal	Quebec.
Schroeder, R.	Toronto	York.
Smith, A.	Simcoe	Norfolk.
Smith, E. P.	Port Hope	Durham.
Spalding, F. J.	Perth	Lanark.
Stamer, O. P.	Hubbard's Cove	Nova Scotia.
Sworder, E.	Qu'Appelle	Manitoba.
Sworder, R.	Qu'Appelle	Manitoba.
Tewson, F. R.	Markham	[illegible]
Tucker, H. V.	Toronto	[illegible]
Thompson, W. D.	Guelph	[illegible]rton.
Vivian, K.	Mohawk	[illegible]
Wilson, T. G.	Hawkstone	Si[illegible]
Walsh, E. F.	Liton, Bedfordshire	Eng[illegible]
Weatherston W.	Toronto	York.
Wark, A. E.	Wanstead	Lambton.
Wroughton, T. A.	Montreal	Quebee.
Total		109

APPENDIX 2.

TIME TABLES FOR FALL TERM (1st October to 22nd December), 1883.

Tables No. 1 and No. 2 indicate the work of the regular students, and No. 3 (A) and (B) the work of the specialists in Live Stock and Veterinary Science, for the term ending the 22nd December, 1883. No. 1 is the same as No. 2, and 3 (A) the same as 3 (B), except the order of the lectures, which change from forenoon to afternoon, and *vice versa* at the beginning of each week, to suit the arrangements for practical work in the outside departments.

TIME TABLE No. 1.

2nd Year.

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

1st Year.

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

TIME TABLE No. 2.

2nd Year.

	Hours	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-8	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Half Holiday.
	8-9	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	
	9-10	English Literature.	Statics.	English Literature.	English Literature.	Levelling or Drainage.	
	10-1	Agricultural Chemistry.	Agricultural Chemistry.	Practical Live Stock.	Meteorology	Agricultural Chemistry.	
	11-12	Veterinary Pathology.	Agriculture.	English Composition.	Veterinary Pathology.	Practical Horse.	
After-noon.	1.30-5	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departments.	Work in outside departm's.

1st Year.

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

TIME TABLE No. 3.—SPECIAL CLASS.

(A) 2ND YEAR.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-12	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.
Afternoon.	2-3	Live Stock in Class-room.	Study of Text-Book on Veterinary Practice.	Study of Text-Book on Live Stock.	Live Stock in Class-room.	Study of Text-Book on Live Stock.	Half Holiday.
	3-4	Study of Text-Book on Live Stock.	Veterinary Science or Practice.	Live Stock in Class-room.	Study of Text-Book on Veterinary Practice.	Study of Text-Book on Veterinary Practice.	
	4-5	Veterinary Pathology.	Agriculture.	Veterinary Science or Practice.	Veterinary Pathology.	Practical Horse.	

1ST YEAR.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-12	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.
Afternoon.	2-3	Live Stock in Class-room.	Study of Text-Book on Veterinary Practice.	Agriculture.	Live Stock in Class-room.	Agriculture.	Half Holiday.
	3-4	Agriculture.	Veterinary Science or Practice.	Study of Text-Book on Live Stock.	Study of Text-Book on Veterinary Practice.	Veterinary Anatomy.	
	4-5	Study of Text-Book on Live Stock.	Veterinary Anatomy.	Veterinary Science or Practice.	Study of Text-Book on Live Stock.	Study of Text-Book on Veterinary Practice.	

TIME TABLE No. 3.—SPECIAL CLASS.—*Continued.*

(B) 2nd Year.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-8	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Half Holiday.
	8-9	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	
	9-10	Live Stock in Class-room.	Study of Text-Book on Veterinary Science.	Study of Text-Book on Live Stock.	Live Stock in Class-room.	Study of Text-Book on Live Stock.	
	10-11	Study of Text-Book on Live Stock.	Veterinary Science or Practice.	Live Stock in Class-room.	Study of Text-Book on Veterinary Practice.	Study of Text-Book on Veterinary Practice.	
	11-12	Veterinary Pathology.	Agriculture.	Veterinary Science or Practice.	Veterinary Pathology.	Practical Horse.	
Afternoon.	1.30-5	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.

1st Year.

	Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
Forenoon.	7-8	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Study or Recreation.	Half Holiday.
	8-9	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	Drill or Gymnastics.	
	9-10	Live Stock in Class-room.	Study of Text-Book on Veterinary Science.	Agriculture.	Live Stock in Class-room.	Agriculture.	
	10-11	Agriculture.	Veterinary Science or Practice.	Study of Text-Book on Live Stock.	Study of Text-Book on Veterinary Practice.	Veterinary Anatomy.	
	11-12	Study of Text-Book on Live Stock.	Veterinary Anatomy.	Veterinary Science or Practice.	Study of Text-Book on Live Stock.	Study of Text-Book on Veterinary Practice.	
Afternoon	1.30-5	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.	Work with Cattle, Sheep and Horses.

APPENDIX 3.

ONTARIO AGRICULTURAL COLLEGE.

EXAMINATION PAPERS.

I. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1883.
II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, JUNE, 1883.
III. PAPERS SET AT THE MATRICULATION EXAMINATIONS, OCTOBER, 1883.

1. PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1883.

ONTARIO AGRICULTURAL COLLEGE, EASTER EXAMINATIONS, 1883.

FIRST YEAR.

LIVE STOCK : CATTLE.

Examiner : WM. BROWN.

1. Make concise notes on the history of the three principal beefing breeds, and the three prominent milking breeds, as handled by you this winter.

2. Explain the meaning of the terms : rough, chunky, even, deep, roomy, sweet, prime, finished, and quality, when applied to cattle.

3. Make a table showing the relative positions of all the pure breeds of cattle here, in regard to maturing, hardiness, and quantity of milk, according to our experience.

4. Give, in proper form, the pedigree of a Short Horn bull called "O.A.C," imported from England to the United States, and afterwards brought to Canada. Register in the Herd Books of each country, and draft up to the 5th sire.

5. Describe the general stamp of a typical milch cow, and say what you would expect her to yield per season, of milk, cream, butter and cheese.

FIRST YEAR.

LIVE STOCK : SHEEP.

Examiner : WM. BROWN.

1. The two samples of Wool require to be classified and compared in regard to texture, soundness, spirals, and lustre.

2. Give a thorough description of the Oxford Down breed, naming everything you know in regard to their history and characteristics.

EASTER EXAMINATIONS, 1883.—Continued.

3. On the accompanying card fill in and complete the valuation of the Shropshire and South Down—using the maximums given on the black-board.

4. Compare the Leicester and South Down, as regards build of carcass, irrespective of size.

5. What is the present position of the Canadian market for wool and mutton?

FIRST YEAR.

PRACTICAL EXAMINATION OF SHEEP.

Examiners: WM. BROWN AND P. J. WOODS.

1. Point out the defects of the Oxford Down and Shropshire grades, and indicate their quality for the butcher.

2. Describe the fleeces present.

3. Point out the marked differences in the build of the two rams.

Time—9 minutes each student.

FIRST YEAR.

INORGANIC CHEMISTRY.

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

1. Define "*Atomicity*" and "*Basicity*."

Write down the formulæ of,

(*i*). The chlorides of silicon, silver, bismuth, barium, gold, iron, magnesium, and platinum.

(*ii*). The sulphates and phosphates of potassium, calcium, and manganese.

2. Describe the occurrence, preparation and properties of oxygen gas.

(*i*). You are given oxygen, nitrous oxide, nitric oxide, carbon monoxide, marsh gas, hydrogen, and sulphur dioxide gases in separate bell-jars, how would you proceed to distinguish them?

(*ii*). State the action produced (1) by *animals* (2) by plants on the *air*.

3. How many cub. centimeters of ammonia gas measured at 15°, under a pressure of 750 mm. can be obtained from 150 grams of ammonium chloride?

4. Describe the occurrence, preparation and properties of sulphur.

(*i*). Write down the *names* and *symbols* of the oxides of sulphur.

(*ii*). If the oxides are acid-forming oxides, give the formulæ for the corresponding acids.

5. Describe the occurrence, preparation and properties of phosphorus.

(*i*). Write down the *names* and *symbols* of the oxides of phosphorus.

(*ii*). If the oxides are acid-forming oxides, give the formulæ for the corresponding acids.

EASTER EXAMINATIONS, 1883.—Continued.

6. Describe the occurrence, preparation and properties of chlorine.

  (*i*). Write down the *names* and *symbols* of the oxides of chlorine.

  (*ii*). If the oxides are acid-forming oxides, give the formulæ for the corresponding acids.

7. Draw a diagram of the apparatus you would make use of, in the preparation of hydrogen, nitrogen, laughing gas, nitric acid, hydrochloric acid, and sulphur trioxide.

8. How would you illustrate by experiment the bleaching action of chlorine and of sulphur dioxide; the oxidizing action of nitric acid and the nitrates, *and* the properties of charcoal, carbon dioxide, ammonia and hydrochloric acid?

9. Formulate the decompositions occurring in the preparation of nitrogen dioxide, carbon monoxide, methyl hydride, phosphuretted hydrogen, and silicon tetrafluoride.

10. (*i*). How would you prepare soluble and insoluble silicon?

  (*ii*). Formulate the action that occurs when silicon tetrafluoride is allowed to bubble up in water.

  (*iii*). How may "temporary" and "permanent" hardness be removed from water?

11. Describe any experiment you have made or seen made.

☞ The student can exercise a choice between the 4th, 5th and 6th questions of the paper.

FIRST YEAR.

ORGANIC CHEMISTRY.

Examiner: R. B. Hare, Ph. Dr.

1. (*i*). Name the chief peculiarities of the carbon compounds.

  (*ii*). Illustrate by structural formulæ the difference between "*saturated*" and "*non-saturated*" carbon compounds.

  (*iii*). Explain what is meant by "*isomeric bodies*" and "homologous series," giving examples.

2. Give names and formulæ of the best known members of the Paraffin Group. The paraffins are called *hydrides* of certain compound radicals.

  (*i*). Write down the names and formulæ of these radicals.

  (*ii*). Using these radicals, represent graphically the constitution of the primary monatomic alcohols.

3. Explain by typical formulæ the relation existing between—

  (*i*). Methyl alcohol, ether, and aldehyde, formic acid and formamide.

  (*ii*). Ethyl alcohol, ether and aldehyde, acetic acid and acetamide.

  (*iii*). What is the chemical change that occurs in the passage from a primary alcohol to the corresponding acid?

4. Write down a list of the olefines, with their formulæ.

  (*i*). Explain what is meant by a diatomic alcohol.

  (*ii*). Represent by structural formulæ the relation *lactic acid* and *oxalic acid* bear to the diatomic alcohols.

5. Explain the composition of the "*drying*" and "*non-drying*" oils and fats. What is soap?

EASTER EXAMINATIONS, 1883.—Continued.

FIRST YEAR.

PHYSIOLOGY AND ZOOLOGY.

Examiner: J. PLAYFAIR McMURRICH, M.A.

1. Cartilage. Where is it principally found, and what are its uses?
2. Discuss the question of bathing from a physiological standpoint.
3. Describe the digestion of an ordinary meal.
4. Describe briefly the early development of any animal.
5. Rudimentary organs. What is meant by this term? How may their presence be explained?
6. Describe the life-history of *Trichina spiralis*.
7. Compare the sub-classes *Myriapoda*, *Insecta*, and *Arachnida*.
8. Compare the structure of the heart in the *Pisces*, *Reptilia*, *Aves*, and *Mammalia*.
9. Mention the principal birds that feed partly on the wing and partly at rest. Discuss the usefulness of each.

FIRST YEAR.

VETERINARY ANATOMY.

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

1. Mention the structures entering into the formation of the teeth, stating which is the hardest and which is the most abundant.
2. State the difference between the teeth of the mare and the horse; also the number of permanent teeth possessed by ruminants, the pig, dog and cat, as well as the number of permanent teeth a horse has at three and a half years old.
3. Describe the Trachea, Bronchi and Bronchial Tubes.
4. Mention the chief differences between the intestines, liver, kidneys, and genital organs of the horse and ox.
5. Describe the process of rumination.
6. Describe the Œsophagus, and the course which it takes with respect to the other organs.
7. Describe the valves of the heart.
8. Mention an artery that transmits venous blood, and veins that convey arterial, also a vein that begins in capillaries and ends in capillaries.
9. How do arteries differ from veins anatomically, and state the colour of the blood conveyed by each system.
10. Give a description of the Genital Organs of the mare, and state how they differ from those of the cow.

EASTER EXAMINATIONS, 1883.—Continued.

FIRST YEAR.

ENGLISH LITERATURE.

Examiner: J. PLAYFAIR MCMURRICH, M.A.

1. "A royal messenger he came,
Though most unworthy of the name.—
A letter forged! Saint Jude to speed!
Did ever knight so foul a deed!
At first in heart it liked me ill,
When the King praised his clerky skill.
Thanks to Saint Bothan, son of mine,
Save Gawain, ne'er could pen a line;
So swore I, and I swear it still
Let my boy-bishop fret his fill."

(*a*) Under what circumstances were these words spoken?

(*b*) "A letter forged!" Explain the allusion.

(*c*) "Saint Jude to speed!" Explain.

(*d*) "It liked me ill." What form of expression is this? Give examples of other words used similarly.

(*e*) Write notes on *King*, *Saint Bothan*, and *Gawain*.

2. Describe the metre of Marmion giving quotations in illustration.

3. "The pheasant in the falcon's claw,
He scarce will yield to please a daw."

By whom were these words spoken? Explain the metaphor.

4. Give the derivation and meaning of the following words:—pavilion, monarch, tyrant, ambition, patriot.

5. "To men of other minds my fancy flies,
Embosom'd in the deep where Holland lies:
Methinks her patient sons before me stand,
Where the broad ocean leans against the land,
And, sedulous to stop the coming tide,
Lift the tall rampire's artificial pride.
Onward, methinks, and diligently slow,
The firm connected bulwark seems to grow,
Spreads its long arms amid the watery roar,
Scoops out an Empire, and usurps the shore."

(*a*) To what physical feature of Holland does Goldsmith refer?
(*b*) "To men of other minds," "artificial pride." Explain.
(*c*) Point out the figures of speech in the extract.

6. What was Goldsmith's object in writing "The Traveller"?
7. Give Goldsmith's estimate of England, and Englishmen.

FIRST YEAR.

COMPOSITION.

Examiner: JAS. MILLS, M.A.

1. Write a composition on one of the following subjects:—

(1) Order and cleanliness in our homes.

EASTER EXAMINATIONS, 1883.—Continued.

(2) What a farmer's Education in this Province should be.

(3) Should the standard for admission to this College be raised: or the course of study lengthened to three years? If so, what subjects should be added or omitted, and what changes made?

2. Comment briefly on each of the leading peculiarities of poetic diction.

3. Give rules for use of the *colon* and the *semicolon*, and for punctuating *appositives*, *equivalents*, and *repetitions*.

4. Supply the necessary capital letters and punctuation marks in the following sentences:—

(*a*). Horace Jones jr MD LL D FRS

(*b*). So eagerly the fiend oer bog or steep through straight rough dense or rare with head hands wings or feet pursues his way

(*c*). He is a a a excuse me but I must say it a cold-blooded villain

"Inform me friend is alonzo the peruvian confined in this dungeon" "he is" "I must speak with him" "you must not" "he is my friend" "not if he were your brother" "what is to be his fate" "he dies at sunrise" "ha then I am come in time"

I agree with the honorable gentleman Mr Allen that it is pleasing to every generous mind to obey the dictates of sympathy but sir truth and justice impose on us higher obligations Lengthened applause and confusion in the galleries during which several sentences were lost Mr chairman I can not vote for this resolution Cheers I owe it not only to my country but to the rights of man of which so much is said to preserve the wise and long-established policy of the former and to stand by the principle of non-intervention as a high moral defence and security for the latter The speaker took his seat amid loud applause

5. Give the rule for each point inserted in sentence (*b*).

FIRST YEAR.

ARITHMETIC.

Examiner: E. L. Hunt.

1. If wire fencing cost 70 cents a yard, what will it cost to enclose a field 168 yards long and 126 yards wide?

2. A bought 37 head of cattle for $1,332, and after keeping them for 3 months and paying $4 each per month for their keep, sold the lot for $2,257. Find the gain on each.

3. A sold to B on March 13th:—

280	bushels	wheat	@ $1	25	per bushel
170	"	peas	" 0	60	"
290	"	barley	" 0	70	"
175	"	oats	" 0	40	"

and took B's note for the amount, due 6 months after date. On July 5th, he got the note discounted at the Bank at 6 per cent. How much did he receive for it?

4. The true discount off a note of $1,558, drawn at 6 months, is $38. Find rate per cent.

5. In a School Section a School House is to be built at an expense of $4,365, to be defrayed by a tax levied on property valued at $800,000. What is rate of taxation to

cover both cost of house and collector's commission at 3 per cent? (*b*) What tax must A pay, whose property is valued at $4,800?

6. Explain very briefly some of the principal causes of rise and fall in the price of stocks:

I hold $25,000 of Bank Stock, yielding 7 per cent. yearly dividend. I sell out at $124\frac{3}{4}$—brokerage $\frac{1}{4}$ per cent.—and invest the proceeds in Railway bonds selling at $82\frac{1}{2}$ and yielding 5 per cent. yearly dividends—brokerage $\frac{1}{2}$ per cent. Find the difference in my income.

7. I sold 2 horses for $140 each, thereby gaining 25 per cent. on one, and losing 25 per cent. on the other. Did I gain or loose on the whole, and how much?

8. A's property is insured for 4-5ths of its value. The premium of Insurance at $\frac{1}{4}$ per cent. amounts to $25. If property is destroyed, find A's entire loss.

9. I send 850 bushels wheat to an agent, who sells it for $1.30 a bushel, charging 2 per cent. commission. He invests the proceeds for me in cattle, after deducting his commission for this, at 3 per cent. Find the amount invested in cattle, also agent's total commission.

10. A and B working together can do a piece of work in 22 days. B and C in 20 days. A, B and C in 14 days. (*a*) How long would it take B alone to do the work?

(*b*) If A, B and C work together for 4 days, and B and C then leave, how long will it take A to finish?

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. The proper construction of buildings for mixed farming in Ontario involves certain principles; define these and apply them in a description of what you consider model barns.

2. How much importance is generally placed on Fertilizers being influenced in their action on crops by the particular physical condition of the soil, as well as the washing away by rains? Mention the other influences that regulate manures.

3. Define the proper place of permanent pasture in association with mixed farming in Ontario, and show wherein its value consists.

4. What are the ordinary evidences of the necessity of Drainage; what regulates the depth and distance apart of drains, and in what manner do you expect a return for the outlay?

5. Climate, soil, and markets regulate the production of particular crops,—what other conditions do so, and apply the whole subject to Ontario at the present moment.

SECOND YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. By what would you be guided in choosing part of this Continent for the large and cheap production of mutton and wool, for the present markets?

2. Give a concise sketch of the stamp, conduct and financial position of the various Grade Shearling Wethers bred and fed by us.

EASTER EXAMINATIONS, 1883.—Continued.

3. As a producer of thoroughbred live stock Ontario has advantages and disadvantages. Name these and sketch the present position of the country in this respect.

4. Name all the points that have to be attended to in the experimental feeding of cattle, and show wherein our work here is incomplete.

SECOND YEAR.

PRACTICAL EXAMINATION OF CATTLE.

Examiners: JOHN HOBSON AND CHAS. DRURY, M.P.P.

1. Mention the strong and weak points of the White Steer.

2. Judge the two Grade Steers for 1st and 2nd prizes, giving reasons for your decision.

3. Compare the Hereford Steer with the standard for a first-class animal of the breed.

4. Indicate what you consider the three best points in the Angus Cow taken as a representative of the beefing breeds.

SECOND YEAR.

ARBORICULTURE.

Examiner: WM. BROWN.

1. What are the causes that are forcing nations to the study and practice of this science and art?

2. What is the general position of Ontario as regards forest area, and in what special respects is the country in need of tree cultivation?

3. Define the full meaning of Conservation and Replanting, and show to what extent each is applicable to Ontario.

4. As a cultivated crop, with a view to direct revenue, specify the principal duties in the practical management of plantations from the seed-bed up to maturity.

5. What would you advise in order to the thorough execution of all that Ontario requires in Arboriculture?

SECOND YEAR.

AGRICULTURAL CHEMISTRY.

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

1. Classify the proximate elements of the volatile part, and briefly describe the ultimate elements of the fixed part of plants.

(*i*). Point out the distinguishing physical and chemical properties of cane sugar, grape sugar, starch, and dextrin.

(*ii*). What is the constitution of beef suet, sheep's tallow and butter?

(*iii*). Distinguish between the indispensable and supplementary elements of the fixed part of plants.

2. Explain briefly the origin and mode of formation of soils.

(*i*). How would you make a mechanical analysis of soil?

(*ii*). Distinguish chemically between granitic, syenitic, and fossiliferous rock-soils.

(*iii*). In visiting a new country, how would you ascertain the *natural* strength of the land.

EASTER EXAMINATIONS, 1883.—Continued.

3. Explain the origin and constitution of the humus of the soil.

    (*i*). How would you bring the ulmic, humic, apocrenic, and crenic acids into solution, and then precipititate them from solution ?

    (*ii*). What salts of these acids are soluble, what insoluble ?

    (*iii*). How does the carbonate of lime, when applied to a peat bog, act upon the nitrogenous and non-nitrogenous compounds contained in it ?

4. Explain the spstem of "Co-operative experimenting as a means of studying the effect of fertilizers and the feeding capacities of plants" we have concluded to follow in some of the field experiments of this year.

5. Explain the different modes in which nitrification takes place.

    (*i*). Describe the experiments which Schlæsing and Muntz and Lawes and Gilbert have made with organic matter nitrifying.

    (*ii*). Explain the conditions that favour, and those that are adverse to nitrification.

6. Give some of the most important results which Lawes and Gilbert, of England, have obtained at Rothamsted with permanent meadow grass, with wheat, with barley, with oats, and with beans, on the same land, without manure, with farm-yard manure, and with a variety of chemical manures, since 1843.

    (*i*). Particularize the results obtained from alternating *wheat* with *beans*.

    (*ii*). What cure do they propose for land that is called "*clover sick*."

7. Give the characteristic composition of cereals, leguminous and root crops.

    (*i*). Is the composition of a crop a sufficient guide to the character of the manure appropriate to it ?

    (*ii*). To secure a full cereal, leguminous or root crop from a somewhat impoverished soil, what artificial manure would you use in each case ?

8. (*i*). What are the results of *bare* fallow ? State briefly the circumstances under which it can be used systematically with advantage.

    (*ii*). Describe the advantages which green crops fed on the land or plowed in have over bare fallow.

    (*i*). Define "digestion co-efficient," "starch equivalent, "nutritive ratio," and "feeding standard."

    (*ii*). For the maintenance of an ox, and for a milch cow, weighing each 1000 lbs., what amount of digestible albuminoids and carbohydrates must the daily ration contain ?

10. A *fodder* containing $1\frac{1}{2}$ lbs. Clover hay,
13 " Barley straw,
25 " Mangolds,
$\frac{1}{2}$ " Rape Cake,

is given as a feeding standard.

Composition of Fodder :

	Clover Hay.	Barley Straw.	Mangolds.	Rape Cake.
Water	16	14.3	88.0	15.0
Ash	5.3	4.1	0.8	7.4
Albuminoids	12.3	4.0	1.1	30.3
Crude Fiber	26.0	40.0	0.9	13.8
Carbohydrates	38.2	36.2	9.1	23.8
Fat	2.2	1.4	0.1	9.5

Give the "nutritive ratio" of this fodder.

☞ The student can exercise a choice between the 3rd, 6th and 9th questions of the paper.

EASTER EXAMINATIONS, 1883.—Continued.

SECOND YEAR.

METEOROLOGY.

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

1. Mention some of the most important physical properties of the atmosphere, specially emphasizing its compressibility, its expansion by heat, its weight, its chemical composition, the cooling effect of evaporation and of rarefaction, the diathermacy of dry air, and the heat absorbing power of aqueous vapour.

2. Explain the structure of Adie's marine barometer.

(i) What is meant by "*Correction* for *Capillarity*," "*Correction* for *Gravitation*," and "*Correction* for *Capacity*" in barometers?

(ii) How is the correction for Capacity avoided in the barometers of Fortin and Adie?

3. Describe Negretti and Zambra's Maximum thermometer. How is the small inaccuracy in its reading occasioned?

4. *(i)* Define "*Relative Humidity*" and "*Dew Point.*"

(ii) When does the *wet bulb thermometer* give a higher reading than the *dry?*

5. Explain the structure of the rain guage in use at Canadian Stations. How is the quantity of water in the form of snow ascertained?

6. Explain the origin of Cyclones and Anticyclones.

(i) Where in the cyclone is the barometric depression greatest and the wind highest?

(ii) What condition of temperature and cloud is connected with the wind?

(iii) Does the wind blow along the isobars with the same pressure on both sides of its course?

(iiii) State the relation that exists between the velocity of the wind, and the height of the barometer. What is a gradient?

7. State the results of comparing barometric observations by the Synchronous method.

8. Summarize the following observations:

EASTER EXAMINATIONS, 1883.—Continued.

	Bar.	Max. T.	Min. T.	Ther.	Rain.	Snow.
1.	7 a.m.—28.145	——— degrees.	——— degrees.	24.6 degrees.	2.05	5.6
	2 p.m.—29.378	———	———	43.4 "	—	—
	9 p.m.—29.143	45.3	7.6	27.8 "	—	—
2.	7 a.m.—29.423	———	———	—5.8 "	—	3.1
	2 p.m.—28.861	———	———	6.3 "	—	—
	9 p.m.—30.016	26.5	—8.4	—7.4 "	—	—
3.	7 a.m.—28.005	———	———	43.3 "	1.78	—
	2 p.m.—28.136	———	———	48.4 "	—	—
	9 p.m.—28.026	27.6	27.6	57.4 "	—	—
4.	7 a.m.—29.578	———	———	24.8 "	—	3.7
	2 p.m.—28.799	———	———	14.6 "	—	—
	9 p.m.—29.114	24.3	—9.7	—4.3 "	—	—

9. Read the instruments before you.

SECOND YEAR.

ENTOMOLOGY.

Examiner: J. Playfair McMurrich, M.A.

1. Describe the mouth parts of a Cockroach (*Blatta*).

2. Give the characters of the *Diptera*. Name the more important injurious insects belonging to the order.

3. What are the characters of the family *Chrysomelidæ?* Name the more important forms belonging to it, briefly stating the habits of each.

4. What plants are affected by the following forms? What remedies may be applied? *Coreus tristis, Leucarctia acræa, Lachnosterna fusca, Agrotis, Bruchus pisi?*

5. Give the life-history, classification, and remedies that may be applied to the Codling moth (*Carpocapsa pomonella*).

6. Describe the larva and imago of *Pieris rapæ.* What remedies may be applied for its destruction?

7. *Micropterus leucopterus.* Describe its habits and appearance.

8. Mention and classify the principal insect forms injurious to the apple.

9. Identify the insects before you, stating the nature of the injury they cause.

EASTER EXAMINATIONS, 1883.—Continued.

SECOND YEAR.

PRACTICAL HORTICULTURE.

Examiner : JAMES FORSYTH.

1. Describe the various modes by which a stock of plants may be increased, state how varieties are obtained, and special ones perpetuated.

2. Name the parts of a perfect flower, and state what transformation takes place when a double flower is produced.

3. Give the natural orders of the following genera : Ageratum, Epiphyllum, Cyclamen, Dianthus, Coronilla, and Tradescantia.

4. Give the generic names of a plant illustrative of each of the following natural orders : Tabaceæ, Solonaceæ, Lamiaceæ, Onagraceæ, Polypodiaceæ, and Asclepidaceæ.

5. Make a selection of 10 half-hardy or bedding plants, giving the technical and common name of each.

6. Relate the differences in structure between endogenous and exogenous stems, and give three examples of each.

7. Describe shortly the usual methods of heating greenhouses, and give general rules for watering, ventilating, etc.

8. Name four of the insect pests troublesome in greenhouses, and state the best means of getting and keeping clear of them.

9. How are hot-beds constructed ? State the principal benefits to be derived from them, and describe their management.

10. Identify the plants before you, giving the technical name, common name, and natural order of each. Describe the peculiarities of Nos. 2, 6, and 9.

SECOND YEAR.

THE PRINCIPLES AND PRACTICE OF VETERINARY MEDICINE AND SURGERY.

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

1. Give the symptoms, and treatment of Open Joint.

2. In what two ways is lameness shown ? Give the general treatment of it.

3. State the differential symptoms of navicular disease, and splint.

4. Name the diseases of the foot of the horse, and give the treatment of Corns and Thrush.

5. Give a definition of Erysipelas, and the treatment of the Phlegmonous form.

6. Give the symptoms of Caries of the teeth, and Dentition Fever, and state at what ages the latter occurs.

7. Mention the diseases of the eye, and give the symptoms and treatment of Conjunctivitis (Simple ophthalmia).

8. Give the differential symptoms of Colic and Enteritis, and the treatment of the ormer.

9. Describe Osteo-Sarcoma, White Scours and Warbles in Cattle, and give the treatment of the two latter.

10. Mention the two most common diseases of the stomach of the Ox, and give their symptoms and treatment.

EASTER EXAMINATIONS, 1883.—Continued.

SECOND YEAR.

ENGLISH LITERATURE.

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

1.—*Julius Cæsar.*

1. By whom, and under what circumstances, were the following passages spoken :—

(*a*). His coward lips did from their colour fly.
(*b*). O world, thou wast the forest to this hart ;
And this, indeed, O world, the heart of thee.
(*c*). . . . . . Vexed I am
Of late with passions of some difference,
Conceptions only proper to myself,
Which give some soil, perhaps, to my behaviours.

2. Point out the figures of speech in extracts (*a*) and (*b*), and explain them fully.
3. Write a paraphrase of extract (*c*).
4. Remark upon peculiarities of construction in the following sentences :—

"There's two or three of us have seen strange sights."
"Three parts of him is ours already."
"There is tears for his love ; joy for his fortune," etc.

Compare the use of the singular verb in these sentences with its use in such sentences as the following :—Thirty acres of my farm is woodland. Three dollars is the price of that book.

5. "*Friends* am I with you all, and love you all."

Write a note upon this use of the word *friends.*

6. "Our yoke and sufferance shows us womanish."

Distinguish *womanish* and *womanly*, *manish* and *manly*.
7. Indicate the pronunciation of *livelong*, *longlived*, *construe*, *Philippi.*
8. Mention any respects in which this play is not historically accurate.

2.—*Richard II.*

1. "The purest treasure mortal times afford
Is spotless reputation * * * ."

Continue this extract, and quote another passage of similar import from Shakespeare.

2. "Since we cannot atone you we shall see
Justice design the victor's chivalry."

Write a paraphrase of this.

3. "Edward's seven sons, whereof thyself art one,
Were as seven vials of his sacred blood,
Or seven fair branches springing from one root :
Some of those seven are dried by nature's course,
Some of those branches by the Destinies cut."

Explain this passage fully.
4. "We will ourself in person to this war."

EASTER EXAMINATIONS, 1883.—Continued.

Parse *we, will, ourself.* Distinguish *ourself* and *ourselves.*

5. Scan the following verses :

"The accuser and the accused freely speak,"
"In rage deep as the sea, hasty as fire."
"Complotted and contrived in this land."
"To plot, contrive, or complot any ill."

6. Quote from this play any passage you particularly admire, and say wherein its merit consists.

7. Give some account of the controversy as to the authorship of the plays of Shakespeare.

SECOND YEAR.

POLITICAL ECONOMY.

Examiner: W. A. Douglas, B. A.

1. The interest of producer and comsumer are identical. In what way?

2. What are the factors that enter into the production of wealth? Name the share appropriated by each of these factors?

3. "There is a tendency to equality of interest." There is a tendency to emigrate. There is a tendency to obtain supplies from certain locations—to adopt the best implements, et cetera. Towards what and from what are men's acts tending in all these cases? Illustrate.

4. "We now begin to see that to increase the productiveness of labour is really the important thing for everybody." Name some commodities which labour cannot increase, but which may diminish.

5. "Man alone, no animal more helpless; man in society, no animal more powerful." State the causes of this difference.

6. Certain causes tend to extend the division of labour, others tend to diminish. Name these, distinguishing the former from the latter.

7. "There are no principles in trade." Discuss this.

8. "A camping party exhibits the same tendency to organization that is found in a vast populous country." Illustrate this.

9. Two men working together will accomplish more than two working separately. Name at least two ways in which this can be accomplished.

10. Is the tendency of society to greater dependence or to greater independence of individuals and nations on each other? Illustrate.

11. Name (1) the beneficial objects that may be accomplished by trades unions; (2) the mistakes they sometimes make.

12. Distinguish nominal and real wages. If the whole body of workmen wish to increase their real wages, on what must they encroach?

13. Name some of the methods of harmonizing the interests of Capitalists and Labourers.

14. Tenant or Mortgagor. Show in what way, if any, the one is more advantageously situated than the other.

EASTER EXAMINATIONS, 1883.—Continued.

15. Money. What its functions?
In what way gold is so suitable for money,
The English law of legal tender.

16. Credit cycles. Describe (1) its progress,
(2) its duration,
(3) dates of depression during this century.

SECOND YEAR.

MECHANICS.

Examiner: E. L. HUNT.

1. Define acceleration. A body starting from rest has been moving for six minutes, and has acquired a velocity of 40 miles an hour. What is the acceleration of the body in feet per second?

2. Explain the meaning of the terms:—mass, momentum, force, force of gravitation, and centre of gravity. Which has the greater momentum, a body weighing 97 lbs. and moving with a velocity of 3 feet per second, or one weighing 76 lbs. and moving with a velocity of 4 feet per second? How would you find practically the centre of gravity of a plane surface.

3. State and illustrate by means of examples Newton's three laws of motion.

4. Which is the greater work, raising a weight of 150 lbs. up a perpendicular height of 70 feet, or raising a weight of 130 lbs. up a perpendicular height of 82 feet?

5. In a system of pulleys, where each pulley hangs by a separate string, the number of pulleys is 4. What weight will be supported by a power of 8 lbs?

6. What is the greatest weight which can be supported by a power of 35 lbs. by means of a wheel and axle when the diameter of the wheel is 11 times that of the axle?
(b). Why is the labour of drawing a bucket of water out of a common well generally greater during the last part of the process than during the first?

7. "Fluids transmit pressure equally and in all directions." Explain. Name any machines where practical advantage is gained from this property of fluids. Draw a diagram of one.

8. In what respect would you alter a reservoir that the force of the water from the taps leading from it may be increased?

9. Explain by diagrams the working of the common pump and siphon.

SECOND YEAR.

LEVELLING AND DRAINING.

Examiner: E. L. HUNT.

1. By what means would you determine definitely whether your land would be benefitted by underdraining?

2. Enumerate, with brief explanations, the benefits arising from thorough drainage.

3. What is the best mode of draining a field where upland is traversed irregularly by low wet portions? Illustrate by diagram—
(b). What disadvantage from such a state of the ground?

EASTER EXAMINATIONS, 1883.—Continued.

4. Write concisely on "Depth and Distance apart of Drains."

5. How many years are required to repay the cost of draining by the increase of the crops?

6. Distinguish between the true and apparent level.

7. From the following table find the distance of A from E, and the height of one point above tne other:—

Distance of station—

No. 1,	from A	175	from B	190	Back observation		4.1	Fore observation		2.6
" 2,	"	B 280	"	C 265	"	"	3.7	"	"	5.8
" 3,	"	C 495	"	D 504	"	"	1.5	"	"	4.3
" 4,	"	D 940	"	E 930	"	"	7.6	"	"	9.4

SECOND YEAR.

BOOK-KEEPING.

Examiner: E. L. Hunt.

1. State clearly how you would keep account in your books of your own work, and that of your horses.

2. Would you debit Live Stock with feed at market price, or at cost of production? Give reasons for your answer. (*b*). How would you value the seed sown?

3. April 4, got plough repaired, 50c., and bought one pair of boots, $4.50. April 6, J. Thomson worked 4 days on wheat field, at $1 a day. April 10, sowed 11 bushels of wheat, for which I paid $1.30 per bushel. April 30, paid J. Thomson $12; also paid R. Smith (grocer) $30 on account. May 1, bought 9 bushels peas at 75c. per bushel, and paid J. Thomson $1.00 for sowing. May 12, sold for cash 34 lbs. butter at 17 cents per lb., and 14 dozen eggs at 11 cents a dozen; also bought bed-room furniture amounting to $12. May 20, blacksmith set wagon tire, $1, for which he took 4 dozen eggs at 11 cents a dozen, and 4 lbs. butter at 16 cents a lb. July 29, I worked 2 days with team and reaper on wheat field; F. White and J. Simpson each worked 2 days on same field at $1.75 a day each; and J. Thomson do, at $1 a day. August 24, paid $10 for threshing wheat. August 29, sold 75 bushels wheat at $1.08 per bushel, and got 5 bushels ground for family use. September 19, paid $1.75 for tickets for social. September 30, went to Toronto; travelling expenses $11.

(*a*). Enter each of the above in the Ledger accounts affected.
(*b*). Write a note with reference to last three, September 30.

SPECIAL CLASS.

LIVE STOCK.

Examiner: P. J. Woods.

1. Name the three best breeds of pigs for our Canadian markets, giving reasons for your selection.

2. How should a pen be prepared for a sow about to pig?

(*a*) Describe treatment of a sow from time of service to weaning of young pigs.

EASTER EXAMINATIONS, 1883.—Continued.

3. Give treatment of a grade bull calf from birth till twelve months old. Mention time of castration.

4. Describe treatment of calf to be sold to butcher when six weeks old. Calf to remain with dam only two days after birth.

SPECIAL CLASS.

PRACTICAL EXAMINATION OF CATTLE.

Examiner: P. J. WOODS.

1. Point out the prime parts of the steer before you—those from which a butcher would expect to realize a profit.

2. Is the question whether an animal is well "ribbed home" or not, a matter of consequence to the butcher, or only to the feeder? Give reasons for your answer.

3. State the special advantages which would result to a butcher from a steer that would measure as much, or nearly as much, from the hooks to the pin bones as from the back of the shoulder to the hooks.

II. PAPERS SET AT THE SESSIONAL EXAMINATIONS, JUNE, 1883.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. Give the cropping rotation in use on this farm, and submit the principal reasons for its adoption.

2. Explain the whole position of a Root Crop in any rotation.

3. Describe the accompanying samples of barley.

4. Classify pastures, and indicate wherein lies the value of that called permanent.

5. Under what circumstances are Green Fodders of importance in farming?

6. A manure being "anything that tends to fertilize a soil," give a list of cases in illustration.

7. What are the effects of under-draining land?

FIRST YEAR.

GEOLOGY.

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

1. Explain the following divisions of Practical Geology:—*Lithology*, *Strategraphy*, *Palæontology*, and *Historical Geology*.

MIDSUMMER EXAMINATIONS, 1883.—Continued.

2. Give *crystallographic form* and *chemical composition* of the minerals, Quartz, *Orthoclas*, Pyroxene, Hornblende, Calcite, Apatite, and Magnetite.

(*i*). Classify the Feldspars *according* to their crystallization and according to their composition.

(*ii*). How would you distinguish Hornblende from Pyroxene?

(*iii*). How would you determine the minerals Magnetite, Hematite, and Limonite by the streak?

3. Classify rocks according to their origin, their predominant chemical ingredients, and their texture.

4. Give the Mineralogical and Chemical Composition of *Diorite*, Syenite, Granite, Hornblendic Schist, Clay Slate, and Quartzite. How do *Basic Pleutonic* Rocks differ from Acidic Pleutonic? Give examples of both.

5. What are the principal ingredients of Soils? *Explain* the *source* of each.

(*i*). *Illustrate* by chemical formulæ the transformation of Hornblendic Gneiss Rock into Soil by atmosphere and rain water.

(*ii*). *Explain* the relation that exists between the composition of a soil and its water-holding power, its capillary powers and its warmth.

6. Aqueous rocks are frequently *coloured*?

(*i*). What is the cause of the red, brown, and black colours?

(*ii*). Why do white sandstones sometimes alternate with reddish shales?

(*iii*). How does the Sulphide of Iron become a distinguishing mark of marine clays?

(*iiii*). Why are fossils *rare* in red rocks and abundant in gray and dark-coloured beds?

7. The whole geological history of the earth has been divided into periods:

(*i*). *Name* the *periods*, stating at the same time the class of animals and plants peculiar to each.

(*ii*). Briefly describe the rocks of the Laurentian and Huronian systems. Where are they distributed, and what are the metallic ores they bear?

*8. Define layer, stratum, formation, seam, joints and slaty cleavage, dip, strike, outcrop, anticline, syncline, fault, unconformability, and denudation.

*9. (*i*). How is the chronology of beds ascertained?

(*ii*). State the condition in which organic remains occur, also the more changes to which they are subject.

*10. Name the *Systems* into which the Palæozoic Period has been divided, and briefly *outline* the *Series* that occur in Ontario.

*11. (*i*). Where in the Dominion of Canada do Rocks of Carboniferous age *occur*?

(*ii*). What is the probable age of the Lignite *formation* of the Western Territories?

(*iii*). Name the formation in which the essential Petroleum area or oil district of Western Canada is situated.

*12. Describe the leading characteristics of the Pleistocene age.

(*i*). State the conditions under which the Boulder Clay, Leda Clay, and Saxicava Clay were formed.

(*ii*). Describe climate, physical changes, and fauna of the Post Glacial age.

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

☞ **The student will choose any two of the questions marked with an asterisk.**

MIDSUMMER EXAMINATIONS, 1883.—Continued.

*FIRST YEAR.

STRUCTURAL AND PHYSIOLOGICAL BOTANY.

Examiner: J. PLAYFAIR McMURRICH, M. A.

1. Describe a typical vegetable cell. Mention some of the more common forms assumed by cells.

2. Describe the structure of a leaf.

3. Describe the structure of an ovule. What changes take place after fertilization?

4. Mention and describe the varieties of stems. Indicate the part played by each in the life of the plants.

5. Describe some of the provisions for the prevention of self-fertilization in plants.

6. Define the following terms :—(*a*) corymb, (*b*) caryopsis, (*c*) stipule, (*d*) carpel, (*e*) spadix and spathe.

7. Name the elements indispensable to plants. Whence are they obtained, and for what are they used?

8. Mention and describe the forces which cause ascent of the sap.

9. Describe the influence of Temperature upon plants. Give the maximum, optimum, and minimum temperatures for wheat.

FIRST YEAR.

MATERIA MEDICA.

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

1. Explain the difference between the physiological and therapeutic, actions of medicines.

2. Explain the antipathic and allopathic modes of cure.

3. What is meant by a diuretic, a purgative, and an anesthetic, and give an example of each.

4. How are tinctures, extracts, infusions and decoctions prepared?

5. Give the symbols for a drachm and a-half, an ounce, a minim, a pint, and three gallons.

6. What is aloes? Give the most important varieties, and actions, and doses for the horse.

7. Mention the different preparations of Ammonia, and give all the names by which each is known.

8. Give a prescription for diarrhœa.

9. Give a prescription for a good anodyne collyrium.

10. Mention the actions, uses, and doses of Chloral Hydrate.

MIDSUMMER EXAMINATIONS, 1883.—Continued.

FIRST YEAR.

ENGLISH LITERATURE.

Examiner : E. L. Hunt.

1. What is the general character of each sketch ?
2. Where is Westminster Abbey ? Whence its name ?
3. Is there any fact or description in this sketch that shows the age of the building ?
4. "I passed some time in Poets' Corner."
   (*a*). What does Irving say of "Poet's Corner ?"
   (*b*). When did the tombs of "Poet's Corner" begin ? What historical inference ?
   (*c*). "Westminster Abbey is petrified history." Explain and illustrate.

5. "It was the tomb of a Crusader." Describe the tomb. Write a brief explanitory note on "Crusader."

6. What moral does Irving draw from the sepulchres of Elizabeth and Mary ? Which does he favour ? Criticise briefly.

7. "Death is robbed of its oblivion when the corpse is laid in the Abbey." Compare or contrast this sentiment with the thoughts awakened in Irving's mind by his visit to the Abbey. (*b*) An author's character is shown by his writings. What features of the author's character are exemplified in this sketch ?

8. Name and describe the three leading characters of Sleepy Hollow.

9. When was this sketch written ? Does Irving express a wish in this sketch which he realized later in life ?

10. Give a synopsis of the story of Rip Van Winkle. (*b*) In your opinion what moral might this sketch point.

11. Quote four striking passages from the sketches read.

12. Locate the following :

(*i*) "It was shuffled through, therefore, in form but coldly and unfeelingly." What was so shuffled through and why ?

(*ii*) "He evinced an hereditary disposition to attend to anything else but his business."

(*iii*) "I will not attempt to detail the particulars of such a meeting where joy and sorrow were so completely blended."

(*iv*) "A formidable birch-tree growing at one end of it." Is there anything mentioned later in the sketch which explains the meaning of formidable ?

(*v*) "It is neither to be chilled by selfishness, nor daunted by danger, nor weakened by worthlessness, nor stifled by ingratitude.

(*vi*) "An insuperable aversion to all kinds of profitable labor." Meaning of 'profitable' ?

(*vii*) "A torrent of household eloquence."

(*viii*) "A tart temper never mellows with age, and a sharp," etc. Complete the proverb.

(*ix*) "He would rather starve on a penny than work for a pound."

MIDSUMMER EXAMINATIONS, 1883.—Continued.

FIRST YEAR.

COMPOSITION.

Examiner: JAMES MILLS, M.A.

1. Combine the following elements into a simple sentence:
   The robber was shot dead at the entrance to the cave.
   The cave ran far into the interior of the hill.
   The robber had spread terror in all directions.
   The robber was pursued by the king's troops.
   The troops were commanded by the king in person.

2. Substitute other and appropriate words in the following passage for those printed in *Italics*:—Towards *evening* Columbus *returned* to his *ships*, *accompanied* by *many* of the Islanders in their boats, which they *called* canoes, and which, though *rudely formed* out of the trunk of a *single* tree, they *rowed* with *surprising dexterity*.

3. Expand the following sentences, expressing the ideas in words and sentences of your own arrangement and construction:—"Without law there is no security, no abundance, no certain subsistence; and the only equality in such a condition, is an equality of misery."

4. Write a composition on one of the following subjects:
   (*a*) The farmer's home, and what its surroundings should be.
   (*b*) Order and cleanliness.

FIRST YEAR.

MENSURATION.

Examiner: E. L. HUNT.

1. What will it cost to surround a circular grass plot whose diameter is 42 feet, with a gravel walk $3\frac{1}{2}$ feet wide, and costing 7 cents a square yard?

2. (*a*). A bin is 6 feet 5 inches long, 4 feet 7 inches wide, and the grain in it 3 feet 9 inches deep. How many bushels are there?
   (A gallon contains 277.274 cubic inches).
   (*b*). How many bushels, if 2 sides only are parallel, one 7 feet 7 inches and the other 4 feet 3 inches, the perpendicular distance between them 4 feet, and the grain 3 feet 9 inches deep?

3. The diagonal of a square field is 14 chains. Find its area.

4. Find the solidity of a squared tapering log of wood, the breadth and thickness at one end being 33 and 22 inches respectively, and those of the other 27 and 18 inches, and length 40 feet.

5. Find both approximately and exactly the solidity of a piece of round timber, the girt at one end 16 feet and the other 12 feet; length 26 feet, 6 inches.
   (*b*). If the timber did not taper regularly, how would you find the solidity.

6. The diameter of a cylindrical cistern is 12 feet. How deep must it be to contain 8,000 gallons?

7. Which will carry off more water, a tile whose diameter is 6 inches, or three tiles, each having a diameter of 3 inches?

8. How many cords of wood is in a pile 92 feet long, 8 feet wide, and 7 feet high?

9. A room is 20 feet 6 inches long, 15 feet 6 inches broad, and 16 feet high. Find the expense of covering the walls with paper 30 inches wide, at 7 cents a yard; allowing for 2 doors, each 8 feet by 3 feet 9 inches, one window 5 feet by 7 feet, two other windows each 5 feet by 4 feet, and a fire-place 4 feet 8 inches by 3 feet.

SECOND YEAR.

AGRICULTURAL AND LIVE STOCK.

Examiner: WM. BROWN.

1. What are the advantages and disadvantages of a variety of grasses and clovers in hay and pasture, by a rotation in cropping?

2. Apply your knowledge of Pastures and Green Fodders to the particular spring weather we have just had, showing wherein each has been prominent in any respect.

3. Give a brief criticism on the systems of Bare Fallowing, and Root Cultivation.

4. What do you consider first-class management of young Store Steers from April to October, with a view to profit and rapid results? Indicate the nature of the profits.

5. Give your opinion on the stamp of Hereford and Aberdeen Poll grade steers examined by you yesterday.

SECOND YEAR.

HORTICULTURE.

Examiner: J. PLAYFAIR MCMURRICH, M.A.

1. Discuss the question as to what kind of soil is most favourable for fruit growing.

2. How are varieties obtained in practice?

3. What natural forces tend to vary or preserve the characters of a species? How do they show themselves in practice?

4. What requisites are necessary for the success of a graft? Mention the more usually employed methods, briefly discussing the value of each.

5. Mention the different methods of hastening fruiting. Give the physiological reasons, and discuss the value of each.

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

Examiner: J. PLAYFAIR MCMURRICH, M.A.

1. Name and characterize the reproductive processes of each group into which the old sub-kingdom *Cryptogamia* is divided.

2. Give a short description of the *Bacteria*. Name some diseases of which they are the cause.

3. Describe the life-history of *Claviceps purpurea*. Mention its uses, and any dangers which may result from its consumption.

MIDSUMMER EXAMINATIONS, 1883.—Continued.

4. Give the characters of the *Gymnospermæ.* Name, describe, and state the economic value of five plants of the order *Conifereræ.*

5. Give the characters of the *Gramineæ.* Describe the following genera, stating the comparative value of each :—*Phleum, Agrostis, Poa,* and *Festuca.*

6. Name the orders and genera to which the following plants belong :—Asparagus, Rice, Hop, Buckwheat, and Beet.

7. Characterize the order *Labiatæ,* and mention some of the useful plants belonging to it. On what does the economic value of the order depend?

8. Describe any flower you have analyzed.

SECOND YEAR.

ANALYTICAL CHEMISTRY.

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

Part I.—Lecture Room—Time 2 hours.

1. Distinguish *qualitative analysis* from *quantitative,* and analysis *in the dry way* from analysis *in the wet.*
2. Explain the terms :—Evaporation, precipitation, decantation, filtration, tests, reagents, and reactions.
3. Describe briefly the conditions under which metallic bases of more common occurrence may be divided into groups.
4. Separate and test the members of Group I. Formulate each reaction.
5. How would you separate in solution :

   (*i*). Arsenic from tin.
   (*ii*). Bismuth from copper.
   (*iii*). Iron from aluminium.
   (*iiii*). Barium from calcium.
   (*iiiii*). Potassium from sodium.

6. Formulate the chemical action that occurs when—

   (*i*). Potassium—ferrocyanide, ferricyanide, and sulphocyanide are introduced to solutions of iron salts.
   (*ii*). Ammonium hydrate to solutions of Alum, Magnesium Sulphate, and Copper Nitrate.
   (*iii*). Water to solutions of Bismuth Chloride and Antimonious Chloride.
   (*iiii*). Yellow ammonium Sulphide to Sulphides of Arsenic, Antimony and Tin.

7. Give the distinguishing tests for the acids—Nitric, Hydrochloric, Sulphuric, Carbonic, and Phosphoric.

Part II.—Laboratory—Time 2 hours.

1. Determine the metals and acids present in *Solution No. 1.*
2. Which metal of Group I. is present in *Solution No. 2*?
3. Which metal of Group II. is present in *Solution No. 3*?
4. Which Metal of Group III. is present in *Solution No. 4*?
5. Which metal of Group V. is present in *Solution No. 5*?

☞ If the metal under examination forms two classes of Salts, state the *basic oxide* present and the acid with which it is united.

MIDSUMMER EXAMINATIONS, 1883.—Continued.

SECOND YEAR.

MATERIA MEDICA.

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

1. Give the other names for Hydrochloric Acid, and dose for the horse.
2. What is Iodine principally obtained from? Give its properties, actions and uses, and state in what disease it acts nearly as a specific.
3. Give a prescription for a good tonic and alterative ball containing Sulphate of Iron.
4. Give the different products of Flax and the uses of them.
5. State how to prepare a good purgative drench for the ox containing Sulphate of Magnesia, and name another medicine for which it is sometimes mistaken.
6. Give the tehnical terms for Corrosive Sublimate and Calomel, and state which is the most soluble.
7. Give the preparation and uses of Biniodide of Mercury.
8. Describe how to prepare Morphine for hypodermic injection, and give dose for this purpose for horse.
9. Give a prescription for Spasmodic and Flatulent Colic respectively.
10. Mention the products that are obtained by boiling wood-tar and turpentine.

SECOND YEAR.

VETERINARY OBSTETRICS.

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

1. Describe the coverings of the fœtus.
2. Describe the placenta of the mare, and state how it differs from that of ruminants.
3. Describe the symptoms of approaching parturition in the mare or cow.
4. What does the term embryotomy mean?
5. Describe the normal presentation of a fœtus.
6. Give a brief description of the instruments necessary in difficult parturition.
7. Describe how to tell the fore-legs from the hind ones of the fœtus when the knees and hocks cannot be reached.
8. State how to deliver an animal when the fœtus has one fore-leg completely retained.

SECOND YEAR.

ENGLISH LITERATURE.

Milton's L'Allegro and Il Penseroso.

Examiner: JAMES MILLS, M.A.

1. " Come, pensive nun, devout and pure,
Sober, stedfast, and demure;
All in a robe of darkest grain,
Flowing with majestic train;

MIDSUMMER EXAMINATIONS, 1883.—Continued.

And sable stole of cipres lawn,
Over thy decent shoulders drawn.
Come, but keep thy wonted state,
With even step and musing gait;
And looks commercing with the skies,
Thy rapt soul sitting in thine eyes:
There, held in holy passion still,
Forget thyself to marble, till,
With sad, leaden, downward cast,
Thou fix them on the earth as fast."

(*a*) Derive the words *pensive*, *nun*, *demure*, and *grain*.
(*b*) Explain the construction of *stole*, *looks*, *soul*, and *held*.
(*c*) "All in a robe of darkest grain." Parse the word *all*.
(*d*) *Train*—give the origin and common applications of this word.
(*e*) "Sable stole of cipres lawn." Give the meaning of *stole*, and write an explanatory note on *cipres lawn*.
(*f*) State exactly the meaning of *decent*, *commercing*, *rapt*, *there*, and *fast* in the above passage.
(*g*) "Forget thyself to marble." Comment on this expression and explain the meaning.
(*h*) Scan the first four lines of the extract.

2. Quote from L'Allegro and Il Penseroso.

(1) The introduction to each—"*Hence—dwell*," and "*Hence—train*";
(2) The different passages descriptive of music or its effects.

3. Write a short criticism of the two poems, illustrating your comments as far as possible by suitable quotations and references.

4. "Under the hawthorne in the dale." Explain why the poets prefer specific to generic terms.

5. *Landscape*—Give the origin and literal meaning of this word.

6. "By friar's lantern led"; "half regained Eurydice"; "Prince Memnon"; "the story of Cambuscan bold"; "presenting Thebes or Pelops' line."—Explain the allusions.

7. "Then to the well-trod stage anon,
If Jonson's learned sock be on;
Or sweetest Shakespeare, fancy's child,
Warble his native wood-notes wild."

Comment on this passage, noticing especially the appropriateness or inappropriateness of the words *learned*, *well-trod*, *sweetest*, *fancy's child*, and *native wood-notes wild*.

8. Name in order of time the four most distinguished Elizabethan authors, and write a note on the leading peculiarities of the period.

SECOND YEAR.

SURVEYING AND ROAD-MAKING.

Examiner: E. L. Hunt.

1. Describe (*a*) Gunter's chain, (*b*) the cross-staff. How would you determine its accuracy?

MIDSUMMER EXAMINATIONS, 1883.—Continued.

2. Draw a rough sketch of the field and find its area from the measurements given in the following field-book.

Left Offsets.	Chain-line.	Right Offsets.
	1842 to O_2	
784	1696	
	1364	478
590	1068	
	820	370
	From O_1	

3. Write fully on "what roads ought to be as to their slopes." What objection to a perfectly level road? What fraction of a load, which a horse can draw on a level road, can he draw on a slope of 1 in 24? On a slope of 1 in 10? Is this ratio constant?

4. Suppose a road is to be carried over a hill, which rises 100 feet in a horizontal distance of 500 feet. How would you avoid this steep slope if it was impracticable to go around it?

5. Describe the best and cheapest way of improving an earth road. In repairing such a road, what objection to filling in the ruts with stones? What advantage from frequent repairs?

6. What are the defects of river-side gravel as road material? The defects of pit gravel? What treatment should the latter receive before being used as a road covering? Should the larger stones be used for the lower layer of the road? Why, or why not?

7. (*a*) Enumerate the evil effects arising from having large stones on the surface of a road. What is the largest allowable size of the stones?

(*b*) Calculate the power required to draw a wheel, whose radius is 26 inches, over a stone 4 inches high, if the weight of the wheel and load on the axle together is 500 pounds. (The non-horizontal direction of the draught, and the thickness of the axle neglected).

III. PAPERS SET AT THE MATRICULATION EXAMINATIONS, APRIL, 1883.

ARITHMETIC.

Examiner : E. L. Hunt.

1. Simplify $\frac{2-\frac{1}{4}}{4} \times \frac{64\frac{16}{49}}{12} + \frac{\frac{1}{2}(2+\frac{1}{5})}{3+\frac{1}{7}} + \frac{11\frac{3}{32}}{17\frac{3}{4}}$

2. Divide 468.3729 by 5.91246 to three decimal places.

3. A lends B \$9,780 ; B repays A by giving him cattle to the amount of \$1,946, a farm worth 4 times as much as the cattle, less \$999, and the balance in cash ; how much cash did B pay A ?

4. A alone can do a piece of work in 8 days, B alone in 9 days, how long will it take both working together ?

5. Find the price of 13 tons, 15 cwt. 60 lbs. of hay at \$17 a ton.

6. A cuts $\frac{1}{4}$ of a cord of wood in 1 hour, 40 minutes. How many days of 8 hours each will it take him to cut 186 cords, 88 feet ?

7. Of a field $\frac{1}{5}$ is meadow, $\frac{3}{8}$ is arable land, and the remainder is 1 acre, 3 roods, 26 poles. Find the quantities of meadow and arable land.

8. A, B and C can together do a piece of work in 20 days ; after 6 days A gives up, and is succeeded by D, who in one day does half as much again as A, B or C can do in a day. When will the work be finished ?

ENGLISH GRAMMAR.

Examiner : James Mills, M.A.

1. Write out the plural of *canto*, *lily*, *roof*, *Mussulman*, *father-in-law*, *phenomenon* ; and the feminine forms corresponding to *bridegroom*, *monk*, *wizard*, *stag*, *hart*, *cock-sparrow*, *and peacock*.

2. Explain and illustrate what is meant by *case*, *degree*, and *voice* in grammar.

3. Enumerate the moods in English, and state briefly the uses of each.

4. Divide the following passage into simple sentences, state the kind and connection of each sentence, and parse the italicised words :—

(a) " *There has* not *been* a better or more illustrious *man than Africanus*."

(b) "The warm heart, the open hand, the free and *cordial* manner of the sailor-King, won the love of his people. He possessed *neither* brilliant genius, nor excellent wisdom, *but* strong sense guided *every* act of *his* useful *reign*."

5. Correct the errors in the following sentences, giving reasons :

(a) "That isn't the way the last teacher learned us to do it."

(b) "One of our town sportsmen shot fifteen brace of partridge, along with a friend on Saturday afternoon last."

(c) He doesn't like those sort of questions.

(d) Please, sir, can I go out ?

(e) I fear we will be late for the train.

MATRICULATION EXAMINATIONS, 1883.—Continued.

GEOGRAPHY.

Examiner : James Mills, M.A.

1. Explain what is meant by the following terms in Geography :—*longitude, latitude, ecliptic, tropics, firth*, and *isthmus.*
2. Give the boundaries of Europe.
   - *(a)* Name in order from east to west the principal rivers flowing into the *Baltic Sea*, the *North Sea*, and the *English Channel.*
3. Name and locate the principal mountain ranges of Asia.
4. Give a list of the British possessions with brief notes as to tne position of each.
5. Name the Provinces of the Dominion of Canada; give the name and position of the capital of each province; and draw an outline map indicating the position of *Father Point, Three Rivers, Amherstburg, Windsor*, and *Sarnia.*
6. What and where are the following :—*May, Galveston, Assiniboine, Belle Isle, Sable, Sandy Hook, Falkland, Anglesey, Islay, Valentia, Sinope, Said, Mozambique ?*

COMPOSITION.

Examiner : R. B. Hare, Ph.D.

Write a composition on one of the following subjects :—

- *(a)* A description of your home and its surroundings.
- *(b)* A letter to a friend, giving some account of your winter's work and amusements.
- *(c)* The best indication of a man's tastes and character is the company he keeps

DICTATION AND READING.

Examiner : R. B. Hare, Ph.D.

Dictation.—Fourth Book, p. 117—"Trees . . . . . . straight line."
Reading.—Fourth Book, p. 117—" Immediately . . . . . . can tell."

APPENDIX 4.

ONTARIO AGRICULTURAL COLLEGE.

CLASS LISTS.

I.—Easter Examinations, 1883.

II.—Midsummer Examinations, 1883.

I.—EASTER EXAMINATIONS, 1883.

FIRST YEAR.

Class.		Cattle. (Written Exam.)	Sheep. (Written Exam.)	Handling and Judging Cattle. (Oral Exam.)	Handling and Judging Sheep. (Oral Exam.)	Inorganic Chemistry.
Honours.	I.	1 Ballantyne, A. W.	1 { Sharman	1 Mathewson		1 Lehmann
		2 { Little, W.	{ Little	2 Sharman		2 Slater
		{ Carpenter, P. A.	3 Ballantyne	3 Black, C. H.		3 Macdonald
		4 McLennan, J. D.				
		5 Rose, G. M.				
	II.	1 Westlake, G.	1 { Hubbard	1 { Little, W.	1 Little	1 Wark
		2 { Macdonald, W. A	{ Macdonald	{ Carpenter	2 Lehmann	2 Ballantyne
		{ Lehmann, A.	3 Black, P. C.	3 McIntosh	3 Ballantyne	3 Little
		{ Black, P. C.	4 { Wroughton	4 Ballantyne		4 Hubbard
		5 { Soden, F. H.	{ Saxton	5 { Keil		5 Powys
		{ Hubbard, W. W.	6 Miller	{ Macdonald		6 Wroughton
		7 { Sharman H. B.	7 McIntosh	7 Hubbard		7 Westlake
		{ McIntosh, G. H.	8 { Paton	8 Hamilton, R. M		8 Miller
		9 { Saxton, E. A.	{ Black, C. H.	9 { Powys		9 Tucker
		{ Wroughton, T.	10 McGregor	{ McGregor		
		10 Mathewson, G.	11 Lehmann	11 Tucker		
		11 Steers, O.	12 Soden	12 Westlake		
		13 { Wark, A. E.	13 { Courbarron	13 Wark		
		{ Slater, H.	{ Hamilton, J. B.	14 { Steers		
		15 { Tucker, H.	15 Mathewson	{ Soden		
		{ Black, C. H.	16 { Rose			
		17 McGregor, H.	{ McLennan, J. D			
		18 { Aylsworth, H.				
		{ Ardagh, A. E.				
		20 Fuller, S. G.				
		21 Hannah, J.				
		22 Edmondson, J. A.				
		23 Paton, G. C.				
		24 { Miller, J. P.				
		{ Courbarron, F. H				
		26 Jones'Williams, A				

Class Lists (Easter Examinations)—*Continued.*

FIRST YEAR.

Class.	Cattle. (Written Exam.)	Sheep. (Written Exam.)	Handling and Judging Cattle. (Oral Exam.)	Handling and Judging Sheep. (Oral Exam.)	Inorganic Chemistry.
Pass. III.	1 Powys, P. C. Keil, C. A. 3 Erskine, H. R. Hamilton, J. B. 5 Braun, P. E. 6 Mohr, A. Jordan, A. W. 8 Shaw, A. G. Black, D. A. Weatherston, D. Hamilton, R. M. Shaw, E. E. Latimer, R. M.	1 Slater Carpenter 3 Fuller 4 Wark 5 Ardagh 6 Latimer 7 Erskine 8 Keil 9 Westlake Powys Jones' Williams Aylsworth Braun Black, D. A. Edmondson Hamilton, R. M. Jordan Mohr Shaw, E. E. Shaw, A. G. Steers Tucker Weatherston, D.	1 Miller 2 Rose 3 Lehmann Black, P. C. 5 Paton 6 Mohr Edmondson 8 Aylsworth Ardagh Hannah Slater Wroughton 13 Jones' Willia's Erskine 15 Courbarron 16 Braun Black, D. A. Fuller Hamilton, J. B. Jordan Shaw, E. E. Shaw, A. G. Weatherston	1 Edmondson Hubbard 3 Keil Rose 5 Aylsworth 6 Black, C. H. 7 Black, P. C. 8 Hannah Wark 10 Mathewson Wroughton 12 Macdonald McGregor Westlake 15 Carpenter Erskine Ham'ton, R. M Paton 19 Ardagh Jones' Willia's McIntosh 22 Braun Fuller Sharman 25 Courbarron Slater 27 Miller Steers Soden Mohr Powys Hamilton, J. B. Jordan Tucker Weatherston Shaw, A. G. Shaw, E. E. Black, D. A.	1 Ardagh 2 Carpenter 3 Mathewson 4 Courbarron 5 Edmondson 6 Mohr 7 Steers 8 Rose 9 McIntosh 10 Black, C. H. 11 Keil Fuller Jones' Williams McGregor Hamilton, R. M Jordan Aylsworth Black, P. C. Braun Black, D. A. Hamilton, J. B. Erskine Hannah Paton Soden Sharman Shaw, E. E. Shaw, A. G. Weatherston, D

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

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

Class Lists (Easter Examinations)—*Continued.*

FIRST YEAR.

Class.		Organic Chemistry.	Physiology and Zoology.	Veterinary Anatomy.	English Literature.	Composition.
Honours.	I.	1 Macdonald.	1 Slater.	1 Carpenter.	1 Powys.	1 Slater.
		2 Slater.	2 Carpenter.	2 Lehmann.	2 Slater.	2 Powys.
		3 Wark.	3 McGregor.	3 Hubbard.	3 Carpenter.	3 Tucker.
		4 Lehmann.	4 Powys.	4 Saxton.	4 Miller.	4 Macdonald.
		5 Ballantyne.	5 Black, P. C.	5 Slater.	5 Tucker.	
		6 Hubbard.	6 { Tucker.	6 Powys.	6 Macdonald.	
		7 Carpenter.	Macdonald.			
	II.	1 McIntosh.	1 Lehmann.	1 Ballantyne.	1 Wroughton.	1 Carpenter.
		2 Powys.	2 { Hubbard.	2 Soden.	2 McIntosh.	2 Hubbard.
		3 Tucker.	Soden.	3 Rose.	3 { Hubbard,	3 Black, P. C.
		4 Wroughton.	4 Little.	4 { Tucker.	Mathewson.	4 Miller.
		5 Miller.	5 { Miller.	Macdonald.	5 Black, P. C.	5 Ballantyne.
		6 Little.	Steers.	6 { Little.	6 Saxton.	6 Erskine.
		7 Ardagh.	7 Mathewson.	Black, C. H.	7 { McGregor.	7 Wroughton.
		8 Westlake.	8 { Black, C. H.	8 Mathewson.	Lehmann.	8 McGregor.
		9 Black, C. H.	Ballantyne.	9 { Mohr.	9 Soden.	
		10 Black, P. C.	10 Paton.	Wroughton.		
			11 Wroughton.	Miller.		
			12 Ardagh.	12 { Edmonson.		
			13 Keil.	Westlake.		
			14 Wark.	14 Black, P. C.		
			15 Courbarron.	15 McGregor.		
			16 { Shaw, E. E.			
			Edmonson.			

Class Lists (Easter Examinations)—*Continued.*

FIRST YEAR.

Class.	Organic Chemistry.	Physiology and Zoology.	Veterinary Anatomy.	English Literature.	Composition.
Pass. III.	1 Edmonson. 2 Paton. 3 Courbarron. 4 Fuller. Mohr. Steers. Mathewson. Hamilton R.M. Jones' Williams Rose. Keil. Aylsworth. Braun. Black, D. A. Hamilton, J.B. Erskine. Hannah. Jordan. McGregor Soden. Sharman. Shaw, E. E. Shaw, A. G. Weath'rston D.	1 McIntosh. 2 Sharman. 3 Fuller. 4 Westlake. 5 Mohr. 6 Hannah. 7 Rose. Jones' Williams Aylsworth. Jordan. Braun. Hamilton, R. M. Weath'rston, D. Hamilton, J. B. Erskine. Shaw, A. G. Black, D. A.	1 Hannah. 2 Ardagh. 3 { McIntosh. Erskine. Steers. 6 Jones' Williams 7 Shaw, E. E. 8 Wark. 9 Keil. 10 { Paton. Courbarron. 12 McLennan J.D. Jordan. Fuller. Braun. Shaw, A. G. Sharman. Aylsworth. Weatherston D. Hamilton, J. B. Hamilton, R. M. Black, D. A. Latimer.	1 Steers. 2 Shaw, E. E. 3 { Keil. Courbarron. 5 Little. 6 Ardagh. 7 { Paton. Erskine. 9 Edmonson. 10 { Wark. Rose. Jones' Williams 13 { Ballantyne. Westlake. 15 { Black, C. H. Fuller. Hamilton, J. B. Aylsworth. Hannah. Weatherston, D. Shaw, A. G. Sharman. Mohr. Hamilton, R. M. Jordan. Braun. Black, D. A.	1 Courbarron. 2 Little. 3 Black, C. H. 4 Saxton. 5 Jones' Williams. 6 { Ardagh. Soden. 8 Paton. 9 Wark. 10 Shaw E. E. 11 { Mathewson. Fuller. 13 Sharman. 14 { Shaw, A. G. Steers. 16 Lehmann. 17 Rose. 18 Westlake. 19 Keil. 20 { McIntosh. Edmonson. Hamilton, J. B. Mohr. Weatherston. Black, D. A. Aylsworth. Hannah. Jordan. Hamilton, R. M. Braun.

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

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

Class Lists (Easter Examinations)—*Continued.*

FIRST YEAR.

Class.		Arithmetic.	Book-Keeping.	General Proficiency.
Honours.	I.	1 Lehmann. 2 Westlake. 3 Carpenter. 4 Powys. 5 Sharman. 6 McGregor. 7 Black, C. H. 8 Ballantyne. 9 Little. 10 Keil. 11 Macdonald.	1 Macdonald. 2 Sharman. 3 Little. 4 Westlake. 5 Lehmann. 6 { Black, C. H. / Ballantyne. 8 Tucker. 9 { Wark. / Ardagh. 11 { Carpenter. / Mathewson. / Steers.	1 Macdonald. 2 Lehmann. 3 Carpenter. 4 { Ballantyne. / Slater. 6 Little. 7 Hubbard. 8 Wroughton. 9 Black, C. H. 10 Wark. 11 { Miller. / Westlake. 13 McIntosh. 14 Ardagh.
	II.	1 Wark. 2 Black, D. A. 3 Rose. 4 Wroughton. 5 McIntosh. 6 Ardagh. 7 Erskine. 8 Hannah. 9 Tucker.	1 McGregor. 2 McIntosh. 3 Wroughton. 4 Courbarron. 5 Keil. 6 Powys. 7 Black, P. C. 8 Miller.	
Pass.	III.	1 Saxton. 2 Soden. 3 { Aylsworth. / Miller. / Slater. 6 Hubbard. Fuller. Courbarron. Steers. Hamilton, R. M Shaw, A. G. Mohr. Shaw, E. E. Hamilton, J. B. Black, P. C. Mathewson. Weath'rston, D. Paton. Edmondson. Jones' Williams Braun. Jordan.	1 Paton. 2 Hannah. 3 Hubbard. 4 { Rose. / Soden. 6 Edmondson. 7 Slater. 8 Aylsworth. Jones' Williams Braun. Jordan. Hamilton, R. M. Erskine. Mohr. Weath'rston, D. Fuller. Hamilton, J. B. Black, D. A.	

Departments.		First-Class Men in the Departments.
I.	Agriculture and Live Stock.	None.
II.	Natural Science.	1 Slater, H. 2 Lehmann, A. 3 Macdonald, W. A.
III.	Veterinary Science.	1 Carpenter, P. A. 2 Lehmann, A. 3 Hubbard, W. W. 4 Saxton, E. A. 5 Powys, P. C.
IV.	English Literature and Composition.	1 Slater, H. 2 Powys, P. C. 3 Tucker, H. V. 4 { Carpenter, P. A. / Macdonald, W. C.
V.	Mathematics and Book-Keeping.	1 Westlake, G. 2 Sharman, H. B. 3 Lehmann, A. 4 Carpenter, P. A. 5 Black, C. H. 6 Little, W. 7 Macdonald, W. A. 8 { Ballantyne, A. W. / McGregor, H. 10 Wark, A. E.

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

Only those who passed in every subject are ranked in general proficiency.

First class men in any department must obtain at least 75 per cent. of the aggregate of marks allotted to the subjects in that department.

Class Lists (Easter Examinations)—*Continued.*

SECOND YEAR.

Class.		Agriculture.	Arboriculture.	Live Stock. (Written Exam.)	Handling and Judging Sheep. (Oral Exam.)	Handling and Judging Cattle. (Oral Exam.)
Honours.	I.	1 Jeffs, H. B. 2 Creelman, J. A. 3 Robertson, W. 4 { Willis, W. B. / Fotheringham, W. 6 McPherson, D.	1 Willis. 2 Torrance. 3 Creelman.	1 Jeffs. 2 Robertson. 3 Torrance. 4 Willis. 5 { Garland. / McPherson.		1 Fotheringham.
	II.	1 Perry, D. E. 2 { Torrance, W. J / Maunsell, G. S. 4 Garland, C. S. 5 { Raynes, G. S. / White, C. D. 7 Gregory, J. 8 Smith, J. A. 9 Schwartz, J. 10 Holcroft, H. S. 11 McLennan, D. 12 { Clark, C. / Smith, J. L. / Luton, E. E. / Tourangeau, A	1 Raynes. 2 Perry. 3 { Robertson. / McPherson. / Maunsell. 6 Garland. 7 Jeffs. 8 Holcroft. 9 { Fotheringham. / Gregory.	1 Holcroft. 2 Perry. 3 { Schwartz. / Smith, J. A. 5 Fotheringham. 6 Raynes. 7 { Creelman. / Maunsell. 9 White. 10 Neilson. 11 Luton. 12 McLennan. 13 { Clark. / Eddington.	1 Torrance. 2 Perry. 3 Maunsell. 4 Willis. 5 Creelman. 6 Fotheringham. 7 McPherson. 8 Robertson. 9 Jeffs. 10 Rennie.	1 McPherson. 2 Torrance. 3 Jeffs. 4 Robertson. 5 Willis. 6 Maunsell. 7 Perry. 8 Creelman.
Pass.	III.	1 Neilson, J. 2 Eddington, D. C	1 Rennie. 2 Smith, J. L. 3 Neilson. 4 Clark. 5 { Schwartz. / Luton. 7 { Tourangeau. / Eddington. White. Smith. McLennan.	1 Smith, J. L. 2 Tourangeau.	1 Luton. 2 Holcroft. 3 Schwartz. 4 Clark. 5 Eddington. 6 Raynes. 7 DeVeber. 8 Garland. 9 Neilson. 10 Smith, J. L. 11 Tourangeau.	1 DeVeber. 2 Eddington. 3 Raynes. 4 Garland. 5 Holcroft. 6 Rennie. 7 Luton. 8 Neilson. 9 Clark. 10 Tourangeau. 11 Schwartz. 12 Smith, J. L.

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

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

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Class.		Practical Horticulture.	Agricultural Chemistry.	Meteorology.	Entomology.	The Principles and Practice of Veterinary Medicine and Surgery.
HONOURS.	I.	1 Willis. 2 Fotheringham. 3 McPherson. 4 Robertson. 5 Jeffs.	1 Torrance. 2 Robertson. 3 Perry. 4 Willis. 5 Fotheringham. 6 Jeffs. 7 Schwartz.	1 Willis. 2 Torrance. 3 Robertson. 4 Perry. 5 Fotheringham. 6 Rennie. 7 Jeffs. 8 Gregory.	1 Robertson. 2 Jeffs. 3 Perry. 4 { Torrance. Fotheringham.	1 McPherson. 2 Torrance. 3 Fotheringham.
	II.	1 Holcroft. 2 Neilson. 3 Torrance. 4 Perry. 5 Gregory. 6 Creelman. 7 Raynes. 8 Schwartz. 9 Maunsell.	1 Gregory. 2 McPherson. 3 Rennie. 4 Creelman.	1 McPherson. 2 Schwartz. 3 Holcroft. 4 Smith, J. L. 5 Clark, C. 6 Eddington.	1 Neilson. 2 { Willis. Holcroft. 4 Clark, C.	1 Garland. 2 Robertson. 3 Jeffs. 4 Willis. 5 { Holcroft. Perry. 7 Smith, J. A.
PASS.	III.	1 { Eddington. Garland. 3 Tourangeau. 4 Clark. 5 Rennie. Luton. Smith, J. L.	1 Clark. 2 Holcroft. 3 Neilson. 4 Tourangeau. 5 Maunsell. 6 DeVeber. 7 Smith, J. L. 8 { Raynes. Eddington. Garland. Luton.	1 Neilson. 2 Maunsell. 3 Tourangeau. 4 DeVeber. 5 Creelman. 6 Luton. 7 Garland. 8 Raynes.	1 Schwartz. 2 { McPherson. Rennie. Garland. 5 Gregory. 6 Luton. 7 Creelman. 8 { Maunsell. Smith, J. L. Tourangeau. DeVeber. Eddington. Raynes.	1 Raynes. 2 Tourangeau. 3 Schwartz. 4 Gregory. 5 { Maunsell. White. Creelman. Neilson. Luton. Eddington. McLennan. Smith, J. L. Clark.

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

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

Class Lists (Easter Examinations)—*Continued.*

SECOND YEAR.

Class.		Handling and Judging Horses. (Oral Exam.)	English Literature.	Composition.	Political Economy.	Mechanics.
Honours.	I.		1 Fotheringham. 2 Eddington. Willis. 4 Robertson.	1 Fotheringham. 2 Willis. 3 Eddington.		1 Jeffs. 2 Robertson. 3 Fotheringham.
Honours.	II.	1 Fotheringham. Jeffs. 3 Maunsell. Raynes. Robertson. 6 Perry. Torrance. Willis. McLennan.	1 Torrance. 2 Perry. 3 Jeffs.	1 Torrance. 2 Gregory. 3 Jeffs. Robertson. 5 Perry. 6 Creelman. 7 Raynes. 8 Maunsell. 9 DeVeber.	1 Clark. 2 Fotheringham. 3 Perry. Willis. 5 Robertson. 6 Eddington. Jeffs. Rennie.	1 Willis. 2 Torrance. 3 Perry.
Pass.	III.	1 Smith, J. L. Eddington. White. 4 Creelman. 5 Garland. Tourangeau. Rennie. 8 McPherson. Smith, J. A. Schwartz. Luton. 12 Neilson. Holcroft. Clark, C.	1 Clark, C. 2 Gregory. Rennie. Schwartz. 5 Creelman. 6 McPherson. 7 Raynes. 8 Maunsell. Holcroft. Luton. Smith, J. L. DeVeber. Garland. Neilson. Tourangeau.	1 Holcroft. 2 Rennie. 3 Schwartz. 4 Smith, J. L. 5 McPherson. 6 Clark. 7 Neilson. 8 Garland. 9 Luton. 10 Tourangeau.	1 Garland. 2 Torrance. 3 Schwartz. 4 McPherson. 5 Creelman. Holcroft. Maunsell. Neilson. Smith, J. L. Tourangeau. Luton. Raynes.	1 McPherson. 2 Schwartz. 3 Clark. Garland. Holcroft. Smith, J. L. Creelman. DeVeber. Maunsell. Neilson. Eddington. Luton. Rennie. Tourangeau. Raynes.

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

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

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASS.		LEVELLING AND DRAINING.	BOOK-KEEPING.	GENERAL PROFICIENCY.
HONOURS.	I.	1 Willis. 2 { Jeffs. 2 { Robertson. 4 Torrance.	1 Gregory. 2 Rennie. 3 { Torrance. 3 { Willis. 5 Perry. 6 Fotheringham.	1 Torrance. 2 Robertson. 3 Fotheringham. 4 Willis. 5 Jeffs. 6 Perry. 7 McPherson. 8 Schwartz.
HONOURS.	II.	1 Fotheringham. 2 { Clark. 2 { McPherson. 2 { Perry. 5 Creelman.	1 Robertson. 2 DeVeber. 3 Schwartz. 4 { McPherson. 4 { Tourangeau. 4 { Creelman. 4 { Garland.	
PASS.	III.	1 Schwartz. 2 Holcroft. 3 { Eddington. 3 { Luton. 3 { Maunsell. 3 { Raynes. 3 { Smith, J. L. DeVeber. Garland. Neilson. Tourangeau.	1 { Eddington. 1 { Jeffs. 1 { Luton. 1 { Smith, J. L. 1 { Clark. 1 { Raynes. Holcroft. Maunsell. Neilson.	

DEPARTMENTS.		FIRST CLASS MEN IN THE DEPARTMENTS.
I.	AGRICULTURE AND LIVE STOCK.	NONE.
II.	NATURAL SCIENCE.	1 Torrance, W. J. 2 Robertson, W. 3 { Fotheringham, W. 3 { Perry, D. E. 5 Jeffs, H. B. 6 Willis, W. B.
III.	VETERINARY SCIENCE.	NONE.
IV.	ENGLISH LITERATURE AND POLITICAL ECONOMY.	NONE.
V.	MATHEMATICS AND BOOK-KEEPING.	1 Willis, W. B. 2 Robertson, W. 3 Torrance, W. J. 4 Fotheringham, W.

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First class men in any department must obtain at least 75 per cent. of the marks allotted to the subjects in that department.

II.—MIDSUMMER EXAMINATIONS, 1883.

Class Lists.

FIRST YEAR.

Class.		Agriculture.	Geology.	Structural and Physiological Botany.	Materia Medica.	English Literature.
Honours.	I.	1 M'donald, W. A. 2 Carpenter, P. A. 3 Ballantine, A. W.	1 Macdonald. 2 Wark. 3 Carpenter. 4 Sharman. 5 Lehmann. 6 Ballantyne. 7 McKay.	1 Carpenter. 2 Lehmann. 3 Powys. 4 McKay. 5 Black, P. C. 6 Wark. 7 { Macdonald. Hubbard.	1 Miller. 2 Carpenter. 3 Hubbard. 4 Wark. 5 Macdonald. 6 Butler. 7 Ballantyne. 8 Shaw, A. G. 9 Black, P. C.	1 Miller. 2 Black, P. C. 3 Carpenter. 4 Macdonald.
	II.	1 Little, W. 2 McKay, J. B. 3 Hubbard, W. W. 4 Sharman, H. B. 5 Black, P. C. 6 { Lehmann, A. McGregor, J. 8 Ardagh, A. E. 9 Wark, A. E. 10 Miller, J. P. 11 Powys, P. C. 12 { Shaw, E. E. Buckingham F. 14 Black, D. A. 15 { Westlake, G. Courbarron, F. H. Jordan, A. W.	1 Wroughton. 2 Butler. 3 Little. 4 Hubbard. 5 Ardagh. 6 Powys. 7 Black, P. C.	1 Steers. 1 Miller. 3 Wroughton. 4 Ballantyne. 5 McGregor. 6 { Sharman. Little. 8 Ardagh. 9 Hannah.	1 Wroughton. 2 Little. 3 Lehmann. 4 { Erskine. Ardagh. 5 Courbarron. 7 { Powys. Lane. Sharman. 10 Shaw, E. E. 11 Braun. 12 Smith, E. P. 13 McGregor. 14 Steers. 15 { Wilson. Mohr. 17 McKay.	1 McKay. 2 Powys. 3 Courbarron. 4 Wroughton. 5 Shaw, E. E. 6 Shaw, A. G.

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

Class Lists (Midsummer Examinations)—*Continued.*

FIRST YEAR.

Class.	Agriculture.	Geology.	Structural and Physiological Botany.	Materia Medica.	English Literature.
Pass. III.	1 Braun, P. C. 2 { Mohr, A. Steers, O. 4 Shaw, A. G. 5 { Butler, G. C. Reford, F. W. 7 { Keil, C. A. Wilson, T. G. 9 { Corsan, G. H Annand, F. W. Lane, H. R. 12 { Weatherst'n D Furner. 14 { Smith, E. P. Macalister. Morris. Hannah. Erskine. Weath'rst'n, N.C Begbie. Watterworth and Brown.	1 Miller. 2 Westlake. 3 Wilson. 4 Mohr. 5 Hannah. 6 Shaw, E. E. 7 Keil. 8 Buckingham. 9 Courbarron. 10 McGregor. 11 Furner. Macalister. Smith, E. P. Steers. Shaw, A. G. Black, D. A. Braun. Fuller. Morris. Annand. Corsan. Begbie. Weatherston, D. Lane. Reford. Erskine. Weatherston, N. J. Watterworth.	1 Westlake. 2 Mohr. 3 { Shaw, E. E. Lane. 5 Smith, E. P. 6 { Butler. Courbarron. 8 Black, D. A. 9 Erskine. 10 Buckingham. 11 { Macallister. Shaw, A. G. Jordan. Fuller. Weatherston, N. J. Braun. Begbie. Keil. Weatherston, D. Annand. Morris. Corsan. Wilson. Brown. Watterworth. Reford. Furner.	1 Westlake. 2 Hannah. 3 Macalister. 4 Corsan. 5 Weatherston, N. J. 6 Begbie. 7 Buckingham. Waterworth. Furner. Jordan. Keil. Morris. Weatherston, D. Annand. Reford. Brown. Black, P. C.	1 Steers. 2 Hubbard. 3 Ballantyne. 4 Butler. 5 Little. 6 { Ardagh. Lane. 8 Sharman. 9 Wark. 10 Lehmann. 11 { Wilson. Weath'rst'n, N.C 13 Hannah. 14 Erskine. 15 Furner. 16 { Westlake. Keil. 18 Macalister. 19 Fuller. 20 McGregor. Watterworth. Begbie. Jordan. Annand. Buckingham. Smith, E. P. { Mohr. Weatherston, D. Black, D. A. Brown. Braun. Corsan. Morris.

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

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

Class Lists (Midsummer Examinations)—*Continued.*

FIRST YEAR.

Class.		English Composition.	Mensuration.	General Proficiency.
Honours.	I.	1 Hubbard. 2 Black, P. C. 3 { Carpenter. 3 { Macdonald. 5 Courbarron. 6 Powys. 7 Miller. 8 Butler. 9 Shaw, E. E. 10 Wroughton.	1 Wark. 2 Little. 3 Sharman. 4 Carpenter. 5 McKay. 6 Ballantyne. 7 Wroughton. 8 Macdonald.	1 Carpenter. 2 Macdonald. 3 Wark. 4 Ballantyne. 5 Black, P. C. 6 Hubbard. 7 Miller. 8 McKay. 9 Wroughton. 10 Sharman. 11 Little. 12 Powys.
	II.	1 McGregor. 2 Wark. 3 Sharman. 4 Ballantyne. 5 McKay. 6 Westlake. 7 { Ardagh. 7 { Little. 9 { Erskine. 9 { Lane. 11 Smith. 12 Begbie.	1 Westlake. 2 Powys. 3 Butler. 4 { Hubbard. 4 { McGregor. 6 Erskine. 7 Black, P. C.	13 Lehmann. 14 Butler. 15 Ardagh. 16 Courbarron. 17 McGregor. 18 Westlake.
Pass.	III.	1 Macalister. 2 { Buckingham. 2 { Lehmann. 2 { Weatherston, N.C. 5 Hannah, 6 { Shaw, A. G. 6 { Annand. 8 Wilson. 9 Fuller. 10 Watterworth. 11 Mohr. 12 Steers. 13 Black, D. A. 14 Corsan. 15 Furner. 16 Weatherston, D. 17 { Braun. 17 { Keil. Brown. Jordan. Morris. Reford.	1 Lane. 2 Miller. 3 Courbarron. 4 Ardagh. 5 Buckingham. 6 { Lehmann. 6 { Mohr. 8 Black, D. A. 9 Hannah. 10 Watterworth. 11 Keil. 12 Wilson. 13 Macalister, 14 Shaw. A. G. 15 Smith, E. P. Shaw, E. E. Steers. Morris. Furner. Annand. Jordan. Corsan. Weatherston, D. Braun. Fuller. Weatherston, N.C Brown. Begbie.	

Departments.		First-Class Men in the Departments.
I.	Agriculture and Live Stock.	1 Macdonald, W. A. 2 Carpenter, P. A. 3 Ballantyne, A. W.
II.	Natural Science.	1 Carpenter. 2 Lehmann, 3 Macdonald. 4 Wark. 5 McKay. 6 Ballantyne.
III.	Veterinary Science.	1 Miller, J. P. 2 Carpenter, P.A. 3 Hubbard, W.W. 4 Wark, A. C. 5 Macdonald, W. A. 6 Butler, G. C. 7 Ballantyne, A. W. 8 Shaw, A. G. 9 Black, P.C.
IV.	English Literature and Composition.	1 Black, P. C. 2 Miller, P. C. 3 Carpenter, P. A. 4 Macdonald, W. A.
V.	Mathematics and Book-Keeping.	1 Wark, A. C. 2 Little, W. 3 Sharman, H. B. 4 Carpenter, P. A. 5 McKay, J. B. 6 Ballantyne, A. W. 7 Wroughton, T. 8 Macdonald, W. A.

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

Only those who passed in every subject are ranked in general proficiency.

First-class men in any department must obtain at least 75 per cent. of the marks allotted to the subject in that department.

Class Lists (Midsummer Examinations)—*Continued.*

SECOND YEAR.

Class.		Agriculture and Live Stock. (Written Exam.)	Handling and Judging Cattle. (Oral Exam.)	Handling and Judging Sheep. (Oral Exam.)	Horticulture.	Systematic and Economic Botany.
Honours.	I.	1 Jeffs, H. B. 2 Robertson, W. Willis, W. B. 4 Fotheringham, W. 5 Slater, H.	Jeffs. McPherson. Robertson. Willis.		1 Robertson. 2 Willis. 3 Jeffs. Fotheringham	1 Robertson. Slater. 2 Fotheringham.
	II.	1 Garland, C. S. Holcroft, H. S. McPherson, D. Saxton, E. A. 5 Rennie, E. A. Austin, W. E. Luton, E. E. 8 Smith, J. L. 9 Mathewson, G. 10 Tauraugeau, A. Rose, G. M.	1 Luton. Fotheringham. 3 Saxton. 4 Austin. Mathewson. 6 Garland. Rennie. Schwartz. 9 Holcroft. Rose. Slater. 10 Eddington.	1 Fotheringham McPherson. Willis. 4 Eddington. Austin. Jeffs. Luton Robertson. Saxton. Garland. Mathewson. 12 Holcroft. Paton. Rennie. Schwartz.	1 Austin. 2 Slater. 3 Tucker. McPherson. 5 Saxton. 6 Rennie. Luton. 8 Schwartz. 9 Eddington. Paton.	1 Jeffs. 2 Willis. 3 Garland.
Pass.	III.	1 Schwartz, J. A. Eddington, D. C. Tucker. Paton.	1 Paton. Tauraugeau. 3 Tucker.	1 Rose. 2 Slater. Smith. Tucker 5 Tauraugeau.	1 Tauraugeau. Rose. 3 Holcroft. 4 Smith. 5 Garland. 6 Mathewson.	1 McPherson. 2 Schwartz. 3 Tucker. 4 Austin. 5 Eddington. Tauraugeau. Rennie. Saxton. Luton. Mathewson. Holcroft. Paton. Smith. Rose.

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

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

Class Lists (Midsummer Examinations)—*Continued.*

SECOND YEAR.

Class.		Analytical Chemistry.	Materia Medica.	Veterinary Obstetrics.	Handling and Judging Horses. (Oral Exam.)	English Literature.
Honours.	I.	1 Slater. 2 McPherson. 3 Robertson. 4 Jeffs. 5 Willis.	1 Fotheringham. 2 Robertson. 3 Slater. 4 Jeffs.	1 Robertson.	1 Fotheringham. 2 Robertson. 3 { Willis. McPherson. 5 Garland. 6 Holcroft. 7 Jeffs.	1 Robertson. 2 Slater. 3 Fotheringham. 4 Willis.
	II.	1 Garland. 2 Fotheringham. 3 Saxton. 4 Schwartz.	1 { Willis. McPherson. 3 Garland. 4 Rennie. 5 Schwartz. 6 Austin. 7 Mathewson.	1 Jeffs. 2 Fotheringham. 3 Slater. 4 Schwartz. 5 Willis. 6 Luton.	1 Schwartz.	1 Tucker. 2 Jeffs.
Pass.	III.	1 Luton. 2 Paton. Rennie. Eddington. Holcroft. Austin. Rose. Smith. Taurangeau. Mathewson. Tucker.	1 { Taurangeau. Tucker. 3 Holcroft. 4 Saxton. 5 Luton. 6 Paton. 7 Eddington. Smith. Rose.	1 Garland. 2 { Rennie. Rose. 4 Tucker. 5 Taurangeau. 6 McPherson. 7 Mathewson. 8 Saxton. 9 Holcroft. 10 { Paton. Eddington. 12 Austin. Smith.	1 Luton. 2 Taurangeau. 3 Smith. 4 Rennie. 5 Eddington. Only a portion of the class had the lectures necessary to pass this Examination.	1 Mathewson. 2 Eddington. 3 Paton. 4 Garland. 5 Schwartz. 6 { McPherson. Rennie. 8 Saxton. 9 Austin. Taurangeau. Rose. Holcroft. Luton. Smith.

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

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

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Class.		Surveying and Road-Making.	General Proficiency (Inside examinations)	General Proficiency (Outside examinations).	Departments.		First-class Men in the Departments.
Honours.	I.	1 Willis. 2 Jeffs.	1 Robertson. 2 Willis. 3 Jeffs. 4 Fotheringham. 5 McPherson. 6 Schwartz. 7 Garland.	1 Robertson. 2 Jeffs. 3 Willis. 4 Fotheringham. 5 McPherson. 6 Schwartz. 7 Garland.	I.	Agriculture.	1 Robertson, W. 2 { Willis, W. B. { Jeffs, H. B.
	II.	1 Robertson. 2 Austin. 3 { Fotheringham. { Slater. 5 Smith. 6 { McPherson. { Tucker.	....	....	II.	Natural Science.	1 Slater, H. 2 Robertson, W. 3 Jeffs, H. B. 4 Willis, W. B.
					III.	Veterinary Science.	1 Robertson, W. 2 Fotheringham, W. 3 Jeffs, H. B. 4 Slater, H.
Pass.	III.	1 { Saxton. { Luton. 3 { Holcroft. { Schwartz. 5 Rennie. 6 Paton. 7 { Rose. { Mathewson. Tourangeau. Garland. Eddington.	....	....	IV.	English Literature.	1 Robertson, W. 2 Slater, H. 3 Fotheringham, W. 4 Willis, W. B.
					V.	Mathematics.	1 Willis, W. B. 2 Jeffs, H. B.

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

Only those who passed in every subject are ranked in general proficiency.

First-class men in any department must obtain at least 75 per cent. of the marks allotted to the subjects in that department.

APPENDIX 5.

FINANCIAL TABLES.

1.—Appropriation Expenditure for 1883.

2.—College Revenue for 1883.

3.—College Account with Farm and Garden for 1883.

4.—Estimated Expenditure for 1884.

ONTARIO AGRICULTURAL COLLEGE.

1. APPROPRIATION EXPENDITURE FOR 1883.

A.—*Maintenance Account.*	$ c.	$ c.
I.—*Salaries and Wages*	12,750 89	
II.—*Food.*		
Meat, fish and fowl	4,390 21	
Bread and biscuits	892 44	
Groceries, butter, and fruit	4,318 63	
III.—*Household Expenses.*		
Fuel	3,218 25	
Light	997 67	
Laundry, soap and cleaning	319 70	
Furniture and furnishings	863 73	
Repairs and alterations	887 72	
Women servants' wages	1,747 10	
IV.—*Business Department.*		
Advertising, printing, postage, and stationery	857 89	
V.—*Miscellaneous.*		
Maintenance of chemicals	199 92	
Library	285 01	
Unenumerated	761 70	
VI.—*Water for College and Farm* (city water works)	550 00	
		33,040 86
B.—*Capital Account.*		
I. Museum	719 76	
		719 76

2.—COLLEGE REVENUE FOR 1883.

	$ c.	$ c.
Tuition fees	3,092 11	
Balances on board accounts	4,109 50	
Supplemental examinations	40 86	
		7,242 47

3. COLLEGE ACCOUNT WITH FARM AND GARDEN FOR 1883.

DR.				
(a) WITH FARM.		$ c.	$ c.	$ c.
To Potatoes	413 bags	0 75	309 75	
" Milk	3,600 gallons	0 12	432 00	
" Flour	21¾ barrels	4 75	103 28	
" Wood			45 00	
" Cartage for College			25 00	
" Keep of College horse			100 00	
" " Matron's horse, nine months			75 00	
				1090 03
(b) WITH GARDEN.				
January.				
To Cabbage	9½ dozen at	0 75	7 07	
" Beets	2½ bushels at	0 35	0 87	
" Carrots	4¾ " "	0 25	1 18	
" Turnips	4¼ " "	0 20	0 85	
" Parsnips	4 " "	0 40	1 60	
" Celery	3½ dozen "	0 75	2 62	
			14 19	14 19
February.				
To Turnips	5¼ bushels at	0 20	1 05	
" Cabbage	10½ dozen "	0 75	7 85	
" Carrots	5 bushels "	0 25	1 25	
" Celery	3½ dozen "	0 75	2 62	
" Parsnips	4 bushels "	0 40	1 60	
" Beets	1 " "	0 35	0 35	
			28 91	14 72
March.				
To Parsnips	4 bushels at	0 40	1 60	
" Turnips	3½ " "	0 27	0 70	
" Carrots	5½ " "	0 25	1 37	
" Beets	3 " "	0 35	1 05	
" Onions	2 " "	1 00	2 00	
" Cabbage	6 dozen "	0 75	4 50	
			40 13	11 22
April.				
To Parsnips	2 bushels at	0 40	0 80	
" Onions	1¼ " "	1 00	1 25	
" Turnips	3¾ " "	0 20	0 75	
" Carrots	2 " "	0 25	0 50	
" Beets	1½ " "	0 35	0 52	
" Cabbage	6 dozen "	0 75	4 50	
" Lettuce	¼ bushels "	3 00	0 75	
			49 20	9 07
May.				
To Turnips	6 bushels at	0 20	1 20	
" Carrots	4 " "	0 25	1 00	
" Onions	2¼ " "	1 00	2 25	
" Beets	2 " "	0 35	0 70	
" Parsnips	5 " "	0 40	2 00	
" Rhubarb	6 " "	0 80	4 80	
" Lettuce	3½ " "	2 00	7 00	
" Cabbage	9½ dozen "	0 75	7 12	
" Radish	30 bunches "	0 05	1 50	
" Asparagus	180 " "	0 03	5 40	
			82 17	32 97
June.				
To Rhubarb			11 41	
" Onions			1 10	
" Parsnips	3 bushels at	0 40	1 20	
" Lettuce			3 70	
" Turnips	6¾ bushels at	0 20	1 35	

3. COLLEGE ACCOUNT WITH FARM AND GARDEN FOR 1883,—*Continued.*

DR.			$ c.	$ c.	
June,—Continued.					
" Carrots	1	bushels at	0 25	0 25	
" Spinach	13	" "	0 50	6 75	
" Asparagus	504	bunches "	0 03	15 12	
" Parsley				0 52	
" Radish	3	" "	0 05	0 15	
				123 72	41 55
July.					
To Spinach	12	bushels at	0 50	6 00	
" Rhubarb	8	" "	0 70	5 60	
" Lettuce	2¾	" "	0 50	1 75	
" Peas	12¼	" "	1 00	12 25	
" Beans	2½	" "	1 50	3 75	
" Potatoes	13¼	" "	1 25	16 56	
" Carrots	1	" "	0 35	0 35	
" Beets	½	" "	0 35	0 17	
" Onions	34	bunches "	0 05	1 70	
" Asparagus	156	" "	0 03	4 68	
" Parsley				0 23	
" Raspberries	166	boxes "	0 12	19 92	
" Mint	6	bunches "	0 05	0 30	
" Radish	12	" "	0 05	0 60	
" Strawberries	144	boxes "	0 07	10 08	
" Goosberries	200	quarts "	0 10	20 00	
" White currants	24	" "	0 12	2 88	
" Red "	4	" "	0 12	0 48	
" Black "	20	" "	0 15	3 00	
				234 02	110 30
August.					
To Potatoes	36¼	bushels at	0 90	32 62	
" Peas	9	" "	0 80	7 20	
" Beans	2¾	" "	1 50	4 12	
" Beets	2¼	" "	0 40	0 90	
" Carrots	2	" "	0 30	0 60	
" Apples	7¼	" "	0 80	5 80	
" Lettuce	2	" "	0 40	0 80	
" Cucumbers				3 34	
" Rhubarb	2	bushels at	0 70	1 40	
" Parsley	5	bunches "	0 03	0 15	
" Onions	48	" "	0 05	2 40	
" Radish	6	" "	0 05	0 30	
" Mint	2	" "	0 05	0 10	
" Raspberries	252	boxes "	0 12	30 24	
" Black Currants	37	quarts "	0 15	5 55	
" Cabbage	3½	dozen "	0 75	2 62	
" Corn	24	" "	0 10	2 40	
" Vegetable Marrow	2½	" "	1 00	2 50	
				337 06	103 04
September.					
To Potatoes	18½	bushels at	0 80	14 60	
" Onions	1¼	" "	0 80	1 00	
" Carrots	¾	" "	0 30	0 22	
" Apples	7¼	" "	0 80	5 80	
" Tomatoes	3½	" "	0 75	2 62	
" Beets	¾	" "	0 40	0 30	
" Turnips	¼	" "	0 20	0 05	
" Cabbage	6½	dozen "	0 75	5 62	
" Corn	83½	" "	0 10	8 35	
" Cauliflowers	17	" "	1 00	17 00	
" Vegetable Marrow	½	" "	1 00	0 50	
" Celery	1	" "	0 75	0 75	
" Parsley				0 26	
" Cucumbers				3 38	
				397 61	60 45

3. COLLEGE ACCOUNT WITH FARM AND GARDEN FOR 1883,—*Concluded.*

DR.		$ c.	$ c.	
October.				
To Apples	4½ bushels at	0 80	3 60	
" Parsnips	4¼ " "	0 40	1 70	
" Potatoes	21 " "	0 80	16 80	
" Tomatoes	1 " "	0 80	0 80	
" Onions	2½ " "	0 90	2 25	
" Turnips	5 " "	0 20	1 00	
" Beets	1 " "	0 30	0 30	
" Salsify	¼ " "	0 80	0 20	
" Cauliflower	15 dozen "	1 00	15 00	
" Cabbage	10 " "	0 75	7 50	
" Celery	30 " "	0 75	22 12	
" Vegetable Marrow	8 " "	1 00	8 00	
" White Radish	¾ bushel "	0 60	0 45	
" Herbs	6 bunches "	0 03	0 18	
" Carrots	2 bushels "	0 25	0 50	
			478 01	80 40
November.				
To Celery			26 24	
" Cabbage			5 99	
" Parsnips			4 37	
" Radish	¾ bushel at	0 60	0 45	
" Herbs	6 bunches "	0 03	0 18	
" Turnips	6 bushels "	0 20	1 20	
" Carrots	7 " "	0 25	1 75	
" Onions	7¾ " "	0 90	6 97	
" Beets	2 " "	0 30	0 60	
" Salsify	1½ " "	0 80	1 20	
" Cauliflower	3 " "	1 00	3 00	
" Cabbage, red	8 " "	0 80	6 40	
" Savory, summer			0 10	
" Sage			0 10	
" Parsley			0 05	
" Mint			0 30	
			536 91	58 90
December.				
To Celery	24½ dozen at	0 75	18 37	
" Cabbage	7 " "	0 75	5 25	
" Onions	11 bushels "	0 90	9 90	
" Carrots	8½ " "	0 25	2 12	
" Beets	2 " "	0 30	0 60	
" Parsnips	3½ " "	0 45	1 57	
" Turnips	3½ " "	0 20	0 70	
" Radish, white	½ " "	0 60	0 30	
" Salsify	3 " "	0 80	2 40	
CR.			578 02	1,678 05
By amount paid for work done by Students in outside departments			4,000 42	
				4,000 42
By balance				2,322 37

4. ESTIMATED EXPENDITURE FOR 1884.

COLLEGE AND BOARDING-HOUSE.	Voted for 1883.	Required for 1884.	
I.—Maintenance Account.			
(a) Salaries and Wages.			
	$ 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 Mineralogy; Lecturer on Meteorology	1,500 00	1,500 00	
Professor of Biology and Horticulture; Lecturer on English Literature	1,300 00	1,500 00	
Professor of Veterinary Science	600 00	1,000 00	
Mathematical and Assistant Resident Master	750 00	800 00	
Instructor in Drill and Gymnastics	150 00	150 00	
Bursar	800 00	1,000 00	
Physician	300 00	300 00	
Matron and Housekeeper	400 00	400 00	
Engineer	600 00	700 00	
Assistant Engineer—6 months	198 00	210 00	
Stoker and Night Watchman—6 months	120 00	120 00	
Janitor, Messenger, and Librarian	180 00	240 00	
Temporary Assistance	100 00	100 00	
	10,998 00		12,020 00
(b) Expenses of Boarding-House.			
Meat, fish, and fowl	4,300 00	4,300 00	
Bread and biscuit	1,500 00	1,500 00	
Groceries, butter, and fruit	4,200 00	4,200 00	
Fuel	2,600 00	3,500 00	
Light	1,000 00	1,200 00	
Laundry, soap and cleaning	300 00	300 00	
Furniture and furnishing	550 00	550 00	
Repairs and alterations	650 00	650 00	
Women servants for Boarding-house, etc	1,750 00	1,870 00	
Advertising, printing, postage and stationery	600 00	600 00	
Maintenance of Chemicals	150 00	200 00	
Library, (books, papers, and periodicals)	200 00	250 00	
Unenumerated	700 00	700 00	19,820 00
	29,498 00		31,840 00
II.—Capital Account.			
Chemical apparatus		300 00	
Apparatus, etc., for Biological Department		300 00	
			600 00
Experimental Farm.			
Maintenance Account.			
Farm Foreman	600 00	1,000 00	
Garden Foreman	600 00	1,000 00	
Mechanical Foreman	600 00	1,000 00	
Experiments	4,500 00	3,000 00	
			6,000 00

APPENDIX 6.

ACT OF INCORPORATION.

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 those 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 :—

School of Agriculture continued. Site. Name.

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."

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 apprenticeship ; 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 en-

couragement 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 or 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.

APPENDIX 7.

CIRCULAR OF THE ONTARIO AGRICULTURAL COLLEGE FOR 1883.

STAFF.

College.

James Mills, M.A., President,
Professor of English Literature and Political Economy.

William Brown, C.E., P.L.S.,
Professor of Agriculture and Arboriculture.

R. B. Hare, B.A., Ph.D.
Professor of Chemistry, and Lecturer on Geology and Meteorology.

J. P. Playfair McMurrich, B.A.,
Professor of Biology and Horticulture, and Lecturer on English.

F. C. Grenside, V.S.,
Professor of Veterinary Science.

E. L. Hunt,
(Third year undergraduate, University of Toronto),
Assistant Resident and Mathematical Master.

A. T. Deacon,
Bursar.

Farm.

William Brown, C.E., P.L.S., Farm Superintendent.

P. J. Woods, Farm Foreman.

James Forsyth, Foreman of the Horticultural Department.

James McIntosh, Foreman of 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 hence is well suited for the purpose for which it was selected.

Immediately upon taking possession, the Government appointed a Commission to enquire 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. Accomodation 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 on a small scale in May, 1874; but owing to a variety of causes, very little was accomplished during the first year and a-half. The country was scarcely prepared for such an institution; and some of the first appointments were unfortunate. Hence, for two or three years, it seemed very doubtful whether the College would survive the attacks of its enemies and the mistakes of its friends. At length, however, common sense prevailed, and success was assured.

The College buildings have been altered and enlarged from time to time till they have assumed the proportions indicated in the frontispiece of this circular; and many improvements have been made on the Farm. A considerable portion of it has been underdrained, suitable buildings have been provided, and a fair representation of stock secured—seven breeds of cattle, six of sheep, and three of pigs.

Terms of Admission.

1. Candidates for admission must not be less than sixteen years of age.
2. Must produce satisfactory certificates—
   (1) As to moral character.
   (2) As to physical health and strength.
   (3) As to their intention to follow Agriculture or Horticulture as an occupation.
3. Must pass the Matriculation Examination.
4. Must pay the tuition-fee and a deposit on account of board in advance.

Matriculation Examination, Certificates, etc.,

The subjects of examination for admission 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 them selves for examination on the 16th of April or the first of October, at nine 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 any such certificates or diplomas. Intending students who do not hold any such certificates or diplomas are advised to pass the examination for admission to some High School.

Candidates are advised to enter on the first of October; and none should leave before the end of the Spring Term in June.

Payments in Advance.

At the time of entrance—

1. Resident Candidates for the Regular Course:—

Tuition fee for one year	$20 00
Deposit on account of board	15 00
	$35 00

2. Non-Resident Candidates for the Regular Course:—

Tuition for one year	$50 00
Deposit on account of board	15 00
	$65 00

3. Resident Candidates for Special Class:—

Tuition fee for One Session	$20 00
Board for Fall Term	30 00
	$50 00

4. Non-Resident Candidates for Special Class:—

Tuition for One Session	$50 00
Board for Fall Term	30 00
	$80 00

After admission—

1. All Regular Students:—

At the beginning of each term, except the Summer Term, deposit on account of board	$15 00

At the commencement of the second year,

Tuition Fee, if Resident	$20 00
Tuition Fee, if Non-Resident	50 00
	$70 00

2. Special Students :—

Fifth January, Board for Winter Term	$30 00

At the Commencement of the Second Year, payments the same as at the time of Entrance.

☞ By the term non-Residents is meant all except those whose parents or guardians are ratepayers or *bona fide* residents of the Province of Ontario.

All the above payments must be made to the President of the College strictly in advance.

There is no refund of fees to students who leave for any cause other than sickness, nor to those who are dismissed for neglect of work or violation of rules.

No allowance is made on board bills for absence of less than one week's duration, nor in any case in which the absence is not shown to be unavoidable.

Residence, Labour, Board, Remuneration, etc.

It is desirable that all students should reside in the building. As, however, the city 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.

Board, Lodging and light, with the washing of towels and bed linen, $2.25 to $2.50 a week.

Washing, thirty cents per dozen pieces.

Allowances for labour, four to ten cents an hour, according to its value as estimated by the Farm Superintendent and his foremen—in no case to exceed the charges for board and washing.

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 $40 to $55 a year for *board, washing, and tuition.*

(1) To an Ontario student without any previous knowledge of farming, $50 to $65 a year for *board, washing, and tuition.*

(3) To non-residents, $70 to $100 a year for *board, washing, and tuition.*

Some students, by regularity and industry, succeed in cancelling almost their entire board accounts.

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 buildings, or in any place except 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, and are at all times responsible to him for their conduct.

2. A register is kept of the attendance of students at prayers, work and lectures.

3. All students must attend prayers regularly, unless exempted from doing so, in consequence of objections raised by their parents or guardians.

4. They are required to attend their respective places of worship every Sabbath forenoon.

5. No student is allowed to leave the Institution during the hours of duty without the permission of the President; nor after seven o'clock in the evening, without the permission of the President or the master in charge *pro tem.*

Students must not be off work or absent from lectures without first getting the consent of the President.

6. In order that there may be no interference with the regular duties of the Institution, the half of every Saturday is set apart as a holiday for recreation and private business.

7. Students must not invite friends or guests to the dining-hall, or to stay over night in the College, without first obtaining the consent of the President.

8. None but the regular boarders are, under any circumstances, to go to meals in the dining-hall or remain over night in the College without permission from the President.

9. 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.

10. Every student damaging or breaking anything, is required to report the same, that the value of the repairs may be charged to his account.

11. The morning bell is rung at 6 a.m.; bell for 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 bell at 5.30 p.m; school bell, at 7 p.m.; bell for roll call and evening prayers, at 9 p.m.; lights out at 10 p.m.; doors closed at 10.30 p.m.

12. The President is authorized to make such additional regulations as may seem to him necessary for the discipline of the Institution, and to impose fines and other penalties for the infraction of rules and regulations.

13. No student whose moral conduct, industrial or intellectual progress, is unsatisfactory to the staff, will be allowed to remain at the Institution.

N. B. (1) It is the duty of the President to enforce the above rules and regulations.

(2) A copy of this circular will be sent to every candidate for admission; and an application thereafter will be taken as an agreement on his part to comply with all the above rules, regulations and prohibitions.

(3) In the case of occasional students who are of age and are their own guardians the President may, if he thinks proper, relax the rules regarding leave of absence and attendance at Church.

Course of Instruction.

The instruction given at the Institution is embraced under two heads: a Course of Study and a Course of Apprenticeship.

I.—Course of Study.

The Course of Study is one of two years, and embraces the following subjects:

FIRST YEAR.—SUBJECTS.

Agriculture.
Live Stock.
Inorganic Chemistry.
Organic Chemistry.
Veterinary Anatomy.
Veterinary Materia Medica.
Physiology.
Zoology.
Structural and Physiological Botany.
Geology and Physical Geography.
English Literature.
English Composition.
Bookkeeping.
Arithmetic.
Mensuration.

SECOND YEAR.—SUBJECTS.

Agriculture.
Arboriculture.
Live Stock.
Agricultural Chemistry.
Veterinary Pathology.
Veterinary Surgery and Practice.
Systematic and Economic Botany.
Entomology.
Meteorology.
English Literature.
Political Economy.
Bookkeeping.
Mechanics.
Levelling and Surveying.

Departments of Instruction.

Department I.—Agriculture.

Introduction: *history of agriculture*—ancient, mediæval, modern; *literature*—standard works, reports of societies, periodicals; *varieties of farming*—dairy stock, mixed.

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 soil.

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*—turnips, carrots, potatoes, etc.; *forage or herbage*—tares, 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.—Improvements by thorough ordinary cultivation; subsoiling; *draining*—its value; principles; various methods of draining; cost; *manuring*—farm-yard manuring; application, uses and properties of artificial manures—lime, plaster, salt, bones, superphosphate, nitrate of soda, etc.; green manures.

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, Ayrshire, 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; *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, etc.; *swine*—characteristics of the various breeds; breeding and management of sows; fattening; relation of food to increase; bacon curing.

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; threshing and dressing machines; barn implements; waggons, sleighs, carts; straw cutters; turnip cutters and pulpers; implements used in stock feeding, etc.,

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, outbuildings, stables, barns, sheds; principles of construction; plans and specifications.

General Business of the Farm.—Capital necessary—value and price 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 tree from the seed bed; what part of the country should be planted; planting operations; transplanting large trees; enclosing and draining planted grounds; management of trees with a view to shelter and economy.

Miscellaneous Subjects.

Department II.—Natural Science.

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

Inorganic Chemistry.—Scope of subject; elementary and compound substances; chemical affinity; symbols; nomenclature; combining properties 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 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.

Organic Chemistry.—Construction 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.

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; 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.

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

Quantitative analysis of soils, manures, and farm produce.

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.

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.

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 of *varieties* by grafting, budding, layering, and division; disease of plants—smut, rust, mildew, etc.

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.

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, etc.

Entomology.—Anatomy of insects; geographical distribution and classification of insects; metamorphosis 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.

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

Department III.—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—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 animals by the same.

Digestive system—nature, causes, symptoms, and treatment of spasmodic and flatulent colic, inflammation of the bowels, acute digestion, 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 lock-jaw, stringhalt, 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.—The preparation, actions, uses, doses, of over one hundred of the principal medicines used in Veterinary practice.

Department IV.—English Literature, and Political Economy.

English.—History of the English language; its formation, and connection with other languages. The sentence, the paragraph, and the period; capitals and punctuation; style—its varieties and qualities; principal figures of speech defined and illustrated; accuracy, purity, propriety, clearness, precision, strength and grace; false syntax discussed and corrected; prose and poetic diction distinguished; standard and characteristics of taste; pleasures of the imagination, etc.

Frequent exercises in letter-writing and impromptu composition.

Committing to memory, and critical study of two of Shakespeare's plays, and of selections from Milton, Gray, Goldsmith, Cowper, and Scott.

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 V.—Mathematics and Bcok-keeping.

Arithmetic.—Review of subject with special reference to farm accounts; tables of weights and measures; interest, discount, stocks and partnership; equation of payments; alligation; exchange, etc.; mental arithmetic—calculations in simple rules, fractions, and compound rules.

Mensuration.—Mensuration of surfaces and solids, with special reference to the measurement of lumber, timber, earth, etc.

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

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

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

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

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.

Road-making.

Book-keeping.—Business forms and correspondence; general farm accounts; dairy, field, and garden accounts; laws relating to farming—deeds, mortgages, notes, etc.

II.—Course of Apprenticeship.

The students 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 sent in rotation ta 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; threshing, winnowing, stoning, draining, levelling, measuring, stumping, etc.

Live Stock Department.—Cutting, pulping, steaming, mixing, feeding, cleaning, general management of cattle feeding, lambing, shearing, castration, dipping, salving, hurdling; general management of sheep feeding and general management of other stock.

Horticultural Department.—Digging, ploughing, raking, seeding, planting, hoeing, mowing, harvesting, storing; general management of vegetables, flowers and lawn. Pruning, grafting, budding, mulching; general management of an orchard. General management of propagating houses, green-houses, vinery, nursery, hedges, walks, and roads, etc.

Mechanical Department.—Planing, sawing, nailing, grooving, matching, morticing, framing and general use of commoner mechanical tools. Fencing, hurdle making, gate making, and general farm improvements. Repairs of all farm buildings, implements, machines, etc.

Terms, Sessions, Vacations, and Examinations.

Terms and Sessions.—The Scholastic Year commences on the 1st of October, and ends on the 31st August. It is divided into two sessions, and each session into two terms, as follows:

Fall Term—1st October to 22nd December, Winter Term—5th January to 31st March,	*Winter Session.*
Spring Term—17th April to 30th June, Summer Term—1st July to 31st August,	*Summer Session.*

Lectures commence on the 1st October, and continue throughout the first three terms—from 1st of October to 30th of June. During that time all regular students have class-room work, and manual labour alternately—three hours a day being spent at the former, and from three and a half to five at the latter. To this are added five hours in two weeks for set-up drill and gymnastics, so that the daily routine of every student in the regular course, for nine months of the year, is—

Lectures in the College.—Three hours a day (excepting Saturday.)

Manual Labour Outside.—Three and a half to five hours a day.

Study in Rooms.—Two hours a day.

Drill and Gymnastics.—One hour a day (for five days of every alternate week.)

While the first year students are at lectures in the College, the second year students are employed outside. Those who go out to work in the forenoon, come in for lectures in the afternoon, and *vice versa*. Thus the theoretical work inside and the practical work outside go on simultaneously during the Fall, Winter, and Spring terms. The Summer Term (1st July to 31st August) is devoted entirely to work in the outside departments—the Farm, the Live Stock, the Garden, the Carpenter Shop, and Experiments.

Vacations.—There are three vacations in the year—the Christmas vacation (22nd Dec. to 5th Jan.), the Easter vacations (1st to 16th April), and the Summer vacation (1st to 30th September). The College boarding house is closed during the Easter and Summer vacations.

Examinations.—The examinations which every student is required to pass each year of the Course are three in number—one in December, on the work of the Fall Term; one at the end of March, on the work of the Fall and Winter Terms: and one at the end of June, on the work of the Spring Term. The last two embrace not only the class-room work, but also the handling and judging of live stock, and the various operations in the outside departments.

DIPLOMAS.

Diplomas admitting to the Status of "Associate of the Ontario Agricultural College," are granted to all students who comply with the following conditions:—

1. Complete the regular course of study and apprenticeship.

2. Pass satisfactorily all prescribed examinations, both on the subjects contained in the curriculum and on the work of apprenticeship.

3. Compose an acceptable Thesis on some subject in the Course of Study or connected therewith.

The subject or topic to be discussed in the Thesis must be selected and submitted for approval not later than the end of January in the second year.

All Theses must be neatly written on foolscap paper, and handed to the President not later than the 10th May.

Medals.

Three medals are offered for competition among the students of the second year, designated—

The Gold Medal,
The First Silver Medal,
The Second Silver Medal.

All second year students are eligible to compete for these medals, provided they continue regularly from the beginning to the end of the Course, without dropping out or missing any of the prescribed examinations.

In case of failure in First Year examinations, or in the Christmas examinations of the Second Year, the Faculty may grant Supplemental Examinations or entertain claims for an *ægrotat*, without interfering with the right to compete.

The competition is—

(1.) By written examinations at Easter on the class-room work of the Fall and Winter Terms.

(2.) By written examinations at the end of June on the class-room work of the Spring Term.

(3.) By practical examinations at the above dates on cattle, sheep, pigs, horses, and various operations taught or performed on the Farm, in the Garden, or in the Carpenter shop.

The minimum standard for the Gold Medal is 50 per cent. of the marks in each subject, and an aggregate of 75 per cent. of the total number of marks in all the subjects; for the Silver Medals, 50 per cent. in each subject and an aggregate of 67 per cent. in all the subjects.

General Remarks.

A few general remarks on the appliances and advantages possessed by the Institution tor training young men for agricultural pursuits, may be given in conclusion.

Farm and Carpenter Shop.

The carpenter shop is provided with three or four benches and the tools necessary for plain work and general repairs.

The farm is being gradually laid out, cleaned and drained. The best and most approved farm implements and machinery are used. Seven breeds of cattle, six of sheep, and three of pigs are kept for the purposes of instruction. The monthly fairs and fat cattle shows in the city of Guelph, are occasionally visited and reported on by the students.

Experiments.

A portion of the farm has been laid out in small plots; and a series of experiments with cereals, roots, grasses, manures, and various modes of management is regularly and systematically carried on from year to year. Besides the field experiments, others in the feeding of live stock are made during the winter, to test the several breeds of animals and the comparative value of different kinds of feed.

Horticultural Department.

In this department there are three green houses, a four-acre kitchen garden, a vinery, a thirty-acre lawn, an arboretum, and a large variety of fruit and ornamental trees.

Veterinary Department.

The veterinary 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, the cause or causes of death sought for and pointed out in presence of the classes. Thus the work is made as practical as possible.

Library, Reading-room, and Gymnasium.

The library contains over 4,000 volumes of choice reading on the different subjects embraced in the course of study, and a good selection of history, poetry, biography, and travels; the reading-room is furnished with thirty-five or forty of the leading papers and periodicals; and the gymnasium is provided with a horizontal bar, parallel bars, Indian clubs, dumb bells, bar-bells, and most of the other articles used in common gymnastic exercises.

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 he is not only able afterwards 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. He becomes acquainted with the prices of stock, implements, produce, building and improvements, and 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 standard works in the library, and newspapers and periodicals in the reading-room, by contact with his fellow-students, and by discussion 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 be secured.

JAMES MILLS,
President.

PART II.

REPORT

OF THE

PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, 1883.

To the President of the Ontario Agricultural College :

DEAR SIR,—In last year's report we gave, in the language of Professor Panton, the size of the college laboratory, "the private room of the Professor of Veterinary Science capable of accommodating not more than six students at work." We further acknowledged your kindness in allowing us, for the use of the second year students in practical and analytical Chemistry, to erect two temporary working tables in the gymnasium, or old dining hall, and to furnish them with appropriate shelves for holding the necessary reagents, etc., etc.

Since the publication of that report you have not only made those temporary tables permanent, but have decided that the room be, for the present, devoted to the interest of Chemistry.

Immediately upon taking possession we sought to give development to Chemistry in every sense practical. Opposite the first table a platform was built and upon the platform a chemical table provided with a pneumatic trough, and the necessary drawers, etc., etc. At one end of the chemical table, against the wall, was erected a case furnished with Professor Richards' Filter Pump and Blast and a leaden trough with cold and hot water water-pipes, and at the other end, an air chamber for carrying off foul gases. By a convenient arrangement of the cases, new and old, and of the students' seats, we endeavoured not only to make the room answer for a lecture room, but for a laboratory in which practical work might be done in qualitative and quantitative Chemistry.

It was not until July of the year that the new laboratory became furnished with apparatus for doing quantitative work. Through the intercession of Professor Brown and yourself, an appeal was made to the Hon. Mr. Young, then Minister of Agriculture, for a grant of Three Hundred Dollars ($300.00) from the Experimental Department, to be applied in the purchase of the most necessary pieces of apparatus. The Hon. Mr. Young granted the request. By going to New York in person, we saved, on catalogue prices, considerably more than our travelling expenses. Among the apparatus purchased were:—A Superior Becker Agate Chemical Balance ; a set of 100 gramme weights ; Combustion Gas Furnace, 25 burners ; Professor Richards' Filter Pump with Blast ; Sprengel's Air Pump ; Eudiometers of Bunsen ; Hoffman's Apparatus for decomposing water ; Kipps' Sulphuretted Hydrogen Apparatus ; Schlozssing's Apparatus for determining Nitric Acid; Nöbel's Silt Apparatus ; Distilled water Apparatus; Liebig's Condensor; Burettes Pipettes, Porcelain Crucibles, Berlin and Meissen, Combustion Tubes, Bulb Tubes, Rubber Corks, Mercury Troughs, Specific Gravity Bottle, Desiccators, Platinum Dishes, and Trays, etc., etc. This apparatus, with a set of pure chemicals purchased at the same time, enable us, in a measure, both to do and teach quantitative analytical work.

This trip to New York for chemical apparatus was made to serve another purpose, viz., that of visiting the Agricultural Experiment Stations of Connecticut, New Jersey, and New York. We shall briefly review the work done by these stations during the past year, indicating at the same time their present standing and future prospects.

1. The Connecticut Agricultural Experiment Station located at New Haven. This Station was incorporated by the State General Assembly in 1877. It is managed by a State Board of Control. The Director, ex-officio, is Professor S. W. Johnson, the first chemist is Dr. E. H. Jenkins. Besides the lady clerk, who attends to the office, there are four assistant chemists. A gardener and his wife are in charge of the building and grounds.

At the time of our visit to the station—first week of July—the Director, Professor Johnson, was absent. Dr. Jenkins most cheerfully and interestingly made us acquainted with the peculiar arrangements and workings of his *well* furnished laboratory. Upon informing us that he was then conducting experiments in general, upon the testing methods of Agricultural Analysis, particularly those referring to nitrogen in some of its forms, and Reverted Phosphoric Acid, we felt assured that the Doctor, under such favorable circumstances, must speedily effect important changes in some of the old methods. He informed us that the relative value of California grown seeds, and of Eastern grown were then engaging his attention. The California seed, though lighter and smaller, seemed to retain its vitality longer. He further informed me that the work of the Station was almost wholly analytical, the examination and analysis of the Commercial Fertilizers of the State constituting the most important feature of the Station's work. Every person selling manure in the State, the retail price of which is ten dollars or more, must affix to every package of it, a printed statement certifying the number of net pounds of fertilizer in the package. He must also send to the Director of the Agricultural Experiment Station a glass jar containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample of it. He must further pay annually to the Director of the Station, an analysis fee of ten dollars for each of the fertilizing ingredients contained, or claimed to exist, in the fertilizer.

The Station makes two classes of analyses of fertilizers; the first for the benefit of farmers, gardeners, and the public generally, the second for the private use of manufacturers and dealers. The first analyses are done gratuitously; for the second, moderate rates are charged. During 1882 one hundred and fifty one (151) samples of fertilizers were analyzed. The ingredients of the fertilizers which are determined and valued are: Nitrogen, Phosphoric Acid and Potash.

The Nitrogen can occur in the form of *Organic Nitrogen*—albumen and fibrine of meat and blood—Urea and Hippuric Acid of urine, etc., etc., or in the form of ammonia and of nitric acid—the altered forms of organic nitrogen existing in the soil and manure heap. In commerce the ammonia occurs as sulphate of ammonia, and the nitric acid as nitrate of soda. 100 parts of steam dried blood will contain 11 parts of nitrogen. 100 parts pure Sulphate Ammonia will contain 21 parts of Nitrogen. 100 parts pure Nitrate of Soda will contain 16 parts of Nitrogen.

The Phosphoric Acid exists also in three forms:

(1) Soluble Phosphoric Acid—The characteristic ingredient of Superphosphates. It is formed by acting on insoluble phosphates with sulphuric acid. It is readily taken up by plants and distributed through the soil by rain.

(2) Reverted Phosphoric Acid—Phosphoric Acid once freely soluble in water, now insoluble—soluble in a strong solution of ammonium citrate. Crops readily assimilate it. It has a lower value than soluble Phosphoric Acid.

(3) Insoluble Phosphoric Acid—phosphates not freely soluble in water or ammonium citrate—Canada apatite, South Carolina rock phosphate, etc. "The phosphate of coarse raw bones is at first nearly insoluble in this sense, because of the animal matter of the bone which envelopes it, but when the latter decays in the soil, the phosphate remains in essentially the reverted form."

Potash signifies potassium oxide. "It is most costly in the form of sulphate, and cheapest in the shape of muriate or chloride."

To estimate the value of a fertilizer we must know the "trade values" of the elements of the fertilizer. The trade values vary with the state of the market. "The average *trade values*, or cost in market per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as found in the Connecticut and New York markets, and employed by the Station during the last two years, have been as follows :—

TRADE VALUES FOR 1881 AND 1882.

	1881 Cents per lb	1882 Cents per lb
Nitrogen in Nitrates	26	26
do in Ammonia Salts	22½	22½
do in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish, superphosphate and special manures	20	24
do in coarse or moist blood, meat or tankage, in cotton seed, linseed and castor pomace	16	18
do in fine ground bone, horn and wool dust	15	17
do in fine medium bone	14	15
do in medium bone	13	14
do in coarse medium bone	12	13
do in coarse bone, horn shavings, hair and fish scraps	11	11
Phosphoric Acid soluble in water	12½	12½
do reverted and in Peruvian guano	9	9
do insoluble, in fine bone, fish guano and superphosphates	6	6
do in fine medium bone	5½	5½
do in medium bone	5	5
do in coarse medium bone	4½	4½
do in coarse bone, bone ash, and bone black	4	4
do in fine ground rock phosphate	3½	3
Potash in high grade sulphate	7½	7
in low grade sulphate and kainite	5½	5½
in muriate or potassium chloride	4½	5

To illustrate the important work the station is doing in estimating the value of the different fertilizers sold in the state, we shall refer to some of the analyses of fertilizers the station has made. Having by analysis determined the quantity of nitrogen in all three forms, of phosphoric acid in all three forms, and of the potash and chlorine, the value of a ton of the fertilizer can be estimated by multiplying the quantity of each element in the ton, by the trade value of each. We shall compare the value so estimated with the price asked for the fertilizer by the manufacturer. In the ammoniated superphosphate of lime of H. J. Baker and Bros., New York, the value estimated by the station exceeded the cost, eight dollars and twenty-three cents. A short list of like honest, liberal manufacturers follows. In Powell's Prepared Chemicals of Brown Chemical Co., Baltimore, the cost exceeded the valuation fifteen dollars and seventy-eight cents. A long list of like dishonest manufacturers follows. In the manufacture of special Fertilizers a similar division occurs. In the corn manure of Geo. B. Forrester, New York, the valuation exceeded the cost eight dollars and thirty-nine cents; in Bradley's patent fertilizer for tobacco, the cost exceeded the valuation thirteen dollars and fifty-four cents. A farmer who purchases seven tons of such a manure suffers a loss of one hundred dollars.

The method of valuing bone manure is interesting. By passing a weighed sample of the bone through a system of four sieves, five grades of ground bone are distinguished. We give the dimensions and trade values of the five grades :—

Grade.	Dimensions.	1882. Estimated value per pound. Nitrogen.	Phos. Acid.
Fine	Smaller than $\frac{1}{50}$ inch.	17 cts.	6 cts.
Fine medium	Between $\frac{1}{50}$ and $\frac{1}{25}$ inch.	15 "	5½ "
Medium	" $\frac{1}{25}$ and $\frac{1}{12}$ inch.	14 "	5 "
Coarse medium	" $\frac{1}{12}$ and $\frac{1}{8}$ inch.	13 "	4½ "
Coarse	Larger than $\frac{1}{8}$ inch.	11 "	4 "

By applying this principle (which is founded on experience) to the ground bone of Preston & Son's, the cost exceeded valuation seventeen dollars and eighty-eight cents. In the manufacture and sale of nitrate of potash and soda, sulphate of ammonia, dried blood and tankage, cotton seed, fowl manure and potash salts, dishonesty has also been detected.

In answer to occasional inquiries made at the station with regard to the method of preparing superphosphate of lime, an explanation of the process of making it from bone charcoal is given. We have received similar inquiries from farmers of the Ottawa District about the method of preparing superphosphate of lime from the mineral phosphate. The only difference between the bone charcoal, or waste product of the factory, and the mineral phosphate is that the former is finely powdered, the latter is not. If the farmers of mineral phosphate districts will buy a "rock grinder," they may cheaply manufacture their own superphosphate of lime. Construct wooden vats after the style of a mortar bed; put 500 pounds of the ground phosphate into the vat, making a slight depression in the middle of the pile, pour fifteen gallons of water slowly over the mass, mixing with a hoe until the whole is wet; pour in the same way, keeping eyes averted and avoiding spattering as much as possible, 300 pounds of sulphuric acid over the heap. If a drop of the acid falls upon the skin immediately wipe it off with a cloth and wash the place well with water. Mix the materials thoroughly with a hoe until steaming and frothing have about ceased. In a short time the mortar consistency of the mixture will have dried to a crumbly state and may be spread on the land.

Attention has been called by the station to galvanized iron and tinned copper as a source of poison. Galvanized iron is sheet iron coated with zinc. The zinc dissolves in the juices of fruit or in vinegar. The soluble salts of zinc are ranked among poisons. "A little zinc dissolved in cider may produce no noticeable ill effects on a vigorous person. Large doses cause disturbance, more or less serious, of the digestive apparatus. Tinned copper can be a source of lead poison. The Connecticut station, needing a vessel of tinned copper for the storage of distilled water, had a tinsmith of New Haven make one. The copper was lined with a tin containing so much lead that "pure water dissolved it rapidly and carbonate of lead, in minute brilliant crystals, formed a film on the surface of the water and coated the sides of the vessel."

The station has further made between 200 and 300 complete or partial analyses of milk. By averaging the analyses, the following composition of the milk was obtained:—

Water	
Fat	87·5
Casein and albumen	3·5
Milk sugar	4.1
Ash	4·3
	0·6
Solids, 12·5.	100·00

Water constitutes, on the average, seven-eights of the total milk, the valuable ingredients being included in the 12·5 per cent. solids which remain when the water is evaporated. We give the following brief description of the solids valuable as food:

"Butter is the fat of milk mixed with some ten or fifteen per cent, of water and one-half per cent. of the other solids of the milk, together with two-fifth per cent. of salt added in the making.

"Butter-milk is the water of milk, with most of the casein and sugar and a small amount of fat.

"Cheese is the casein and albumen of milk, with more or less of the fat and other solids and a variable amount of water.

"Whey is mostly the water of milk, with the larger share of the sugar and small portions of the other solids.

"The worth of milk, for common use as food, depends on the quantity of solids it contains. It is well established that genuine milk is somewhat variable in composition as respects the proportions of water and solids. It is found that differences of breed, characteristics of the individual animals, period of lactation, quantity and kind of food, climate or weather, state of health and other conditions, which largely affect the quantity or yield of milk, also, though to a much less degree, influence its composition on the proportion of its ingredients."

In testing the quality of milk the *specific gravity test* and the test by chemical analyses are both in use. As the specific gravity of milk is diminished by adding water and increased by removing fat, watering and skimming, if artistically combined, can scarcely be detected by the lactometer. It has been found at the station that milk watered to any considerable extent has its specific gravity brought below 1·029, a reading clearly given by the lactometer. In case of double falsification, watering and skimming, the milk has been allowed to stand for cream or has been chemically analyzed. We give a brief summary of some of the analyses made :—

"Thirty analyses of the milk of twelve herds, about 180 head of cows, made in October, 1881, gave :

	Solids.	Fat.
Average	12·89	4·02
Maximum	14·28	5·14
Minimum	12·00	2·68

"Twenty-seven analyses of the milk of the *same herds*, made in July and August, 1882, gave :

	Solids.	Fat.
Average	12·21	4·23
Maximum	13·32	5.63
Minimum	11·02	3·47

"Seventy-seven analyses of the milk of sixty herds, in May, 1882, gave :

	Solids.	Fat.
Average	12·81	4·05
Maximum	14·44	5·23
Minimum	10·93	3·24

In this herd-milk the solids have varied between 14·4 and 9·8 per cent., and fat between 5·6 and 2·6 per cent. The variations in its specific gravity are less striking. "No instance appears to be on record where a competent observer has found for the mixed milk of a number of healthy cows a specific gravity less than 1·029, and we may conclude with certainty that milk which falls below that density has been watered." It is thought that specific gravity, as an evidence of watering simply, furnishes by far the most satisfactory test. If 1·029 be adopted as a minimum "no pure milk will be condemned."

"In more than 6,000 recorded observations on the mixed milk of herds Boachardat and Quevenne found that it was always between 1·029 and 1·033. Müller in Bern, from many hundred observations in Switzerland, France, Belgium, England, and other places, found the same limits. Fleischmann, in 833 samples of milk sold in Lindau, found only four per cent. which had a specific gravity of less than 1·029, and all of these, as he proved, were either from single cows or had been watered. In the reports of examinations, made by the police of European cities, of herd milk taken in the stables, it is possible to find specific gravities under 1·029, but in these cases there is no certainty or even probability that the determinations were made with sufficient care to avoid sources of error."

The station has made analyses of fodder corn and ensilage with the object of learning something of the kind and degree of chemical change which occurs in the silo. In comparing the analyses of duplicate samples of *fresh field corn*, a difference of 0·85 per cent. was noticed in the water content—partly due to unavoidable errors in sub-sampling, drying and weighing. Comparing, on water free substance, the composition of the ensilage with that of the corn itself no satisfactory evidence of any change in the albuminoids was discovered. "As regards the ether extracts, we observe that in both cases the ensilage contains very nearly double what was got from the fresh corn. In ordinary fodder analyses the ether extract consists for the most part of oil, fat or wax, and is usually termed fat or crude fat. In the process of ensilage it is not so likely that fat is produced as that lactic acid is formed, perhaps mainly during the sampling and sending (by transformation of sugar), which dissolve freely in ether.

"That sugar and perhaps other carbhydrates are to some degree destroyed and lost by fermentation in the silo, is proved by the appearance of fermentation products, especially carbonic acid gas." In conclusion they are unable to indicate the quality or even the kind of changes that go on in the silo. The antiseptic quality of acids, especially carbonic acid gas, which has lately been demonstrated by Kolbe, is such as to lead to the conclusion that *no considerable* amount of chemical change or of loss of nutritive matters *can go on* in the well constructed silo.

2. The New Jersey Agricultural Experiment Station, located at New Brunswick, was established by Act of Legislature in 1880. It is controlled by a board of managers, consisting of the Governor of the State, the board of visitors of the State Agricultural College, together with the President and Professor of Agriculture of that institution.

We had the pleasure of meeting the director of the station, Professor George H. Cook, LL.D., who kindly answered every one of our many questions. It was Dr. Neale, the chemist, who most ably and liberally did all in his power to explain to us the experiments both of the laboratory and of the field. In the course of our conversation the Doctor informed me that the station had been three years in existence, that its income, first year, was $5,000, and its income at present, $8,000. He further informed me that the work of the station must be thoroughly practical so that the Government may be warranted in using the people's money. He also said that in some parts of the State the farmers would starve if they did without artificial fertilizers. At the time of my visit he had just finished the analyses of the *incomplete fertilizers.* From the analyses and the valuation based thereupon (price same as that given under Connecticut) he said, the manufacturers would sell the *crude stock*, this year, at a lower price than the station's valuation. The analyses of the complete fertilizers were at the time of my visit under headway and have since been published. By *incomplete fertilizers* is meant any one of the artificial fertilizers taken alone, as for instance, nitrogen in any one of its forms, etc., etc. ; by a *complete fertilizer* is meant a combination of the artificial fertilizers, viz., of superphosphate, potash salt, and of some material containing nitrogen. A special manure represents a complete manure particularly adapted for some one crop. It is not an easy matter to practise dishonesty in the manufacture and sale of the incomplete fertilizers, nitrate of soda, superphosphate of lime, and potassium chloride being almost recognizable by their physical properties. A mixture of these fertilizers may have any appearance and so be exceedingly deceiving to the eye. We shall give a few examples of dishonest dealing that were detected about the time of our visit.

In special fertilizers, the cost in every case, exceeded the station's valuation. In Mape's Corn Manure, H. J. Baker Bros.' Potato-Fertilizer, and in Stockbridge Potato-Fertilizer, the cost per ton exceeded the estimated value more than nine dollars. It is in the manufacture of the complete fertilizers that the greatest dishonesty is practised. In N. J. Chem. Co's Button Bone Fertilizer, the deception amounted to sixteen dollars ($16.00) per ton ; in Jones' Meat, Blood and Bone Fertilizer, the deception amounted to twenty-six dollars and ninety-seven cents,($26.97) per ton. One case we shall give in full. In one hundred pounds of Wagener's Mineral Fertilizer there were 0.12 lbs. organic nitrogen ; 0.93 lbs. reverted phosphoric acid ; 0.46 lbs. insoluble phosphoric acid ; and 1.75 lbs. muriate of potash. The estimated value of these meagre constituents was four dollars and eight cents, ($4.08) and Wagener of the famous Jeptha A. Wagener & Co., New York, had been charging fifty-eight dollars a ton for this manure. The farmers who had purchased their manure from Wagener, paid $58.00 for that which was worth but $4.08. Some of the roguish manufacturers would gladly murder the Station's Chemist if they dared. By the farmers the same chemists are held in great esteem. The analysis of fertilizers forms the chief work of the New Jersey Agricultural Experiment Station.

In the field experiment the Station has made with fertilizers on Indian Corn, superphosphate, (350 lbs.), and muriate of potash, (150 lbs.) have given the highest yield viz., 55 bushels of shelled corn per acre. In the field experiments with fertilizers on Oats, nitrate of soda (150 lbs.), superphosphate, (350 lbs.), and muriate of potash (150 lbs.) yielded the highest returns, viz., 60 bushels per acre. In the field experiments with fertilizers on wheat, fine barn-yard manure stood highest (30.6 bushels per acre); nitrate of soda (150 lbs.), superphosphate (350 lbs.), and muriate of potash (150 lbs.) stood second, viz., 28.1 bushels per acre.

A good suggestion is given by the Station upon the use of dried muck as a bedding for horses and cows. In forms of excellent muck the value of nitrogen and ash constituents may not exceed seventy-eight cents per ton. The cost of muck is little more than the cost of wheat straw and not one half so much as stable men pay for rye straw.

"Straw and sawdust absorb but three and four times their own weight of liquid manure, while muck will absorb eight times its own weight, and prevent all smell of ammonia in the stables.

"A practical farmer in Germany reports that by throwing 50 pounds of dried muck into a horse stall and adding about two pounds each day, the bed remained fit to use for three weeks, and the horse was easier to clean than when straw was used. In case of cows, it was found best to use about 5 pounds per head, cleaning the stable each day. Used in this manner throughout this State, it would affect a very considerable saving in more than one direction.

"Straw contains much stock food, and when properly mixed with cotton seed meal or other similar feed is readily eaten by milch cows. The nitrogen and ash which the straw contains after having passed through the animal's body, are considered more available as plant food than before. In urging farmers and dairymen to feed straw and save hay, the objection has been that there was no substitute to use as an absorbent. Those however, who have accepted the only half dried muck as their absorbent are perfectly satisfied with the results."

In the ensilage experiments three important questions have been asked and answered:

First, is the loss of food by fermentation, when green fodder corn is dried in stacks, greater or less than when it is preserved in a silo?

Second, will cows eat the dried corn fodder as readily and with as little waste as they will eat ensilage?

Third, how does the milk of cows which are fed dried fodder corn compare in quantity and quality with the milk of the same cows when ensilage is used?

Analysis has shown that 100 pounds of the green corn contain 75 pounds of water. This being so, 400 pounds of this corn would yield 100 pounds of dry matter. It was found by analysis and subsequent reckoning that eighty-two pounds of the dry matter of the ensilage and 82¾ pounds of the dry matter of field cured stalks, contain the same weight of ash which 100 pounds of the dry matter of the green corn contain. This being so, 400 pounds of green corn, during the process of field curing lost 17¼ pounds of dry matter, while 400 pounds of green corn packed in a silo lost 18 pounds of dry matter. It was found further that neither the field-cured corn nor the ensilage suffered a loss of proteine, fat or fiber, but that the total loss fell upon the class of Carbohydrates—Sugar Starch &c., &c.

In answer to the second question, the facts of experiment seem to show, that dried fodder corn, when cut and crushed, is eaten quite as readily and with as little waste as ensilage.

In answer to the third question the facts of experiment proved that in three cases the yield of milk was not increased when ensilage was substituted for dried corn, but in one case, ensilage caused an increase of eighty-seven pounds of milk in forty days. The Station's investigation of the subject is not yet closed.

3. The New York Agricultural Experiment Station, located at Geneva, was incorporated by an act of the Legislature passed in August, 1881, and was organized and came into possession of its grounds in March, 1882. It owns a farm, with dwelling house and chemical laboratory, green house and feeding house. The sum of $40,000.00 has been appropriated for two years' support of the Station and $25,000.00 for the purchase of the farm and buildings.

The Director, Dr. E. Lewis Sturtevant, gave his Canadian visitor a hearty welcome, and by an invitation as earnest as it was cordial made it necessary and pleasant for his visitor to become his guest. Between the very learned, fluent and courteous Director and his accurate, genial and obliging chemist, Dr. Babcock a night and part of two days were spent most inspiringly. The first walk with the Director through the Station Gardens presented "an epitome of the seed catalogues" in full bloom, every seed advertized for sale having been planted in its season, with the exception of the potato. At the time of which I speak there were growing in the Gardens considerably over a thousand different varieties of plants. To every attentive observer the potency of seed became at once apparent; he would instinctively recognize that each seed had a character of its own and furnished a plant slightly different in appearance from any other plant.

Dr. Sturtevant is most earnestly endeavoring, in the cultivation of the agricultural plants, to bring them to a normal, and hence perfect, state of development: for the accomplishment of this purpose all the physical and chemical conditions of plant growth are carefully taken into consideration. The Doctor believes that the experiments made upon soils with artificial manures, even on the "Co-operative System," will produce no abiding results, unless the seeds experimented with possess a potency of growth both normal and perfect. The plant whose powers of growth have reached perfection will, under suitable conditions, produce in every case the same results. Unless, in experimenting upon soils with fertilizers, plants of like productive power are used, uncertainty will continue, as in the past, to a great extent, connected with the results. We sincerely hope Dr. Sturtevant may reach a happy completion of his work, that, with like plant-forces, the study of soils and soil-manuring may be successfully undertaken. We can only refer to a few of the more interesting discoveries the Doctor has made.

The almost universal practice of rejecting the butt and tip kernels from the selection of seed corn has been proved foolish. In fruit corn the tip kernels have a stronger vegetative power and showed in 1882 a greater cropping capacity than did the centre or butt kernels. The following table gives the surprising and unexpected results:

SEED USED.

	Butt.	Central.	Tip Kernels
Merchantable ears, per 100 plants............	111	90	118
Unmerchantable ears, per 100 plants..........	42	20	16
Total ears, per 100 plants	153	110	134
	In.	In.	In
Average length of merchantable ears..........	7.1	6.3	7.8
	Lbs.	Lbs.	Lbs.
Average weight merchantable ears, per 100 plants.	50.0	37.3	50.0
Average weight of 100 merchantable ears......	44.6	40.9	42.0

"1. The tip kernels were the most prolific of good corn.

"2. The butt kernels were more prolific of good corn than the central kernels.

"3. The tip kernels bore longer ears than the other kernels, the butt kernels the next, and the central kernels the shortest. This fact was apparent to the sight as the corn lay upon the ground after husking.

"4. The merchantable ears from the butt were distinctly heavier than those from the tip, and those from the tip distinctly heavier than those from the central kernels.

"5. The butt kernels furnished more unmerchantable corn than did the central kernels, and the central kernels more than did the tip kernels."

Our attention was called by Dr. Sturtevant to the internal visible structure of the potato tuber. From peculiarly organized central stem, "vegetative axis," similarly organized branches run out to the different eyes. As these potato eyes are arranged in a spiral upon the tuber, we can readily, by commencing to cut with the stem and at the first eye, and, secondly, by rotating the potato so as to bring the eyes in succession under the knife, divide the potato tuber into pieces containing each an eye and a portion of the interior vegetative axis of the potato.

This theory of cutting the potato tuber is based upon its structure. To put the theory to a crucial test, two potatoes, under conditions of green-house control, were cut in a reverse manner, the slope of the cutting in the one being toward the stem end—the proper cut—that of the cutting in the other being toward the seed end. "The proper cut"—10 seed—furnished plants 2·6 inches tall, bearing seven underground stems and four tubers from three-fourth inch to one inch in diameter. The reversed cut, twelve seed, yielded plants 1·9 inches in height, bearing eight underground stems and one tuber three-fourth inch in diameter." This green house experiment has since been verified by numerous field experiments, under the natural conditions of growth. It has further been found that single eyes are capable of bearing all the potatoes that can be expected to be grown in a hill. In planting whole potatoes or half potatoes but few eyes normally develop growth. It is therefore considered a waste to use whole potatoes for seed, each eye of the potato being able to produce a stalk or a conglomeration of stalks.

We were further interested in Dr. Sturtevants method of cultivating the potato. He believes that the system of cultivation which allows the tubers to be formed *in warm and dry soil*, while the roots occupy a *cool and moist soil*, is the most advantageous. To produce these conditions high ridges were thrown up four feet apart and planted with ordinary cuts, one foot apart on the ridge. On June 7th, sixteen days after they had vegetated, a mulching of four inches of moist straw was applied between the ridges. It was thought by the high ridging to secure dryness for the tuber, and by mulching the intervals to secure moisture and coolness for the roots. To disturb the soil as little as possible there was no hoeing or cultivation during growth, the weeds being simply cut away lightly. There had been gained by this method, in 1882, a yield per hundred hills of 184 pounds of merchantable tubers as against eighty-three pounds grown under ordinary ridge culture.

Though the experiments of 1882 so highly favoured the hypothesis, the Doctor, when we saw him in July of this year, did not appear absolutely certain that the experiments of wet 1883 would continue to do so. From the October bulletin of the station we learned that with seven trials on areas 1-20 acre for each method, the mulched plats in no case yielded the larger crop, and, in most cases, a manifestly inferior crop. The 10·59 inches of rain which fell during June, July and August had made the ridges between the mulching damp, and so destroyed the theoretical conditions of the experiment. Many other interesting points about seeds might be noticed if time permitted.

A well built and conveniently furnished house for feeding cattle was carefully examined. In the feeding experiments the ingestor and egestor are carefully weighed and analyzed. The anlmals are also weighed at proper intervals. The principle brought out by a series of experiments, the Doctor informed me, was that food influenced the butter quantity of the milk to a greater extent than it did the butter quality.

Upon the lysimeters, or drain gauges, of the station we shall speak under meteorology.

The laboratory of the station is filled with very choice sets of chemical apparatus. Some of Dr. Babcock's cases with the necessary apparatus attached we have to the extent of our resources imitated.

4. Results of Experiments at Rothamsted, England.

In last year's report we briefly reviewed "Memoranda of the origin, plan, and results of the experiments conducted on the farm and in the laboratory of Sir John Bennet Lawes, Bart., LL.D., F.R.S., at Rothamsted, Herts." First, we considered the conditions under which the field experiments and the cattle feeding experiments were conducted. Second, the interesting results, obtained from the field experiments on the growth of permanent meadow land, wheat, barley, oats, and some leguminous crops, with no manure, and with different manures, were given. Third, the remarkable result obtained by alternating wheat with beans and the supposed cause of "clover sickness" and its best cure were noticed.

The memoranda of this year give a continuation of the experiments with little that is really new. The experiments on *root crops*, not referred to in last year's report, we shall briefly review in this year's,

Experiments with turnips were commenced in 1843. Eight acres, divided into numerous plots, were set apart for the purpose, and the crop was grown for ten consecutive years on the same land. "Norfolk whites," 1843-1848; and "Swedes," 1849-1852; on some plots without manure, and on others with different descriptions of manure.

A new series of experiments with Swedes was arranged in 1856, having regard to the character of the manures previously applied on the different plots, and to the results previously obtained. This second series was continued for fifteen years, namely, from 1856 to 1870 inclusive.

1. *Norfolk White Turnips;* roots and leaves carted off the land:—

(1) Average 1846–'47–'48, without manure, roots, 1 ton, 4 cwt.; leaves 0 tons, 17 cwts. per acre. The same, cross-dressed with 1840 lbs. rape-cake, yielded 6 tons, 11 cwts. roots and 3 tons, 3 cwts. leaves.

(2) Superphosphate, each year; potass, soda and magnesia, 1847–'48, 8 tons, 1 cwt. roots and 2 tons 15 cwts. leaves. The same, cross-dressed with 160 lbs. sulphate ammonia, 75 lbs. muriate ammonia and 1840 lbs. rape-cake, yielded 10 tons 5 cwts. roots and 6 tons 1 cwt. leaves.

2. Swedish Turnips; four seasons, 1849–1852; roots and leaves carted off the land:—

(1) Without manure, 1846 and since, 2 tons 6 cwts. roots and 0 tons 6 cwts. leaves. The same, cross-dressed with 2000 lbs. rape-cake, yielded 7 tons 14 cwts. roots and 0 tons 13 cwts. leaves.

(2) Superphosphate, sulphates potass and magnesia, and soda ash, 7 tons 17 cwts. roots and 0 tons 10 cwts. leaves per acre. The same, cross-dressed with 200 lbs. ammonia-salts and 2000 lbs. rape-cake, yielded 13 tons 1 cwt. roots and 0 tons 18 cwts. leaves.

The experiments on *Sugar Beet*, commencing 1871, were grown year after year on the same land, without manure, and with different descriptions of manure. The area under experiment has been about eight acres.

14 tons farm yard manure produced, 1871, 18 tons 3 cwt. roots and 3 tons 5 cwts. leaves. In 1872, the yield was 15 tons 13 cwts. roots and 4 tons 2 cwts. leaves. The yield of other years is about the same. The 14 tons farm yard manure, cross-dressed with 2000 lbs. rape-cake, yielded, 1872, 28 tons 18 cwts. roots and 5 tons 14 cwts. leaves per acre. This is the highest yield. The yield from artificial manures is scarcely half the yield from farm yard manures.

The experimenters at Rothamsted have been endeavouring, by chemical analysis, to ascertain the influence of different manures and different seasons on the composition of Sugar beet. Each year the seed was sown on all the plots at the same time, and the samples for analysis were taken from all within a period of about a week, beginning with the ripest. The dry matter, ash and nitrogen, were determined in the roots themselves; but they have generally been determined in the expressed juice also. The sugar was determined in the juice; and calculated into its percentage in the roots, on the assumption that they contain uniformly 95 per cent. of juice. In the yield we gave of the plot with 14 tons farm yard manure there were 17.04 per cent. dry matter, 11.77 per cent. sugar, 0.821 per cent. ash, and 0.142 per cent. nitrogen. The highest percentage of dry matter and of sugar was obtained from no manure, the yield being only 4 tons 11 cwts. roots and 1 ton 7 cwts. leaves per acre. The percentage dry matter was 20.22; the percentage sugar 14.66.

The experiments on mangold wurzel were commenced, 1876, and continued five seasons, until 1880.

Fourteen tons of farm yard, 1876, yielded 19 tons 12 cwts. roots and 4 tons 9 cwts. leaves per acre. The same quantity farm yard manure cross-dressed:—

1. With 550 lbs. nitrate of soda, yielded 23 tons 2 cwts. roots and 7 tons 5 cwts. leaves per acre.

2. With 400 lbs. ammonia salts, yielded 29 tons 19 cwt. roots and 7 tons 12 cwts. leaves per acre.

3. With 2000 lbs. rape-cake and 400 lbs. ammonia salts, yielded 31 tons 9 cwts. roots, and 10 tons 5 cwts. leaves per acre.

4. With 2000 lbs. rape-cake simply, the yield was 24 tons 9 cwts. roots and 5 tons 19 cwts. leaves.

The 14 tons farm yard manure and $3\frac{1}{2}$ cwts. superphosphate produced together, and with the cross-dressings just mentioned, about the same as farm yard manure alone. No manure (1846 and since) produced 6 tons 10 cwts. roots and 1 ton 14 cwts. leaves; cross-dressed with 2000 lbs. rape-cake and 400 lbs. ammonia salts, the yield was 19 tons and 19 cwts. roots and 7 tons 7 cwts. leaves.

In the experiments on Potatoes, commencing 1876 and continuing five seasons, a mixture of 550 lbs. nitrate of soda, $3\frac{1}{2}$ cwts. superphosphate, 300 lbs. sulph. potass, 100 lbs. sulph. soda and 100 lbs. sulph. mag., produced the highest yield. In 1876, the total produce per acre was 8 tons $15\frac{7}{8}$ cwts.; in 1877, it was 8 tons $13\frac{3}{4}$ cwts.; in 1878, it was 9 tons $4\frac{1}{4}$ cwts. The total yield, from 14 tons farm yard was, in 1876, 4 tons $5\frac{1}{4}$ cwts.; in 1877, 5 tons 18 cwts.; in 1878, 5 tons $11\frac{3}{4}$ cwts. It is remarkable that the mixture of artificial fertilizers has produced, in every case, about twice as much as the farm yard manure.

Experiments on an actual course of Rotation—turnips, barley, leguminous crops (or fallow), and wheat were commenced in 1848. The present crop (1883) is the 36th experimental one, or the fourth crop of the ninth course. One-third of the land has been continuously unmanured; one-third manured with Superphosphate of Lime alone once every four years, that is for the turnip crop commencing each course, and one-third manured (also for the turnip crop only) with a complex manure which, for the third, fourth, fifth, sixth, seventh, eighth, and ninth courses, consisted of 300 lbs. sulphate of potass, 200 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, 200 lbs. bone ash, 150 lbs. sulphuric acid, 100 lbs. sulphate of ammonia, 100 lbs. muriate of ammonia, and 2000 lbs. of rape cake. Clover was sown in some of the courses, but failed; in other of the courses beans were taken instead of the clover on half of each plot, and the other half left fallow. From half of each of the three plots the whole turnip crop (roots and leaves) was removed, and on the other half the roots were eaten on the land by sheep, and the uneaten leaves spread and ploughed in. In the case of all the other crops, the total produce was removed from the land. The following table contains the average of the first eight courses, 1848—1879:—

AREA UNDER EXPERIMENT, ABOUT $2\frac{1}{2}$ ACRES.

YEARS.	Description of Crop.	PRODUCE PER ACRE. Plot 1. *Unmanured Continuously.* Grain (or Roots)	Plot 1. Straw (or Leaf)	Plot 1. Total Produce.	Plot 2. *Superphosphate of Lime, alone, for the Turnip Crops only.* Grain (or Roots.)	Plot 2. Straw (or Leaf.)	Plot 2. Total Produce.	Plot 3. *Complex Manure for the Turnip Crops only.* Grain (or Roots.)	Plot 3. Straw (or Leaf.)	Plot 3. Total Produce.
1848, '52, '56, '60, '64, '72, '76	Swedish Turnips	$26\frac{3}{8}$ cwts.	$9\frac{1}{2}$ cwts.	$35\frac{7}{8}$ cwts.	$148\frac{3}{4}$ cwts.	$26\frac{5}{8}$ cwts.	$175\frac{3}{8}$ cwts.	$272\frac{1}{2}$ cwts.	$43\frac{3}{8}$ cwts.	$315\frac{7}{8}$ cwts.
1849, '53, '57, '61, '65, '69, '73, '77................	Barley	$34\frac{5}{8}$ bush	2159 lbs.	4132 lbs.	$28\frac{1}{8}$ bush.	1730 lbs.	3346 lbs.	$41\frac{5}{8}$ bush	2577 lbs.	4955 lbs.
1850, '54, '58, '62, '66, '70, '74, '78................	Clover........	....	....	$42\frac{7}{8}$ cwts.	....	....	55 cwts.	....	....	$73\frac{5}{8}$ cwts.
	Beans	$12\frac{7}{8}$ bush.	1081 lbs.	1867 lbs.	$12\frac{1}{8}$ bush	1200 lbs.	1996 lbs.	$21\frac{7}{8}$ bush	1809 lbs.	3230 lbs.
1851, '55, '59, '63, '67, '71, '75, '79................	Wheat	$25\frac{7}{8}$ bush.	2905 lbs.	4559 lbs.	$27\frac{3}{8}$ bush.	3067 lbs.	4823 lbs.	$30\frac{5}{8}$ bush.	3698 lbs.	5669 lbs.

The results given in this table are highly suggestive. The weight in roots of Swedish turnips from superphosphate of lime ($3\frac{1}{2}$ cwts. third, fourth, fifth, sixth, seventh, eighth and ninth courses) was nearly six times that from *no manure*. The Barley did better after Swedish turnips with no manure ($34\frac{5}{8}$ bush.) than after Swedish turnips with $3\frac{1}{2}$ cwts. superphosphate of lime ($28\frac{1}{8}$ bushels.) After turnips with *mixed manure* the barley yield was high, $41\frac{5}{8}$ bushels. The beans following barley were as productive on the unmanured plot, as on the plot that had received with the turnips $3\frac{1}{2}$ cwts. superphosphate of lime. From the plot, with complex manure, nearly double as many bushels of beans were taken as from the unmanured plot. In every case the manure increased the yield of clover. The plot manured with the superphosphate (the turnip year) yielded two bushels more wheat to the acre than the unmanured plot; and the plot which had received the complex manure (the turnip year) yielded five bushels more wheat to the acre than the unmanured plot. It is evident from the yield of this four years' rotation (covering 32 years) that the superphosphate of lime most aids the turnips, has no influence on the barley, and helps the wheat four years after its application. It is to be regretted that the cost of the fertilizer has not been given; by a simple reckoning the actual gain or loss from the manures in the rotation could be easily ascertained.

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2. METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College During 1883.

During the past year some additions have been made to the instruments of the Meteorological Department of our College.

Observations are regularly taken at the hours of 7 a.m., 2 p.m., and 9 p.m. daily, and recorded in a book printed for the purpose. The instruments in use are as follows:—

Anemometer—Recording the direction of the wind and indicating the number of miles travelled.

Barometer—Showing the atmospheric pressure at the time of observation.

Maximum thermometer — Indicating the highest temperature between times of observation.

Minimum thermometer — Indicating the lowest temperature between times of observation.

Hygrometer—With *dry* and *wet* bulb thermometers, for the purpose of showing the condition of the atmosphere with reference to moisture.

Pluviameter—Used in measuring the rainfall.

Thermometer—For observing ordinary temperature.

Besides taking observations from these instruments, the cloudiness of the sky is observed, and general remarks on the weather for the day are recorded in the daily register. Each morning a form, as seen below, is filled out and given for publication to the daily papers in Guelph. At the close of each month a summary of the month's observations is also given for publication. From these monthly summaries the condensed statement of the year's meteorology is made out.

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

At examinations the same practical method is used.

The "series of experiments for the purpose of ascertaining some facts in reference to the temperature of different soils exposed to similar conditions," promised by Professor Panton in the report of 1881, and by the writer in last year's report, we shall begin making in the spring of 1884. From J. and H. T. Green, 757 Broadway, New York, eight soil thermometers have been purchased. These thermometers will be inserted in the soil, first, one inch; second, three inches; third, six inches; fourth, nine inches; fifth, twelve inches; sixth, twenty-four inches; seventh, thirty-six inches; eighth, forty-eighth inches, and will be read *three times* a day. By these soil thermometers we shall be able, first, to ascertain the femperature of the soil when the different agricultural seeds are sown; second, to follow the variations in soil temperature duriug spring, summer and autumn.

A new minimum thermometer was, during the year, presented to the College by the Meteorological Office, Toronto.

Form of Record Published Daily in the Guelph Papers.

WEATHER RECORD.

Ontario Agricultural College.

........1883.

Normal height of barometer at Guelph (1,100 feet above sea level and 740 above sea level and 740 above Lake Ontario), 28.86 inches. Average temperature for........

Barometer ...... { Height......inches.
{ Change......

Hygrometer........Moisture......

Anemometer .... { Direction of wind......
{ Miles travelled during previous twenty-four hours......

Minimum temperature during preceding twenty-four hours......

Maximum " " " " ......

Pluviameter—Rainfall......inches.

Form of Monthly Summary.

Meteorology.

A summary of the meteorological observations taken at Ontario Agricultural College during the month of........

Barometer—

Highest barometer.
Lowest "
Highest mean barometer.
Lowest " "
Monthly " "
Monthly range.

Thermometer—

Highest thermometer.
Lowest "
Highest mean thermometer.
Lowest " "
Monthly " "
Monthly range.

Hygrometer—

Day of greatest humidity.
Day of least "
Mean "

Pluviameter—
Days rain fell.
Greatest rainfall.
Days snow fell.
Greatest snowfall.
Total precipitation.

Anemometer—
Direction of wind.
Greatest number of miles travelled in twenty-four hours.
" velocity per hour.
Mean velocity per month.

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

The following is a summary of the observation taken during the year 1883 :—

I. January.

Barometer.

Highest barometer, 14th, 9 p.m.	29.954 inches.
Lowest barometer, 20th, 9 p.m.	28.210 "
Highest mean barometer, 4th	29.214 "
Lowest mean barometer, 13th	28.385 "
Monthly mean barometer	28.784 "
Monthly range	1.744 "

Thermometer.

Highest temperature, 30th	40. °
Lowest temperature, 23rd	−.16°
Highest mean temperature, 30th	32.1°
Lowest mean temperature, 22nd	−.9°
Monthly mean temperature	19.8°
Monthly range	56°

Pluviameter.

Days rain fell, 1, 20th	0.5 inches.
Days snow fell, 7	11.0 "
Greatest snowfall, 13th	4.0 "
Total precipitation	1.6 "

Anemometer.

Direction of the wind :

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
8	4	13	12	15	5	4	29

Greatest number of miles travelled in 24 hours, 21st	913 miles.
Greatest velocity per hour, 13th	48 "
Mean velocity for the month	15.29 "

Clouds.

Cloudy days	16
Clear days	10
Mean Cloudiness for the month	4.6

Remarks.

The first part of this month was cold—the wind blowing from the west and north-west. The barometric pressure was steady until the 10th and 11th, when it fell to 28.404 inches. On the 14th, at 9 p.m., it gradaally rose to 29.954 inches, the weather becoming finer. A slight thaw on the 20th was accompanied by rain to the depth of .5 of an inch.

The latter half of the month was characterized by steady cold weather—little snow falling, and the wind being changeable.

The January of 1883 differs from that of 1882 in two respects:

1. The *lowest temperature* of the first being 22° below zero, that of the latter but 16° below zero. 2. The *monthly mean temperature* of the first being 20.5°, that of the latter 19.8°.

II. February.

Barometer.

Highest barometer, 12th, 2 p.m.	29.372 inches.
Lowest barometer, 16th, 9 p.m.	28.450 "
Highest mean barometer, 12th	29.278 "
Lowest mean barometer, 16th	28.585 "
Monthly mean barometer	28.957 "
Monthly range	0.922 "

Thermometer.

Highest temperature, 17th	49.°
Lowest temperature, 13th	– 5°
Highest mean temperature, 16th	33.5°
Lowest mean temperature, 5th	4.6°
Monthly mean temperature	16.2°
Monthly range	54.°

Pluviameter.

Days rain fell, 2	0.26 inches
Greatest rainfall, 16th	0.25 "
Days snow fell, 5	13.5 "
Greatest snowfall, 3rd	6.0 "
Total precipitation	1.61 "

Anemometer.

Direction of wind:

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
1	2	8	23	8	10	1	25 times.

Greatest number of miles travelled in 24 hours, 8th	723 miles.
Greatest velocity travelled per hour, 8th	30 "
Mean velocity for the month	16.2 "

Clouds.

Cloudy days	8
Clear days	11
Mean cloudiness for the month	6

Remarks.

The weather was changeable and sky overcast during the first week of February, the wind blowing from the south-west, accompanied by flurries of snow on the 1st, 2nd, and 7th.

On the 14th, with north-east wind, snow again fell, the temperature rising towards noon. A thaw commenced on the 15th and continued three days, rain falling on the 16th.

During the rest of the month the temperature was lower and winds stronger, accompanied by local snow-storms. The mean temperature of February was much below the average. The lowest temperature of Febrnary, 1882, was 8°, that of 1883, 5° below zero; the monthly mean temperature of 1882 was 27.8°, that of 1883, 16.2°.

The last day of the month was calm and pleasant.

III. March.

Barometer.

Highest barometer, 5th, 7 a.m.	29.214 inches.
Lowest barometer, 10th, 2 p.m.	28.064 "
Highest mean barometer, 5th	29.133 "
Lowest mean barometer, 10th	28.129 "
Monthly mean barometer	28.765 "
Monthly range	1.150 "

Thermometer.

Highest temperature, 14th	47.°
Lowest temperature, 21st	–.7°
Highest mean temperature, 14th	37.1°
Lowest mean temperature, 7th	6.°
Monthly mean temperature	20.1°
Monthly range	54.°

Pluviameter.

Days snow fell, 4	19.5 inches.
Greatest snowfall, 19th	11. "
Total precipitation	1.95 "

Anemometer.

Direction of the wind :

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
4	2	7	15	11	19	4	23

Greatest number of miles travelled in 24 hours, 15th	790 miles.
Greatest velocity per hour, 15th	33 "
Mean velocity for the month	13.7 "

Clouds.

Cloudy days	8
Clear days	11
Mean cloudiness for the month	6.5

Remarks.

The 1st of March was fair and bright, with moderate temperature and S. to S.W. winds. The 2nd was colder, with N.E. wind and sky a little overcast; the cold continued during the 3rd and 4th, snow falling upon the 4th. The 5th was warmer, with a light breeze from the N. E., snow falling on the morning of the 6th. Towards the evening of the 6th the temperature fell and the wind changed to the S. E. The cold was continued during the 7th and 8th, with stronger winds from the S. W. and W.

During the 9th and 10th the weather was again pleasant. On the evening of the 10th the wind blew firmer from the N. W., changing on the 11th, aud increasing on the 12th to a strong wind from the S. W. A S. W. breeze with continued mild weather prevailed during the 13th and 14th, causing a thaw on the 14th. The wind changed to N. W. on the 15th, with lower temperature and drifting snow storm in the afternoon; clearing away towards evening the weather remained pleasant until the evening of the 16th, when the sky became cloudy and flakes of snow were drifted from the west. The 17th was mild with wind changing to the N.; at 9 p.m. snow began to fall and continued falling until the evening of the 19th, the wind in the meantime having changed to the N. E. After the snow the sky cleared and the temperature fell to 7° below zero. The cold continued until the 25th. During the last week the weather was steady, with cold, frosty nights and sunny days.

The barometric pressure was high and steady during the first week of the month. At noon of the 6th the barometer fell to 28.344, rising on the evening of the 7th to 29.208, and falling again at noon of the 10th to 28.064. The pressure remained comparatively low until the 24th, when it became higher and steadier.

IV.—April.

Barometer.

Highest barometer, 13th, 2 p.m	29·068	inches.
Lowest barometer, 11th, 7 a.m	28·234	"
Highest mean barometer, 13th	29·041	"
Lowest mean barometer, 11th	28·399	"
Monthly mean barometer	28·794	"
Monthly range	0·834	"

Thermometer.

Highest temperature, 15th	74°·5
Lowest temperature, 1st	8°
Highest mean temperature, 14th	56°·5
Lowest mean temperature, 2nd	27°
Monthly mean temperature	36°·7
Monthly range	66°·5

Pluviameter.

Days rain fell, 3	1·39	inches
Greatest rainfall, 19th	0·71	"
Days snow fell, 1	1·6	"
Total precipitation	1·45	"

Anemometer.

Direction of wind :—

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
7	5	5	10	19	12	2	20

Greatest number of miles travelled in 24 hours, 11th........ 648 miles.
Greatest velocity per hour, 11th .... 29 "
Mean for the month .... 19 miles per hour.

CLOUDS.

Cloudy days 8
Clear days 13
Mean cloudiness for the month .... 5·8

REMARKS.

The first week of April was fair with steady temperature; the barometric pressure was high and regular.

Snow fell to the depth of 1·5 inches on the 7th. From the 7th to the 15th the temperature was higher with easterly winds and overcast sky. The barometric pressure fell to 28·570, with ·71 of an inch of rain on the 19th. After the 19th the weather became cooler with chilling winds which continued throughout the remainder of the month.

The marked features of the month were: (1) The absence of the usual April showers. (2) The continued cold weather and frosty nights. (3) The dry and chilling winds. These conditions retarded growth and seriously injured fall wheat.

V.—MAY.

Barometer.

Highest barometer, 3rd, 9 p.m .... 29·104 inches
Lowest barometer, 30th, 9 p.m .... 28·464 "
Highest mean barometer, 17th .... 29·041 "
Lowest mean barometer, 21st .... 28·525 "
Monthly mean barometer .... 28·770 "
Monthly range .... 0·640 "

Thermometer.

Highest temperature, 19th .... 76°
Lowest temperature, 10th .... 30°
Highest mean temperature, 19th .... 64·2°
Lowest mean temperature, 14th .... 37·5°
Monthly mean temperature .... 49·2°
Monthly range .... 46°

Pluviameter.

Days rain fell, 8 ....
Greatest rainfall, 11th .... 1·01 inches
Total precipitation .... 2·871 "

Anemometer.

Direction of the wind :—

N.	E.	S.	W.	N. E.	N. W.	S. E.	S. W.
14	13	10	17	8	6	1	16

Greatest number of miles travelled in 24 hours, 19th........ 728 miles.
Greatest velocity per hour, 19th .... 30·3 "
Mean for the month .... 14.138 "

Clouds.

Cloudy days..
Clear days.. 8
Mean cloudiness for the month.. 10

Remarks.

The cool chilling weather of April continued through the first half of May, with high barometric pressure and temperature varying from 35° to 49°. The atmosphere was dull and little rain fell.

The first mild and pleasant weather occurred on the 16th. It continued pleasant until the 20th, with a warm shower favourable to plant growth on the 19th. Rain kept falling from the 21st to the 23rd. After the 23rd the temperature became higher, accompanied by pleasant weather and S. W. wind which continued with increased force until the 27th. A steady rain occurred on the 26th and local showers at intervals on the 27th. With increased cloudiness and occasional rain during the remainder of the month the weather continued mild and favourable for plant growth.

June.

Barometer.

Highest barometer, 1st, 2 p.m..
Lowest barometer, 11th, 7 a.m.............................. 29·194 inches.
Highest mean barometer, 1st .... 28·264 "
Lowest mean barometer, 11th................................. 29·172 "
Monthly mean barometer...................................... 28·453 "
Monthly range .... 28·791 "
.... 0·930 "

Thermometer.

Highest temperature, 17th..
Lowest temperature, 1st .... 88°
Highest mean temperature, 23rd..................................... 42°
Lowest mean temperature, 1st....................................... 71·6°
Monthly mean temperature... 56·3°
Monthly range.. 65·0°
.... 46°

Pluviameter.

Days rain fell, 9..
Greatest rainfall, 17th..
Total precipitation.................................... 0·9 inches.
.... 4.41 "

Anemometer.

Direction of the wind:—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
2	6	11	15	10	8	8	21

Greatest number of miles travelled in 24 hours, 11th........ 612 miles.
Greatest velocity per hour................................ 56.8 "
Mean velocity per month................................... 11.7 "

Clouds.

Cloudy days..
Clear days.. 9
Mean cloudiness for the month.. 21
.... 4·4

REMARKS.

June opened with clear pleasant weather and high barometric pressure.

During the first nine days, the temperature was high and steady, many rains occurring which completely saturated the soil; a decrease in temperature followed and was continued until the 14th.

A yellowish tinge about the leaf commenced to be visible in many of the spring crops.

On the 15th the weather was warm and pleasant, on the 17th oppressive, a thunder storm from the S. W. occurring at 5 p.m. During most of the following night heavy rain fell, followed by more heavy rain on the 18th, with a decrease in the atmospheric pressure.

From the 20th to the 23rd the weather was pleasant and vegetable growth rapid. The temperature rose to 80° on the 23rd, the atmosphere again becoming very oppressive.

Four wet days followed in succession.

The month throughout was wet and the temperature generally high.

JULY.

Barometer.

Highest barometer, 18th, 9 p.m.	29·058	inches.
Lowest barometer, 12th, 9 p.m.	28·530	"
Highest mean barometer, 19th.	29·048	"
Lowest mean barometer, 12th.	28.576	"
Monthly mean barometer	28.848	"
Monthly range	0.528	"

Thermometer.

Highest temperature, 4th.	89°
Lowest temperature, 20th	46·5°
Highest mean temperature, 4th.	80.3°
Lowest mean temperature, 19th.	59·3°
Monthly mean temperature	68·2°
Monthly range	42·5°

Pluviameter.

Days rain fell, 11		
Greatest rainfall, 27th.	0·97	inches.
Total precipitation	3·45	"

Anemometer.

Direction of wind :—

N.	E.	W.	S.	N.E.	N.W.	S.E.	S.W.
0	3	24	12	6	7	7	24

Greatest number of miles travelled in 24 hours, 17th.	600 miles.
Greatest velocity per hour	23 "
Mean velocity per month.	11·0 "

CLOUDS.

Cloudy days	12
Clear days.	19
Mean cloudiness for the month	3.8

REMARKS.

The first week of July was remarkable for its rainy nights, misty mornings and cloudy afternoons. The temperature was high with little change in the barometric pressure. Four days of fair weather and bright sunshine followed. During the afternoon of the 12th, clouds gathered and an hour's heavy rain commenced falling at 6 p.m. On the following day the temperature fell to 54° at 9 p.m.

From the 14th to the 17th, the weather was changeable—hot sun followed by a sultry atmosphere.

The weather during the 18th, 19th, 20th and 21st, being dry and pleasant, was favourable for ripening crops and making hay. The heaviest rainfall occurred on the 27th. It was accompanied by a western gale that laid flat the crops.

About 12 times as much rain fell during this month as during the corresponding month of last year. This unusually wet July favoured the formation of rust upon the agricultural crops.

August.

Barometer.

Highest barometer, 27th, 7 a.m.	29·168	inches.
Lowest barometer, 2nd, 7 a.m.	28·610	"
Highest mean barometer, 14th	29.137	"
Lowest mean barometer, 2nd	28.650	"
Monthly mean barometer	28·927	"
Monthly range	0·558	"

Thermometer.

Highest temperature, 24th	89°
Lowest temperature, 27th	41°
Highest mean temperature, 22nd	78°
Lowest mean temperature, 27th	56°
Monthly mean temperature	65·2°
Monthly range	48°

Pluviameter.

Days rain fell 2	
Greatest rainfall, 27th	0·14 inches
Total precipitation	0·2 "

Anemometer.

Direction of the wind :—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W
4	4	8	12	12	17	14	16

Greatest number of miles travelled in 24 hours, 3rd	464 miles.
Greatest velocity per hour	22·3 "
Mean velocity per month	10·6 "

Clouds.

Cloudy days	5
Clear days	25
Mean cloudiness for the month	2.4

Remarks.

August opened with fair weather. The barometric pressure gradually increased at the beginning of the month and continued high and steady throughout it. The days were warm and sunny, the nights clear and cool. On the 17th and 18th the temperature was high and the atmosphere oppressive. Rain followed with clear atmosphere and chilly nights. A light shower occurred on the 27th. The last days of the month were warm and pleasant, the nights chilly.

SEPTEMBER.

Barometer.

Highest barometer, 10th, 7 a.m	29·280 inches.
Lowest barometer, 24th, 9 p.m	28·218 "
Highest mean barometer, 10th	29·223 "
Lowest mean barometer, 24th	28·393 "
Monthly mean barometer	28·931 "
Monthly range	1·062 "

Thermometer.

Highest temperature, 16th	81°
Lowest temperature, 9th	29°
Highest mean temperature, 15th	69·1°
Lowest mean temperature, 29th	42·3°
Monthly mean temperature	55·4°
Monthly range	52°

Pluviameter.

Days rain fell 6	
Greatest rainfall, 24th	0.7 inches.
Total precipitation	2·07 "

Anemometer.

Direction of the wind :—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
2	7	13	3	7	20	10	19

Greatest number of miles travelled in 24 hours, 25th	646 miles.
Greatest velocity per hour	31.7 "
Mean velocity per month	9·09 "

Clouds.

Cloudy days	
Clear days	
Mean cloudiness for the month	3·1

Remarks.

Unlike the corresponding month of last year, the weather for the first few days of September this year was changeable, the 1st being overcast, 2nd and 3rd fair, and the 4th dull with a light rain towards evening, and dull cool days following.

A hard frost occurred on the nights of the 9th and 10th doing much damage to many agricultural crops. The frost was followed by a light rain on the 13th when the weather became warm and sunny. The barometer rose to 29·218 on the 18th at 2 p.m., accompanied by fair weather. Light rains occurred on the 24th and 27th, the barometric pressure falling on the 24th at 9 p.m. to 28.218. The weather, during the last days of the month, was fair, the temperature remaining steady and the pressure high.

OCTOBER.

Barometer.

Highest barometer, 16th, 2 p.m	29·522 inches.
Lowest barometer, 29th, 2 p.m.	28·062 "
Highest mean barometer, 16th	29·475 "
Lowest mean barometer, 29th	28·194 "
Monthly mean barometer	28·949 "
Monthly range	1·460 "

Thermometer.

Highest temperature, 9th	77°
Lowest temperature, 21st and 27th	25°
Highest mean temperature, 9th	67·3°
Lowest mean temperature, 20th	32°
Monthly mean temperature	44·1°
Monthly range	52°

Pluviameter.

Days rain fell, 6	
Greatest rainfall, 2nd	0·7 inches.
Total precipitation	1·18 "

Anemometer.

Direction of the wind :—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
4	9	12	3	12	20	10	14

Greatest number of miles travelled in 24 hours, 31st	804 miles.
Greatest velocity per hour	38·4 "
Mean velocity per month	10·7 "

CLOUDS.

Cloudy days	18
Clear days	13
Mean cloudiness for the month	5·1

REMARKS.

The temperature throughout this month was steady. The reading of the thermometer on the 1st was 30° at 7 a.m., 40° at 9 p.m.; on the 2nd 41° at 7 a.m., 40 at 9 p.m., and 40° at 7 a.m., on the 3rd. During the first week the weather was fair and the sky clear.

A few cloudy days followed. The temperature remained steady up to the 14th when the wind changed to the N. E. and the pressure gradually increased to 29·522 at 2 p.m. on the 16th, accompanied by a slight fall in the temperature. During this time the days were clear and nights chilly.

From the 18th to the 20th the sky was overcast and the temperature low. Flakes of snow were observed on the 20th.

During the remainder of the month, the sky, with the exception of the 26th and the 27th, was overcast and temperature moderate. A light rain occurred on the 29th, accompanied by a S. W. wind and a decrease in the barometric pressure to 28.062.

The marked features of the month, were the unusually steady temperature and extremes of atmospheric pressure.

November.

Barometer.

Highest barometer, 28th, 9 p.m	29·314	inches.
Lowest barometer, 16th, 7 a.m.	28·168	"
Highest mean barometer, 28th	29·185	"
Lowest mean barometer, 13th	28·411	"
Monthly mean barometer	28·794	"
Monthly range	1·146	"

Thermometer.

Highest temperature, 5th, 9th 21st	58°
Lowest temperature, 15th, 16th	10°
Highest mean temperature, 5th	55°·6
Lowest mean temperature, 16th	14°·6
Monthly mean temperature	35°·1
Monthly range	48°

Pluviameter.

Days rain fell, 3	1·24	inches.
Greatest rainfall, 20th	0·8	"
Days snow fell, 5	6·0	"
Greatest snowfall, 15th	3	"
Total precipitation	1·84	"

Anemometer.

Direction of wind :—

N.	E.	W.	S.	N. E.	N. W.	S. E.	S. W.
11	2	10	5	1	14	2	18

Greatest number of miles travelled in 24 hours, 12th	828 miles.
Greatest velocity per hour	36.9 "
Mean velocity for the month	18·2 "

Clouds.

Cloudy days	19
Clear days	11
Mean cloudiness for the month	5·7

Remarks.

The most marked features of the month were :

First, the snow-storms which occurred during the week beginning with Sunday the 11th;

Second, the heavy gales of wind which blew from the North West and South West on the 12th, 13th and 14th.

The atmospheric pressure was remarkably steady (about 28·8) for the first eight days; it then became changeable and continued so until the stormy period had passed. The barometer read very low on the 16th at 7 a.m.

The temperature from the 1st to the 3rd was below the average for the month; it rose on the 4th, and remained steady (at about 43°) until the cold of the second week commenced. The weather throughout the month was generally cold and little rain fell.

December.

Barometer.

Highest barometer .... 22nd, 7 a.m., 29·522 inches.
Lowest " .... 18th, 7 a.m., 28·276 "
Highest mean barometer .... 22nd, ... 29·384 "
Lowest " " .... 27th, ... 28·452 "
Monthly " " .... 28·806 "
Monthly range .... 1·246 "

Thermometer.

Highest temperature .... 8th, 50°
Lowest " .... 22nd, 23rd, – 2°
Highest mean temperature .... 7th, 44·1°
Lowest " " .... 15th, 22nd, 8·6°
Monthly " " .... 24·69°
Monthly range .... 52°

Pluviameter.

Days rain fell .... 2, 0·22 inches.
Greatest rainfall .... 7th, 0·17 "
Days snow fell .... 4, 6·0 "
Greatest snowfall .... 28th, 2·5 "
Total precipitation .... 0·82 "

Anemometer.

	N.	E.	W.	S.	N.-E.	N.-W.	S.-E.	S.-W.	
Direction of wind..	10	4	15	7	5	12	16	13	times.

Greatest number of miles travelled in 24 hours .... 14th, 609 miles.
Greatest velocity per hour .... 30·7 "
Mean velocity for the month .... 15·5 "

Clouds.

Cloudy days 24
Clear days 7
Mean cloudiness for the month .... 6·5

Remarks.

During the early part of this month the wintry appearance of last month was scarcely visible, the weather being so much milder.

There was very little rain at any time, and no snow until the 17th; the light one which occurred at that date protected the fall crops from the continued cold which followed.

The atmospheric pressure was generally high, the temperature of the early part of the month being moderate, that of the latter part low.

The winds were very changeable, though not so heavy as during November.

Mean Meteorological Results for the Year 1883.

	1883. — Guelph.	Average of 40 Years. — Toronto.
Barometer.		
Mean pressure for the year	29·194	29·616
Month of highest mean pressure	October.	September.
Highest mean, monthly	29·475	29·664
Lowest " "	28·129	29·572
Month of the lowest mean	March.	June.
Date of the highest pressure in the year	Jan. 14th.	
Highest pressure	29·954	30·358
Date of the lowest pressure in the year	Oct. 29th.	
Lowest pressure	28·062	28·692
Range of the year	1·892	1·668
Thermometer.		
Mean temperature of the year	41·6°	44·17°
Warmest month	July.	July.
Mean temperature of the warmest month	68·2°	67·64°
Coldest month	February.	February.
Mean temperature of the coldest month	16·2°	22·73°
Warmest day	July 4th. August 24th.	
Mean temperature of the warmest day	80·3°	77·85°
Coldest day	Jan. 23rd.	
Mean temperature of the coldest day	−8·2°	−1·50°
Date of the highest temperature	July 4th. August 24th.	
Highest temperature	89°	91°
Date of the lowest temperature	Jan. 23rd.	
Lowest temperature	−16°	11·9°
Range of the year	105°	102°
Pluviameter.		
Total depth of *rain* in inches	17·791	28·30
Number of days on which *rain* fell	53	110
Month in which the greatest depth of *rain* fell	June.	September.
Greatest depth of *rain* in one month	4·41	3·55
Month with most *rainy* days	July.	October.
Greatest number of *rainy* days in one month	11	13
Day on which the greatest amount of *rain* fell	May 11th.	
Greatest amount of *rain* in one day	1·01	1·98
Total depth of *snow* in inches	57·6	
Number of days on which *snow* fell	26	
Month in which the greatest depth of *snow* fell	March.	
Greatest depth of *snow* in one month	19·5	
Month with most *snowy* days	January.	
Greatest number of *snowy* days in one month	7	
Day on which the greatest amount of *snow* fell	March 19th.	
Greatest amount of *snow* in one day	·11	
Total precipitation in inches	23·551	

3. Experimental Department.

1. *Rain Gauge.*

A large rain gauge, rectangular in form and having an area of $\frac{1}{1000}$ of an acre, has been erected during the year upon a central plot of the Experimental Field. The purpose of the rain guage has been two-fold: (1) To determine accurately the amount of the rainfall. (2) To collect rain in sufficient quantity to allow of its chemical analysis. It has been the careful examination of a work published last year, by Sir J. B. Lawes and Dr. Gilbert, of England, "On the Amount and Composition of the rain and Drainage-waters collected at Rothamsted," that has made the determination of the amount and composition of the rain and drainage-waters of the Experimental Farm, appear not only desirable but highly necessary. Rain-gauges, having an area of $\frac{1}{1000}$ of an acre, have been in use on the Rothamsted estate since the winter of 1852-3; drain-guages of the same surface but of different depths (twenty inches, forty inches, and sixty inches) have been in use since the summer of 1870. Under the headings of Rain-gauge and Drain-gauge, we shall briefly discuss the more important results Sir J. B. Lawes and Dr. Gilbert have published in this work on the rain and drainage waters of Rothamsted.

They found, that the small rain-gauge gives a distinctly smaller rainfall on the average than the large gauges. Taking a mean of twenty-eight years (1853-80) the large and small guages compare as follows:

COMPARISON OF THE LARGE AND SMALL GAUGES (MEAN OF 28 YEARS).

——	Mean Monthly Rainfall.		Deficiency of Small Gauges.	
	Large Gauges.	Small Gauges.	Actual.	Per Cent.
	Inches.	Inches.	Inches.	Inches.
January	2·590	2·263	0.327	12·6
February	1·728	1·508	0·220	12·7
March	1.693	1·399	0·294	17·4
April	2·008	1·803	0·205	10·2
May	2·329	2·149	0·180	7·7
June	2·451	2·272	0·179	7·3
July	2·704	2·533	0·171	6·3
August	2·643	2·440	0·203	7·7
September	2·638	2·403	0·235	8·9
October	3·089	2·784	0·305	9·9
November	2·345	2·113	0·232	9·9
December	2·084	1·861	0·223	10·7
Totals for year	28·302	25·528	2·774	9·8

On the whole year the small gauge showed on an average, 2·774 inches less rain than the large gauges, or a deficiency of 9·8 per cent.

Under the heading "The Composition of the Rain-water," a brief description of the sources of the more important matters dissolved by rain-water in its passage through the air is given. We quote the following:—

To make a complete analysis of rain-water, all the constituents, solid, as well as gaseous, held in solution, would have to be determined—the oxygen, nitrogen, and carbonic acid, the carbonate of ammonium, the chlorides, sulphates, and nitrates of sodium, calcium, and ammonium, and the mechanically held dust and soot.

The sources of the more important matters dissolved by rain-water in its passage through the air are briefly and clearly given in the work of Sir J. B. Lawes and Dr. Gilbert, to which we have already referred :

"The *ammonia* of the atmosphere is derived from the decay of animal and vegetable matter, both on land and in the ocean, and from the combustion of fuel, especially coal ; the air of towns is much richer in ammonia than that of the country. According to M. Schlæsing, the ocean of the tropical regions is the most important source of atmospheric ammonia. At the high temperature of tropical latitudes the ammonia produced by the decay of organic matter diffuses freely into the atmosphere, and is carried by winds to all parts of the globe. In northern latitudes southerly winds are those richest in ammonia.

"The *nitric acid* in the atmosphere is due in part to electrical agency. Discharges of electricity in the air determine the combination of the nitrogen and oxygen, of which the atmosphere is composed, nitrous acid being formed ; ozone is at the same time produced, which is capable of oxidizing both nitrous acid and ammonia, nitric acid in each case resulting. A source of nitric acid, independent of electrical discharge, exists in the oxidation of ammonia by ozone and peroxide of hydrogen. As the latter substance is evolved when turpentine, and possibly other bodies, are oxidized in the air, the neighbourhood of a pine forest should be favourable to the formation of nitric acid in the atmosphere.

"The *sulphates* of the atmosphere are, according to Angus Smith, chiefly derived from the oxidation of the sulphur compounds evolved during the decay of animal matter. In towns the sulphates are much increased by the oxidation of the sulphurous acid contained in coal smoke.

"Chlorides are principally furnished by the sea, fine spray of salt water being carried long distances by high winds. To a small excent chlorides may also be furnished by the combustion of fuel."

To avoid the use of long decimals the amount of nitrogen existing as ammonia or nitric acid is given in "parts per million." To make the term "parts per million" clear, we may here state, "that one inch of water per acre weighs 226,263 pounds, consequently ten parts per million of nitrogen, or of any other constituent of rain or drainage water, correspond to 2·26 pounds per acre for each inch of rain or drainage."

The nitrogen existing as ammonia in the rain-water collected at Rothamsted in 1853-4 was determined by Sir J. B. Lawes and Dr. Gilbert. There was, during the first twelve months, a total rainfall of 29·014 inches, containing nitrogen in the form of ammonia equal to 5·20 pounds per acre. During fifteen months there was a rainfall of 34·41 inches, containing on an average 0·74 of nitrogen, as ammonia, per million of water.

During 1855 and 1856, Professor J. T. Way determined the quantity both of ammonia and nitric acid which mixed samples of water, representing the rainfall of each month, contained. On the average of the whole twenty-four months, Way found the proportion of nitrogen in the form of ammonia to be 1·03 per million of rain-water, that in the form of nitric acid only 0·12 per million. If we only regard these two years in which the nitric acid, as well as the ammonia, was determined, the total nitrogen becomes 7·29 pounds per acre, equivalent to forty-six and a-half pounds of ordinary nitrate of sodium.

The next analyses of Rothamsted rain-water, noticed in the work, are those made by Dr. E. Frankland. In seventy-one samples of rain and snow-water, and in seven samples of dew and hoar frost collected between April, 1869, and May, 1870, Dr. Frankland determined the total solid matter dissolved in the water, the quantity of carbon and nitrogen existing in the form of organic matter, and the ammonia, nitric acid, chlorine, and *hardness of the water*. To avoid the dust, the excrements of birds, and the small insects that sometimes collect upon the surface of the gauge, the gauge was in some instances washed with distilled water before the samples of rain were collected for analysis.

"AVERAGE COMPOSITION OF RAIN-WATER COLLECTED BOTH FROM A WASHED GAUGE, AND WITHOUT SPECIAL PRECAUTION, IN PARTS PER MILLION :—

——	Total solid matter.	Carbon in organic matter.	Nitrogen as				Chlorine.	Hardness, or Lime Magnesia.
			Organic matter.	Ammonia.	Nitrates and Nitrites.	Total Nitrogen.		
From washed gauge, 22 samples...	28·0	0·64	0·16	0·30	0·12	0·58	2·1	4·0
Without special precaution, 47 samples	36·6	1·03	0·20	0·41	0·15	0·76	3·6	4·8"

The average amount of ammonia found by Dr. Frankland is equal to only 0·37 of nitrogen per million. The mean of the earlier analyses is 0·95 of nitrogen per million. It is thought that Dr. Frankland's results cannot properly be compared with those obtained by the chemists who preceded him, seeing his samples of rain-water did not include every fall of rain in a given period, but consisted of selected samples only. It is further thought, that Dr. Frankland's determination of the ammonia by the Nessler process, is more accurate than the old method of fractional distillation of the water and the determination of the ammonia in the distillate with a standard acid and alkali. The last consideration is probably the accurate one, as the determinations made quite recently at Rothamsted confirm Dr. Frankland's results.

It has been found that the composition of rain-water greatly depends on the quantity of the fall. The proportion of each constituent tends to diminish as the amount of rainfall increases, the decrease being most rapid in the case of chlorides and least marked in the case of the organic elements. It has further been found that the amount of total solid matter dissolved in the rain-water is considerably greater in summer than in winter. In a majority of cases the ammonia is greater in summer than in winter. The nitric acid is also in every case greatest in summer time. The most striking difference in the two seasons occurs in the organic matter, the proportion of nitrogen to carbon being different. In summer the carbon is generally greater than in winter, while the nitrogen in summer is less than in winter.

In the explanation of this difference it is assumed that a larger proportion of fresh vegetable matter is present in the rain-water of summer than in that of winter.

Dr. Frankland insists that the south-east wind produces at Rothamsted rain richest in ammonia, and the north-east wind rain richest in chlorine. This conclusion of Dr. Frankland is regarded as probably correct. London city, lying to the south-east of the rain-gauge, will give to the south-east wind, naturally rich in ammonia, additional ammonia; and the North Sea, lying to the north-east of the rain-gauge, will naturally supply the largest proportion of chlorine.

It is interesting to notice the range in the amount of chlorides present in rain-water. The average proportion of chlorine in the rain-water of Rothamsted, during a period of forty-three months, was 1·75 per million. In the course of a year, (average of three and a-half years) the quantity of chlorine brought by rain on an acre of land was 13·42 lbs., for a rainfall of 34·038 inches, equal to 22·12 lbs. of pure common salt. At Cirencester, about thirty-five miles distant from the Bristol Channel, the mean rainfall for a year has been 33·571 inches, the chlorine amounting to 4·28 parts per million, equal to 53·66 lbs. of pure common salt per acre.

We hope the following statement of the amount of ammonia and nitric acid supplied to the soil in rain in the course of a year, in various parts of the continent of Europe, will be of interest to our readers.

Station.	Rainfall.	Nitrogen per million, as		Total Nitrogen per acre.
		Ammonia.	Nitric Acid.	
	inches.			lbs.
Kuschen, 1864-5	11·85	0·54	0·16	1·86
" 1865-6	17·70	0·44	0·16	2·50
Justerburg, 1864-5	27·55	0·55	0·30	5·49
" 1865-6	23·79	0·76	0·49	6·81
Dahme, 1865	17·09	1·42	0·30	6·66
Regenwalde, 1864-5	23·48	2·03	0·80	15·09
" 1865-6	19·31	1·88	0·48	10·38
" 1866-7	25·37	2·28	0·56	16·44
Ida-Marienhütte; mean of 6 years, 1865-70	22·65	....	....	9·92
Proskau, 1864-5	17·81	3·21	1·73	20·91
Florence, 1870	36·55	1·17	0·44	13·36
" 1871	42·48	0·81	0·22	9·89
" 1872	50·82	0·82	0·26	12·51
Vallombrosa, 1872	79·83	0·42	0·15	10·38
Montsouris, Paris, 1877-8	23·62	1·91	0·24	11·54
" " 1878-9	25·79	1·20	0·70	11·16
" " 1879-80	15·70	1·36	1·60	10·52
Mean of 22 years	27·03	....	....	10·23

It is interesting to notice how these widely varying determinations, some of which have been made in the vicinity of towns, give a mean of 10·23 lbs. of combined nitrogen annually supplied per acre by rain, with a mean rainfall of 27·03 inches.

In July last, in answer to a communication of inquiry from us, we received from the chemist of Rothamsted, Dr. Gilbert, a very courteous letter, in which the structure of the rain-gauge itself, and especially of the *gauge-cylinders* was fully explained. In accordance with his directions, the *rain-gauge collector* consists of a wooden frame lined with lead, with a vertical rim of plate glass, three inches deep and three-eighths inch thick, bevelled outwards. The angles are also bevelled or mitred and cemented; the rim is further held in place by an angle fillet of wood outside. He informed us, from their experience at Rothamsted, that the wooden frame was liable to swell and warp, and that lead was sometimes found in the rain-water. "If it were practicable it would be better if the whole collector could be made of glass. But there would be not only great difficulty in first construction, but great liability to accident. The question is whether copper, though expensive in the first instance, would not be the best."

As to the gauge cylinders, Dr. Gilbert sent us a sketch (side-view) of one with its fittings and dimensions, also, the lower end of a broken rain-gauge tube, showing the graduation. The gauge-cylinders are made of strong galvanized iron, and are fitted with moveable lids. The height is twenty-seven inches inside, the diameter, twelve and five-eighths inches inside.

"The tube fits into a piece of elbow iron gas-piping, fixed quite at bottom of the cylinder. The bore of the iron pipe is, I believe, one and a-quarter inch; it is fitted with a brass ring or rim screw threaded outside. On the flat top of this ring (which has an orifice to receive the tube about one-quarter inch wider than the outside measure of the tube) is placed a thick caoutchouc washer, then a flat ring of brass with orifice one-eighth inch larger than the tube, and then the cap with ferrule screw to fit the outside screw of the ring, is screwed on, the glass tube having been first properly placed. The cap has also a hole to receive the tube large enough to allow of play, the caoutchouc washer making the joint. All being fitted, and the cylinder placed perfectly level, 11 lbs., 5 ozs. of water at 60° F. is poured in, and the height marked on the glass, and this mark represents 0·05 inch on the $\frac{1}{1000}$ acre area. 11 lbs., 5 ozs. more water is then put in, and the point marked, and so on until ten lots have been put in. The amount then representing 0·50 or one-half inch. With these land marks, the tube is then graduated. The main divisions will each represent 0·01 or $\frac{1}{100}$ inch; these are sub-divided into five, and as the water can be read to half a division, $\frac{1}{1000}$ inch can be read. All quantities below 0·05 are drawn out of the tap and measured in a small cylinder, constructed to measure 0·10 inch of dimension given on the plan, and the tube is graduated to 0·001."

Before this letter from Dr. Gilbert had had time to reach us, in accordance with a wish expressed by Professor Brown, letters had been written to Canadian and American glass manufacturers, asking them if glass cylinders accurately graduated and furnished with necessary stop cocks, etc., could be constructed. As negative answers were received in each case, it was with no little pleasure that we adopted the simple yet ingenious method employed at Rothamsted. It is still the intention of Prof. Brown, when a suitable opportunity occurs, of having glass cylinders made.

2. The Drain-Gauges or Lysimeters.

The larger part of the work of Sir J. B. Lawes and Dr. Gilbert, which we have been reviewing, is devoted to the amount and composition of the drainage-waters at Rothamsted. The Rothamsted drain-gauges are three in number, and consist of retangular plots of soil having the same surface as the large rain-gauge, namely, $\frac{1}{1000}$th of an acre. The depth of the soil varies. In the first gauge, the depth is twenty inches; in the second, it is forty inches; and in the third, sixty inches. The gauges were constructed in the summer of 1870, and in the following manner :—

"In order to obtain a *natural* drainage, it was of primary importance that the soil should be in a perfectly natural condition of consolidation, neither more porous nor more condensed than the ordinary field soil. To accomplish this object a deep trench was dug along the front of each intended gauge; the mass of soil was then gradually undermined, at the depth previously determined; and plates of cast iron, eight inches wide and perforated with holes, were introduced to support the soil as the work proceeded. This perforated iron bottom was finally strengthened by transverse iron girders, and the ends of the plates and girders supported by brickwork on three sides of the intended gauge. The soil being now supported from beneath, trenches were made one by one on the three remaining sides of the block of soil to be isolated; walls of brick, laid in cement, four and one-half inches thick, were built against the soil, and the trenches were again filled in with earth. The mass of soil was in this manner built in on all sides with brick and cement. The surrounding walls were carried three inches above the level of the soil, the edges at the top being made to slope outwards." The water is collected in galvanized iron cylinders, fitted with external gauge tubes, similar in structure to those used for the large rain-gauge.

The soil of Rothamsted is described as a somewhat heavy loam with a subsoil of clay mixed with flint and lying on chalk.

In digging the trenches round the rain-gauges, it was found, that the ordinary soil is not a uniform porous mass "which simply becomes saturated with water and then parts with its surplus by drainage." Besides the shallow surface cracks that remain partially open after dry weather has ceased, there are deeper channels that have been produced by the roots of plants and by the burrowing of worms. Barley roots were observed penetrating the soil to a depth of fifty and even sixty inches. In the decay of such roots, small open channels are left through which drainage can take place. Worms have not unfrequently appeared on the collecting funnel of the twenty-inch gauge, and much more rarely on the collecting funnels on the forty-inch and sixty-inch gauges.

The drainage-water from the soil may consist of two kinds:—

(1) Of rain-water which has passed with but little alteration in composition down the open channels of the soil; or

(2) Of water which has been discharged from the pores of a saturated soil. The drainage through the open channels of the soil contains a much smaller proportion of soluble salts than the true drainage of the soil.

As the surface soil dries, water will be gradually drawn from the subsoil and be itself in turn evaporated. "The depth to which the subsoil will be dried by this loss of water through capillary attraction will depend on the mechanical texture of the soil; the depth will be greater in the case of a loam or clay than in the case of a soil of more open texture, the height to which water can be raised by capillary attraction being in proportion to the fineness of the spaces through which it passes."

We give the average annual rain-fall and drainage at Rothamsted through twenty, forty and sixty inches of soil, during the periods 1871–74, 1875–80, and 1871–80:—

——	Rainfall Inches.	Drainage in Inches.			Drainage in 100 Rainfall.		
		20-Inch Gauge.	40-Inch Gauge.	60-Inch Gauge.	20-Inch Gauge.	40-Inch Gauge.	60-Inch Gauge.
Four years, 1871-74.........	27·344	9·683	9·476	7·753	35·4	34·7	28·4
Six years, 1875-80..........	34·189	16·944	18·544	16·899	49·6	54·2	49·4
Ten years, 1871-80.........	31·451	14·040	14·916	13·241	44·6	47·4	42·1

Expressed in percentages of the rainfall, the drainage in summer has varied from 7·9 to 47·6, with a mean of 26·8 per cent.; the drainage in winter from 39·8 to 80·1, with a mean of 61·9 per cent.; and the drainage of the whole year from 21·7 to 60·5, with a mean of 43·4 per cent.

The amount of evaporation taking place from a bare uncropped soil depends, (1) on the temperature of the soil, (2) on the temperature and dryness of the air, (3) on the amount of wind, (4) on the amount and distribution of the rain. Drainage is, in fact, merely *the excess of rainfall over evaporation.* Plants, during their growth by the rapid transpiration of water through their leaves, are very active in evaporating the water of the soil. "A crop of manured hay of 29½ cwts. had removed from the soil at least two inches, and another manured crop of 56¼ cwts. at least 3·2 inches more water than an unmanured crop of 5¾ cwts. In the case of a crop of barley grown on the same field in which the drain-gauges were afterwards established, the crop had apparently removed from the soil about nine inches more water than had evaporated from the adjoining bare fallow.

Under the heading "The Composition of the Drainage-waters," nitrification or the formation of nitrates is discussed. It was Schlæsing and Müntz who discovered the mode in which the nitrification takes place. A living ferment contained in the soil is capable of oxidizing ammonia and other nitrogenous bodies into nitric acid. "The nitrifying ferment is apparently present in all fertile soils; it requires for its activity *a sufficient supply of water and air*, and also *some salifiable base, as chalk; a certain degree* *of warmth is also necessary. No nitrification will take place in a dry soil; the production of nitrates will* increase in activity as the soil becomes wetter up to the point at which the water begins to interfere with the free aëration of the soil. Nitrification is at a stand-still near the freezing-point, and gradually increases in activity as the temperature rises, reaching its maximum of energy about 98° Fahr. (37° C.) At a higher temperature it diminishes in activity, and ceases altogether at 131° (55° C.). The process of nitrification is probably chiefly confined to the surface soil, where nitrogenous matters are most abundant, and the supply of air greatest; it will proceed with greatest energy in summer-time, and be especially active during a wet summer. The nitrate produced in soil is chiefly nitrate of calcium."

The work under review gives a very intelligent classification of the substances that may be dissolved by rain :—

(1) Substances freely diffusible within the soil. The freely diffusible acids are hydro-chloric, nitric, and to a less extent sulphuric acid; the most readily diffusible bases are soda and lime. By combining these diffusible acids and bases, the chlorides and nitrates of sodium and calcium, and, to a less extent the sulphates, are readily diffusible salts, and may be easily extracted from a soil, if sufficient water be applied;

(2) Substances for which soil exerts more or less attraction, and which are therefore not freely diffusible. "Most fertile soils possess a great retentive power for phosphoric acid, ammonia, and potash, and these substances are consequently found in drainage-waters in minute quantity, except under very special circumstances. In the case of such substances, the small solvent action of rain results rather in their more equable distribution throughout a limited area of soil than in their removal from it."

We give Dr. Frankland's analysis of drainage-waters from the three drain-guages, twenty, forty, and sixty inches deep, in parts per million :—

Date of Collection.	Total Solid Matter.	Carbon in Organic Matter.	Nitrogen as Organic Matter.	Nitrogen as Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Nitrogen.	Chlorine.	Total Hardness.
Soil 20 Inches Deep.								
Nov. 20-23, 1870	632·8	1·08	0·45	0·00	49·36	49·81	21·5	129
Dec. 15-17, 1870	400·4	1·84	0·64	0·00	31·76	32·40	38·0	146
Oct. 30-31, 1872	302·4	1·14	0·45	0·01	26·36	26·82	6·0	166
Feb. 25-26, 1873	180·0	1·42	0·45	0·02	6·07	6·54	9·5	120
April 2-30, 1874	274·4	1·74	0·75	0·20	21·46	22·41	9·5	137
Mean	358·0	1·44	0·55	0·05	27·00	27·60	16·9	140
Soil 40 Inches Deep.								
Nov. 20-23, 1870	362·4	1·47	0·49	0·00	23·45	23·94	28·6	134
Dec. 15-17, 1870	386·0	2·35	0·82	0·00	23·89	24·71	30·0	131
Oct. 30-31, 1872	273·2	0·96	0·32	0·00	21·06	21·38	8·0	166
Feb. 25-26, 1873	192·4	1·27	0·26	0·01	7·89	8·16	9·5	97
April 2-30, 1874	230·8	1·17	0·54	0·10	16·02	16·66	9·5	120
Mean	289·0	1·44	0·49	0·02	18·46	18·97	17·1	130
Soil 60 Inches Deep.								
Nov. 20-23, 1870	392·4	1·27	0·42	0·00	28·53	28·95	26·0	155
Dec. 15-17, 1870	366·8	3·71	1·16	0·21	24·89	26·26	21·5	35
Oct. 30-31, 1872	326·8	0·98	0·37	0·01	23·65	24·03	10·5	126
Feb. 25-26, 1873	223·6	1·68	0·40	0·02	7·59	8·01	9·5	104
April 2-30, 1874	264·0	0·98	0·42	0·16	17·32	17·90	9·5	130
Mean	314·7	1·72	0·55	0·08	20·4	21·03	15·4	110

"Looking at these analyses generally, we see that ammonia is either absent or occurs in very small quantity. The amount of organic matter dissolved in the water is but small; it is increased when the water is turbid; it is in all cases highly nitrogenous. The mean ratio of organic nitrogen to carbon in the drainage-waters from the three gauges is 1: 2·6, 1: 2·9, and 1: 3·1, the proportion of carbon apparently increasing with the depth of the soil." In turbid waters the proportion of carbon is highest. Turbidity in drainage-water being a sign that direct channel drainage has occurred, and that matter has been brought immediately from the surface. Dr. E. J. Mills has found that the relation between the nitrogen and carbon of the organic matter found in clear well and drainage-waters is constant. "He considers that the slow oxidation which organic matter undergoes in a soil finally reduces all forms of organic matter to a few simple compounds, in which the carbon and nitrogen have the relation $\frac{C}{12} : \frac{N}{3}$, $\frac{C}{12} : \frac{N}{4}$, or $\frac{C}{12} : \frac{N}{5}$; in the drainage-waters we are now considering the composition of the organic matter corresponds with the second of the above ratios." Little is known of the part these nitrogenous organic bodies possibly play in plant nutrition.

The large proportion of chlorides is thought to be probably due to a previous manuring with guano. The "hardness" represents the amount of lime present in the waters. It is interesting to notice that the drainage from the 40-inch gauge is weaker than that from either of the others, the order of strength being in fact 20, 60, 40.

"The maximum richness in nitrates occur in early autumn drainage, the proportion diminishing through winter, and reaching a minimum in spring." "In early autumn the drainage from the 20-inch gauge is richest in nitrates," but "in late winter and spring the drainage from the 60-inch becomes generally the richest."

These facts are easily explained if we remember—

(1) That it is in summer that the nitrates are most abundantly produced in the surface soil.

(2) That little drainage occurs in summer time, owing to the high rate of evaporation.

(3) That in autumn, drainage becomes active, and the washing out of the nitrates commences.

(4) That as the nitrates are most abundant at the surface they, after being displaced by rain, require time for diffusion before they can appear in quantity in the drainage-water. This further explains why drainage from the shallowest soil is the first *to show the maximum* contents of nitrates. Continuous wheat cropping without manure is found to lower the proportion of nitrates in the drainage-water, the crop actively appropriating the nitrates formed in the soil. "So complete is the appropriation of nitrates by the wheat crop, that during the time of active growth, and for some time after, no nitric acid, or a trace only, can be found in the drainage-water from several of the plots in Broadbalk."

A brief *summary* of the amount and composition of rainfall, drainage-waters from land unmanured and uncropped, drainage-waters from land manured and cropped with wheat, and quantity of nitrogen lost per acre by drainage, is given by Sir J. B. Lawes and Gilbert at the end of their work. We shall give from this summary a few of the more interesting items:—

(1) "The quantity of nitrogen as nitrates annually removed in the drainage-waters has varied from 31·78 lbs. to 57·95 lbs. per acre. The average of four years, 1877-8 to 1880-1, is 41·81 lbs., equal to 268 lbs. of ordinary nitrate of sodium per acre.

(2) "The amount of chlorine in the drainage from the drain-gauges, is approximately the same as in the rainfall.

(3) "The advantages of a bare fallow is largely due to the production of nitrates in the soil; in fields in bare fallow at Rothamsted, 50 lbs. per acre of nitrogen as nitrates have been found at the end of summer in the first twenty inches. *If followed by a wet winter*, bare fallow must result in a serious loss of soil nitrogen.

(4) "The annual average of loss of lime and magnesia by drainage from the continuously unmanured wheat plot is apparently about 223 lbs.; where 400 lbs. ammonium salts are applied, the loss is 389 lbs.; where sulphates of sodium, potassium, and magnesium are also added, the loss is still greater, the two last-named salts exerting most influence. Nitrate of sodium does not apparently increase the loss of lime.

(5) "When ammonium salts are applied to land, the ammonia is at first retained by

the soil, while the sulphuric acid or chlorine passes into the drainage water, chiefly as calcium salts.

(6) "The conversion of ammonia into nitric acid commences almost immediately after the application of ammonium salts to wet soil. The conversion is apparently complete in a few weeks, if wet weather follows. The nitrogen of rape-cake is more slowly converted into nitric acid.

(7) "The drainage-waters from plots manured with ammonium salts are richest in nitrates shortly after their application. With 400 lbs. of ammonium salts per acre applied in March, the April drainage-waters have averaged 6·7 lbs. of nitrogen (=42·8 lb. nitrate of sodium) per inch of drainage.

(8) "In summer the drainage-waters from plots receiving 200–400 lbs. ammonium salts contain *little* or *no nitrates*, if *phosphates* and *potash* have been supplied; but with an excess of ammonia, or a deficiency of ash constituents, the nitrates produced are imperfectly assimilated by the crop, and appear in the drainage-water.

(9) "Reckoned over thirty years, *not quite one-third* of the *nitrogen* supplied by manure was recovered *in the increase of crop* under favourable conditions as to mineral manure and growth, and *very much less* when there was a *deficiency* of *potash* and *phosphoric* acid, and defective growth accordingly.

(10) "With 400 lbs. of ammonium salts, and the most liberal mineral manure, there was the *maximum* amount of nitrogen recovered in the crop, and the *minimum* amount in the drainage; but with the ammonium salts used alone, there was the *minimum* amount in the crop, and the *maximum* amount in the drainage.

(11) "When farmyard manure is largely used, there is sometimes considerable loss of nitrogen, due to the decomposition of nitrogenous organic matter, and the evolution of free nitrogen, or when the soil is saturated with water, or imperfectly aërated, there may be destruction of nitric acid and evolution of free nitrogen."

In July of last summer we visited the New York Agricultural Experiment Station situated at Geneva, and carefully examined the lysimeters in use by Dr. Sturtevant, the director of the station. We found the Geneva drain-gauges neater and more compact than those of Rothamsted. They cover an area of $\frac{1}{10000}$th of an acre, and are of uniform depth, namely, three feet. The drainage experiments conducted by Dr. Sturtevant, at Boston, before he became director of the Geneva Station, were made with lysimeters of this area. We give a condensed form of the Boston results:—

YEARS 1876-7-8-9.

	Rainfall, Inches.	Percolation, Inches.	Evaporation, Inches.
January, February, March, April. Average	16·84	2·768	83·5
May, June, July, August. Average	13·77	0·589	95·7
Sept., Oct., Nov., Dec. Average	14·70	3·401	76·8
For the twelve months. Average	45·34	6·759	85·1

Under the head evaporation is included the difference between rainfall and percolation. The soil experimented with is described, as a sandy or gravel loam, in so poor an agricultural condition that, "a sod would produce a short half ton of hay per acre in a favourable season." It has been assumed from these figures, that percolation is practically *nil* during the growing season, and that leaching, so much dreaded by the farmer, is under farm conditions, not to be practically feared.

After our return to Guelph, we held a consultation with Professor Brown, and decided to build our lysimeter after the Geneva pattern. It was the greater compactness of its form and the comparatively small cost involved in its construction, that principally lead us to prefer the Geneva drain-gauge to the one of Rothamsted. In reply to a private note from us, in which Dr. Sturtevant was requested to send us a detailed statement of how his lysimeter had been built, we received the following prompt and courteous answer :—

"In the first place strong oak frames were made of two inch plank—$25\frac{4}{10}$ inches square, internal diameter, and three feet deep; these frames were strongly bound at the corners with iron, besides being dove-tailed together. These frames were then lined with sheet copper, tacked in place with heavy copper tacks at frequent intervals, and the heads of the tacks counter-sunk. The copper was allowed to project an inch above and below the frame, and the projection was turned down and securely tacked. A tinsmith then soldered all the joints, and covered also the heads of the tacks with solder. Four pieces of angle-iron were then procured, and one edge ground sharp on the grindstone. These were secured on the lower edge of the frame, the cutting edge in line with the interior surface of the frame. These frames were then set upon the sod, heavily weighted upon the top, and were driven down evenly by heavy mauls striking the two diagonal corners at the same time. A trench is kept dug upon the outside a little in advance of the sinking of the frame, and by means of a trowel the earth is kept cut away close to the cutting edge, in order to allow the bottom to pass down without resistance. This whole operation of sinking is one requiring much patience, and is easily done if not hurried. When sunk to the proper depth, *i.e.*, when the sod is even to the surface of the frame, a plate of boiler iron is forced under the bottom of the frame by means of a jack-screw, skids extending on either side to preserve the plate parallel. When this cutting plate has separated the prism, a chain is passed around it, and the box is lifted from the hole, and inverted alongside. The angle-iron is now to be unscrewed, the soil to be trimmed away even with the bottom of the frame, a copper bottom laid on, and the copper edge, which had been previously turned over the frame, now turned over the bottom and securely soldered. A pipe from the centre of the bottom enables the water to be collected after the apparatus is put in position."

To calculate the amount of water evaporated from growing sod, from a bare surface, and from a stirred surface, respectively, the Geneva Station has three lysimeters :

Lysimeter No. 1 retaining the sod upon its surface ; No. 2 having its surface kept bare and undisturbed ; No. 3 having its surface kept pulverized during the open season to the depth of an inch or two by frequent stirring with a trowel.

The soil contained within these lysimeters Dr. Sturtevant describes as follows : "A dark clay loam, moderately friable for the first eight inches ; below this and sharply defined from it, is a bed of heavy clay, dark red in colour, granular and not very tenacious, about a foot thick ; below this a bed of clay about a foot thick, of similar colour to the last, but quite compact and tenacious ; below this four inches, of a peculiar, soapy soil ; below this last, but not included in the lysimeter boxes, was a strong clay hard pan."

To allow settling and to wash out the accidental impurities that may have come from the acid used in soldering, Dr. Sturtevant does not intend to keep records of drainage until next year. The following figures for the year 1882 have been published :

PERCOLATION FROM LYSIMETERS IN INCHES.

Lysimeter.	Aug.	Sept.	Oct.	Nov.	Dec.
No. 1.	0·00	0·00	0·00	0·00	0·001
No. 2.	0·135	0·001	trace	0·009	0·578
No. 3.	0·575	0·284	0·001	0·011	0·559
Rainfall..........	2·371	1·251	0·621	1·220	0·551

A marked influence in favour of the effect of stirring the soil upon conserving the moisture to land is here visible, No. 3 kept stirred, holding more water than did the others, required less of the rainfall for saturation and subsequent percolation. The growing sod evaporated more water than did the bare soil, and the bare soil more than the stirred soil.

According to the directions received from Dr. Sturtevant, three lysimeters have been built and placed on one side of the large rain-gauge. The lysimeters sit upon a rocky bottom, their surface being on a level with that of the experimental field. The pipes which pass from the bottom of the lysimeters are carried into the subterranean alcove of the large rain-gauge. Carboys similar in structure to those of the large rain-gauge, and kept under each pipe, will enable us to collect all the water which drains through, and at the same time measure it in thousandths of an inch. About the top of the frames an edging of hard brass, strickly defining the area and one inch high, is fastened. Hence all the rainfall over this area is compelled to enter the soil, and by measuring the amount which percolates we can account for the balance through evaporation.

The soils of the lysimeters have been taken from the Experimental Field of the Farm. Great care has been observed in their selection. They are as nearly as possible identical in physical and chemical properties; they further, fairly represent the soil of the entire field. The surface soil is a sandy loam eight inches in depth—the humus being abundant. The subsoil consists of three distinct layers: First, is a firm clay loam ten inches deep, having a reddish tinge and a slight sprinkling of gravel; second is a gravel loam fourteen inches deep, the gravel varying from one inch to the $\frac{1}{10}$ of an inch in diameter; third, a layer of pure building sand four inches deep.

Lysimeter.

No. 1 will have sod grown upon its surface; No. 2 will be treated as a bare fallow. To Lysimeter No. 3 a manure will be applied and a crop grown. The drainage-waters passing through all three lysimeters will be collected, measured, and their composition determined by analysis. In Lysimeter No. 2 we shall ascertain for Ontario the loss of nitrates in a bare fallow. It is thought by some that during our frequently dry falls and our frosty winters, little or no loss of nitrates occur. Knowing in Lysimeter No. 3 the substances applied as manure and removed in the crop and drainage-water, much valuable information must be obtained, if different manures are applied and different crops grown.

While writing this three other lysimeters are in process of erection. They will be placed on the other side of the large rain-gauge, and will contain soils that differ both physically and chemically. Lysimeter No. 4 will contain a light sandy soil; No. 5, a heavy clay-soil; No. 6, a loam. Professor Brown intends to test different modes of farming with these lysimeters; in other words the manure and crop will be, each year, in each case, the same, the treatment will, each year, differ.

3.—*Field Experiments.*

As a means of studying the effects of fertilizers and the feeding capacities of plants, we intimated in last year's Report, our intention of adopting the system of "Co-operative Experimenting," which was submitted to the Department of Agriculture, Washington, D. C., March 27th, 1882 by Prof. W. O. Atwater. It is provided in this system, that the fertilizing materials may be used separately, two by two, and altogether. Before we proceed to give the results of this year's experiments, we shall briefly review the conditions under which the fertilizers have been used.

Nitrogen was used in three distinct forms:—

First, in the form of nitric acid. 1. Nitrate of soda.
Second, in the form of ammonia. 2. Sulphate of ammonia.
Third, in the form of organic nitrogen. 3. Steam dried blood.

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

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

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

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

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

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

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

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

FIRST TWO ACRE SET—NITROGEN AND POTASH.

NUMBER OF PLOT.	FERTILIZERS.	QUANTITIES PER ONE-TENTH ACRE PLOTS.
	I.—PRELIMINARY GROUP.	Pounds.
40	Nitrate of soda, two-thirds ration	30·0
39	Superphosphate " "	40·0
38	Muriate of potash " "	13·3
37	Nitrate of soda, } mixed minerals	30·0
	Superphosphate, }	40·0
36	Nitrate of soda, } "	30·0
	Muriate of potash }	13·3
35	Superphosphate, } "	40·0
	Muriate of potash }	13·3
	II.—NITRATE OF SODA GROUP.	
34	Mixed minerals as No. 35	53·3
	Nitrate of soda, one-third ration	15·0
33	Mixed minerals as No. 35	53·3
	Nitrate of soda, two-thirds ration	30·0
32	Mixed minerals as No. 35	53·3
	Nitrate of soda, full ration	45·0
	III.—SULPHATE OF AMMONIA GROUP.	
31	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, one-thirds ration	11·4
30	No manure	
29	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, two-thirds ration	22·8
28	Mixed minerals as No. 35	53·3
	Sulphate of ammonia, full ration	34·3
	IV.—DRIED BLOOD GROUP.	
27	Mixed minerals as No. 35	53·3
	Dried blood, one-third ration	22·0
26	Mixed minerals as No. 35	53·3
	Dried blood, two-thirds ration	44·0
25	Farm-yard manure	15 tons per acre.
24	Mixed minerals as No. 35	53·3
	Dried blood, full ration	66·0
	V.—MURIATE OF POTASH GROUP.	
23	Mixed minerals as No. 37	70·0
	Muriate of potash, one-third ration	6·7
22	Mixed minerals as No. 37	70·0
	Muriate of potash, two-thirds ration	13·3
21	Mixed minerals as No. 37	70·0
	Muriate of potash, full ration	20·0

SECOND TWO ACRE SET—Phosphoric Acid and Sulphate Lime.

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

The plots that have been used in testing the artificial fertilizers, according to the co-operative system, make up ranges II. and III. of the Experimental field.

The soil, though not rich, is by no means poor; not much farm-yard manure has ever been applied to it. It was broken from sod in the fall of 1881, and was summer-fallowed the following summer. In the spring of 1883, it was twice cultivated and once harrowed. On May 1st and 2nd, six pecks per acre of white Russian wheat were drilled in; on May 2nd, the artificial fertilizers were sown by hand. On May 15th, the blades commenced to appear above ground, a difference in their growth not becoming perceptible until June 12th. On June 23rd and 27th, the injurious effects of the wet weather were everywhere apparent, parts of many of the plots having turned yellow. On July 11th, rust was distinctly visible on the leaves of the wheat of all plots; on July 25th, the amount of rust was great, all the plots apparently suffering alike.

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

1st TWO ACRE SET.—Result of testing special

Date of Ripening.	Market Grain, Bushels per acre.	Market Grain, Pounds per acre.	Small Grain, Pounds per one-tenth acre.	Total pounds per acre.	Weight per measured bushel.	Straw, pounds per acre.	Total Weight of crop per acre.
Aug. 28..........	9.291	497.5	6	557.5	49.8	2512.5	4070
" 28	10.958	602.5	5.5	657.5	54.5	2762.5	3420
" 29..........	11.333	630	5	680	47.3	2870	3550
" 29..........	12.625	697.5	6	757.5	54.8	3182	3940
" 28..........	15.541	892.5	4	932.5	50.8	3377	4310
" 28	8.541	467.5	4.5	512.5	52.6	2237.5	2750
" 28..........	11.166	640	3	670	54.3	3020	3690
" 28..........	8.208	442.5	5	492.5	51	2457.5	2950
" 29..........	15.125	837.5	7	907.5	55	3532.5	4440
" 29..........	15.375	862.5	6	922.5	54.2	3987.5	4910
" 29..........	16.708	942.5	6	1002.5	55.2	4007.5	5010
" 28..........	16.791	935.6	7.5	1007.5	53.8	4302.5	5310
" 28..........	16.166	910	6	970	53.2	4720	5690
" 28..........	17.208	982.5	5	1032.5	54.5	4362.5	5395
" 28..........	17.791	1027.5	4	1067.5	54.6	4362.5	5430
" 28..........	16.875	972.5	4	1012.5	55.2	4777.5	5790
" 28..........	23.291	1337.5	6	1397.5	54.5	5312.5	6710

manures, Nitrogen and Potash, on Spring Wheat.

Per cent. of crop, grain.	Per cent. of crop, straw.	Ratio of grain to straw.	Appearance of crop when standing.	Amount of rust.	Length of straw.	Strength of straw.	Condition of straw.	Remarks on Grain.	Number of plot.
18.2	81.8	1:4.5	61	80	70	80	......	Badly shrunken	40
19.3	80.7	1:4.2	75	80	78	82	......	Well filled	39
19.2	80.8	1:4.2	70	92	68	80	......	Small; not filled	38
19.3	80.7	1:4.2	75	90	75	82	......	Even sample but small	37
21.7	78.3	1:3.6	70	99	70	80	......	Small and shrunken	36
18.7	81.3	1:4.3	65	98	70	80	......	Uneven and shrunken...... ...	35
18.1	81.9	1:4.5	68	98	75	80	......	Small and shrunken	31
16.7	83.3	1:4.9	58	90	60	80	......	Small and shrunken	30
20.5	79.5	1:3.9	68	98	78	80	......	Small and uneven	29
18.8	81.2	1:4.3	68	98	80	80	......	Large but uneven	28
20.1	79.9	1:3.9	89	95	90	85	......	Large and even................	27
19	81	1:4.2	90	98	90	80	......	Small, even sample............	26
17.1	82.9	1:4.7	90	95	95	80	......	Large but shrunken	25
19.2	80.8	1:4.2	95	98	92	80	......	Even but small	24
19.6	80.4	1:4.0	87	98	90	80	......	Even but small	23
19.2	80.8	1:4.7	87	98	90	80	......	Even sample.....	22
20.8	79.2	1:3.8	90	98	95	80	......	Large and well filled.........	21

2ND TWO ACRE SET.—Result of testing special manures,

Date of Ripening.	Market Grain, Bushels per acre.	Market Grain, Pounds per acre.	Small Grain, Pounds per one-tenth acre.	Total pounds per acre.	Weight per measured bushel.	Straw, pounds per acre.	Total weight of crop per acre.
Aug. 29..........	18.416	1055	5	1105	52.8	4085	5190
" 29..........	19.375	1067.5	9.5	1162.5	54.5	3787.5	4950
" 29..........	18.000	1005	7.5	1080	50	4010	5090
" 29..........	16.208	932.5	4	972.5	52.5	3697.5	4670
" 29..........	15.125	842.5	6.5	907.5	53.2	3422.5	4330
" 29..........	22.416	1305	4	1345	55	4785	6130
" 29..........	19.750	1135	5	1185	53.5	4345	5532
" 29..........	17.291	997.5	4	1037.5	52.5	4072.5	5110
" 29..........	20.583	1175	3	1235	56	3925	5160
" 29..........	21.883	1205	3	1265	54.3	4075	5340
" 29..........	17.666	1000	3	1060	54.9	3260	4320
" 29..........	17.458	992.5	5.5	1047.5	55.3	3522.5	4570
" 29..........	18.958	1087.5	5	1137.5	55.5	3502.5	4640
" 29..........	24.916	1415	4	1495	55.5	4405	5900
" 29..........	19.291	1097.5	6	1157.5	54.3	3492.5	4650
" 29..........	17.000	970	5	1020	51	3360	4380
" 29..........	15.291	877.5	4	917.5	49.5	3142.5	4060
" 29..........	17.125	892.5	13.5	1027.5	58	3182.5	4210
" 29..........	16.666	910	9	1000	50.2	3170	4170
" 29..........	17.541	987.5	6.5	1052.5	52	3297.5	4350

Phosphoric

Per cent. of crop, grain.	Per cent. of crop, straw.
21.3	78.7
23.5	76.5
21.3	78.7
20.8	79.2
21	79
21.9	78.1
21.4	78.6
20.3	79.7
23.9	76.1
23.6	76.4
24.5	75.6
23	77
24.6	75.4
25.4	74.6
24.9	75.1
23.3	76.7
22.6	77.4
24.3	75.7
24	76
24.2	75.8

...ecial manures,

Total weight of crop per acre.
5190
4950
5090
4670
4330
6130
5532
5110
5160
5340
4320
4570
4640
5900
4650
4380
4060
4210
4170
4350

Phosphoric Acid and Sulphate of Lime, on Spring Wheat, 1883.

Per cent. of crop, grain.	Per cent. of crop, straw.	Ratio of grain to straw.	Appearance of crop when standing.	Amount of rust.	Length of straw.	Strength of straw.	Condition of straw.	Remarks on Grain.	Number of plot.
21.3	78.7	1:3.7	95	79	90	79	....	Large but shrunken..........	41
23.5	76.5	1:3.2	90	78	80	80	.....	Large but uneven	42
21.3	78.7	1:3.7	65	80	79	70	.....	" "	43
20.8	79.2	1:3.8	90	84	80	70	....	Sample even	44
21	79	1:3.8	70	80	80	69	.....	Small and shrunken	45
21.9	78.1	1:3.5	95	85	90	70	.....	Sample even and well filled	46
21.4	78.6	1:3.6	93	87	90	70	.....	Small but well filled	47
20.3	79.7	1:3.9	90	85	95	70	.....	Large but shrunken............	48
23.9	76.1	1:3.1	95	85	98	70	.....	Uneven sample	49
23.6	76.4	1:3.2	100	85	99	70	.....	Sample large but shrunken	50
24.5	75.6	1:3.0	95	85	74	78	.....	Sample uneven..................	51
23	77	1:3.3	93	85	75	80	.....	Sample even but shrunken......	52
24.6	75.4	1:3.0	95	85	79	80	.....	Large; well filled	53
25.4	74.6	1:2.9	98	85	82	78	.....	Sample even and well filled......	54
24.9	75.1	1:3.0	95	85	76	80	.....	Very large and well filled	55
23.3	76.7	1:3.3	75	85	80	80	.....	Very large but shrunken	56
22.6	77.4	1:3.4	78	85	78	80	.....	Sample coarse; not filled	57
24.3	75.7	1:3.1	80	80	88	80	.....	Sample large but shrunken	58
24	76	1:3.1	80	80	88	80	.....	Sample large but badly shrunken.	59
24.2	75.8	1:3.1	82	80	90	80	.....	Sample large but not filled	60

In briefly reviewing these results of the field experiments we shall examine—

First, the plots which received no manure;
Secondly, the plots which received farm-yard manure;
Thirdly, the plots which received one artificial fertilizer;
Fourthly, the plots which received two artificial fertilizers;
Fifthly, the plots which received all three artificial fertilizers.

1st. The plots which received no manure are—No. 30 of the 1st Two-acre Set and No. 45 of the 2nd Two-acre Set. Per acre, the bushels of market grain from plot 30 were, 8.2; the pounds of market grain, 442.5; the weight per measured bushel, 51; the total weight of crop, 2,950; the grain small and shrunken. Per acre, the bushels of market grain from plot 45 were, 15.1; the pounds of market grain, 842.5; the weight per measured bushel, 53.2; the total weight of crop, 4,330; the grain also small and shrunken.

The returns from one of these unmanured plots nearly doubles the returns from the other. The average of the two plots, expressed in bushels of wheat per acre, is 11.5.

2nd. The results obtained from the plots treated with farm-yard manure—plots 25 and 50—show also a great divergence. Per acre, the bushels of market grain from plot 25 were, 16.1; the pounds of market grain, 910; the weight per measured bushel, 53.2; the total weight of crop, 5,690; the grain large but shrunken. Per acre, the bushels of market grain from plot 50 were, 21.8; the pounds of market grain, 1,205; the weight per measured bushel, 54.3; the total weight of crop, 5,340; the grain large but shrunken.

It will be noticed that a difference of 5½ bushels per acre occurs in plots that have been treated with the same quantity of farm-yard manure. The average of the two plots, expressed in bushels of wheat per acre, is 18.9.

3rd. The plots which received one artificial fertilizer are Nos. 40, 39, and 38, of 1st Two-acre Set; and Nos. 41, 42, and 43, of 2nd Two acre Set.

Per acre, the yield of plot 40—nitrate of soda, two-thirds ration—was, 9.2 bushels, only one bushel more than the return from no manure in the same range; the yield of plot 39—superphosphate, two-thirds ration—was, 10.9 bushels; and the yield of plot 38—muriate of potash, two-thirds ration—was, 11 bushels.

Turning to the plots of the 2nd Two-acre Set that were treated with one artificial fertilizer, we notice a marked difference in the results. Per acre, plot 41—nitrogen mixture, two-thirds ration—yielded nearly 18½ bushels; plot 42—superphosphate, two-thirds ration—19¼ bushels; and plot 43—muriate of potash, two-thirds ration—18 bushels. Is it not remarkable that the average of these three returns from two-thirds rations of simple fertilizers is equal to the average obtained from heavy dressings of farm-yard manure?

4th. The plots which received two artificial fertilizers are Nos. 37, 36, and 35, of 1st Two-acre Set; and Nos. 44, 46, and 47, of 2nd Two-acre Set.

The yield from the plots of the 1st Two-acre Set, with the exception of plot 36—two-thirds ration, nitrate of soda and muriate of potash—is scarcely up to the average of no manure; that from the plots of the 2nd Two-acre Set, with the exception of plot 44—two-thirds ration, nitrogen mixture and superphosphate—is greater than the average from farm-yard manure. Plot 46—two-thirds ration, superphosphate and muriate of potash—yielded per acre 22½ bushels.

5th. The plots which received all three artificial fertilizers will be best considered in groups.

1. Nitrogen Group.

(*a*) Nitrate of Soda Set.

(*b*) Ammonium Sulphate Set.

(*c*) Organic Nitrogen—Dried Blood Set.

In these three sets of the Nitrogen Group there were used two-thirds rations of superphosphate of lime and muriate of potash, with one-third, two-thirds, and full rations of the nitrogen in each form.

(*a*) *Nitrate of Soda Set*—Plots 34, 33, and 32. They were so thrown back by wet that no account could be taken of them.

(*b*) *Ammonium Sulphate Set*—Plots 31, 29, and 28. Per acre, the yield of 31—one-third ration—was, 11 bushels; the yield of 29—two-thirds ration—was, 15 bushels; the yield of 28—full ration—was, $15\frac{1}{4}$ bushels. Though these crops gave considerable promise at one time, and were thought almost too rank and superior, through wet the return is much smaller than that obtained in three cases by the fertilizers used separately.

(*c*) *Dried Blood Set*—Plots 27, 26, and 24. Per acre, the yield from plot 27—one-third ration—and plot 26—two-thirds ration—was in each case nearly 17 bushels; that from plot 24—full ration—more than 17 bushels. These returns appear low, they are, however, higher than those obtained from farm-yard manure under like conditions. Plot 25, lying between the plots with dried blood, was treated with farm-yard manure, and yielded only 16 bushels per acre.

2. Muriate of Potash Group.

In the one set of this group, there were two-thirds rations of superphosphate of lime and nitrate of soda used with one-third, two-thirds, and full rations of muriate of potash. The plots are 23, 22, and 21. Per acre, the yield from plot 23—one third ration—was nearly 18 bushels; the yield from plot 22—two-thirds ration—was nearly 17 bushels; the yield from plot 21—full ration—was $23\frac{1}{4}$ bushels. In this set the return from two-thirds ration is smaller than that from one-third ration, indicating a difference in the physical condition of the two plots lying side by side.

3. Phosphoric Acid Group.

(*a*) Soluble Phosphoric Acid Set.

(*b*) Precipitated Phosphoric Acid Set.

(*c*) Insoluble Phosphoric Acid Set.

In these three sets of the phosphoric acid group, there were two-thirds rations of nitrogen mixture and muriate of potash used with one-third, two-thirds, and full rations of phosphoric acid in each form.

(*a*) *Soluble Phosphoric Acid Set*—Plots 48, 49 and 51. Per acre, the yield of Plot 48—one-third ration—was $17\frac{1}{4}$ bushels; the yield of Plot 49—two-thirds rations—was $20\frac{1}{2}$ bushels; the yield of Plot 51—full rations—was $17\frac{1}{2}$ bushels. More evidence of inequality in the physical conditions of the soil of the Plots become apparent. First, a greater yield is obtained from the two-thirds rations than from the full. Secondly, the nitrogen mixture and the muriate of patash, used without the superphosphate, gave $19\frac{3}{4}$ bushels per acre. This yield of the two fertilizers is higher than the average of all three fertilizers taken together.

(*b*) *Precipitated Phosphoric Acid Set*—Plots 52, 53, and 54. Per acre, the yield from Plot 52—one-third ration—was nearly $17\frac{1}{2}$ bushels; the yield from Plot 53—two-thirds ration—was nearly 19 bushels; the yield from Plot 54—*full ration—was about 25 bushels—the highest return.*

(*c*) *Insoluble Phosphoric Acid Set*—Plots 55, 56, and 57. Per acre, the yield from Plot 55—one-third ration—was $19\frac{1}{4}$ bushels; the yield from Plot 56—two-thirds ration—was 17 bushels; the yield from Plot 57—full ration—was $15\frac{1}{4}$ bushels. In this Insoluble Phosphoric Acid Set, the greatest return is obtained from the *one-third ration*, the least from the full ration. One striking peculiarity characterizes the Phosphoric Acid group. However dark and healthy the crop looked in dry spots, during the wet season, in "low places," it had "a yellow colour."

4. *Sulphate of Lime Group*—Plots 58, 59, and 60. The average from the three plots of this group is 17 bushels per acre.

The results obtained from one and the same fertilizer when applied to different plots vary so much, no explanation can be given of them, if like physical conditions be assigned the soil of all the plots. Seven bushels market grain per acre, indicates the difference between the *no manure plots*, and, nearly six bushels, the difference between those treated with farm-yard manure. Simple fertilizers on one plot are without apparent action; their effect upon another plot more than equals that of the complete fertilizer. These facts force us to admit that the unusually wet Summer has made manifest *the unequal drainage of the field.* From the results of this year's manuring, on the *Co-operative Principle*, no judgment can be passed either upon the quantity or quality of the soil's plant food. In conclusion, we shall briefly indicate the appearance the plots presented during the early part of Summer.

The blades came up evenly on all the plots; when the roots began to draw nourishment from the soil, a difference in growth became at once apparent.

Of the Nitrogen Plots, those that evinced the most rapid growth were 27, 26, and 24—*the dried blood Set.* The rapidity of growth appeared to vary according to the amount of the manure applied. The growth of Plot 41 (nitrogen mixture) resembled greatly that of 26—two-thirds ration of dried blood.

The Ammonium Sulphate Plots—31, 29, and 28—stood second in rapidity of growth. It was interesting to notice how boldly the crops of these plots struggled against the cold and wet of May and June. Plot 30—no manure—lying between 31 and 29, though drier, had a very inferior crop.

The Nitrate of Soda Plots—34, 33, and 32, (also 40—Nitrate of Soda, two-thirds ration) could not be distinguished from Plot 30 to which no manure had been applied. Nitric acid, the great cereal fertilizer, must have been completely washed from the soil by rain. It will be applied next year as a top-dressing.

On Plot 41—nitrogen mixture—larger and fuller heads appeared than on the plots treated with dried blood; the tendency to rust was not so great though the situations were similar.

Muriate of potash gave apparently no results.

Superphosphate greatly aided growth, giving a healthy dark green colour to the blade.

Reverted *phosphoric acid* appeared perfectly inactive until the heads began to form. The highest return was obtained from this fertilizer.

Gypsum and bone dust were apparently of no value in producing growth of straw.

Plots classified, June 15th, according to the growth displayed by crops:

1. Plots 24 to 27, 41.
2. " 21 to 23, 28, 29, 50, 46, 42, and 48 to 51.
3. " 39, and 52 to 60.
4. " The balance.

4. *Soil Analysis.*

In discussing the system of cooperative experimenting with fertilizers in last year's Report, we said that "a most careful examination of the physical and chemical character of the soil should precede and accompany the experiments in order, if possible, exactly to formulate, the *effects* of the fertilizers and the *feeding capacities* of different plants." In acknowledging the assistance rendered by Professor Brown in making four cross-sections of the surface soil and the subsoil of the experimental field, we promised to publish in this year's Report, an analysis of the soil and of some of the experimental crops.

We have found, during 1883, that the Educational work we have in the College is quite equal to our strength; besides, it was not until the middle of August that quantitative work could be done in the laboratory.

We found, from the conversations we held with the Chemists of the Agricultural Stations we visited during the summer, that the analyses of soil were entirely discouraged. In the Report of 1882 of the Connecticut Agricultural Stations, the work that "a Chemist cannot do," is well stated:

"You know that it has been frequently a matter of experience that a hundred pounds of Peruvian guano, of the old-fashioned sort that we had twenty years ago, would make the difference between a good crop and a poor crop, when it happened to be applied to the right land, with the right crop and right weather. That hundred pounds of Peruvian guano contained about fifteen per cent. of nitrogen, fifteen per cent. of phosphoric acid, and about three per cent. of potash, to which thirty-three pounds of ingredients its fertilizing value was alone due. The soil of an acre of land, taken to the depth of one foot, will weigh about four millions of pounds. Thirty-three pounds of fertilizer, and four millions of pounds of soil. Assuming that the crop got all its nutriment from the first foot of ground, are the two quantities which, put one above the other, the smallest at the top and a line between, make the fraction which the Chemist must figure down to if he will find out from an analysis of the soil what element of fertility that soil is deficient in, viz: $\frac{33}{4000000}$ or $\frac{1}{121000}$. But, in fact, if the Chemist in two analyses of the same sample of soil gets results which agree within $\frac{1}{10000}$ he is lucky, and his luck does more towards that result than his skill, for usually the tenth of one per cent., or $\frac{1}{1000}$ is about the limit accuracy in Chemical Analysis. *It may thus easily happen that the Chemists cannot by analysis distinguish between two soils, one of which has had a dressing of $\frac{1}{1000}$ lbs. of the best Peruvian guano to the acre, and the other nothing.*"

It was not until we had progressed some distance in the analysis of the soil, according to the generally followed method of Wolff, that the full meaning of the quotation we have just given became apparent. The weight that the *available* and *essential* constituents of a soil bears to the weight of the soil itself, is so small, that the agricultural chemist, by the most accurate analytical methods, cannot distinguish between two acres of land, one of which has received a dressing of $\frac{1}{1000}$ lbs. of the best Peruvian guano, and the other nothing; and yet, the first acre will yield a luxuriant crop, the second a comparatively poor one. Further, to ascertain the nutritive constituents of a soil, a number of *acid solvents, arbitrarily chosen*, and without any known relation to the solvent action excited by roots, are successively brought in contact with it, and the soil's *actual* and *possible* nutritive value determined from an analysis of the extractions.

The acid solvents used consecutively in extracting the available plant food from the soil are of different strength, beginning with distilled water and ending with boiling sulphuric or hydrofluoric acid. In the following list, the order and manner of their application are given:

1. Cold, distilled water, one-fourth saturated with carbonic acid.
2. Cold concentrated hydrochloric acid (*Sp. Gr.* $= 1{\cdot}15$).
3. Boiling concentrated hydrochloric acid of the same strength.
4. Hot concentrated sulphuric acid.
5. Hydrofluoric acid.

Every one believes, other things being equal, that "*productiveness is, or should be, sensibly proportional to the amount of available plant food within reach of the roots during the period of the plant's development.*" Could solvents that would represent correctly the action of the plant itself on the soil ingredients, be found, we would be able readily to distinguish between the fruitful and the unfruitful soil, and to assign reasons for the distinction.

Knowing that Professor E. W. Hilgard, Professor of Agriculture, at the University of California, strongly favoured the making of soil analyses, we opened a correspondence with him, in which, he was particularly requested to send us his writings upon the subject. His writings upon soil analysis were soon in onr possession.

Professor Hilgard accepts the universally admitted fact that the ultimate analysis of soils affords little or no clew to their agricultural value. "Such agents as fluohydric acid and alkaline carbonates go by far, deeper than the solvents, naturally acting in soils bearing vegetation, will go within the limits of time in which we are interested."

He thinks that the two chief factors that have contributed to bringing soil analysis into disrepute in Europe are, first, "the fact that virgin soils are there practically non-existent, nearly all the soils analyzed having been at some time subjected to cultivation, and concurrently, to the use of manures, thus veiling their original characteristics, and rendering extremely difficult, to say the least, the taking of any sample of soil that shall correctly represent the whole of a large field or district"; second, "the absence of systematic investigation of the subject, since the time of the introduction of the most essential improvements in the determination of some of the chiefly important mineral soil ingredients."

In his remarks upon the advantages and need of soil investigation in the United States, reference is made to the vast tracts of land (that the plough has never yet touched, and where manure, outside of the flower and vegetable garden, is an unknown quality), that are covered with their original vegetation, and to the intelligent settler, who, as a means of diagnosing the actual productiveness of the land he proposes to clear, examines the quality of the vegetation that grows upon it. The remark of Professor Johnson, that he "would rather trust an old farmer to tell him about the value of a soil, than the best chemist alive," is not very flattering to the chemist, especially, as "old farmers will frequently disagree," "If the old farmer can train his judgment in this matter so as to make shrewd guesses, the agricultural chemist ought to be able to do a great deal better; for he should know all that the farmer does, and a great deal more besides; and, in addition, he should bring to bear upon the whole subject a well-trained mind, accustomed to accurate observation and logical reasoning; unlike the old farmer who 'knows' that 'wheat turns into cheat' in unfavourable seasons."

Professor Hilgard is now endeavouring to approach the solution of the problem by taking for granted, that the old farmer's method of judging of a soil's productiveness from its natural condition, is a good one. By a close chemical and physical examination of soils in their natural condition, he is seeking to find out the causes that determine this natural selection on the part of certain species of trees and herbaceous plants. In the selection of the solvent for making the soil extract to be analyzed, he considers, that minerals not sensibly attacked by several days' hot digestion with strong hydrochloric acid, are not likely to furnish anything of importance to agriculture, within a generation or two. From investigations he has had Dr. R. H. Loughridge make upon a soil as fully "generalized" in its origin as can be obtained, he has found, that hydrochloric acid of about the specific gravity of 1.115 seems to exert the maximum effect, and, that the extraction is practically complete after a water-bath digestion of five days. In the analysis of this extraction the methods of Grandeau are particularly favoured by the Professor.

Professor Hilgard determines the "moisture co-efficient" of the "fine earth" by exposing a very thin layer of the same to a fully saturated atmosphere for at least twelve hours, at a sensibly constant temperature. His results differ somewhat from those obtained by Knop, Shübler, and others, owing, he thinks, to the more complete fulfilment in his experiments of the full conditions of full saturation of air as well as soil. He finds that the absorbtion-co-efficient is practically constant at temperatures between $+7°$ and $+25°$. He further finds that this co-efficient, contrary to conclusions reached by Adolph Mayer, exerts an important influence upon the actual productiveness of soils.

The main *points* he considers substantially proven by the comparison of soil analysis are the following:—

1. "Other things being equal, the thriftiness (*i.e.*, present productiveness), of a soil is measurably dependant upon the presence of a certain minimum percentage of lime." Almost all the trees, the Professor says, which the "old farmer" habitually selects as a guide to a good "location" are such as frequent *calcareous soils*. If the lime percentage will manifest itself unequivocally in the free-growth it "should not fall below 0·100 in the lightest sandy soils; in clay loams not below a fourth of one per cent. 0·250; and in heavy clay soils not below 0·500, and may advantageously rise to one and even two per cent. Beyond the latter figure it seems in no case to act more favourably than a less amount, unless it be mechanically."

The advantages resulting from the presence of an adequate supply of lime in soils, he specifies as follows:—

"(*a*) A more rapid transformation of vegetable matter into *active* humus, which manifests itself by a dark, or deep black tint of the soil.

"(*b*) The retention of such humus, against the oxidizing influence of hot climates;

witness the high humus percentages of such soils, as against all others in the Southern States.

"(*c*) Whether through the medium of this humus, or in a more direct manner, it renders adequate for profitable culture percentages of phosphoric acid and potash so small that in the case of deficiency or absence of lime, the soil is practically sterile.

"(*d*) It tends to secure the proper maintenance of the conditions of nitrification, whereby the inert nitrogen of the soil is rendered available.

"(*e*) It exerts a most important physical action on the flocculation, and therefore on the tillability of the soil, as heretofore shown by Schlæssing and by myself."

In the great majority of soils the lime percentage is greater in the sub-soil than in the surface soil, owing, he thinks, to the easy solubility of calcic carbonate in the soil water. "The efficacy of lime in preventing running to weed in fresh soils, and in favouring the production of fruit, is conspicuously shown in a number of cases. This controlling influence of lime renders its determination alone a matter of no small interest, since its deficiency can very generally be cheaply remedied, avoiding the use of more costly fertilizers."

Professor Hilgard has been unable to trace any connection of magnesia with any of the important qualities of soils, though its percentage is frequently double that of the lime.

"2. The *phosphoric acid* percentage is that which, in conneection with that of lime, seems to govern most commonly the productiveness of our virgin soils. In any of these, less than five hundreds (0·05) must be regarded as a serious deficiency. In sandy loam soils, one-tenth (0·100), when accompanied by a fair supply of lime, secures a fair productiveness for eight to fifteen years; with a deficiency of lime, twice that percentage will only serve for a similar time. The maximum percentage thus far found in an upland soil by my method of analysis, is about a quarter of one per cent. (0·250), in the splendid tableland soils of West Tennessee and Mississippi. In the best bottom ('buckshot') soil of the Mississippi, three-tenths (0·30). In that of a black prairie of Texas, 0·46 per cent. This being the highest figure that has come under my observation."

How the lime compounds contained in the soil act in rendering the phosphates more available Prof. Hilyard is at present unable to explain.

"3. The potash percentages of soils seem in a large number of cases, to vary with that of 'clay'; that is, in clay soils they are usually high, in sandy soils low; and since sub-soils are in all ordinary cases more clayey than surface soils, their potash percentage is almost invariably higher also."

"The potash-percentage of heavy clay upland soil and clay loams ranges from about 0.8 to 0.5 per cent., lighter loams from 0.45 to 0.30, sandy loams below 0.3, and sandy soils of great depth may fall below 0.100 consistently with good productiveness and durability; the former depending upon the amounts of lime and phosphoric acid with which it is associated. Virgin soils falling below 0.060 in their potash-percentage seem, in all cases that have come under my observation, to be deficient in available potash, its application to such soils being followed by an immediate great increase of production."

Since but few soils fall below this minimum, it is the Professor's opinion that potash manures are not among the first to be sought for after the soils have become "tired" by exhaustive culture.

4. Soda, he finds, varies mostly from one-eighth to one-third of the percentage of potash; he can trace no connection between its percentage and any important property of the soil, any more than in the case of *magnesia* and *manganese*.

"5. *Sulphuric acid* is found in very small quantities only, even in highly fertile soils. From two to four hundredths of one per cent. (0.02 to 0.04), seems to be an adequate supply, but it frequently rises to one-tenth (0.1) per cent., rarely higher."

6. *Chlorine*, on account of its "constant variability and universal presence in waters," was left undetermined.

7. "Iron, in the shape of ferric hydrate finely diffused, appears to be an important soil ingredient on account of its physical, and partly also its chemical properties. The universal preference given to red lands, by farmers, is sufficiently indicative of the results of experience in this respect, and I have taken pains to investigate its causes. The high absorptive power of ferric hydrate for gases is probably first among the benefits it confers. Red soils resist drought better than similar soils lacking the ferric hydrate."

The following analysis of the soil of the Experimental Field was made according to the method of Professor Hilgard :—

Moisture	2.941
Organic and volatile matter	10.494
Sand, silica and insoluble silicates	78.590
Phosphoric acid	0.039
Sulphuric acid	0.150
Oxide of iron and alumina	6.297
Lime	0 925
Magnesia	0.420
Potash	0.086
Soda	0.056
	100.000

The "mechanical" and "Physico-chemical" analysis of the soil of the Experimental Field, nearly completed last August, we shall complete and publish in a subsequent Report.

We would respectfully suggest through you, Sir, to the Honourable the Minister of Agriculture, our great need of an assistant in the department of Chemistry. The educational work of this department demands the full time and energy of one chemist. If analytical work is done for the Province, or the farmers of the Province, a proportionate neglect of the educational work must result, or the health of the chemist in charge suffer. The Agricultural Experimental Stations of the United States owe their great popularity to the analytical work that is done in them. The farmers of the different States that sustain these stations have, as they desire, analyses of soils, manures, food, etc., *made free of cost.* We are constantly receiving letters from Ontario farmers, in which like favours are asked of us, and are humiliated by not being able to grant them.

Your obedient servant,

R. B. HARE,

Professor of Chemistry and Lecturer on Geology and Meteorology.

PART III.

REPORT

OF THE

PROFESSOR OF BIOLOGY.

ONTARIO AGRICULTURAL COLLEGE,

December 31st, 1883.

To the President of the Ontario Agricultural College :

SIR,—I have the honour of presenting to you the second annual report of what has been accomplished in the department of Biology and Theoretical Horticulture in the Ontario Agricultural College. The late Professor Agassiz has remarked that "Agriculture is Biology applied," a fact which must be clear to any one considering the relations of the two sciences. The science of Agriculture is the study of the most suitable conditions for the growth and increase of economic plants and animals; the science of Biology is the study of life, and its relations to surrounding circumstances. By Biology we are taught, for instance, the nature of a plant's food, the mode of absorption of that food, the character of the tissues, or fruit, of the plant, as the case may be. Agriculture taking cognizance of these facts discovered by Biology, applies them; employs a certain manure rich in the proper nutritive substances, cultivates the ground, prunes the useless branches, etc., in order that the proper conditions for healthy absorption may be present, and makes use of those parts of the plant which Biological investigation has shown to be of economic value.

And so it is with the Zoological division. Physiology (a branch of Biology) teaches how foods are digested, and what foods are most suitable for the formation of any structure. Agriculture applies this knowledge in fattening live stock, and in rendering more abundant and suitable any particular product. By judicious food and proper environments, we should be able, by feeding an excess of certain fodders, to produce an extra amount of flesh, an extra amount of milk, or an extra amount of wool, as the case may be. And this, to a certain extent, we can do; but in this, as in many departments, we have not yet reached perfection, simply because our knowledge of the proper fodder and proper conditions for its transformation into the required substances is not perfect. Another important aid the study of Biology affords to Agriculturists, is the knowledge of the life-histories, and conditions of existence of the ecto- and endo-parasites which annually destroy so much of the agricultural produce of any country. A knowledge of the life-history of these pests is, of course, necessary, before we can discuss the best and most economical means of destroying them, and this the study of Biology furnishes. Much has been done by scientific investigators in this field. Entomologists, Helminthologists, and Fungologists, have all rendered, and are still rendering, efficient se vices to agriculture. Many of the most destructive and virulent diseases have been brought to nothing, or, at all events, greatly ameliorated, by the discovery by biologists of their œtiology. The researches of Pasteur *et alii* in France, have discovered to us a means of combating the deadly anthrax. Thomas, and independently at the same time, Leuckart, within the last year, have unveiled the mystery which has so long shrouded the "liver-rot" in sheep, and have given us data by which we can determine on prophylactic treatment.

These remarks have been called forth not so much by a desire to point out the value of the study of Biology, as to indicate certain lines in which the science may be applied with great advantage. This institution being an Experimental Farm, established not only with the object of giving intending agriculturists a scientific knowledge of their future profession, but also, as I take it, with the view of discovering facts in any department of study which may be of advantage to the farming community, ought to aid by all means in its power the carrying on of observations and experiments which have this end in view. Dr. Maxwell T. Masters, in a recently published work on *Life on the Farm*, remarks: "The special value to the cultivator of scientific knowledge will probably be found in the power it gives him of availing himself of new resources, and of adapting himself to altered conditions—no light matter in the present state of agriculture." It is the bounden duty of this College not only to give that scientific knowledge, but also to furnish the "new resources," whereby difficulties may be overcome, and advantages increased.

In certain departments it has been possible to fulfil both duties, but in the department I have the honour to represent, much has yet to be done before the "new resources" can be supplied in any adequate manner. During the past year I have endeavoured to carry on investigations in certain of the lines indicated above, but with only partial success. The science of Biology has now reached such a state of advancement that it is only with a thoroughly equipped laboratory, with proper instruments, and with ample literature, that one can expect to make satisfactory investigations. The Biological department of the Ontario Agricultural College has no specially appointed laboratory, no instruments, microscopes, etc., by which either instruction may be communicated to the students, or investigations carried on by the Professor, and the Biological literature, though certain valuable works have been added in the last two years, is very scant.

Perhaps, under these circumstances, I may be allowed to urge the immediate construction of the conservatories and attached laboratory, and the granting of permission to purchase two or three microscopes, at a moderate cost. The latter it is very necessary to have before I commence the lectures on Structural and Systematic Botany; since, if it were possible to show the students the actual stages, for instance, in the life-history of the "Rust" fungus, they would be enabled to retain the facts connected therewith much more perfectly than from merely hearing of them, reading about them, or seeing an imperfect representation of them by a diagram, and, in addition, greater interest could be awakened in the study of fungoid and other diseases, which would, perhaps, result in a more perfect knowledge of their origin, and of the means to be employed to eradicate and prevent them.

Lectures.

As regards the teaching work in the College, I have to report an increased attention manifested by the students, and an earnest desire to profit by the instruction offered them by the large majority. In the Biological lectures to the first year, I have to report a change in the programme. Hitherto it has been the custom to lecture on Zoology during both the fall and winter terms. This plan appeared to me unwise, for several reasons. In the first place, when it is considered that after the short course of instruction obtained in the first year, the immense majority of students pay no attention whatever to comparative morphology, and since, unless the subject is followed out, a course of lectures entering to any great extent into the details of the morphology of the less important forms, is of very little use, and consumes valuable time, which might be otherwise employed, it seemed that a course of lectures on Animal Physiology, dealing with the physiology of man and the domestic animals, and entering also into the subjects of Sanitary Science and Hygiene, would be of considerable value to young men, whose intention it was to become farmers in various parts of the country.

The first term I therefore devoted to a course of lectures on Animal Physiology, Sanitary Science, and Hygiene, for a more detailed account of which the circular must be consulted, and I had the gratification of finding the course greatly appreciated by all who had an opportunity of listening to it. The second term I employed for Comparative Anatomy and Zoology, condensing many of the relatively unimportant portions of the subject, and laying more stress on the subjects more related to agriculture, and and the allied sciences. By this change I accomplished two very important objects; the course was made more useful, from a practical point of view, and it was also made much more interesting.

During the first and second terms I also pursued a course of critical reading of English Classics, taking first, Scott's "Marmion," Canto. VI, and after Christmas Goldsmith's "Traveller." The spring term was taken up with a course on Structural and Physiological Botany. To the second year, during the winter term, I delivered a course of lectures on Economic Entomology, drawing especial attention to the insects which had manifested their presence to a more than usual extent during the previous summer, and illustrating the lectures as far as possible with specimens from our entomological collection. It is much to be regretted that so short a time is devoted to the study of this most important subject. It is impossible to treat it as it ought to be treated in a short course of lectures, and a course virtually devoid of any practical instruction. If the course could be given during the summer months, it would be a great improvement, for then the various insect forms could be studied in the fields, and benefits much more lasting and important would be derived from the study. It is all very well to inform the students that such and such a form makes its appearance in the imago state in such and such a month, and the larva so many days later, and that such and such remedies should be applied for the destruction of the imago, and others to the larva. He may by a systematic "cram" drive these facts into his head, only to forget them immediately examinations are over. Could he follow these stages during the summer months, and apply, or see applied, the remedies, and note their success, the fact would be indelibly impressed upon his mind, and in the future should he be obliged to use his knowledge to determine the nature of the pest, and the remedies to be applied, he would not be at a loss.

During the spring term I also delivered lectures to the second year on Systematic and Economic Botany, and Theoretical Horticulture. The former of these subjects I endeavoured, and with considerable success, to make practical. On several occasions we spent a couple of hours in the woods, examining the various plants, both cryptogamous and phanerogamous, then to be found, identifying typical examples, and so learning practically the general characters of important groups, and, in addition to this, by giving to each student one or two examples of a plant previously collected, and requiring a detailed account of its structure, and an identification of it, to be handed into me at the next lecture, I made the course as practical as was possible under the circumstances.

The economic portion of the course unfortunately could not be dealt with in a similar manner. Owing to the want of space in, and the imperfection of our present conservatories, it has been impossible to cultivate examples of many plants of great economic importance, and I have been obliged to content myself with a mere verbal description of them, except in cases of indigenous forms, when, as a rule, a dried specimen could be shown. The Horticultural lectures were of the same nature as last year, an exposition of the physiological grounds for various operations, and the conditions best suited for successful fruit growing, descriptions of the various operations, etc., being to a large extent neglected since the students receive instructions in these points from our very efficient Superintendent of the Horticultural Department.

SPECIAL WORK.

(A) Black Knot.

In last year's report I took occasion to present an account of the life-history of the fungus of Black Knot as far as known. As a result, I have received several letters from different parts of the country upon various points in connection with the subject, and having had my attention drawn to one or two facts not enumerated in last year's report, it may be well to mention them here.

The Black Knot this year has affected to a very large extent the Cherry trees throughout the country, in many districts to an alarming extent. Knots have been sent to me from different localities for examination; all presented the same characters. They were similar in all general features to the knots of the plum which I had previously examined, but this difference was to be noticed :—The knot in every instance was found to be traversed by a channel varying somewhat in size, some knots containing two or three. In these channels were to be found small larvæ about half an inch long, flesh-coloured, with brown, rather hard, heads, footless, but provided with locomotive bristles. (See plate fig. 8.) These I recognized to be larvæ of the plum weevil, *Conotrachelus nenuphar*, (Herbst).

Here is a fact then of no little importance, and yet, strange to say, in more recent Entomological works no notice whatever is taken of it, although the fact of insects inhabiting these warts has been known for a very considerable length of time.. In July, 1818, Professor W. D. Peck obtained from warty excrescences of the cherry tree the same insect he "had long known to occasion the fall of peaches, apricots, and plums, before they had acquired half their growth;" and, not aware that this species had received a scientific name, he called it *Rynchænus Cerasi*, the cherry weevil. On studying this larva Professor Peck found that, leaving the wart after a time, it descended to the ground, where it pupated, and twenty-four days after, the adult insect appeared. This is a description of the very form under consideration, it having previously been named *Curculio nenuphar* by Herbst, and later *Conotrachelus* by Dejean. Harris in his "Insects Injurious to Vegetation," thus speaks of the inhabitants of the knot: "Insects are often found in the warts of the plum-tree, as well as those of the cherry-tree. The larvæ of a minute Cynips, or gall-fly, are said to inhabit them, but have never fallen under my observation. The naked caterpillars of a minute moth are very common in the warts of the plum-tree, in which also are sometimes found other insects, among them little grubs, from which genuine plum-weevils have been raised. This is a very interesting fact in the economy of the plum-weevil. It may be questioned, however, whether it be a mere mistake of instinct that leads the curculio to lay its eggs in the warts of the plum tree, or a special provision of a wise Providence to secure thereby a succession of the species in fruitful seasons."

It has been supposed by some that the insect was the cause of the wart, but even old writers, such as Harris, Burnett, and others, to whom the real fungoid character of the disease was not a certainty, unite in considering the larva of *Conotrachelus nenuphar*, merely a temporary occupant of the knot, and not its cause. There can be no doubt now that such is really the case. The fact of the knot frequently occurring without any contained weevils, the general characters of the Sphæriaceous group of fungi, and the special investigations that have been carried on in the Black Knot, all prove its fungoid nature.

This being the case, are we to consider the presence of the larvæ in the interior of the wart as the result of a "mere mistake of instinct," or a manifestation of a high degree of instinct, or perhaps reason? The latter hypothesis seems the more probable. The parent weevils have discovered that the larvæ will thrive probably as well in the knot as in the plum, and in default of the latter, have made use of this knowledge. In the previous report I showed that the growth of the wart was due to an increased growth of the bast cells of the plum or cherry, i.e., of the cells through which the sap ascends or descends the tree. This explains how the larvæ can exist in such a spot. Well can they do so, for they are in a situation to obtain a large quantity, and an oft renewed supply, of light nutritive food.

The great prevalence of this peculiarity renders, to a certain extent, the remedies usually adopted for the plum-weevil of none effect. These remedies are (1), jarring the tree whilst the beetles are flying and ovopositing in the young plums, so that they will drop into a receptacle placed at the foot of the tree; (2) collecting and destroying all half formed plums which have fallen to the ground. Now, it is evident that if the larvæ can thrive in the knots on the cherry trees, and the beetles will ovoposit there, our remedies, being applied altogether to the plum-trees, will be useless. This is a further reason for the extermination of the Black Knot. Not only does it enfeeble and render unfruitful the trees which it has attacked, but it may also be a harbour for other pests, quite troublesome enough under ordinary circumstances. It behooves all fruit growers whose trees are in the slightest degree affected with Black Knot to *cut it out and burn it*; by not doing so they render themselves culpable, injuring not only themselves, but their neighbours.

Horticulturists throughout the country do not appear to recognize the importance of the remedial measures. I have seen young trees literally almost covered with knot, and forming most unsightly objects, capable of inoculating the trees over the whole country. The law for the protection of plum and cherry trees (Statutes of Ontario, 42 Vic., Chap. 33) is almost a dead-letter. Little or no importance seems to be paid to it. This is owing to the fact that it is nobody's duty to enforce it. The third section of the act permits the appointment by any Municipal Corporation, of an officer or inspector for the enforcement of the law, "and if no such officer or inspector be appointed, it shall be the duty of the overseer of highways, upon request of any person interested, to give the notice mentioned in section one." The municipal corporations do not seem to have considered it advisable or worth while to appoint an inspector, and interested parties, probably partly from a dislike to call down the majesty of the law upon their neighbours, and partly from ignorance of the great importance of the complete eradication of the pest, have not requested the inspector of highways to interfere, and since this functionary is only authorized by law to take action in the matter when requested to do so, affairs have been allowed to go on as they please, the knot has spread more and more every year, and has now become a most important and serious trouble. The remedy for this—it is important that a remedy should be applied—is either to compel the municipalities to appoint inspectors to see the law enforced, or else to make it the duty of the inspector of highways to compel horticulturists to extirpate the disease. For this purpose powers similar to those bestowed upon that official for the destruction of Canada thistles should be granted. This latter plan would probably answer more or less satisfactorily, but the former would be still more effective. In fact, it would be of very great benefit to the country were the Government, following the example of the state of California, to pass an act for the protection of crops of all kinds from pests, whether insect or fungoid, appointing inspectors for each county or district, whose sole duty it would be to see that proper remedies were put in force for the destruction of any pest, acting on the authority and advice of a board composed of individuals capable of recognizing the importance of the evil, and of recommending efficient remedies. In this way, and this only, we might expect immunity, not only from black knot, Canada thistles, "yellows" of peaches, which are now supposed to be dealt with by Act of Parliament, but likewise in the course of time from such pests as the "Hessian fly," the midge, phylloxera, and many others, which will immediately suggest themselves.

New pests also, which make their appearance from time to time, might thus be combated. Here I may call attention to a weed which has within the last few years made its appearance here, and now threatens to become somewhat of a pest, as it is already in certain parts of the States. The plant I allude to is variously known as "Devil's weed," "Viper's Bugloss," "Blue weed," (*Echium vulgare, L*). Imported to this continent orginally from Europe, and into Canada either directly from Europe or from the States, it has rapidly become naturalized and has spread with almost amazing rapidity. Introduced here within the last six or seven years, it now forms a common feature of our road-side flora, and is spreading rapidly over uncultivated land, and even making its appearance in cultivated fields near the road-sides, vying with the Canada Thistle with considerable success. The plant is a foot and a half or two feet high, with elongated bunches of flowers at the extremities of the branches, the flowers being of a deep purplish blue color, shading off in places into violet or purplish red. The seeds are produced in very large numbers, the plant flowering during the greater part of the summer, one flower being succeeded by another in rapid succession. It is a well known fact that when animals and plants imported into a new country become naturalized, they rapidly increase, and in many instances become exceedingly annoying, finding the conditions for existence in the new country even more favourable than in the old. So it was with the rabbits imported into Australia, so it is with the sparrows in this and other countries. In Virginia this "Blue weed" has invaded cultivated fields and is quite as great a nuisance as our thistles, and from the manner in which the plant is spreading in this locality, there is a great probability of its proving as great an annoyance, unless means are adopted for its destruction.

(B) The Tape-worm Epizootic.

Interesting and important as the study of parasites is at all times, it becomes doubly so when one is brought face to face with their destructive powers. Of these the past spring gave us indubitable examples. Our lambs were attacked in large numbers by a species of tape-worm, which in many cases was so numerous in the intestines as to cause death. Into the diagnosis, pathology and medicinal treatment it is not my province to enter. These subjects will no doubt be treated of by the Professor of Veterinary Science in his report. The origin of the disease and the cause of its spread belongs, however, to the department of Biology, since these are points which can only be understood when one is acquainted with the mode of life exhibited by the tape-worms. Before going into these subjects it will be necessary, in order that they may be understood, to give an account of the structure of this form, and of the life-history of another, in which this is known, for, unfortunately, we do not as yet know the changes undergone by the worm under consideration, but can only imagine their general feature from analogy with what occurs in all forms in which they are known. And first of all as to the structure.

The worm which thus affected the lambs is known to science as *Tænia expansa, Rud.* The mature worm measures sometimes as much as fifteen feet, but the average is very much less than this, being perhaps about a foot, some individuals measuring not more than two inches, and measuring in breadth from the thickness of a pin at the head (Fig. 4, a) to a quarter of an inch or more, according to the length (Fig. 4, d). It is flat and thin, and presents, especially towards the posterior region, a segmented appearance, due to the fact that the worm is really segmented into a series of joints, each of which correspond to a distinct animal formed by budding from the original head, just as the various individuals of a "sea-fir" or "sea-mat" bud off from a parent form, and so produce a colony. These are all the points to be noted in a naked-eye examination, and it is necessary to resort to the miscroscope for further particulars as to the organization. Takin~ the anterior region then, (Fig. 6) we find that there is a well-marked dilated portion forming the extremity and corresponding to the head of the worm, and on this are to be seen four circular depressions, (Fig. 6, s) two on one side and two on the other, surrounded with muscular tissue. These are the suckers by which the worm retains its hold upon the intestine of its host. Many forms, in addition, possess an anterior projection furnished with several hook-like spicules, which aid in fixing the parasite. These, however, are absent in *Tænia expansa* and some other forms, which are therefore said to belong to the "unarmed" group.

Passing posteriorly we come to the upper portion of the body, which cannot be described in this form, as in many others, as being separated from the head by a distinct neck. At the anterior portion of this no traces of segmentation can be seen, but a clear line can be seen running down each side—the water-vascular tubes, (Fig. 6, v) as they are termed, probably excretory in their functions. A little further back the budding commences, (Fig. 4, b) indicated by a transverse striation, the segments not being separated off. Still further back, (Fig. 4, c) however, they become formed, and the first traces of the generative organs make their appearance, but do not become fully mature until we reach the segments near the posterior extremity. Here (Fig. 4, d, and 5) by a careful examination we can see that each segment is furnished with two pairs of reproductive organs, a male and female organ on either side, and that corresponding with each pair there is a genital pore on either side, (Fig. 7, g a) consisting of a hollow with a thickened wall, at the bottom of which the reproductive organs open, and which is capable of being extended out so as to form a protrusion upon the side of the segment. This is an important feature, since in the majority of *Tæniæ* each segment contains only a single pair of organs, a male and a female, and possesses only a single generative pore, found now on one side of the segment, now on the other. The mature segments in *Tænia expansa* are rectangular, always broader than long, measuring from six to twenty-four two-hundred and fiftieths of an inch ($\frac{6}{250}$-$\frac{24}{250}$),—the latter size being rarely found even in very old and long examples—in breadth, and from one to three two-hundred and fiftieths of an inch in length ($\frac{1}{250}$-$\frac{3}{250}$). These mature posterior segments will also be seen to contain many eggs scattered irregularly throughout the segment, round in shape, and measuring from $\frac{1}{6250}$ to $\frac{1}{5000}$ of an inch.

It will perhaps be as well to insert here a few remarks of a more technical nature upon the structure and measurements of the *T. expansa*. The segments appear to vary somewhat in thickness. In the example pourtrayed in Fig. 4, in which the posterior segments were not quite mature, they measured on an average about 1.84 mm., the breadth being about 3 mm. In the form represented by Fig. 5, however, in which the posterior segments were mature, they were very much broader in comparison to the length (by the length I mean the antero-posterior measurement). They measured 9.2 mm. in length, and 6 mm. in breadth, so that not only is the relative proportion between the length and breadth different, but the actual breadth is only one half. Another point in regard to the segments was very noticeable. In several instances what may be termed a malformation of the segments occur, of which examples are shown in Fig. 4 c and in Fig. 5. This consists in the development of the segment only on one side, it tapering away and being undeveloped on the other.

Two sets of generative organs exist in each segment. The complete morphology of these organs I have not yet had opportunity to study; but from what I have been able to observe the following points may be stated: The genital opening (one on either side of each segment, with the occasional exceptions mentioned above) is surrounded by a comparatively thick muscular ring, measuring .192–.24 mm. From this a deep "cirrusbeutel" passes inwards, in which lies the cirrus (Fig. 7 p) slightly protruding from the opening. At the base of the "cirrusbeutel" the vagina opens. The vas deferens (vd) passes almost directly inwards to the testis (t), a granular clump which stains very deeply. The vagina is directed at first downwards, and then passes upwards to the neighbourhood of the testis. The uterus seems somewhat discrete; the ova lying scattered somewhat irregularly throughout the segment, measure about 52 mm.

So much then for the structure; now for a few facts in regard to the physiology of the *Tænia*. Fastened to the wall of the intestine, and streaming back along it, the tape-worm lies surrounded with nutritive fluid. The tissues of the body being soft, nutrition can penetrate them, and no stomach or intestine is required, and accordingly no trace of them is found in tape-worms. The nervous system is of a comparatively low grade of organization, as is usual in parasites. When the ova in the posterior segment become properly ripe, that segment drops off, is passed to the exterior with the fæces, and lies upon the ground. In the course of time, by the decay of the tissues of the segment, the eggs (Fig. 7 Ov.) are set free. They being enclosed in a hard shell will not suffer from the putrefactive changes going on around them, and if supplied with a sufficient amount of moisture and warmth will develope. The segment which now forms the posterior extremity of the worm, in its turn becomes ripe and drops off, new ones being formed over the anterior extremity of the body, behind the head, so that there is a constant succession of segments as long as the head remains alive. This accounts for the difficulty usually experienced in getting rid of tape-worms, since unless the head can be got away or destroyed, budding will go on as usual, and the trouble remains as bad as before treatment.

The *Tœnia expansa* occurs usually in the intestine of our domestic sheep and goats, less frequently in cattle. Especially often is it present in numbers in lambs, then causing the so-called tape-worm plague (Bandwurmseuche).

For a description of the plan of developement of the tape-worms, we are obliged to leave *Tœnia expansa*, since its life-history is not yet known. The general plan of development, which characterizes more or less closely all forms yet examined, is as follows.

The egg, developing under the influence of a certain amount of heat and *moisture*, hatches out as a minute ciliated embryo. This swims about in the water for a while, a very small quantity of water being sufficient for this purpose, and in the interior a second skin developes, unciliated, provided with six hooks. The ciliated larva having gained entrance into the intestine of some animal (as a rule a different animal than the adult worm inhabits, the tape-worm of man, for instance, occurring first in the pig), the ciliated covering is thrown off, and the six-hooked unciliated embryo (Fig. 2) bores through the intestinal walls and becomes encysted in some part of the body—the liver, muscles, connective tissue, lungs, or even the brain. Here the solid embryo becomes hollow or filled with fluid, and the hooks disappear, what is known as the "cystic" or "bladder-worm" resulting from these changes. The next change is the development of the head of the future tape-worm. This is formed by an involution on the inner surface of the cystic worm, on which the suckers and hooks, if they be present, eventually arise, but are at this time situated on the inner surface of the involution, the future head being just now in reality turned outside in. The larva, when these changes have been consummated, is known as the *Cysticercus* (Fig. 1). In many forms the ciliated stage is passed over, the worm leaving the egg as the six-hooked embryo; in this case the embryo is swallowed by the intermediate host unwittingly and developes into the cystic stage. Moisture, however, is still necessary for the development of the egg. This mode probably obtains in *T. expansa*.

Development now comes to a standstill until the animal infected by the cysticercus is eaten by some other form, *i. e.*, by the one in which the mature worm is found, usually a vertebrate. Then the cyst around the cysticercus becomes dissolved, and the cysticercus set free, whereupon it immediately causes the head to turn inside out, and fasten to the wall of the intestine. We have now the commencement of the adult worm; the head fully formed, succeeded by a larger or smaller sac (Fig. 3). This stage is known as the *Scolex*. Segmentation now commences, and we very soon obtain the sexually mature form, by which the eggs were formed.

It will be seen from these facts that certain requisites are necessary before the embyro can come to maturity. (1) The eggs must be supplied with moisture; (2) the six-hooked larva must become encysted in the body of some intermediate form; (3) this intermediate form must be devoured by the animal in which the mature worm occurs. The second of the above conditions has some apparent exceptions, but they are very few. Mègnin ("Comptes Rendus," XCVI, 1883) has given an instance in which examples of *T. serrata* in the intestine of a dog must have been derived by direct reproduction from ova set free by larger forms.

It will now be readily perceived that the discovery of the intermediate host would be very important, for once it is known, prophylactic treatment might be easily adopted. However, going further back, the moisture is evidently an important factor in causing the spread of tape-worms; for without it the ova will not develope. The great amount of wet weather we experienced last spring, and the pasturing of the sheep during it, was probably one of the great causes of the origin of the epizootic. Although not widely spread over the country, by inquiry I learned of two or three other instances of it, and in all, the sheep had been on the pasture during the wet weather; and further, in both of the cases where I had an opportunity to make an examination of the pasture, I found that in some parts of it there were depressions filled with water, the ground for some distance around being soft. Dr. Zürn, extraordinary professor of Veterinary Science in the University of Leipsic, in his work on animal parasites, makes a somewhat similar statement. He says:—"The affection indeed occurs in sheep which have fed idly in stalls, but more usually in the younger or youngest animals of a flock which has been put out to pasture. There is no doubt that the first stages of the parasite are usually received by the sheep upon the pasture. A wet year; wet, moist, boggy, meadow pastures, wet sandy soils, are favourable to the development of the tape-worm. When the disease occurs in sucking-lambs, it must either be received during the time which they are still within the mother—the tape-worm coming from the mother, or received with the mother's milk, as has been supposed. When, however, young tender lambs on the pasture take a draught of water here and there (and the eggs of *T. expansa* appear only to be able to develope in water and damp earth), then in that case a direct infection is possible."

The intermediate host. On the first intimation of the presence of the trouble I made a careful search on the pastures over which the sheep had been running for any forms which might be likely to contain the encysted stage, and which were sufficiently numerous to excite suspicion. The only forms I found in any numbers, in any of the fields, was the ordinary slug. This, had the question been of a Trematode or the final host a bird, would have awakened suspicion, but not so when a Cestode and a mammal were concerned, nevertheless I gathered many, made a careful dissection of them, but my search was fruitless. I may state here that the facilities I possess for work of this kind are exceedingly small, having, as has been already mentioned, no laboratory, and little literature from which to obtain assistance, and these facts have militated very strongly against, and in fact prevented any prosecution of, the suggestions to be presentd hereafter on this subject.

The pastures being, to all intents and purposes, destitute of any forms that were to be suspected, my attentions were directed elsewhere. After various false starts, I at length struck upon what I now consider to be the desired animal, but unfortunately was unable to verify my idea by direct proof, my opinion being based mainly on *a priori* reasons. The form which I believe to contain the encysted stage of *T. expansa* is the sheep tick (*Melophagus ovinus*,) Linn.

My reasons for believing the Tick to be the offending form are as follows:—

1. As we learn from the extract above quoted from Zürn, the tape-worm occurs in sucking lambs. The theories he there puts forward to explain this fact are improbable, to say the least. It is quite possible, and even probable, that the lambs, in sucking, may swallow some of the ticks, since it is well known that balls of wool are frequently found in their stomachs, which wool has been pulled from the mother. Ticks might readily be taken in along with this wool, or even sucked off a teat in the ordinary course of events. I see no other way in which sucking lambs can obtain the worm.

2. After a careful examination of the pastures at the farm, and at other localities in which the disease had broken out, I could find no animal uniformly present, or in sufficient numbers to justify its being considered the intermediate host, with the exception of the Ticks. These were present, in both instances in large numbers.

3. The life history of *T. cucumerina*, Bloch, has been discovered. This form which inhabits the intestine of the dog, belongs structurally to to the same group as *T. expansa* and there are good grounds for supposing that associated with the similarities of structure are similarities of development. According to Leuckart and Melnikoff the cysticercoid stage of *T. cucumerina* occurs in the dog-louse (*Trichodectes canis*, DeGeer.). The cysticercoids of the meal-worm are probably also the young stage of certain worms occurring in mice and rats. The supposition as to the host of the cysticercoid of *T. expansa* is quite in analogy with these facts.

It is not difficult to imagine how the embryo could make its way into the ticks. The sheep congregate together in certain parts of the pasture, and there the ova of the tape-worm will be deposited by older infected sheep along with the excrement. In the wet weather they would develope, the six-hooked embryos hatch, and would readily get among the sheep's wool when it was lying down, and so be liable to be swallowed by a tick.

Prophylactic treatment. Whether this theory proves correct or not on further research, the fact remains that the ticks are dangerous, and no harm and possibly much good will result from their destruction when a flock is known to be in danger of infection. In addition to this the sheep should be kept housed in wet weather, and the dung collected and burnt as soon after it is cast as possible. By these plans, the eggs will be prevented from developing, and if medical treatment be bestowed upon the older infected sheep the disease will soon be eradicated.

Interesting experiments have been made by Schwalenberg on the efficiency of various medicines in expelling the tape-worm from sheep, and perhaps I may be pardoned for exceeding my limits to give a short account of them. He tried the effect of the following substances:—Persian insect powder, Petroleum, Chabert's oil, Kamala, Kousso, and Koussin. The three last named, proved most successful.

I. Experiment. A drachm of Kamala was given to each lamb. On the following morning the animals were very sick and had no appetite; the body temperature was lowered, the skin pale, and the body thin; after forty-eight hours, profuse diarrhœa occurred, and tape-worms were passed, the lambs recovered very slowly, and remained thin for a long time, in spite of good care. This remedy seems to act on the tape-worms quite satisfactorily, but its constitutional effects preclude its use under ordinary circumstances.

II. Experiment. Two drachms (7½ grains) Kousso, per lamb, showed good result. Koussin (also called Tæniin or Brayerin, a rosin from the flowers of *Brayera anthelminthica*, which is crystalline and colourless, with acid reaction, and acts very powerfully on parasites,) acted still more successfully; 2 grains or 12 centigrs. were given to each lamb in decoction of wormwood, the tape-worms were almost instantly expelled, the animals under treatment remained well, with good appetite, and continued well subsequently.

As to the original source of the worms, it is probable that more or fewer of the older sheep are always infected, and that in ordinary weather the spread of the infection does not proceed rapidly, nor are sufficient worms developed to render the infection noticeable. In exceptional weather such as we experienced last spring, in which a constant succession of rainy days prevailed for some time, the conditions are particularly favourable for the development of the ova, and for the metamorphoses, so that large numbers of lambs become infected and that too, severely: under these circumstances the epizootic becomes evident. The tape-worm disease then may be said to be *endemic*, and under certain circumstances may become *epidemic*.

Explanation of Plate.

Fig. 1. Encysted or Cysticercus stage of *Tænia*. *a*, head. *b*, envelope. *c*, remains of the six embryonic hooks (From Gegenbaur after von Siebold.)

Fig. 2. Six-hooked embryo (after Huxley.)

Fig. 3. Same *Tænia* as fig. 1 in which the head has been protruded. Lettering as in fig. 1. (from Gegenbaur after von Siebold,)

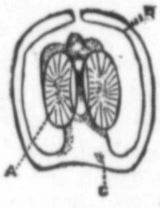
Fig. 4. Portions of a *Tænia expansa* not quite mature, natural size. *a*, head. *b*, commencement of segmentation. *c*, first distinct appearance of genital organs. *d*, terminal portion.

Fig. 5. Posterior segments of mature *Tænia expansa*, mature natural size.

Fig. 6. Head of *Tænia expansa* highly magnified *s*, sucker. *v*, excretory vessels.

Fig. 7. Portion of segment from same form as fig. 5, highly magnified. *t*, testis. *v. d.*, vas deference. *v*, longitudinal excretory vessel. *p*, cirrus. *ga*, genital pore, *ov.*, ova. *va.*, vagina.

Fig. 8. Larva of *Conotrachelus nenuphar* the plum curculio, (slightly modified from figure in Packard's Guide.)



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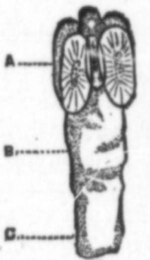

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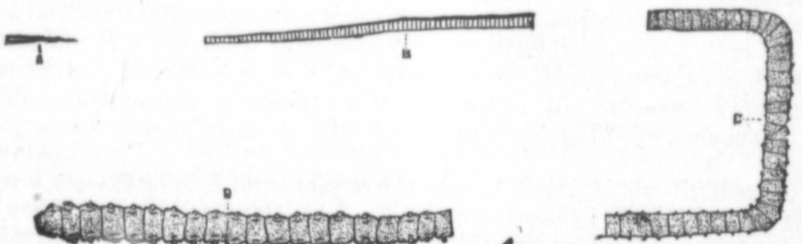

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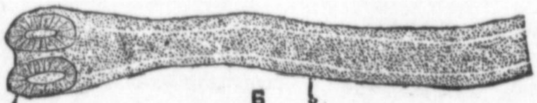

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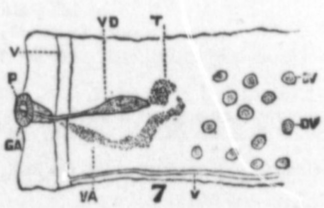

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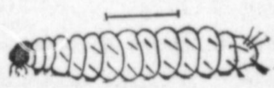
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(c) The Japanese Herbarium.

The collection of Japanese plants which has been added to the Botanical section of our Museum since the publication of the report for 1882, merits a somewhat detailed notice, as illustrating the similarities, as far as the larger groups are concerned, which exist between the floras of countries so widely separated as Canada and Japan.

To the scientific Botanists of Canada, a list of the genera and species in the collection may not come amiss, and to Horticulturists, and others, such a list will indicate how much we are indebted to Japan for choice exotics.

The collection was made, and the genera and species were identified by a Japanese Botanist, and, although the most difficult portion of the work of classifying and arranging was thus already accomplished, still no little labour remained in arranging the various genera in their proper sequence, and referring them to their proper orders, since many are unfamiliar to a Canadian Botanist, and the literature on the flora of Japan not easily attainable. I must here record my thanks to Mr. H. B. Spotton, M.A., F.L.S., for the valuable assistance he afforded me in this work, his extensive knowledge of Botany coming to my aid in cases in which, for want of works of reference, I was unable to proceed.

The general classification I have followed is that of Prof. A. de Jussieu, as given in Le Maout and Decaisne's valuable work, edited and amended by Sir J. D. Hooker. The principal points in which I have deviated from this arrangement are in the elevating the sub-classes Angiospermæ and Gymnospermæ to the dignity of classes, and similarly degrading the classes Dicotyledones and Monocotyledones. The reasons for this change are well known to all Botanists familiar with the modern researches on the development and the homologies of the reproductive processes in the various groups of the Vegetable Kingdom. For simplicity, I have omitted to give tribes, sub-orders, etc., and similarly have arranged the genera of each order, and the species of each genus alphabetically.

PHANEROGAMIA.

I. Sub-kingdom.—*Class I*, Angiospermæ.—*Sub-class I*, Dicotyledones.—*Division I*, Polypetala.—*Series I*, Thalamifloræ.

Cohort I.—Ranales.

I. Order—*Ranunculaceæ.*

Aconitum—
(1) Fischeri (Reich).

Anemone—
(2) cernua (Thb.).
(3) flaccida (Schm.).
(4) Japonica (S. et Z.).
(5) Nikoensis (Max.).

Aquilegia—
(6) glandulosa (Fisch.).

Clematis—
(7) paniculata (Thb.).
(8) patens (Morr. et Decne.).
(9) stans (S. et Z.).

Coptis—
(10) brachypetala (S. et Z.) *var.* major (Miq.).

Pæonia—
(11) albiflora (Pall.).

Ranunculus—
(12) acris (L.).
(13) sceleratus (L.).
(14) ternatus (Thb.).
(15) zuccarinii (Miq.).

Thalictrum—
(16) minus (L.).

II. Order—*Calycantheæ.*

Chimonanthus—
(17) fragrans (Lindl.).

III. Order—*Magnoliaceæ.*

Illicium—
(18) anisatum (L.).

Magnolia—
(19) compressa (Max.).
(20) conspicua (Salisb.).
(21) hypoleuca (S. et Z.).
(22) kobus (D. C.).
(23) obovata (Thb.).
(24) stellata (Max.).

IV. Order—*Menispermeæ.*

Cocculus—
(25) Thunbergii (D. C.).

V. Order—*Berberidaceæ.*

Aceranthus—
(26) sagittatus (S. et Z.).

Berberis—
(27) Chinensis (Desf.).
(28) Japonica (Roxb.).
(29) vulgaris (L.).

Epimedium—
(30) macranthum (Morr. et Decne).

Nandina—
(31) domestica (Thb.).

VI. Order—*Lardizabaleæ.*

Akebia—
(32) quinata (Decais.).

Stauntonia—
(33) hexaphylla (Decne.).

VII. Order—*Nymphæineæ.*

Brasenia—
(34) peltatum (Pursh.).

Nuphar—
(35) Japonicum (D. C.).

COHORT II.—PARIETALES.

VIII. Order—*Papaveraceæ.*

Chelidonium—
(3 majus (Mill.).

Macleya—
(37) cordata (R. Br.).

Stylophorum—
(38) Japonicum (Miq.).

IX. Order—*Fumariaceæ.*

Corydalis—
(39) decumbens (Pers.).
(40) incisa (Pers.).
(41) Wilfordi (Regel.), *var.* japonica (Fr.) et Sav.).

Dicentra—
(42) spectabilis (Miq.).

X. Order—*Cruciferæ.*

Arabis—
(43) saggittata (D. C.).

Capsella—
(44) bursa-pastoris (Mœnch.).

Cardamine—
(45) sylvatica (Leb.).

Draba—
(46) nemoralis (L.)

Entrema—
(47) Wasabi (Max.).

Nasturtium—
(48) montanum (Wall.).
(49) palustre (D. C.).

Thlaspi—
(50) arvense (L.).

XI. Order—*Violarieæ.*

Viola—
(51) grypocerus (Gray).
(52) Japonica (Langs.).
(53) longepedunculata ? (Torr. et Sav.).
(54) Patrinii (D. C.).
(55) verecunda (Gray).

COHORT III.—POLYGALALES.

XII. Order—*Pittosporeæ.*

Pittosporum—
(56) Tobira (Ait.).

XIII. Order—*Polygaleæ.*

Polygala—
(57) Japonica (Houtt.).

COHORT IV.—CARYOPHYLLALES.

XIV. Order—*Caryophylleæ.*

Arenaria—
(58) leptodados (Guess.).

Cerastium—
(59) vulgatum (L.), *var.* glandulosum (Koch).

Dianthus—
(60) superbus (L.).

Lychnis—
(61) grandiflora (Jacq.).

Mollugo—
(62) stricta (L.), *var.* latifolia.

Saponaria—
(63) vaccaria (L.).

Silene—
(64) gallica (L.), *var.* quinquevulnera (L.).

Stellaria—
(65) media (Vill.).
(66) neglecta (Weihe).
(67) nemorum (L.) *var.* Japonica (Fr. et Sav.).
(68) uliginosa (Mum.).

COHORT V.—GUTTIFERALES.

XV. Order—*Hypericineæ.*

Hypericum—
(69) ascyron (L.).
(70) erectum (Thb.).
(71) patulum (Thb.).
(72) salicifolium (S. et Z.).

XVI. Order.—*Camelliaceæ.*

Actinidia—
(73) volubilis (Planch).

Camellia—
(74) japonica (L.).

Eurya—
(75) japonica (Thb.).

Stuartia—
(76) monadelpha (S. et Z.).

Ternstrœmia—
(77) japonica (Thb.).

COHORT VI.—MALVALES.

XVII. Order—*Tiliaceæ.*

Corchoropsis—
(78) crenata (S. and Z.).

Tilia—
(79) mandshurica.

SERIES II.—DISCIFLORÆ.

COHORT VII.—GERANIALES.

XVIII. Order—*Oxalideæ.*

Oxalis—
(80) corniculata (L.).

XIX. Order—*Coriarieæ.*

Coriaria.
(81) Japonica (Gray).

XX. Order—*Zygophylleæ.*

Tribulus—
(82) terrestris (L.).

XXI. Order—*Balsamineæ.*

Impatiens—
(83) Texteri (Miq.).

XXII. Order—*Zanthoxyleæ.*

Evodia—
(84) glauca (Miq.).
(85) rutæcarpa (Benth. and Hook.)

Picrasma—
(86) ailanthoides (Planch.).

Zanthoxylon—
(87) piperitum (D.C.).
(88) schinnifolium (S. et Z.).

COHORT VIII.—OLACALES.

XXIII. Order—*Ilicineæ.*

Ilex—
(89) crenata (Thb.).
(90) integra (Thb.).
(91) pedunculosa (Miq.).
(92) Sieboldi (Miq.).

COHORT IX.—CELASTRALES.

XXIV. Order—*Celastrineæ.*

Celastrus—
(93) articulatus (Thb.).
Euonymus—
(94) Japonicus (Thb.).
(95) radicans (Sieb.).
(96) Sieboldianus (Bl.).

XXV. Order—*Staphylaceæ.*

Euscaphus—
(97) staphyleoides (S. et Z.).

Staphylea—
(98) bumalda (S. et Z.).

XXVI. Order—*Rhamneæ.*

Berchemia—
(99) racemosa (S. et Z.).

Hovenia—
(100) dulcis (Thb.).

Zizyphus—
101 vulgaris (Lam.).

XXVII. Order—*Ampelideæ.*

Vitis—
(102) heterophylla (Thb.).
(103) Labrusca (L.).
(104) pentaphylla (Thb.)

COHORT X.—SAPINDALES.

XXVIII. Order.—*Sapindaceæ.*

Sapindus—
(105) Mukurosi (Gaertn.)

XXIX Order—*Acerineæ.*

Acer—
(106) cissifolium. (S. et Z.).
(107) Japonicum (Thb.).
(108) palmatum (Thb.).
(109) trifidum (Thb.).

XXX. Order—*Terebinthaceæ.*

Rhus—
(110) succedanea (L.).
(111) vernicifera (D.C.).

SERIES III.—CALYCIFLORÆ.

COHORT XI.—ROSALES.

XXXI Order—*Leguminosæ.*

Albizzia—
(112) Julibrissin (Boiv.).

Amphicarpæa—
(113) Edgeworthii (Benth.), *var.* Japonica (Ol.).

Astragalus—
(114) lotoides (Lam.).

Atylosia—
(115) subrhombea (Miq.).

Cæsalpinia—
(116) Japonica (S. et Z.).

Caragana—
(117) Chamlagri (Diet.).

Cercis—
(118) Chinensis (Bunge).

Cladrastis—
(119) amurensis (Benth), *var.* floribunda (Max.).

Desmodium—
(120) Japonicum (Miq.).

Gleditschia—
(121) Japonica (Miq.).

Glycine—
(122) Soja (S. et Z.).

Indigofera—
(123) decora (Lindl.).
(124) tinctoria (L.).

Lathyrus—
(125) Davidii (Hance.).
(126) maritimus (Biq.).
(127) palustris (L) *var.* lin earifolius (Ser.).

Lespedeza—
(128) Juncea (Pers.).
(129) pilosa (S. et Z.)

Lotus.
(130) corniculatus (L.).

Medicago—
(131) denticulata (Willd.).
(132) Lupulina (L.).

Rhynchosia—
(133) volubilis (Lour)

Sophora—
(134) angustifolia (S. et Z.).
(135) Japonica (L.).

Thermopsis—
(136) fabacea (D. C.).

Trifolium—
(137) lupinaster (L.).
(138) repens (L.).

Vicia—
(139) angustifolia (Roth.).
(140) cracca (L.). *var.* Japonica (Miq.).
(141) hirsuta (Koch.).
(142) tetrasperma (Mœnch.).
(143) unijuga (Al. Braun).

Wistaria—
(144) Chinensis (S. et Z.).

XXXII. Order—*Rosaceæ.*

Agrimonia—
(145) viridula (Bunge.), *var.* Japonica (Miq.).

Amelanchier—
(146) Canadensis (Torr. et Gray), *var.* Japonica (Miq.).

Cratægus—
(147) cuneata (S et Z.).
(148) sanguinea (Pall.).

Fragaria—
(149) indica (Andr.).

Geum—
(150) Japonicum (Thb.).

Kerria—
(151) Japonica (D. C.).

Photinia—
(152) glabra (Thb.).
(153) Japonica (Thb.).
(154) villosa (D. C.).

Potentilla—
(155) fragarioides (L.).
(156) fragarioides (L.), *var.* ternata (Max.).
(157) fruticosa (L.).
(158) Wallichiana (Del.).

Prunus—
(159) Buergeriana (Miq.).
(160) Japonica (Thb.).
(161) Mume (S. et Z.).
(162) Ssiori (Fr. Schm.).

Pyrus—
(163) Chinensis (Poir.).
(164) Cydonia (L.).
(165) Japonica (Thb.).

Pyrus—
(166) Japonica (Thb.), *var.* genuina (Max.).
(167) spectabilis (Ait.).
(168) Toringo (Sieb.).

Raphiolepis—
(169) Japonica (S. et Z.).

Rhodotypos—
(170) kerrioides (S. et Z.).

Rosa—
(171) luciæ (Torr. et Sav.), *var.* poteriifolia.
(172) microphylla (Rub.).
(173) multiflora (Thb.).
(174) rugosa (Thb.).

Rubus—
(175) cratægifolius (Bunge.). (?)
(176) palmatus (Thb.).
(177) parvifolius (L.).
(178) Thunbergii (S. et Z.).

Spiræ—
(179) callosa (Thb.).
(180) Japonica (L.).
(181) palmata (Thb.).
(182) prunifolia (S. et Z.).
(183) sorbifolia (L.).
(184) Thunbergii (Sieb.).

Stephanandra—
(185) flexuosa (S. et Z.).

XXXIII. Order—*Saxifrageæ.*

Astilbe—
(186) Chinensis (Max.).
(187) Chinensis (Max.), *var.* Japonica (Max.).
(188) Japonica (Miq.).
(189) Thunbergii (Miq.).

Chrysoplenium—
(190) alternifolium (L.).
(191) Grayanum (Max.), *var.* nipponica (Fr. et Sav.).

Hydrangea—
(192) hortensis (Sm.), *var.*
(193) hortensis (Sm.), *var*, acuminata (Gray).
(194) paniculata (Sieb.).
(195) Thunbergii (Sieb.).
(196) virens (Sieb.).

Saxifraga—
(197) tellimoides (Max.).

XXXIV. Order—*Philadelpheæ.*

Deutzia—
(198) gracilis (S. et Z.).
(199) scabra (Thb.).

XXXV. Order—*Crassulaceæ.*

Penthorum—
(200) Sedoides (L.).

Sedum—
(201) Kamtschaticum (Fisch. et Mey.).
(202) lineare (Thb.).
(203) subtile (Miq.).

XXXVI. Order—*Ribesiaceæ.*

Ribes—
(204) fasciculatum (S. et Z.).

XXXVII. Order—*Hamamelidæ.*

Corylopsis—
(205) spicata (S. et Z.).
(206) pauciflora (S. et Z.).

Distylium—
(207) racemosum (S. et Z.).

XXXVIII. Order—*Halorageæ.*

Haloragis—
(208) micrantha (R. Br.).

COHORT XII.—MYRTALES.

XXXIX. Order—*Lythrarieæ.*

Lythrum—
(209) virgatum (L.).

XL. Order—*Onagrarieæ.*

Epilobium—
(210) spicatum (Lam.).

Jussiæa—
(211) repens (L.).

Ludwigia—
(212) prostrata (Roxb.).

COHORT XIII.—PASSIFLORALES.

XLI. Order—*Cucurbitaceæ.*

Actinostemma—
(213) Japonicum (Miq.).

COHORT XIV.—FICOIDALES.

XLII. Order—*Tetragonieæ.*

Tetragonia—
(214) expansa (Ait.).

COHORT XV.—UMBELLALES.

XLIII. Order—*Umbelliferæ.*

Angelica—
(215) decursiva (Miq.).
(216) Kinsiana (Max.).

Bupleurum—
(217) sachalinense (Fr. Schm.).

Caucalis—
(218) Japonica (Houtt).

Chamæle—
(219) tenera (Miq.).

Cryptotænia—
(220) Canadensis (D.C.).

Heracleum—
(221) barbatum (Led.).

Hydrocotyle—
(222) sibthorpioides (Lamk.).

Nothosmyrnium—
(223) Japonicum (Miq.)

Œnanthe—
(224) stoloniferum (D. C.).

Osmorrhiza—
(225) Japonica (S. et Z.)

Phelopterus—
(226) littoralis (Fr. Schm.).

Sanicula—
(227) elata (Hamilton).

Seseli—
(228) Libanostis (Koch).

Siler—
(229) divaricatum (Benth & Hook).

XLIV. Order—*Araliaceæ.*

Acanthopanax—
(230) spinosum (Miq.).

Fatsia—
(231) Japonica (Decne & Planch).

Helwingia—
(232) Japonica (Dietr.).

XLV. Order—*Corneæ.*

Aucuba—
(233) Japonica (Thb.).

Cornus—
(234) brachypoda (C. A. Mey).
(235) officinalis (S. et Z.).

Marlea—
(236) plantanifolia (S. et Z.).

DIVISION II.—MONOPETALA.

SERIES I.—EPIGYNÆ.

COHORT XVI.—CAPRIFOLIALES.

XLVI. Order—*Caprifoliaceæ.*

Abelia—
(237) serrata (S. et Z.).

Diervilla—
(238) grandiflora (S. et Z.).
(239) versicolor (S. et Z.).

Lonicera—
(240) gracilipes (Mig.)
(241) Japonica (Thb.).
(242) Morrowii (Gray).

Sambucus—
(243) racemosa (L.).
(244) Thunbergiana (Bl.).

Viburnum—
(245) dilatatum (Th.).
(246) odoratissimum (Ker.).
(247) opulus (L.)
(248) phlebotrichum (S. et Z).
(249) plicatum (Thb.).
(250) Sieboldi (Miq.).
(251) Wrightii.

XLVII. Order—*Rubiaceæ.*

Galium—
(252) aparine (L.).
(253) poɫonanthum (Fr. et Sav).

Galium—
(254) trifidum (L.).
(255) verum (L.).

Gardenia—
(256) florida (L.).

Musænda—
(257) parviflora (Miq.).

Oldenlandia—
(258) brachypoda (D. C.).
(259) Japonica (Miq.).

Pæderia—
(260) fœtida (L.).

Serissa—
(261) fœtida (Com).

COHORT XVII.—ASTERALES.

XLVIII. Order—*Valerianæ.*

Patrinia—
(262) scabiosæfolia (Link).

Valeriana—
(263) flaccidissima (Max).
(264) officinalis (L.) *var.* angustifolia (Max.).

XLIX. Order—*Compositæ.*

Achillæa—
(265) sibirica (Lea).

Adenocaulou—
(266) adhærescens (Max.).

Artemisia—
(267) gilrescens (Miq.).

Aster—
(268) Cantoniensis (Bl.).
(269) Glehni (Fr. Schm.).
(270) hispidus (Thb.).
(271) indicus (L.).
(272) scaber (Thb.).
(273) spathulifolius (Max.).
(274) trinervus (Roxb.) *var.* ovata (Fr. et Sav.).

Atractylis—
(275) ovata (Thb.).

Bidens—
(276) pilosa (L.).
(277) tripartita (L.).

Carduus—
(278) crispus (L.) *var.* congesta (Fr. et Sav.).

Carpesium—
(279) abrotanoides (L.).

Cnicus—
(280) Japonicus (Max.).
(281) pendulus (Max.).
(282) spicatus (Max.).

Crepis—
(283) Japonica (Benth).
(284) Keiskeana (Max.).

Eclipta—
(285) alba (Hesk.).

Erigeron—
(286) Thunbergii (Gray).

Eupatorium—
(287) Japonicum (Th.).

Gerbera—
(288) anandria (Schult).

Gnaphalium—
(289) Japonicum (Thb.).
(290) margaritaceum (L.).
(291) multiceps (Wall.).

Gynura—
(292) pinnatida (D. C.).

Inula—
(293) Japonica (Thb.).

Ixeris—
(294) debilis (Gray).
(295) ramossima (Gray).
(296) Thunbergii (Gray).
(297) versicolor (D. C.)

Lampsana—
(298) apogonoides (Max.).
(299) parviflora (Gray).

Leucanthemum—
(300) nipponicum (Fr. et Sav.).

Macroclinidium—
(301) robustum (Max.).

Miriogyne—
(302) minuta (Less.).

Pertya—
(303) scandens (Thb.).

Petasites—
(304) Japonicus (Miq.).

Platycrater—
(305) arguta (S. et Z.).

Pyrethum—
(306) Decaisneanum (Max.).
(307) indicum (Cass.).
(308) sinense (Sav.) *var.* Japonicum (Max.).

Saussurea—
(309) Bungei (Hk. et Am.).

Senecio—
(310) campestris (D. C.).
(311) flammeus (D. C.)
(312) Japonicus (Schultz).
(313) Kœmpferi (D. C.).
(314) Krameri (Fr. et Sav.).
(315) stenocephalus (Max.) *var.* coruesa (Fr. et Sav.)
(316) Zuccarinii (Max.).

Serratula—
(317) coronata (L.).

Siegesbeckia—
(318) orientalis (L.).

Solidago—
(319) virga-aurea (L.).

Sonchus—
(320) oleraceus (L.).

Taraxcum—
(321) officinale (Wigg.) *var.* corniculatum (Koch.)

Xanthium—
(322) strumarium (L.).

COHORT XVIII.—CAMPANALES.

L. Order—*Campanulaceæ.*

Adenophora—
(323) trachelioides (Max.).
(324) verticillata (Fisch.).

Campanula—
(325) punctata (Lam.).

Phyteuma—
(326) Japonicum (Miq.).

Platycodon—
(327) grandiflorum (D. C.).

SERIES II.—HYPOGYNÆ ET PERIGYNÆ.

COHORT XIX.—ERICALES.

LI. Order—*Ericineæ.*

Andromeda—
(328) Japonica (Thb.).

Clethra—
(329) barbinervis (S. et Z.).

Eukianthus—
(330) Japonicus (Hk.).

Rhododendron—
(331) Indicum (Sw.) *var.* obtusum (Max.).
(332) ledifolium (Dm.).
(333) ledifolium (Dm.) *var.* leucanthemum (D. C.).
(334) Metternichii (S. et Z.).

LII. Order—*Monotropeæ.*

Monotropa—
(335) uniflora (L.).

LIII. Order—*Pyrolaceæ.*

Pyrola—
(336) rotundifolia (L.).

COHORT XX.—PRIMULALES.

LIV. Order—*Primulaceæ.*

Lysimachia—
(337) clethroides (Dubq.).
(338) davurica (Wild).
(339) fortunei (Max.).
(340) Japonica (Thb.).

Primula—
(341) cortusoides (L.).
(342) farinosa (L.) *var.* luteo-farinosa (Reg.) *forma* Japonica (Fr. et Sav.).

LV. Order—*Myrsineæ.*

Ardisia—
(343) crispula (D. C.).
(344) Japonica (D. C.).

Edgeworthia—
(345) papyrifera (S. et. Z.).

Orixa—
(346) Japonica (Thb.).

COHORT XXI.—EBENALES.

LVI. Order—*Ebenaceæ.*

Diospyros—
(347) Kaki (L.).

LVII. Order—*Styracaceæ.*

Styrax—
(348) Japonicum (S. et Z.).
(349) obassia (S. et Z.)

COHORT XXII.—GENTIANALES.

LVIII. Order—*Oleineæ.*

Forsythia—
(350) suspensa (Vahl.).

Ligustrum—
(351) Ibota (Sieb.).
(352) Japonicum (Thb.).
(353) reticulatum (Bl.).

Olea—
(354) aquifolium (S. et Z.).

LIX. Order—*Apocyneæ.*

Amsonia—
(355) elliptica (Rœm. et Schult).

Trachelospermum—
(356) jasminoides (Benth et Hook).

LX. Order—*Asclepiadeæ.*

Pycnostelma—
(357) Japonicum (Bunge).

Vincetoxicum—
(358) atratum (Morr et Decne.)
(359) Brandtii (Fr. et Sav.).
(360) Japonicum (Morr. et Decne).
(361) sublanceolatum (Max.)

LXI. Order—*Loganiaceæ.*

Buddleya—
(362) curviflora (Hk. et Am.).
Mitrasacme—
(363) Indica (R. Br.).

LXII. Order—*Gentianeæ.*

Gentiana—
(364) Buergeri (Miq.).
(365) squarrosa (Ledep.).
(366) Thunbergii (Griseb.).

Limnanthemum—
(367) nymphoides (Link.).

COHORT XXIII.—POLEMONIALES.

LXIII. Order—*Convolvulaceæ.*

Calystegia—
(368) Japonica (Miq.).
(369) soldanella (R. Br.).

LXIV. Order—*Borragineæ.*

Bothriospermum—
(370) tenellum (Miq.).

Eritrichium—
(371) Giulielmi (Gray).
(372) pedunculare (D. C.).

Lithospermum—
(373) Zollingeri (D. C.).

Omphalodes—
(374) Krameri (Fr. et Sav.).

COHORT XXIV.—SOLANALES.

LXV. Order—*Solaneæ.*

Chamæsaracha—
(375) Japonica (Fr. et Sav.).

Lycium—
(376) Chinense (Mill).

Scopolia—
(377) Japonica (Max.).

Solanum—
(378) Dulcamara (L.) *var.* ovatum (Dan.).
(379) lyratum (Thb.).
(380) nigrum (L.).

COHORT XXV.—PERSONALES.

LXVI. Order—*Scrophularineæ.*

Chelonopsis—
(381) moschuta (Miq.).

Mazus—
(382) rugosus (Lour.).

Monochasma—
(383) Sheareri (Max.).

Paulownia—
(384) imperialis (S. et Z.).

Scrophularia—
(385) alata (Gray).
(386) oldhami (Oliv.).

Vandelia—
(387) erecta (Benth).

Veronica—
(888) agrestis (L.).
(389) Anagallis (L.).
(390) longifolia (L.) *var.* subsessilis (Miq.).
(391) Thunbergii (Gray).
(392) Virginica (L.).

LXVII. Order—*Gesneraceæ.*

Rehmannia—
(393) lutea (Max.).

Conandron—
(393)* ramondioides (S. et Z.).

LXVIII. Order—*Bignoniaceæ.*

Catalpa—
(394) Kæmpferi (S. et Z.).

Tecoma—
(395) grandiflora (Delaun.).

LXIX. Order—*Acanthaceæ.*

Dicliptera—
(396) Buergeriana (Miq.).

Rostellularia—
(397) procumbens (Mes.).

COHORT XXVI.—LAMIALES.

LXX. Order—*Verbenaceæ.*

Callicarpa—
(398) Japonica (Th.).

Clerodendron—
(399) divaricatum (S. et Z.).
(400) trichostomum (Thb.).

Phrymna—
(401) leptostachys (L.).

Verbena—
(402) officinalis (L.).

Vitex—
(403) cannabifolia (S. et Z.).

LXXI. Order—*Labiatæ.*

Ajuga—
(404) decumbens (Th.) *var.* typica.
(405) ciliata (Bunge).

Brunella—
(406) vulgaris (L.).

Calamintha—
(407) Chinensis (Benth).
(408) gracilis (Benth).

Dracocephalum—
(409) Ryschianum (L.).
(410) urticæfolium (Miq.).

Dysophylla—
(411) Japonica (Miq.).

Elscholtzia—
(412) barbinervia (Miq.).
(413) cristata (Wild).
(414) sublanceolata (Miq.).

Lamium—
(415) album (L.).
(416) amplexicaule (L.).

Leonurus—
(417) sibiricus L.).

Mentha—
(418) arvensis (L.) *var.* vulgaris (Benth).

Mosla—
(418)* punctata (Max.) *var.*

Nepeta—
(419) Glechoma (Benth).
(420) Japonica (Max.).

Salvia—
(421) Japonica (Thb.).

Scutellaria—
(422) Indica (L.) *var.* Japonica.
(423) macrantha (Fisch.).
(424) Tanakæ (Fr. et Sav.)

Stachys—
(425) Baicalensis (Fisch.).

Thymus—
(426) serpyllum (L.) *var.*

LXXII. Order—*Plantaginaceæ*.

Plantago—
(427) Asiatica (L.).

DIVISION III.—APETALA.

COHORT XXVII.—CHENOPODIALES.

LXXIII. Order—*Phytolaccaceæ*.

Phytolacca—
(428) acinosa (Roxb.).

LXXIV. Order—*Polygoneæ*.

Polygonum—
(429) aviculare (L.).
(430) bistorta (L.).
(431) Blumei (Meisn.).
(432) Chinense (L.) *var.* Thunbergianum (Meisn.).
(433) cuspidatum (S. et Z.).
(434) filiforme (Thb.)
(435) multiflorum (Thb.).
(436) nodosum (Pers.).
(437) perfoliatum (L.).
(438) Thunbergii (S. et Z.) *var.* Mackianum.
(439) Thunbergii (S. et Z.) *var.* typica.

Rumex—
(440) acetosa (L.).
(441) Japonicus (Meisn.).

COHORT XXVIII.—LAURALES.

LXXV. Order—*Laurineæ*.

Cinnamomum—
(442) camphora (Nies.).
(443) Loureiri (Nies.).

Daphnidium—
(444) strychnifolium.

Lindera—
(445) obtusiloba (Bl.)
(446) præcox (Bl.).

COHORT XXIX.—DAPHNALES.

LXXVI. Order—*Thymeleæ*.

Daphne—
(447) odora (Thb.).
(448) pseudomezereum (Gray).

LXXVII. Order—*Elæagneæ*.

Elæagnus—
(449) longipes (Gray).
(450) umbellata (Th.).

COHORT XXX.—URTICALES.

LXXVIII. Order—*Urticeæ*.

Aphananthe—
(451) aspera (Planch).

Bœhmeria—
(452) biloba (Wedd.).
(453) longispica (Sten.) *var.* tricuspis (Hana.).
(454) nivea (Bl.).

Urtica—
(455) Thunbergiana (S. et Z.).

LXXIX. Order—*Moreæ*.

Broussonetia—
(456) papyrifera (Vent.)

Fatona—
(457) pilosa (Gand.).

Ficus—
(458) pyrifolia (Burm.).

LXXX. Order—*Celtideæ*.

Celtis—
(459) sinensis (Pers.).

LXXXI. Order—*Cannabineæ*.

Humulus—
(460) Japonica (S. et D.)

LXXXII. Order—*Ulmaceæ*.

Ulmus—
(461) parvifolia (Jacq.).

Zelkowa—
462) Keaki (Sieb.).

COHORT XXXI.—AMENTALES.

LXXIII. Order—*Betulaceæ*.

Alnus—
(463) incana (Wild) *var.* glauca (Ait.).
(464) maritima (Nutt.) *var.* Japonica (Regel.).

LXXXIV. Order—*Myriceæ*.

Myrica—
(465) rubra (S. et Z.).

LXXXV. Order—*Salicineæ*.

Salix—
(466) brachystachys (Benth.).
(467) multinervis (Fr. et Sav.).
(468) padifolia (Anders.).
(469) purpurea (L.).

COHORT XXXII.—EUPHORBIALES.

LXXXVI. Order—*Euphorbiaceæ*.

Elæococca—
(470) cordata (Bl.).

Euphorbia—
(471) helioscopia (L.).
(472) humifusa (Wild).
(473) lasiocaula (Bois.).
(474) Rochebruni (Fr. et Sav.).
(475) Sieboldiana (Morr. et Decne.).

Exœcaria—
(476) Japonica (J. Müll).

Mercurialis—
(477) liocarpus (S. et Z.)

Rottlera—
(478) Japonica (S. et Z.).

Securinega—
(479) Japonica (Miq.).

COHORT XXXIII.—PIPERALES.

LXXXVII. Order—*Saurureæ.*

Houttuynia—
(480) cordata (Thb.).

Saururus—
(481) Loureiri (D.C.)

LXXXVIII. Order—*Chloranthaceæ.*

Chloranthus—
(482) inconspicuus (Sw.)
(483) Japonicus (Sieb.).
(484) serratus (Rœm et Seb.)

COHORT XXXV.—ASARALES.

LXXXIX. Order—*Aristolochieæ.*

Aristolochia—
(485) debilis (S. et Z.).

Asarum—
(486) caulescens (Max.).

COHORT XXXVI.—QUERNALES.

XC. Order—*Juglandeæ.*

Juglans—
(487) Sieboldiana (Max.).

XCI. Order—*Cupuliferæ.*

Castanea—
(488) vulgaris (Lam.) *var.* Japonica (D.C.).

Quercus—
(489) acuta (Thb.).
(490) cuspidata (Thb.).
(491) dentata (Thb.).
(492) glabra (Thb.).
(493) glauca (Thb.) *forma* glabra.
(494) glauca (Thb.) *forma* sericea.
(495) phyllireoides (Gray).

XCII. Order—*Corylaceæ.*

Carpinus—
(496) Japonica (Bl.)
(497) laxiflora (Bl.).

COHORT XXXVII.—SANTALALES.

XCIII. Order—*Loranthaceæ.*

Viscum—
(498) album (L.).

XCIV. Order—*Santalaceæ.*

Thesium—
(499) decurrens (Bl.).

SUB-CLASS II.—MONOCOTYLEDONES.

DIVISION I.—OVARY INFERIOR.

COHORT III.—ORCHIDALES.

I. Order—*Orchideæ.*

Bletia—
(500) hyacintha (R. Br.).

Calanthe—
(501) discolor (Lindl.).

Cephalanthera—
(502) erecta (Lindl.).
(503) falcata (Lindl.).

Cymbidium—
(504) virens (Lindl.).

Cypripedium—
(505) cardiophyllum (Fr. et Sav.).

Gymnadenia—
(506) lancifolia (Fr. et Sav.).

Spiranthes—
(507) Australis (Lindl.).

COHORT V.—NARCISSALES.

II. Order—*Irideæ.*

Iris—
(508) sp? (Kakitsubata).
(509) lævigata (Fisch).
(510) sibirica (L.).

Pardanthus—
(511) Chinensis (Ker.).

III. Order—*Amaryllideæ.*

Narcissus—
(512) Tazzetta (F.). *var.* Chinensis (Rœm.).

COHORT VI.—DIOSCORALES.

IV. Order—*Dioscoreæ.*

Dioscorea—
(513) quinque-loba (Thb.).
(514) sativa (L.).

DIVISION II.—OVARY SUPERIOR.

COHORT VIII.—POTAMALES.

V. Order—*Potameæ (Jussieu).*

Potamogeton—
(515) crispus (L.).
(516) polygonifolius (Pouw.).

Ruppia—
(517) maritima (L.).

VI. Order—*Naiadeæ.*

Najas—
(518) major (All.).

COHORT X.—ARALES.

VII. Order—*Typhaceæ.*

Sparganium—
(519) longifolium (Turez).

Typha—
(520) Japonica (Miq.).

VIII. Order—*Aroideæ.*

Acorus—
(521) graminensis (Ait.).

Arisæma—
(522) Japonicum (Bl.).
(523) ringens (Schott).
(524) Thunbergii (Bl.).

Pinellia—
(525) tuberifera (Ten.).

IX. Order—*Lemnaceæ.*

Spirodela—
(526) polyrrhiza (Schleid.).

COHORT XI.—LILIALES.

X. Order—*Ophiopogoneæ.*

Ophiopogon—
(527) Japonicus (Gawl.).
(528) spicatus (Gawl.).

XI. Order—*Liliaceæ.*

Allium—
(529) nipponicum (Fr. et Sav.).

Barnardia—
(530) Japonica (Rœm. et Schult.).

Erythronium—
(531) dens-canis (L.).

Fritillaria—
(532) Thunbergii (Miq.).

Funkia—
(533) Sieboldiana (Spreng.).

Hemerocallis—
(534) fulva (L.).
(535) minor (Mill.).

Lilium—
(536) auratum (Lindl.).
(537) coridion (Sieb.) *var.* parthenion (Sieb.).
(538) longiflorum (Thb.).
(539) Maximowiczii (Regel.).
(540) Thunbergianum (Rœm. et Sch.).

Orithya—
(541) edulis (Miq.).

XII. Order—*Melanthaceæ.*

Disporum—
(542) pullum (Salisb.).
(543) sessile (Don).
(544) smilacinum (A. Gray).

XIII. Order—*Smilaceæ.*

Paris—
(545) quadrifolia (L.). *var.* obovata (Regel).

Polygonatum—
(546) canaliculatum (Pursh).
(547) vulgare (Desf.)

Smilacina—
(548) bifolia (Desf.).
(549) Japonica (A. Gray).

Smilax—
(550) China (L.).
(551) herbacea (L.) *var.* nipponica (Max.).
(552) Sieboldi (Miq.).

Stemone—
(553) Japonica (Miq.).
(554) sessilifolia (Miq.).

XIV. Order—*Asparageæ.*

Asparagus—
(555) lucidus (Lindl.).

Dianella—
(556) odorata (Bl.).

XV. Order—*Junceæ.*

Juncus—
(557) alatus (Fr. et Sav.).
(558) bufonius (L.).
(559) communis (Miq.) *var.* effusus.
(560) Leschenaultii (J. Gray).

Luzula—
(561) campestris (D. C.).

COHORT XV.—GLUMALES.

XVI. Order—*Cyperaceæ.*

Carex—
(562) confertiflora (Boot.).
(563) gibba (Walhb.).
(564) incisa (Boot.).
(565) neurocarpa (Max.).
(566) picta (Boot.).
(567) trichostylos (Fr. et. Sav.).
(568) vulgaris (L.).

Cyperus—
(569) difformis (L.).
(570) rotundus (L.).

Fimbristylis—
(571) autumnalis (Rœm. et Sch.).
(572) diphylla (Vahl.).
(573) Japonica (S. et Z.).
(574) miliacea (Vahl.).
(575) squarrosa (Miq.).

Lipocarpha—
(576) microcephala (Knuth.).

Scirpus—
(577) Japonicus (Miq.).
(578) maritimus (L.).
(579) mucronatus (L.).?
(580) ononei (Fr. et Sav.).
(581) Yokoscensis (Fr. et. Sav.)

Zoysia—
(582) pungens (Willd.).

XVII. Order—*Gramineæ.*

Adenophora—
(583) latifolia (Fisch.).

Agrostis—
(584) perennans (Tuck.).

Alopecurus—
(585) geniculatus (L.).
(586) Japonicus (Stend.).

Andropogon—
(587) brevifolius (Sw.) *var.* pulla (Fr. et Sav.).

Arthraxon—
(588) ciliare (Beauv.).

Arundinaria—
(589) Japonica (S. et Z.)

Avena—
(590) fatua (L.).

Bambusa—
(591) Kamasasa (Zoll.).

Beckmannia—
(592) crucæformis (Host).

Brachypodium—
593) Japonicum (Miq.).
(594) sylvaticum (Rœm. et Schult.).

Bromus—
(595) Japonicus (Thb.).

Cynodon—
(596) dactylon (Pers.).

Eleusine—
(597) indica (Gærtn.).

Eragrostis—
(598) ferrugiana (Beauv.).
(599) megastachya (Rœl.).
(600) pilosa (Beauv.).

Eriochloa—
(601) villosa (Kunth.).

Eularia—
(602) Japonica (Frin.).

Festuca—
(603) parvigluma (Stend.).

Gyceria—
(604) caspia (Frin.).
(605) Japonica (Miq.).

Gymnothrix—
(606) Japonica (Kunth.).

Hemarthria—
(607) compressa (Rob.)

Hierochloa—
(608) borealis (Rœm et Schult.).

Hydropyrum—
(609) latifolium (Griseb.).

Imperata—
(610) arundinacea (Cyr.).

Isachne—
(611) Australis (R. Br.).

Ischæmum—
(612) distachyum (S. et. Z.).
(613) latifolium.

Kœleria—
(614) cristata (Pers.).

Leersia—
(615) orizoides (Pers.).

Panicum—
(616) acroanthum (Stend.).
(617) Burmanni (Retz.).
(618) crus-galli (L.).
(619) excurrens (Frin.).

(620) glaucum (L.).
(621) indicum (L.). *var.* contracta (Miq.).
(622) viride (L.).

Paspalum—
(623) Thunbergii (Kunth).

Phalaris—
(624) arundinacea (L.).

Phragmitis—
(625) communis (Frin.).

Poa—
(626) sphondyolodes (Frin.).

Polypogon—
(627) littoralis (Sm.).

Schenodorus—
(628) remotiflorus (Miq.).

Spodiopogon—
(629) sp ?

Trisetum—
(630) cernuum (Frin.).

CLASS II.—GYMNOSPERMÆ.

Tribe—*Abietineæ.*

Tamarix—
(631) Chinensis (Lour.).

Pinus—
(632) parviflora (S. et Z.).

Tribe *Cupressineæ.*

Chamæcyparis—
(633) obtusa (S. et Z.).

Tribe—*Taxineæ.*

Cryptomeria—
(634) Japonica (Don.).

Taxus—
(635) cuspidata (S. et Z.).

SUB-KINGDOM II.—CRYPTOGAMIA.

Order I—*Filices.*

Aspidium—
(636) aculeatum (Doll.) *var.* Japonicum.
(637) decursive-pinnatum (Kze.).
(638) erythrosorum (Eat.).
(639) falcatum (Sw.).
(640) lacerum (Sw.).
(641) sophoroides (Sw.).
(642) tri pteron (Kunz.).
(643) varium (Sw.).

Asplenium—
(644) incisum (Thb.).
(645) nipponicum (Mett.).

Davallia—
(646) hirsuta (Sw.).
(647) Wilfordii (Baker.)

Gymnogramme—
(648) Totta (Schlecht).

Lygodium—
(649) Japonicum (Sw.).

Onoclea—
(650) sensibilis (L.).

Osmunda—
(651) regalis (L.) *var.* Japonica (Milde).

Polypodium—
(652) lineare (Thb.).

Order II—*Equisetaceæ.*

Equisetum—
(653) arvense (L.).
(654) palustre (L.).
(655) ramossimum (L.).

Order III—*Salvineæ (Bartling).*

Azolla—
(656) pinnata (R. Br.).

Order IV—*Lycopodiaceæ.*

Lycopodium—
(657) serratum (Thb.).

Order V—*Isoeteæ.*

Isoetes—
(658) Japonica (R. Br.).

APPENDIX.

(659) Keiskea Japonica (Mig.).
(660) Pollia Japonica (Horust.).
(661) Phteirospermum Chinense (Bunge.).
(662) Idesia (polycarpa Max.).

I remain, Sir,

Yours respectfully,

J. PLAYFAIR McMURRICH.

Professor of Biology and Horticulture.

PART IV.

REPORT

OF THE

PROFESSOR OF VETERINARY SCIENCE.

GUELPH, DECEMBER 31ST, 1883.

To the President of Ontario Agricultural College :—

SIR,—I have the honour to lay before you the first annual report of work done in connection with the Veterinary department of the Ontario Agricultural College. Although this department has been in existence since the inception of the College, no description of the work done in this section of the teaching of the institution has ever been submitted to the public. On that account I will endeavour to put before you the duties of the head of the Veterinary department, and the manner in which they have been carried out. It is the duty of the Veterinary Surgeon not only to attend to all matters in connection with the teaching of the various subjects necessary to a veterinary education, but also to attend professionally any of the live stock on the farm that may require medical treatment, as well as to make any suggestions and arrangements that will in his opinion tend to the conservation of the health of the various animals kept on the farm. Of course it is not to be expected that at an institution of this kind, circumstances will admit of a thoroughly practical and theoretical veterinary education being given, but the advantages are of such a character, that a careful student may carry away a knowledge of the more prevalent and simpler diseases, as well as ideas of how to prevent and combat them when they have made their appearance. He is also put in a position to be able to recognize any departure from health, which is a most important matter, as it gives an opportunity of resorting to means of relief at an early period, thus often materially and favorably influencing the termination of a case. His attention is so drawn to morbid conditions of horses, as to render him capable when purchasing, or under other circumstances, of discriminating between soundness and unsoundness. The possession of such knowledge by stock-raisers in rural districts, where the services of qualified Veterinarians cannot be obtained, or only after much delay, is invaluable.

Since I have stated the amount and kind of knowledge a student has the privilege of gaining in my department, I will now describe the method which is pursued in allowing an opportunity for the attainment of that knowledge. The student on entering the college at the beginning of October, commences the study of Veterinary Anatomy, by taking the horse as the standard; and after investigating and studying the manner in which that animal is organized, the more important differences existing between him and ruminants are considered. Two lectures a week are devoted to this subject during the fall and winter terms; but, unfortunately, the only means of practical demonstration that is afforded by our present facilities for teaching is a skeleton of the horse, and some detached bones; and, although they are quite sufficient for teaching practically that branch of the anatomy, they come very far short of providing material for the practical teaching of the numerous other branches, which I may almost say are of even more importance; but I will allude to what is required in this and other branches further on. Anatomy then is the only veterinary subject that the student has to engage his attention during the first winter, with the exception of a brief consideration of the physiology of the different structures and organs that come under our notice in the anatomy. It is not necessary for me to go into the physiology more minutely, as the Professor of Biology gives a course of lectures on human physiology, which so closely resembles that of the lower animals, that a reference to the chief differences is all that is required to be given by me. This closes the student's anatomical studies; and during the next or spring term, he applies himself to the study of "Veterinary Materia Medica," or to gaining a knowledge of the drugs that are of most importance in the treatment of the diseases of the domestic animals.

If a satisfactory examination has been passed in the above mentioned subjects, he is then admitted into what is called the "Second Year." In this senior class, they have two lectures a week, on what has hitherto been styled in the curriculum "Hippopathology"; but this term is not sufficiently comprehensive to express what is taught to this class, and would be more correctly designated "The Principles and Practice of Veterinary Medicine and Surgery." In the somewhat limited time we have to devote to this subject, which in the present enlightened days has assumed such vast proportions, it is continually our aim and object only to deal with such of the diseases that are most commonly met with, and are consequently of most importance, so that the student may not be puzzled, but be able to carry away with him something that will admit of practical application. The students of this class also receive another lecture weekly, called a "Practical Lecture." This hour is devoted to keeping up as nearly as circumstances will permit with the theoretical ones, and giving practical demonstrations wherever admissible. For instance, when any of the animals on the farm are suffering from any disease, I take the students to the stable, and deliver a clinical lecture to them, by considering all the symptoms presented; the cause for the symptoms, the advisable treatment to pursue, and, in fact, discuss generally all the different phenomena the case may present to our notice. Opportunities of this kind, however, are not always presented to us; but there are other practical matters which are always available for demonstration, and which I will explain. These are the different modes of administering medicine to animals; for there is no use in telling a student to give a drench in some case, a ball in another, a hypodermic injection or an enema in another, without indicating to him how this is to be carried out. For this purpose, and for numerous others, I procure old and useless horses as subjects for doing anything with that is required, which will not cause the infliction of much pain. After medicines have been given in the various ways, we find out the situations in which the pulse may be taken, and the manner of doing so, as well as taking the temperature. Catheters are passed in the male and female; the various modes of restraining animals for operations are shown by means of the twitch, side-lines, hobbles and ropes; and the manner of producing insensibility to pain during operations, by the administration of anæsthetics, as chloroform and ether. The mouth is examined, and the abnormal conditions that are oftenest met with are described; and the means of overcoming them are pointed out, whether by operation or otherwise. After the different kinds of fractures have been discussed in the lecture room, the treatment of such conditions is gone through; as, the application of splints of the various kinds, and putting the animal in the most favourable position by means of slings. All the minor operations are performed, such as putting in setons, bleeding, firing, puncturing in tympanitis, tracheotomy, passing the probang, neurotomy, trephining, drawing teeth, etc. In any of the above operations, which cause the infliction of much pain, sensibility is destroyed by the use of anæsthetics. Cattle and sheep of different ages are brought into the lecture room, and their mouths examined, with a view of showing the students the appearance presented by the mouth at the different ages, and the use of the teeth as age indicators. The external conformation of the horse is considered, and the names of the different sub-divisions—usually called points—are given, and each of these points is taken up, and the most desirable formation for it described, whether for light or heavy horses. These points are not only considered separately, but in the aggregate, so that an estimate may be formed of what is desirable in the horse for speed, strength, and endurance, and the opposite conditions guarded against. Towards the end of the session, the subject is destroyed and a couple of hours spent in dissection, which of course is of a rough character, and more with the object of pointing out the situations of the various organs than for anything else. Now, sir, this is a brief outline of the work done by me in connection with the ordinary class, with the exception of acting as examiner to them in the different subjects.

But last year a number of students presented themselves at the College, whose time was limited for attendance there, and who wished to devote what they had to spare to the study of agriculture, live stock, and veterinary surgery. I was appealed to regarding my department, and asked what I could do in the way of profitably employing the time of these gentlemen on veterinary subjects. On enquiring into the knowledge possessed by the members of this class, I found that some of them had studied Anatomy, others Materia Medica, while others had never had any teaching in these subjects. Now here was a class occupying an anomalous position, their attainments being so varied that it would have been wasting the time of one portion of the class to go into the foundation subjects, while others were incapable of understanding more advanced branches, from a want of previous training in Anatomy, Physiology, and Materia Medica. After duly considering the matter, I came to the conclusion that a course on Veterinary Obstetrics would be the most beneficial to them I could give, not only on account of its being one of paramount importance to the raisers of stock, but also from the fact that gaining a knowledge of the anatomy and physiology of the genital organs would occupy a comparatively short time, and allow them to devote themselves to something really practical. After spending three or four lectures in treating of the genital organs, we took up the subject proper, which consists in a study of all the phenomena in connection with the process of reproduction. We began at puberty, and considered its advent in the different domesticated animals, and the signs by which its arrival can be recognized. The conditions called heat, rutting, or œstrum, was treated of, the symptoms of its presence, the time it lasts, the time of year it makes its appearance, and the spaces of time between its recurrence in the different females. The signs of conception were given, as well as the normal periods of gestation, and the variations therefrom noted. Sterility was spoken of, its prevalence, and the mode of overcoming it—where possible—considered. Abortion was defined, its causes, etc., discussed, as well as the means of avoiding such a calamity. Parturition next engaged our attention; the causes of it, the symptoms of its approach, and the variations occurring even when that act is carried out normally, as well as the deviations from it, and the means of affording relief when such deviations occur. This latter subject is a very extensive one, and takes up a length of time. The study of it is begun by describing the normal position of the fœtus in the womb—some time prior to parturition—and the change of position which takes place on the approach of that act. The normal presentation, or the only one which will admit of that act being carried out without extraneous assistance, is spoken of, as well as the departures from this natural state of affairs—which are numerous—and the means of bringing about the most favourable issues, when such departures arise. This necessitates a description of the instruments, modes of manipulation to be pursued, and the manner of performing the different operations.

It is my intention this year to demonstrate by means of large diagrams, the position of the genital organs and the fœtus in the womb as well as the normal and abnormal presentations, thus forming the best substitute for clinical instruction; other forms of difficult parturition are considered, as those arising from obstruction in the genital passages of the mother, whether the result of disease, or unfavourable conformations, and also the diseased conditions of the offspring; the care and treatment of the mother before, during and after parturition is discussed, with a view of showing how to bring that act to a favorable termination, and how to avoid subsequent disease; the treatment of the offspring is also dealt with as the means of resuscitation to be employed if necessary, and the general care which may be required before the young animal is sufficiently developed to exercise its natural instinct of looking after its own nourishment. The study of the phenomena, and contingencies of reproduction would not be complete unless the diseases, which frequently occur during the period that the young animal is carried by the mother, also those that occur as sequels to parturition, as well as those ailments to which young animals are particularly prone.

What I have given is an outline of what I teach in the college, and last year I delivered nine lectures a week, bearing on the different subjects described, having to repeat those given on anatomy on account of the first year being divided into two classes; but so far, this year, no such division has been made, consequently I only have seven a week.

From looking over the curriculum, and constitution of the College, no one could arrive at a correct idea of the position held by the head of the Veterinary department, in comparison with the heads of other departments; of course this is a matter affecting myself personally, and if it had no other influence it would be out of place for me to mention it here; but as I, with others, consider that it materially militates against the good results that might be accomplished by this department, it would be delinquency on my part to omit to draw attention to it. All the other officers that have been appointed in connection with this institution were so situated, that all their time and attention could be devoted to the work of their office, but such is not the case in my branch, for it seems that the position is looked upon as a perquisite to my practice, which it very materially interferes with, as does the practice with the teaching.

Now it may be asked why the arrangement should differ from that with the other lecturers. Is it because there is less work in this department, or is it on account of the subjects taught being of secondary importance to the students? An inquiry into the matter would show that there is as much to be done, as in some of the other departments in the lecture room alone, and in addition to that there is the medical treatment which has to be bestowed upon the animals on the farm, and to which all my other actions and duties have to be made subservient, the delivery of the lectures and going to the college and back, although occupying considerable time, does not constitute by any means all the work to be performed; for there is the preparation of all this matter in the way of so arranging it that is may be received and assimilated by the students, who are non-professional, in a manner most conducive to its bearing practical results. As to the importance of the subject in a semi-stock-raising country, I think we need not fear the opposition of the most sceptical, when we aver that it stands second to none; as an indication of how the students estimate and appreciate the subject, I have but to mention that they are unanimous in asking for more time to be bestowed upon it. It requires not the constant petitions from the students which I am receiving to show me that time is all that is wanted to render the teaching much more practical and beneficial. I will now try to point out how more time could be beneficially employed in addition to perfecting the work that is at present being done. Of course it would be impossible in an institution of this kind for all the students to dissect; and the only way I can conceive of, to supply this almost indispensible means of learning anatomy, is to have the different parts of animals already dissected and brought into the lecture room, and there explained, of course this would entail a great deal of extra work on the lecturer, but would amply repay for the time thus spent. In the summer term the "Second Year" should receive a course on Veterinary Obstetrics, which according to the present arrangement of affairs, they are unable to do, and consequently complete their term without an opportunity being afforded them of studying one of the most important branches of Veterinary Surgery; there is no department that could furnish more numerous and interesting specimens for the museum than the Veterinary Department, if time were only available for their preparation. The treatment and diseases of sheep, especially in the lambing season, could, with benefit not only to the students, but to the public at large receive that attention that the importance of the subject demands. This is a subject that has received very little attention up to the present time, and there is comparatively little literature on the subject owing to the fact that facilities for study and observation are not easily procurable by the profession; but there would not be this difficulty here, where two hundred sheep are kept, if no other ties prevented the means of constant observation and study, which is essential to the correct recordance of data bearing on the subject, a closer observation might be made, and and a more general supervision gives to all the animals on the place, and the students' attention directly drawn to the avoidance of dietetic errors, and the observance of sanitary rules generally.

Since my appointment to my present position, there have been no losses of a serious character, from death among the stock, with the exception of the mortality of some forty lambs last spring, caused by "Tape-worm", an account of which I gave at the time of its ocurrence, in a letter written to one of our local papers, and which I will append to this report, as it gives all particulars concerning it. Considering that most of the stock are highly bred, and are often subjected to a process of forcing for experimental purposes, I think we may say that we have comparatively little sickness amongst the animals, and what does occur is chiefly the result of accidental causes. The usual ill effects of high feeding are to some extent prevented by the regular manner in which the animals are fed, and the careful attendance they receive generally. We have had some trouble, and some loss has been occasioned by a hereditary and constitutional disease among the cattle, called "Tuberculosis," which disease is unfortunately only too prevalent among the better bred cattle of this country, the chief losses that were sustained, were among the "Polled-Angus" breed, a breed that were supposed to enjoy an especial immunity from this disease. One of the cows of this breed that was imported, seems to have had the germs of the disease lying latent in her system at the time of her arrival here, as she transmitted it to all the progeny that she produced after that time, but a considerable period elapsed before she developed any local manifestation of it herself. She was fattened and slaughtered, and a *post mortem* examination revealed tuberculous deposits in the peritoneum, liver, lungs, pleuræ, and also a very extensive one in the abdominal muscles of the left side, which was plainly to be seen before death. Two of this cow's progeny succumbed to the same disease; the tubercular matter in these cases selecting the glands at the posterior part of the throat to deposit itself in. Death would have resulted from suffocation in a short time if these animals had not have been slaughtered; a thoroughbred shorthorn cow also fell a victim to this disease, presenting very distressing symptoms at times, for some months previous to death; she had deposits in a variety of organs, but the one causing the greatest trouble was situated in the vocal cords of the larynx and which would have caused death in the same way as the two preceding cases. I have yet another case of this fatal disease to relate, which occurred in an Aryshire cow, the symptoms of which became so aggravated as to necessitate slaughtering during the preparation of this report. Another phase of the disease was presented in this case, for in addition to a want of thrift, there were well marked symptoms of partial paralysis, accompanied by brain disorder; on making a *post mortem* we found some minute tubercles situated in one of the coverings of the brain, which would account for the brain disturbance shown; the chest on being opened was found literally lined with tubercles, the lining varying from an inch to three inches in thickness, and was closely attached to the ribs and diaphragm throughout, as well as to the lungs in places. The greater portion of the lungs were in a normal condition, but that surrounding the heart for a thickness of three inches, was a mass of deposit; there was also a deposit in the womb accounting for abortion taking place the last time she was pregnant. Since I have given you the history of several cases of this affection, it may be as well to give a short account of the disease.

Tuberculosis.

The term "tuberculosis" implies the existence of a disease in an animal which is characterized by the presence of tubercles or small tumours in some part or parts of the body. This term is often confounded with "scrofulosis," which merely means the presence of a constitutional taint that predisposes to an attack of tubercle, while this latter is but the local expression of the constitutional taint known as Scrofula. *Symptoms*: This disease may be acute, but is generally chronic. The onset is insidious, and easily overlooked, tubercles often being found in animals killed in prime condition. We have an example of this in the first case I related—the one in which there was a deposit in the abdominal muscles—for this animal gained weight at the rate of two and a half pounds a day, and there were extensive deposits in her, but the function of no important organ appeared to be interfered with. After a varying time symptoms of the disease are generally shown, which vary according to the seat of the deposit, yet there is a constitutional condition common to all, giving rise to a similarity of symptoms. In milking cows the earliest signs are those of unthriftiness. The quantity of milk given may not decrease for some time, but it is of poor quality, being thin, blue, and watery. If the cow be in calf abortion is apt to occur; if not pregnant, the condition called nymphomania, (constant heat) is frequently present. In any of the ox tribe, when so affected, the appetite is capricious, the mucous membrane pale, occasional dryness of the nose, heat of the horns and ears, slightly increased temperature (102°), weak accelerated pulse, a dry cough of a dull character exists, the skin looks dull, and the hair dirty. Hastened breathing is sometimes observed, especially when the disease has made much progress, and markedly so on exertion. Emaciation proceeds more or less rapidly, and the cough becomes more troublesome. The digestive organs are weak, the rumen prove to tympanitis, and in some cases diarrhœa sets in, which soon carries off the animal now become a mere skeleton. The terms "Wasting," "Consumption," and "Pining" are often applied to this disease, which have arisen from the prominence of the above mentioned symptoms in some cases. Lameness is sometimes present, with no local signs, but a *post mortem* reveals tubercular inflammation of a joint or joints. Tubercular tumours often present themselves in the neighbourhood of the lower jaw, appearing as round, moveable, painful nodules, which gradually enlarge, and become attached to the skin, which inflames, and finally ulcerates, leaving a raw and unhealthy surface, with no tendency to heal, which distinguishes it from an ordinary abscess, and with which it is apt to be confounded. These tumours may be found in any part of horned cattle.

The above symptoms are present in many phases of the disease, but are subject to modification, and variation, according as any organ is more particularly the subject of deposit, its function being interfered with in direct ratio to the amount of such deposit, thus giving greater prominence to the symptoms of an organic lesion in one case than in another.

Causes.

Animals no doubt inherit a tendency to the development of this disease, which is excited by various adverse circumstances, such as food deficient in quantity and defective in quality, improper ventilation, prolonged milking, etc., "*In and in breeding*," has certainly developed the constitutional taint in some strains that are notorious for the development of tubercle, *early*, *late* and *overbreeding—i.e.*, breeding from animals at an age when their tissues are imperfectly formed, or worn out. Over-breeding or not allowing sufficient time for the system to strengthen after calving, before again allowing conception to take place. It occurs, however, under the most favourable circumstances, and has been noticed as a congenital condition. It appears, from recorded facts, that tuberculosis may be transmitted under favourable circumstances, from the actually diseased to the healthy. These conditions are cohabitation, partaking of milk from tuberculous subjects, and the using of their flesh as food.

It is found to be dependent on a microscopic organism, which has actually been separated from tubercular matter, and cultivated; and on inoculating healthy animals with the result of this cultivation, tuberculosis has resulted. This shows conclusively that this organism, which is called the bacillus of tubercle, is the cause of the disease, and in any way that this can gain admission into the system, in this way may the disease be caused.

Post Mortem Appearance.

Scarcely any part of an animal seems exempt from tubercular deposit, so it may be looked for in any situation, but is most frequently found in the chest in connection with the lungs, and pleuræ. The deposit may consist of one tubercle or of a number congregated together. They vary in size from a millet-seed to that of a nut, having a greyish colour, spherical form, and firm consistence. This is the highest state of development in which they are found; but they are subject to retrogressive changes, and consequently are seen in various stages of degeneration. The most frequent change, the result of degeneration, is the conversion of the nodule into a cheesy-like matter, which change begins in the centre, and involves more or less of its substance, giving it a yellowish appearance, when cut into. In some cases the tubercles assume a consistence resembling that of cartilage. In connection with both these conditions is frequently found a deposit of some of the salts of lime, which gives the matter a gritty feeling when pressed between the fingers. These are the most noticeable features observable, on making an examination of this kind.

Treatment.

If any means of relief are to be resorted to, they should consist of placing the animal under the most favourable conditions, as to surroundings, allowing warmth, pure dry air, and attention to cleanliness. The food should be nutritious, and contain abundance of fat, as linseed, corn, peas, etc. Tonics and restoratives may be given, consisting of Cod-liver or linseed oil in small doses; and sulphate of iron combined with gentian or cinchona.

However, it is doubtful if it is ever advantageous to resort to treatment, as it is rarely successful; and if it were, it is not desirable to preserve an animal for breeding purposes, which is very liable to hand down to its progeny a predisposition to the disease. There are also very grave suspicions held by the most scientific and keen observers of the present day, that the milk and flesh of infected animals are likely to prove media for the transmission of this disease to human beings; for the tubercle of man and cattle are held to be identical. So much has this impression gained currency among the profession, that it was one of the chief subjects discussed at "The International Veterinary Congress," held during September of this year at Brussels in Belgium. There were present at that meeting representatives of nearly every seat of Veterinary learning in the civilized world, and the conclusion arrived at was, that consumers of meat from an animal affected by this disease in any form ran a decided risk of incurring the malady. Some animals are much more prone to the disease than others, those of the ox tribe being particularly susceptible; and next in order among the larger animals come the pig, while the sheep and dog are comparatively exempt. It is extremely rare in the horse, some of the oldest and most experienced practitioners never having seen it.

The extent to which this disease exists, amongst the better breed of cattle in this country, is alarming, for many reasons; not the least one of which is the danger to which the public are exposed from the consumption of meat from such animals. From an economic standpoint the outlook is serious, as the annual loss must be very great, and will continue to become greater, as long as so little care is observed in the selection of healthy dams and sires. Of course a great deal of this is unavoidable, from the difficulty of diagnosing the disease in some of its forms, and the undecided symptoms shown in the earlier stages, as well as the inability, on the part of breeders, to realize the seriousness of the condition even when shown most unmistakably. Added to this, many people show a selfishness and criminal negligence in taking no precaution against its dissemination by heredity among cattle, and its propagation amongst human beings, by allowing the sale of the meat from infected animals, even when it is pointed out to them by the Veterinarian.

In addition to the symptoms already mentioned of this disease in cattle, it may be as well to state the kind of physical conformation which is often possessed by these animals that show a peculiar predisposition to the malady. They have light barrels, narrow chests, disproportionally long legs, with attenuated necks and ears, and horns set close together. Some observers consider that those of a light colour are more prone to the disease, especially light roans.

The disease amongst the cattle to which my attention has been most frequently called is that of "Foul in the Foot," and it has certainly caused a great deal of trouble and annoyance; but no loss has resulted, with the exception of preventing the animals from thriving as they should have done during the trouble. In order to convey a more correct impression of what we have encountered, it will be necessary for me to give a brief description of this disease.

Foul in the Foot.

This is an inflammation of the interdigital substance, of varying intensity, which may extend, and involve the sensitive structures within the digits, as well as cause death of the bones (necrosis) as far up as the fetlock joint.

Causes.

Pre-eminent among the causes of this condition is filth, as standing in a stable or loose-box, in which the manure is allowed to accumulate, or when a stable is floored with plank, and constant soakage has taken place, resulting in the collection of a material, that is constantly undergoing decomposition, which causes the evolution of gases of an irritating character, and which, coming in contact with the sensitive interdigital substance, produces inflammation. Overgrowth of the hoof, causing a strain on the internal structures. The irritation caused by dirt collecting between the digits, or any injury or condition causing irritation sufficient to produce inflammation of that part. Tubercular deposits also give rise to a very serious form of the disease.

Symptoms.

Lameness is always present, which may be so severe as to cause fever, and loss of appetite; and, when the bones become involved, the suffering is sometimes very great, causing the animals to lie down and groan with pain, and, in some cases, death results. In milder cases, on examining the affected foot, the substance between the digits will appear raw and red, and cracks are frequently present, with a discharge of pus which may have a fetid odour, especially if it has burrowed underneath the horn. There is sometimes a swelling above the coronet, which may extend as high as the fetlock joint, and if the bone is involved, abscesses may be formed in that region.

Treatment.

Remove the cause, and, if from filth, it is often better to change the animal to another and more favourable situation. Pare the hoof into its natural form, if required, and also remove any portion of it that is underrun with pus. Apply warm poultices until the pain is relieved, afterwards keep the part clean and enveloped in a bag. In most cases the application of mild astringents, and antiseptics is sufficient, as a drachm each of acetate of lead and sulphate of zinc to a pint of water, mixed with a two per cent. solution of carbolic acid, and applied once daily after cleansing. If what is vulgarly called proud flesh (fleshy granulations) appear, the pure carbolic acid may be applied for once or twice. When the bones are much diseased, it is sometimes advisable to amputate the limb above the diseased portion, which will admit of the animal being prepared for the butcher.

I attribute the frequency of the occurrence of this affection among the cattle of the College to the condition of the flooring, which is of plank, and has been down for a great number of years; consequently there must necessarily be a large accumulation of filth, and the conditions that result from it. Of course the cattle are more or less predisposed to an affection of this sort, from the fact of their generally being in a plethoric condition, the result of high feeding.

To prove that the cause I have mentioned, as operating in these cases, is the correct one, I have but to state that any of them very seldom yielded to treatment until I had them moved to another building. On this account I advised having the floor taken up, and the place thoroughly cleansed, before putting down again; but it was not thought advisable to do this, as there is some talk of our having new buildings.

Stable Floors.

I don't wish it to be inferred from this, that I am opposed altogether to plank flooring, for I think it presents advantages in some respects, as it can be more cheaply taken up and replaced than any other kind made; but when holes are bored in it to allow the urine and fecal matter to drain through and collect below, it becomes an abomination. I think on the whole that the cedar-block pavement is the most convenient, and best calculated to keep a building in a healthy condition, if the blocks are laid in any substance that will tend to prevent percolation, such as a puddle of clay. But there is no doubt, if it were always practicable to have abundance of litter continually underneath animals, which would absorb all moisture, and admit of it being removed regularly, then we should have an arrangement most conducive to health.

I am sorry to say that this is not the only part of the stabling arrangements that is defective, and any one glancing at our main building, which affords the major part of the stabling accommodation for the cattle, could easily see that it does not afford what modern sanitarians consider is indispensable to health, viz.—light, ventilation, sufficient warmth, and pure, dry atmosphere. But, however, these considerations can hardly be remedied short of the erection of a new building.

We also find that there is insufficient room for the amount of stock kept, which necessitates crowding, making it inconvenient, and unwholesome at any time, but which is much more noticeable when any of the stock are sick, as it prevents their isolation, which is so desirable to the patient at all times, and necessary as a means of prevention in some cases to the unaffected.

I think I have drawn attention to most points of interest in connection with what I have observed and encountered on the farm, and have described more fully than will be required in any subsequent report, the mode of my teaching, the subjects taught, and the way in which the teaching of my department might be rendered more efficient; consequently I will conclude,

Having the honour to be,

Sir,

Your obedient servant,

F. C. GRENSIDE, V.S.

APPENDIX.

TAPE WORM IN LAMBS.

Having lost some forty lambs at the Agricultural College, and hearing that a number of farmers in the different parts of the Province have been suffering similar losses from the same cause, I thought it might prove interesting, and perhaps instructive to sheep raisers, if I related my experience in connection with this serious mortality. There is perhaps no province or country of the size of Ontario in the world that enjoys immunity from disease of an epizootic, infectious or contagious character among the domesticated animals to the same extent that we do in this province. On this account it is natural for us to become considerably alarmed and wary, when we see one of the resources and food supplies of the country endangered. It certainly behoves every veterinarian who has encountered the disease I am about to speak of, to lay his experience before the country, so that from the aggregate of experiences a correct knowledge of this disease may be gleaned.

The disease which I am referring to is caused by the tape worm. To the presence of a species of this genus of worms in the bowels of the lambs is the whole trouble due. It is called the expanded tape-worm *(Tenia Expansa)* on account of the breadth of the segments, and has been found in the intestines of the goat and ox, as well as those of the sheep, but most frequently in the latter, and from the ravages it has caused among these animals especially in Germany, it has given rise to what is called the tape-worm plague. It is pretty certain that previous to this year, this disease has not caused much loss in this country, for Prof. Smith—the most experienced veterinarian in this Province—whom I consulted, and in whose company I investigated the present outbreak, had not previously had his attention drawn to similar cases. Veterinary literature on this subject is most meagre, and any that I have been able to find merely mentions the disease as having been noticed, without giving any of the symptoms or history. But Professor McMurrich has kindly procured and translated for me a pretty minute account of the disease from an eminent German Helminthologist's work; and as this tallies to some extent with what I have observed, I think I cannot do better than give what he says on the subject. He says "the expanded tape-worm does not often make its appearance singly, and when it does no marked sign of sickness is the result. It is most commonly found among the lambs and shearlings of a flock, causing sickness in such large numbers that we may correctly speak of a tape-worm epizootic. The first symptom of this persistent flock sickness is the sheep presenting white skin and mucous membranes, light coloured wool from which the yolk is absent. Next they become emaciated, and cease to grow, although they eat and drink more than naturally. Digestive trouble soon appears shown by an unnatural sweetness of the breath, uneasiness, and symptoms of pain; the animal strains to void fæces, but often without success. The belly becomes swollen, caused by the collection of fæces and formation of gas. The animal becomes thinner and weaker and can only with great difficulty follow the flock. At times convulsions appear. If fæces are passed they are yellow and slimy, and frequently contain segments of the worm here and there The weakness and depression increase so that the patient remains lying on the ground unable to raise itself, and dies from exhaustion. By making a post-mortem the worms are sometimes found in a mass in the intestines, usually very long and much intertwined, often filling the canal in places completely." The same author says there is no doubt that the immature parasite is taken up by the sheep from the meadows, and that wet, boggy pastures are most favourable to the development of it. The first deaths that took place at the College occurred about the middle of May, after we had had a series of cold rains. Six lambs and a ewe were found dead by the shepherd one morning; this is the first intimation we had that anything was wrong with the sheep. Upon making a post-mortem on three of the lambs that died the nature of the disease was revealed, but it differed somewhat from the above quotation, as I found well marked signs of inflammation existing in the intestines as well as in the stomach. The severity of the inflammation seemed to be in direct ratio to the abundance of the worms. There must have been more than one hundred feet in some of the lambs, and they varied from one-sixty-fourth to one-quarter of an inch in breadth. After these deaths we kept a pretty close watch on the sheep but failed to detect any signs of sickness in any of them until three mornings afterwards, when there was another lot of six or seven of them found dead—some of which showed much the same post mortem appearances—and two or three suffering violently. Although there were well marked signs of inflammation of the bowels on making a post mortem on some of them, these signs were entirely absent in others. The symptoms before death differed also, some showing evident signs of abdominal trouble manifested by hurried breathing, constant changing of position, laying down, kicking, and tenderness on pressure over the bowels, while others presented the symptoms quoted from the German author, but in a very aggravated form. They exhibited great dullness and depression, reeled and staggered when moving, and showed loss of vision by running against fences, etc., and by the pupil of the eye becoming very much dilated, giving the organ a glassy appearance. On examining the brain and its coverings of one of them which showed these latter symptoms, evident signs of congestion were easily detected. Since the loss of this second lot such large numbers have not died at one time, but two or three kept dropping off every few days for a couple of weeks, with the symptoms just described, but in a much less acute form, in fact more like the German author has described. The shepherd says he never had a finer lot of lambs than these up to the time the disease began to show itself, but those that have survived are much lower in flesh than they ought to be. After the worms had evidently seriously deranged the health of the animals, treating them sncessfully seemed hopeless, so we directed our efforts towards the source of the trouble in those that had not yet showed any alarming symptoms, and we have been pretty successful. I first tried an infusion of pumpkin seeds which has the reputation of acting well in such cases, but it did not prove effectual, which may be owing to some fault either in the preparation or in the manner of administering it. I will just state the course I pursued; I infused two ounces of the seeds in a pint of boiling water for five or six hours, and after keeping the lambs without food for some hours previous gave them two wineglassfuls three times a day until five doses had been given, and then gave them a purgative consisting of linseed oil. As no worms were expelled I thought I would try oil of Male Shield Fern, which I did the following way: I took ten drops of the oil and mixed it with three ounces of linseed oil, giving this dose to each lamb after fasting, and following in a few hours with a purgative dose of linseed oil. This caused a considerable number of worms to be expelled. I pursued a similar course of treatment again in a couple of days and a lot more were passed. This showed that oil of Male Fern can be relied upon for this purpose, and in order to thoroughly get rid of the worms it is only necessary to administer it in a proper manner. I think it would be better to give three or four doses following, allowing three hours between each dose and then follow up with a purgative, but of course it is a very laborious and tiresome undertaking to drench sixty or seventy lambs so many times, and it also seems to nauseate them to some extent. Full grown sheep take twenty-five drops of the oil of Male Fern. Of course the size of the dose must be regulated according to the age and size of the sheep. Those that I gave ten drops to were between three and four months old. It may be asked how it was that the immediate cause of death differed in the different cases, why some died of inflammation of the bowels, others with brain derangement, while others succumbed from apparent starvation. Of course the latter is the manner of death to be expected as the result of tape-worms in such numbers, and I think one might reasonably attribute in this case, the diverse modes of death to the modifying influences of the weather. For, as I stated before, that previous to the death of the first lot we had had a series of cold rains, which any one with any experience of sheep knows act most injuriously upon these animals, often causing inflammation of some internal organ or organs. Now, with the predisposing effects of the weather, and the presence of the worms to act as an exciting cause, there does not seem to be much reason for astonishment at the post mortem appearance revealed in the first cases. After the death of the first lot the weather moderated, and although we had repeated rains the temperature was higher, and the wind did not blow from the east, in fact the weather was less unfavourable. Without reasoning out the cause for the symptoms and post mortem appearance presented by the second lot, I may state that derangement of the digestive organs is not infrequently followed by brain disorder amongst ruminants. Of course, the matter of most practical importance in connection with an outbreak of this kind, is to find out the cause of the trouble and remove it if possible, but this, I am sorry to say, we have been unable to do.

In finding out the source of any species of tape-worm there is one thing to be remembered particularly in their life history, and that is that before the embryo can become developed into a mature tape-worm it is absolutely necessary for it to change its host or pass into some other form of animal life, and thence back again into the animal or animals it naturally infests. So that finding out the intermediary bearer of the worm is equivalent to finding out its source. Now, from the fact that wet weather has been found to influence the propagation of this species of worm, it is reasonable to infer that the intermediary bearer is some form of aquatic insect. On this account Professor McMurrich made a careful search in the field in which the sheep had been, and although he found a number of slugs, the microscope failed to reveal any signs of the presence of the immature tape-worm. This is the most difficult matter to solve in connection with the study of the life history of helminths; which can be understood when it is known that it is only within the last two years that the intermediary bearer of the "Liver Fluke" has been determined upon. This is the worm that causes "rot" in sheep, and there is no disease amongst ovines that has caused such serious losses to flock-owners in Great Britian as this one. So that no pains have been spared in investigating the life history of the cause, and it was only after years and years of toil that the matter was settled. I just mention this to show the difficulty of tracing the life history of worms and hence of removing our patients from the source of contagion. It is found that flocks grazing on low pastures and marshy districts were much more liable to invasions of "Rot" than those on higher and drier grounds, but an exception is observed among sheep pasturing on salt water marshes. This would suggest as more than probable that salt proves destructive to the intermediary bearer of the fluke-worm, and if this is the case, and as we also suspect some mollusc or aquatic insect to be the intermediary bearer of the expanded tape-worm, it might be a good plan to spread a couple of hundred of salt to the acre over the pasture on which sheep become infected. As we are now speaking of means of prevention, I might state it would be a good plan if medicine is being given to cause the expulsion of the worms, to keep the sheep in a yard where there is no grass, and where the excrement could be collected and burned. And now, sir, apologising for taking so much of your space.

F. G. GRENSIDE, V.S.

Guelph, June 25th, 1883.

PART V.

REPORT

OF

THE PHYSICIAN.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, 29th December, 1883.

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

SIR,—I have the honour to present to you my Annual Report.

This year we have to record one death, caused by rupture of a blood-vessel in a case of advanced Phthisis, in a young man twenty years of age, who had only been a short time in this country, and whom I had advised to return to his friends, which he intended to do had death not come so suddenly.

We have had very few cases of a serious nature, although we have had a good many of ordinary character.

I consider we have had a favourable year.

I still press the importance of having an isolated sick-room.

I have the honour to be, Sir,
Your obedient Servant,
E. W. McGUIRE.

REPORT

OF THE

PROFESSOR OF AGRICULTURE,

FARM MANAGER,

AND

EXPERIMENTAL SUPERINTENDENT.

Printed by Order of the Legislative Assembly.

Toronto:
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1884.

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PART VI.

REPORT

OF THE

PROFESSOR OF AGRICULTURE,

FARM MANAGER AND EXPERIMENTAL SUPERINTENDENT.

Ontario Agricultural College and Experimental Farm,
31st December, 1883.

Sir,—I have the honour to submit the Ninth Annual Report of the Outside Departments of this Institution.

In Agriculture, as in other businesses, men are apt to have their attention withdrawn from the older line of work by some new and possibly more interesting, and as valuable, branch of their own profession. I do not mean that the older is usually entirely neglected, but it certainly does not receive that fair measure of attention which its importance demands. We have a very marked example of this at present in Grain growing, along with the Live Stock interest of the Province.

Ontario has given as good wheat in quantity and quality as can be obtained anywhere else. Her early history in this specialty was very interesting, and, in my opinion, does not merit that form of censure now so common with some. I cannot join the unmeasured wail of the present moment in the United States and Canada about *disafforesting*, which is intimately related to this subject. It has always been, and still is, a national duty to overclear, so to speak. When modern scientists are but groping their way amongst "Trees and Climate," how reasonable we ought to be in commenting upon the pioneers of even a quarter of a century ago, whose meteorological knowledge was nothing without an untimbered sky and golden grain. Men long ago, and now, did not grow much of the non-essentials of life, in a new country. Life was too serious to be trifled with among Hemp and Hops, and even among Roots and Apples. I am not arguing advisedly with the Art and Science in saying so, because no art or science agrees with man's *easy* existence. To-day all the civilized world knows that man's bread and beef are *harder* on the soil than anything else. Those who blame for the Wheat growing of the past unthinkingly censure the very life blood of a new nation. Farmers of 1850, Ontario, were more justified in their agricultural practice than we are in some now prevailing; it was more legitimate under their circumstances to take Wheat and Wheat than it is for us to graze permanent pastures without systematic top-dressings.

But Ontario may have to take a second place in the extensive and cheap production of cereals, because the possession of the country westwards being in some respects a repetition of our own life, will produce cheaper, and maintain plant excellence better, than older lands can do. This new feature of our Dominion agriculture must be acknowledged in Ontario practice, and that practice made to tie with it. This position does not imply that Ontario must give up her wheat area, or that the proper maintenance of varieties should be abandoned. I think, on the contrary, that it devolves upon us more than ever to give attention to these. Under the increasing fertility of our older lands, by the better system of farming and larger number of live stock kept per acre, Ontario is as able as ever to grow perfect Wheat—both winter and spring varieties. The fine old SOULE and FIFE have left us meantime—not for want of proper nourishment in climate or soil, but simply because in the regular course of their day as cultivated plants they require a change. We did not allow them that thorough recuperation by change to other climates and soils, which alone affords new life, and hence, serious disappointments and loss—that are too often ignorantly charged to other causes. It comes in as an interesting point in these considerations, whether our North-West Territories will send us back the Fife, Club, and White Russian, so reinvigorated as to give another lease of a quarter of a century. Meanwhile something else must be done.

It is considered to be the duty of the Legislature, in connection with this Experimental station, to maintain a system of grain testing, for ourselves, *as well as others*. I am of opinion that Ontario, by all her physical conditions, is better adapted for this purpose than any other position on the American Continent. European and United States experience say that the change of seed most suitable for them and us is from Southern Russia and Hungary, which have a climate in more respects resembling Canada than any other country. The Isothermal of 45° joins Ontario and the Black Sea district, which is still so famous for sound Wheats.

A good deal has been attempted during the last ten years in introducing new Wheats from the United States, both by private enterprise and this Experimental Farm, but, with few exceptions, they have failed, or were but short-lived. This was a natural consequence of bringing from the South to the North. The work must be accomplished through equal or more severe climatic conditions than the country proposed to be benefited, so that further attempts from the United States may be looked upon as fruitless.

It is not uninteresting in this connection to place on record that in November last I had a communication from Messrs. Oakshott & Co., the well-known Seedsmen, of Reading, England, submitting a number of varieties of Wheat, Barley, Oats and Peas to be experimented upon at Guelph. As evidence of their confidence in our work, they enclosed the following letter:—

"THE INSTITUTE OF AGRICULTURE,
" South Kensington, London.

" GENTLEMEN:

" I have the honour to thank you for bringing under my notice the series of experiments you purpose having carried out in different districts. Let me mention that at Guelph College they have facilities for carrying and testing such experimental results in a manner surpassed by none, excelled by few, if any. I think you should put yourself in communication with Professor Brown; for it is very probable that the College can give such valuable help as will surprise many in the old country. Wishing you every success in this great international work.

" HENRY TANNER.

"Messrs. OAKSHOTT & Co."

International work of this kind—to which we have been invited in such complimentary terms, and to which I gave hearty response after consultation with the Department—is no doubt valuable in itself; but there is a larger and more immediate duty awaiting us. We should at once begin the purchase of wheats from Europe, not only for experimental testing here but immediate distribution throughout the Province. For this purpose I ask that $3,000 be placed in the Estimates for 1884, and that means be taken for a proper selection by a competent person, so that the fall of 1884 and spring of 1885 may be fully provided for in chosen parts of the Province.

I beg your best consideration to this important matter, which you will remember had the favourable view of the Legislature last session.

I now beg to submit another subject, of equal importance at least to Wheat: that subject is, the importation of LIVE STOCK for this Farm.

Cattle, Sheep and Swine are kept here for four great purposes:—

1. As educational agents for students, who are daily taught by handling, comparison, discussion of characteristics, conduct under similar conditions in the stall and on pas-

ture, and otherwise the whole practical standing of breeds and individuals, as suitable for different purposes.

2. As reference material for the farmers of the Province, both by personal examinations and experimental issue, through the important results of beef, mutton, wool, milk, cream, butter and cheese.

3. As immediately productive subjects in ordinary farm practice, as well as their distribution by public sale.

4. As on hand for improvement of other herds and flocks when required by service.

In each of these, our position, during the last eight years, has been not only highly satisfactory, but progressive and far-reaching.

We have had two systematic importations from Britain during that period: one in 1876, at a cost of $8,108, and another in 1881 that cost $6,250. In addition to these, other purchases were made to the amount of $2,530. Thus then, altogether, in our experience, $16,888 have been expended in the purchase of thoroughbred stock.

The amount of public and private sales, with service and wool, has been $31,876. The cost of management, with losses by death and non-breeding, on the one hand, and the value from manure on the other, is not easily calculated; but, taking a fair view of all circumstances, which would embrace the educational advantages in all their width, there results, at least, the sum of $11,000, as clear cash profit upon the investments. And besides this balance there are on hand animals valued at $5,000, though practically we are at present without any herds and flocks.

It is therefore proposed to import as early in 1884 as possible; and, in view of the reputation we have to sustain, as well as the desire on the part of almost every one that we should be in possession of *everything worth having*, I beg to submit the following:—

CATTLE.	SHEEP.
Short Horn Bull and four Cows	Lincoln Ram and three Ewes
Aberdeen Poll “ “ four “	Cotswold “ “ six “
Hereford “ “ four “	Leicester “ “ six “
Devon “ “ two “	Cheviot “ “ three “
Galloway “ “ two “	Oxford Down Ram and six Ewes
Norfolk Suffolk Polls, Bull and two Cows	Hampshire Down Ram and six Ewes
Ayrshire Bull and three Cows	Shropshire Down Ram and six Ewes
Holstein “ “ three “	South Down Ram and six Ewes
Jersey “ “ two “	Merino Ram and three Ewes

SWINE.

Berkshire Boar and two Sows
Poland China Boar and two Sows
Essex Boar and two Sows
Suffolk Boar and two Sows

Nine breeds each of Cattle and Sheep, and four of Swine. The least number of each on an average that should be got is one bull and three cows, one ram and five ewes, and one boar with two sows. Thus then, altogether, thirty-six Cattle, fifty-four Sheep, and twelve Swine.

With reference to the probable cost of these, it is well known that since I submitted a similar list—less two breeds of each—to the Government during last session, the value, owing to increased demand in Britain, has risen one-third at least. At the lowest computation, each cattle beast could not be less than $400, each sheep $50, and each pig $50, and as it costs, including every item, about $150 for cattle and $25 for sheep and pigs, to deliver at Guelph, there results a total requirement of $23,850. In this, no allowance is made for incidentals, nor for an additional animal of the same, or other breeds that might be recommended.

$30,000 would place us in a good position, and $25,000 would be risky. In this opinion I am supported by all who have made a study of the subject, and who desire to place us above any other similar Institution on the American continent. Indeed, were it necessary to use influence, with yourself, or the Government in this matter, I could submit many communications from our own farmers and breeders, advising the importance of this third importation, and that at least $50,000 ought to be set aside for the purpose.

II. FARM CROPPING, 1883.

Our nine years' experience of Mixed Farming by a certain rotation and with a large proportion of live stock, under the physical conditions of climate and soil characteristic of this district, have made us certain of some things in science and practice :—

1. We find it is injudicious, as well as impracticable, to adhere strictly to a particular system or rotation in cropping.

2. We find it is indispensible on certain soils to have summer fallow for the eradication of weeds.

3. We find that one kind of grass does not make a pasture, and that pasture has to be fed like other crops.

4. We find it is possible to overdrain certain soils, and that deep drains remove water more rapidly than shallow ones.

5. We find that special manures are more than half removed by heavy rains and under-drainage, and that a manure to be most efficacious, must have a certain "body," size or length.

6. We find, on an average, that soils of medium fertility give more value of annual produce than others.

7. We find that rich, permanent pasture induces too high condition in breeding with certain cattle and sheep, without a change.

8. We find thistles following potatoes and hay more than other crops, and that it is not difficult to smother them out for several years with green fodders.

9. We find a northern aspect more reliable for a variety of crops than a southern or south-eastern one, on certain soils.

10. We find that foot-sore among sheep is not foot-rot, and that sheep or liver-rot has no connection with tapeworm.

11. We find the Hereford breed of cattle, and Southdown breed of sheep to be less subject to diseases than others.

12. We find mangolds to be easier and cheaper cultivated, more reliable, and a more valuable, February to May, food than turnips.

13. We find no trouble whatever in the "bad marking" of cattle, sheep, or pigs, by allowing breeds to run continually together.

14. We find that for the best results in forest tree culture, the young plants must be regularly cultivated for some years.

15. We find it a dangerous thing to have too few live stock and too much crop.

16. We find it a good thing at times to have small crops and much live stock.

17. We find it very tempting, in such a season as 1883, to take two crops of hay, and grow no green fodders.

18. We find we cannot maintain soil fertility without first-class farm-yard manure.

19. We find it is impossible to uphold the best conditions of cattle-life in winter, without roots.

20. We find it is easy to kill a beast in administering medicine, and difficult to save one after "bloating" with food.

21. We find no trouble, as yet, from patronizing the English sparrow.

22. We find it very difficult to grow a genuine gooseberry.

23. We find it simply impossible to train a Scotch collie dog, with one hundred shepherds, on one farm.

24. We find practically no deterioration of farm-yard manure, by proper management, in open courts, especially during a close winter.

25. We find no advantage whatever by washing sheep before clipping.

26. We find most clear and practical advantage in clipping lambs once, and all other sheep, twice a year, under certain conditions.

27. We find very little advantage to the animals by giving grain on first-class permanent pasture.

28. We find no such thing as a "rust-proof" cereal, nor a cow giving lots of milk on little food.

29. And we find mixed farming to be the most difficult, the hardest physically, the deepest mentally, and the most reliable of any other system.

Following is abstract of our farm cropping for 1883:

Farm Cropping, 1883.

Field.	Area.	Extent of Crop.	Nature of Crop.	Quantity per acre. T., tons, B., bushels.	Total Quantities.
		10	Corn Fodder	20 T.	200
1	20½	10½	Late Oats	3 T.	33
2	19	19	Spring Wheat	21 B.	400
3	22	22	Pasture, 2nd year	....	....
4	9	9	Hay, 1st year	2½ T.	22
5	13½	13½	Hay, 1st year	2½ T.	33
6	25	25	Hay, 1st and 2nd year	2 T.	50 T.
7	20¼	20¼	Hay, 2nd year	2 T.	40 T.
8	22¼	22¼	Hay, 1st year	2¾ T.	60 T.
9	21½	21½	Pasture, 1st year	....	....
10	19	....	Bare Summer Fallow	....	....
11	21¼	21¼	Oats	40 B.	850
12	18½	....	Uncultivated Pasture	....	....
13	23	4	Pasture	....	....
		19	Peas	25 B.	475
14	24	....	Experimental Plots	....	....
15	21½	21½	Hay, 1st year	2¾ T.	58
16	22¼	4¼	Peas	18 B.	81
		18	Winter Wheat	15 B.	270
17	20	8	Potatoes	100 B.	800 B.
		8	Mangolds	650 B.	5200
		1	Carrots	500 B.	500
		3	Vinery	....	....
18	19	13	Turnips	450 B.	5850
		....	Uncultivated Pasture	....	....
19	30	16	Barley	35 B.	560
		14	Oats	70 B.	980
20	11	....	Uncultivated Pasture	....	....
21	16½	16½	Pasture, 3rd year	....	....

Abstract of Farm Cropping.

	Acres.		
Grain	122	=	⅓
Hay and Fodder	121	=	⅓
Roots and Fallow	49	=	⅐
Pasture cultivated	64	=	⅕

Mr. Wood's report to me is as follows :—

To Prof. Wm. Brown :—

Sir,—I have the honour of submitting the following statement of the Farm and Live Stock Department. Three years and a-half have elapsed since I came to this Institution. One of the first cares after my appointment was to set to work and eradicate the remaining thistles with which some fields were badly infected.

Loose and fast stones held supremacy in some other fields. In former years my position was occupied by two, the work then was not so extensive and laborious as at present, in consequence of fewer students and stock.

Since my appointment we have summer-fallowed No. 6 field, removed fast and loose stones, stumps, and the second growth brush, and 4, 5, 14 and 16 fields were thoroughly grubbed out. From 1, 2, 7, 15, 17, and 18 fields fast and loose stones were removed. In field 14, now used for experimental purposes, there were from three to four acres of marshy land entirely overgrown with saplings; this is now utilized and efficiently drained. Our next attention was directed to the five uncultivated acres, in field 16, from which stumps and loose stones having been removed, were ploughed and sown with peas, the balance of it was underdrained, and is now in excellent condition for cropping. Although most anxious I have been unable to remove the stone piles from fields 19 and 21, but anticipate doing so at an early date. As soon as our present rotation of cropping will permit, field 19 should be summer-fallowed. It affords me much pleasure to state that the root crop, while a great success, proved in some cases unsuccessful in checking the growth of thistles. There is nothing in my estimation to surpass that of a bare summer-fallow for the thorough extermination of these formidable foes and to place the land in a good condition for the reception of fall wheat.

Herein will be found a narration of the crops gathered from the various fields during 1883, which, for quantity and quality we have reason to feel justly satisfied when we consider the many and numerous rain storms with which they were visited. That our labours have been amply compensated the following catalogue of productions will clearly denote.

Fields.

No. 1—Twenty acres, ten of which were sown with corn and ten with oats. The former at one time showed indications of great success, but being visited by early and severe frosts, proved a failure. The oats were intended as a test for self-binders, and is now used as fodder.

No. 2.—Eighteen acres, sown with wheat (White Russian), yielded twenty-one bushels per acre.

No. 3.—Twenty acres, are pasture.

No. 4. " " pasture and bush.

No. 5. " " under hay of splendid quality, yielded two and a-half tons per acre.

No. 6. " " hay crop yielded two tons per acre.

No. 7. " " " " " " " "

No. 8. " " " " " two and three-quarter tons per acre.

No. 9. " " pasture.

No. 10. " " fifteen acres of which are summer-fallowed and sown with wheat. The balance is under small fruit.

No. 11.—Twenty-three acres, sown with oats (Black Tartarian), was broken down by rain storms, and yielded forty bushels per acre.

No. 12.—Fifteen acres, pasture.

No. 13.—Twenty acres, sixteen acres sown with peas, yielded twenty-five bushels per acre, the remaining four acres of which are at the disposal of the students as recreation grounds, meantime.

No. 14.—Twenty-five acres, experimental field.

No. 15.—Twenty acres, hay crop, yielded two and three-quarter tons per acre.

No. 16.—Twenty-five acres, twenty of which were sown with fall wheat (Clawson), yielded fifteen bushels per acre, five remaining were stumped, cleared from stone, ploughed and sown with peas, yielded eighteen bushels per acre, straw measuring ten and twelve feet in length which explains the deficiency.

No. 17.—In this field seventeen acres were sown with roots, eight acres of which were potatoes. As I already intimated the amount of rain which was baneful in many respects, proved doubly so in regard to the low lands which were completely flooded. Notwithstanding all these drawbacks the crop of potatoes was really excellent, yielding no less than eight hundred bushels, which for quality can favourably compare with any others. Eight acres of mangels and sugar beet yielded 650 bushels per acre, and one acre of carrots (White Belgium), yielded 500 bushels.

No. 18.—Thirteen acres sown with turnips yielded 450 bushels per acre.

No. 19.—Containing thirty acres, sixteen of which were sown with barley, yielded thirty-five bushels per acre, and the remaining fourteen sown with oats, (Black Tartarian) on turnip ground, proved most successful —yielding seventy bushels per acre.

No. 20.—Remains uncultivated, while

No. 21 contains sixteen and a-half acres in pasture.

Thoroughly convinced of your efforts to see this Institution enjoy the distinction its founders desired, and being a daily witness of your labours to render it such, I am persuaded that a brief notice on the special Live Stock class will cause you as much pleasure as it has given satisfaction to myself. The class proper consists of fifteen students, and I am bound to say that for gentlemanly conduct aud deportment, they are first class, and as for the interest they evince in the lectures, it is only equalled by their untiring perseverance and assiduity at class. The many branches in the Live Stock Department furnish them with ample subjects, especially in a practical sense. Nothing is hurriedly gone through. Every subject is carefully handled and analyzed, even the most minute is not set aside until we are assured that the students have mastered and developed it in all its parts.

While under my supervision for the first hour, two are weekly detained in charge of experimental sheep, the remainder are distributed to cattleman, shepherd, and experimental cattle.

My lectures to them may be enumerated under the following heads, which occupy the second hour.

1st.—On the treatment of cattle, sheep, and swine.

2nd.—Judging and handling store and fat cattle.

3rd.—Milking properties of cattle.

While occupied in cutting up the meat for College, I explain the different parts of beef, mutton, and pork, stating the market value of each part of the carcase. This information furnishes the students with much practical knowledge and at the same time points out the places in which the prime parts of the animal are to be found, and judge the value of it when alive.

The Importation of Cattle, Sheep, and Swine, requisite for 1884.

Before submitting the kind and quantity of cattle for your consideration. I would beg to state that the short-horned breed has been very poorly represented on the farm during my term of office.

The reputation of this breed throughout Europe and America should make us the more anxious to secure a fair representation. I trust the Government will make a sufficiently large appropriation to enable you to import *superior cattle*, not only for the interests of education, but also for the improvement of the stock in Ontario. Above all no second rate cattle should be tolerated on the farm for breeding purposes.

I cheerfully submit the following *superior breeds* and numbers of both sexes, with the estimated amount required to purchase them. In my estimation the sum of thirty five thousand dollars ($35,000) is necessary.

CATTLE.

Shorthorn.
1 Bull ;
5 Females.

Aberdeen Poll.
1 Bull ;
5 Females.

Norfolk or Suffolk Polls.
1 Bull ;
2 Females.

Hereford.
1 Bull ;
5 Females.

Devon.
1 Bull ;
2 Females.

West Highland.
2 Females.

Ayrshire.
1 Bull ;
2 Females.

Holstein.
1 Bull ;
2 Females.

Alderney.
1 Bull ;
2 Females.

Galloway.
1 Bull ;
2 Females.

SHEEP.

Lincoln.
1 Ram ;
5 Ewes.

Leicester.—English.
1 Ram ;
5 Ewes.

Leicester.—Border.
1 Ram ;
5 Ewes.

Cotswold.
1 Ram ;
5 Ewes.

Cheviot.
1 Ram ;
5 Ewes.

Oxford Down.
1 Ram ;
5 Ewes.

South Down.
1 Ram ;
5 Ewes.

Merino.
1 Ram ;
5 Ewes.

Hampshire Down.
1 Ram ;
5 Ewes.

Shropshire Down.
1 Ram ;
5 Ewes.

SWINE.

Berkshire.
1 Boar ;
2 Sows.

Poland China.
1 Boar ;
1 Sows.

Essex.
1 Boar ;
2 Sows.

HORSES.

1 Clyde Stallion.
2 do. Mares.

Remarks.

It seems to me, and I heartily recommend that shafting be fixed in the implement shed for running machinery, for the instruction and benefit of the students as far as the practical management is concerned. There is nothing, I am sure, would or could interest the students more and add a very valuable acquisition to their already well earned stock of information.

To facilitate this, the portable engine now in our possession would answer the purpose excellently, while the placing of the shafting would, after all, be but secondary when we consider the benefit and amount of real solid knowledge to be derived therefrom. This being accomplished the winter months, which in themselves are more or less dreary, would be rendered cheerful, while each and every student would become thoroughly competent in all the intricate workings of farm machinery.

Coupled with this a long shed with close floor would be necessary to instruct the students in hand sowing. In spring the season being so short between ploughing and sowing, and having so many students for instruction, it seems to me impossible (at least beneficially), to impart the amount of instruction necessary for this important branch of education.

Now as the Government is about to erect new buildings, viz.: barn, cattle and horse stables, etc., I trust that nothing may be brought to their notice quicker than the necessity of erecting among the others a building commodious in all its apartments for the instruction of students during the winter term. Moreover, I can afford to give more of my time at this season of the year than at any other.

Another very important matter I would like to call your attention to is, that the students' vacation commences on September 1st, in each year. It is at the beginning of this month, we start our fall ploughing, and by their absence they lose the most beneficial part of the year to reap a rich harvest of useful information in this special branch.

Another remark which may be of interest and which has frequently occurred to me is that while farmers' sons depart for home it would be well to retain those who are not farmers' sons, as they require much more instruction.

I am, sir,

Your obedient Servant,

P. J. Woods,

Farm Foreman.

III.—LIVE STOCK.

1.—Public Sale of Live Stock.

Our Seventh Annual Sale of Live Stock was the largest of the kind, and the most varied of anything from one farm, in European or American experience. As many as two hundred and sixty head of fifteen distinct breeds of cattle, sheep, swine and dogs were sold without any reserve. This was done in view of new importations next year. The sale was held on the grounds and during the exhibition of the Agricultural and Arts Association, at Guelph, which afforded the best time and facilities for the purpose. Of the merits of many of the animals much could be said in commendation. The country, to a large extent, is acquainted with their stamp, and I need therefore but refer to a few.

Among the Shorthorns, *Louan of Guelph* possesses, in addition to a first-class pedigree, a great depth and width of frame, with most of the points of a good milker, for which her family, on the dam's side, has been famous. *Cambridge Queen 2nd*, as a branch of another distinct family, have been most renowned as beefers, and this heifer having made an unusual growth, with many points of beauty for her age, has been put early to breed.

Among Herefords, the cow *Heatherbell* is considered one of the finest in the Province, is still a true breeder, a grand doer, and is dam of some of the prominent stock bulls of the United States and Canada. Her latest calf, *Heatherbell 5th*, is clearly the best heifer ever sent from this herd. The imported three year old bull *Hopedale* has several times fetched us an offer of $1,000. The evidence of his get in the catalogue, and his own characteristic stamp, will ensure high commendation.

With regard to Aberdeen-Angus Polls, the first cow on the list, *Haughton Lass*—for which we hold handsome private offers—is out of the cow that stood first in an extensive competition at Alford, Aberdeenshire, 1876, beating even Mr. McCombie, of Tillyfour. The heifers *Donside Lass* and *Maid of Meldrum*, are those that have been so much admired by hundreds of visitors during the past summer. The bull *Marquis of Huntly* is an unusually good animal, showing already all the fulness and finish of his kind; his pedigree on the dam's side is one of the best liked in Scotland. *Meldrum* is only three years old, and is certainly the most even of all our herd bulls.

The Devons show their usual sweetness, with the comparatively heavy weight of 2,100 lbs., for the bull *General Wyndham*, which is but four years and very active.

Taken as a whole, the Ayrshires are one of the most regular and true lots to be sold. Few exhibition records are equal to that of *Stoncalsey*—a winner of cups, medals, and 1st prizes in Scotland. We had difficulty in securing *Juno 2nd of Drumlanrig* from the Duke of Buccleugh.

The Jersey cow and bull calf are from England's best blood—the one a direct importation, and the other by a fine bull of Mr. Fuller's, of Hamilton Ontario.

That some of the grade cows meet with much favour is well-known, as for symmetry and markings several are superior to those having full pedigree. The case of lot fifty-three will be readily understood by those who are acquainted with our experimental objects.

Our position as breeders of sheep is perhaps higher than that of cattle. The large and varied lot in the catalogue are all pure bred—either directly imported or from recent importations—systematic bi-annual purchases of stock rams from Britain having been part of the management.

Those who wished subjects for late fall, and for Christmas shows, had room enough among the shearling and two shear fat wethers. Some of the latter took first prizes at the last Chicago Fat Stock Exhibition, and the others are even superior, according to age.

Our exhibit of Swine was very much better than it has been for some years; and while, maybe, some fanciers would like somewhat better "markings," the vigour and form no one will object to. The stock boar *Sterling Value* is well worth the notice of high class breeders.

And our shepherd dogs—Scotch Collies—need no comment, other than that they are of the usual black and tan, shaggy type, true to their pedigree, and maintaining the remarkable intelligence for which the kind is noted.

The sale, by reason of the exhibition, largely, although we have always had over 500, was attended by nearly 2,000 people. We had provided a tent to seat 500, but the crush was so much that adjournment was made to one of the judging rings. Mr. James Taylor, the auctioneer, outdid all expectations, not only in expedition, in gentlemanly conduct, but the power of drawing money where stiffness existed. Through him, as also favourable weather, good animals and a keen demand, the sale was a fine success, we realized $1,600 over my own valuation.

The following is the catalogue and list of purchases and prices realized.

Analysis of Prices.

Cattle—

Average of Shorthorn cows	$150
" " " heifers	118
" " " bulls (one)	145
" " Hereford cows	307
" " " heifers	215
" " " bulls (one)	210

Average of Aberdeen Angus cows (one)	420
" " " " heifers	405
" " " " bulls (two)	625
" " Devon cows (one)	60
" " " bulls (two)	50
" " Ayrshire cows	76
" " " heifers (one)	42
" " " bulls (four)	79
" " Jersey cows (one)	205
" " " bulls "	102
" " Shorthorn Grade cows	69
" " Aberdeen Poll Grade cows	66
" " Ayrshire Grade cows	53
One fat two-year-old Shorthorn steer	270

Sheep—

Average of Cotswold Rams	$13
" " Leicester "	20
" " Oxford Down Rams	27
" " Shropshire Rams	36
" " Southdown "	18
" " Merino Rams (one)	31
" " Cotswold ewes	13
" " Leicester "	11
" " Oxford Down ewes	29
" " Shropshire ewes	32
" " Southdown "	20
" " fat wethers	14

Swine—

Average of Berkshire boars	$23
" " " sows	13
" " Essex sows (one)	25
" " Poland China boar (one old)	12

Dogs—

Average of Scotch Collies	$12

Public Sale of Live Stock, September 28th, 1883.

Lot.	Class.	Purchaser, Etc.	Amount.	Total.
	CATTLE (Short Horn).			
	Cows and Heifers—		$ c.	
1	Cow	J. McLaren, Gore of London	150 00	
2	"	Thos. Graham, Ottawa	210 00	
3	"	Jas. Gowand, Dunblane	116 00	
4	"	Wm. Graham, Ottawa	120 00	
5	Heifer	Amos Butter, Coldstream	160 00	
6	"	A. Taylor, Dromore	75 00	
7	"	A. G. White, Pembroke	130 00	
8	"	S. Hogarth, Exeter	105 00	
	Bull	John Tough, Blake	145 00	
				$1,211 00

PUBLIC SALE OF LIVE STOCK, SEPTEMBER 28th, 1883.—*Continued.*

LOT.	CLASS.	PURCHASER, ETC.	AMOUNT.	TOTAL.
	HEREFORDS—		$ c.	
10	Cow	L. G. Drew, Oshawa	310 00	
11	"	" "	360 00	
12	"	W. Howitt, Guelph	250 00	
13	Heifer	" "	230 00	
14	"	L. G. Drew, Oshawa	275 00	
15	"	Dr. A. Norris, Spencer, N. Y	140 00	
16	Bull	Oliver Duck, Hannibal, Miss	210 00	
				$1,775 00
	ANGUS OR ABERDEEN POLLS—			
17	Cow	Oliver Duck, Hannibal	420 00	
18	Heifer	Geary Bros., London, Ont	525 00	
19	"	T. W. Harvey, Nebraska	395 00	
20	"	Oliver Duck, Hannibal	205 00	
21	Bull	T. W. Harvey, Nebraska	550 00	
22	"	Oliver Duck, Hannibal	700 00	
				$2,795 00
	DEVONS—			
23	Cow	F. W. Rothera	60 00	
24	Bull	W. Curtis, Darlington	50 00	
25	"	Harry Hawes, Guelph township	50 00	
26	"	" "	191 00	
				$351 00
	AYRSHIRES—			
27	Cow	Thos. Fisher, Creekbank	80 00	
28	"	Bernard McName, Lansdowne	78 00	
29	"	Archibald Cearns, Flesherton	86 00	
30	Heifer	Thos. McRae, Guelph	42 00	
31	Cow	Chas. Howitt, Guelph	65 00	
32	Bull	Thos. Fisher, Creekbank	72 00	
33	"	T. Guy & Son, Oshawa	82 00	
34	"	W. Jiles, Hawick	60 00	
35	"	F. W. Rothera, Simcoe	101 00	
				$666 00
	JERSEYS—			
36	Cow	A. Jeffrey, St. Catharines	205 00	
37	Bull	" "	102 00	
				$307 00
	GRADES (Short Horn)—			
38	Cow	W. West, Guelph	67 00	
39	"	" "	25 00	
40	"	Stewart & Bennett, Orangeville	89 00	
41	"	W. West, Guelph	100 00	
42	"	J. Armstrong, Warkworth	88 00	
43	"	Chas. Howitt, Guelph	95 00	
44	"	" "	81 00	
45	"	" "	92 00	
46	"	R. A. Ramsay, Eden Mills	72 00	
47	"	Mark Langdon, Arthur township	71 00	
48	"	J. Webb, Ospringe	40 00	
49	"	W. West, Guelph	39 00	
50	"	G. Taylor, Rockwood	35 00	
				$894 00
	ABERDEEN POLL GRADE—			
51	Cow	John Nelson, Orillia	50 00	
52	"	T. Evans, Puslinch	83 00	
53	Bull	J. McCorkindale, Paisley Block	80 00	
				$213 00
	AYRSHIRE GRADES—			
54	Cow	J. Rennelson, Galt	64 00	
55	Heifer	Chas. Howitt, Guelph	41 00	
				$105 00
	FAT CATTLE—			
56	The White Duke	Rich. Gibson, London, Ont	270 00	
				$270 00
		Gross total for Cattle		$8,587 00

PUBLIC SALE OF LIVE STOCK, SEPTEMBER 28th, 1883.—*Continued.*

LOT.	CLASS.	PURCHASER, ETC.	AMOUNT.	TOTAL.
	SHEEP.			
	RAMS—		$ c.	
1	Cotswold	W. Argo, Eramosa	30 00	
2	Leicester	D. Johnston, Campbellford	42 00	
3	Oxford Down	J. Sharman, Stratford	45 00	
4	Shropshire	T. Shaw, Hamilton	52 00	
5	Southdown	H. B. Jeffs, Bond Head	46 00	
6	Merino	Geo. Hood, Guelph	31 00	$246 00
7	Cotswold	W. C. Smith, New Hamburg	20 00	
8	"			
9	"	T. Manderson, Guelph	14 00	
10	"	D. Linderman, Eramosa	14 00	
11	"	T. C. Stark, Gananoque	31 00	$79 00
12	Oxford Down	R. Gowan, Walkerton	23 00	$23 00
13	Southdown	Chas. Kay, Fergus	17 00	
14	"	D. McLennan, Glengarry	15 00	
15	"	F. J. Chadwick, Guelph	18 00	$50 00
16	Cotswold ram lamb	H. Arkell, Arkell	10 00	
17	" "			
18	" "	W. Barker, Puslinch	8 00	
19	" "	J. Myers, Koworth	10 00	
20	" "	T. Taylor, Hazel	8 00	
21	" "			
22	" "	D. McLennan	8 00	
23	" "	H. Webster, West Garafraxa	9 00	
24	" "			
25	" "	M. Harrison, Shelburne	21 00	
26	" "	W. Ramsay, Eden Mills	5 00	$79 00
	OXFORD DOWNS—			
27	Ram lamb			
28	"	W. C. Smith, New Hamburg	20 00	
29	"	F. Penton, Maple Hill	18 00	$38 00
	SHROPSHIRE DOWNS—			
30	Ram lamb	W. Smith, Innerkip	28 00	
31	"	S. Whitman, Keppel	27 00	$55 00
	SOUTHDOWNS—			
32	Ram lamb	J. Cormack, Rockton	7 00	
33	"	S. Whitman, Keppel	6 00	
34	"	R. Andrew, Palmerston	7 00	
35	"	G. Garbutt, Thistletown	15 00	
36	"			
37	"			
38	"	A. R. Kidd, Warsaw	13 00	
39	"	Dan. McLennan, Glengarry	13 00	
40	"			$61 00
	COTSWOLDS—			
41	Ewe lamb	G. Tomson, Elora	9 00	
42	"	" "	9 00	
43	"	W. Argo, Eden Mills	7 00	
44	"	" "	7 00	
45	"	J. W. Oversholt, Marshville	14 00	
46	"	" " "	14 00	
47	"	T. Hume, Seymour	24 00	$84 00
	LEICESTERS—			
48	Ewe lamb			
49	"	A. Cearns, Flesherton	21 00	$21 00
50	"			
	OXFORD DOWN—			
51	Ewe lamb			
52	"	D. A. Norris, Spencer, N.Y	60 00	$60 00
53	"			

PUCLIC SALE OF LIVE STOCK, SEPTEMBER 28th, 1883.—*Continued.*

LOT.	CLASS.	PURCHASER, ETC.	AMOUNT.	TOTAL.
	SHROPSHIRE—		$ c.	$ c.
54	Ewe lamb	C. Rennie, Hamilton	48 00	48 00
55	"			
56	"			
	SOUTHDOWN—			
57	Ewe lamb	W. Howitt, Guelph	45 00	45 00
58	"			
59	"			
60	"			
	COTSWOLD—			
61	Ewes, pair	J. Martin, Cayuga	22 00	
62	"	T. Waters, Rockwook	18 00	
63	"	W. Rudd, Guelph	24 00	
64	"	J. R. Martin, Cayuga	20 00	
65	"	F. C. Stark, Gananoque	26 00	
66	"	J. W. Overholt, Marshville	28 00	
67	"	J. R. Martin, Cayuga	40 00	
68	"	A. C. Cornell, Harley	24 00	
69	"	F. C. Stark, Gananoque	28 00	
70	"	A. C. Cornell, Harley	20 00	
71	"	G. Taylor, Rockwood	22 00	
72	"	A. C. Cornell, Harley	26 00	
73	"	T. Howie, Summerville	24 00	
74	"	A. C. Cornell, Harley	16 00	
75	"	J. Overholt, Marshville	36 00	
76	"			384 00
	LEICESTER—			
77	Ewes, pair	J. Neilson, Lyn	20 00	
78	"	G. Stewart, Flesherton	26 00	
79	"	M. Gourlay, Mitchell	18 00	
80	"	R. Wightman, Marnock P. O	28 00	
81	"	G. Tomson, Elora	22 00	
82	"	E. V. Thomson, Guelph.	20 00	
83	"			
84	"	J. R. Martin, Cayuga	33 00	
85	"			
86	"			167 00
	OXFORD DOWNS—			
87	Ewes, pair	W. C. Smith. N. Hamburg	58 00	
88	"	G. Cassie, Fergus	80 00	
89	"	J. Sharman Stratford	66 00	
90	"	G. Cassie, Fergus	50 00	
91	"	J. Sharman, Stratford	62 00	316 00
	SHROPSHIRE—			
92	Ewes, pair	J. Howe, Kimberly	72 00	
93	"	J. B. Lynder, Waterloo	62 00	
94	"	H. Watson, Guelph	66 00	
95	"	S. Whitman, Keppel	50 00	
96	"	T. Ellis, Kimberly	84 00	
97	"	G. Howitt, Guelph	68 00	
98	"	G. Garbutt, Thistletown	54 00	456 00
	SOUTHDOWN—			
	Ewes, pair			
99	"	S. Whitman, Keppel	36 00	
100	"	W. Howitt, Guelph	30 00	
101	"	J. Cormock, Erin	30 00	
102	"	S. Brown, Dunboyne	32 00	
103	"	J. Martin Cayuga	30 00	
104	"	W. Howitt, Guelph	36 00	
105	"	J. McBeth, Eden Grove	48 00	
106	"		48 00	290 00

PUBLIC SALE OF LIVE STOCK, SEPTEMBER 28th, 1883.—*Continued.*

LOT.	CLASS.	PURCHASER, ETC.	AMOUNT.	TOTAL.
	FAT SHEEP—			
107	Pair Shropshires..........	Jas. Glennie, Puslinch	34 00	
108	" Oxfords	G. Hood, Guelph..........	30 00	
109	" "	" "	34 00	
110	" Cotswolds	" "	24 00	
111	" Leicesters	" "	34 00	
112	" "	....		
113	" Cotswolds	....		
114	" Oxfords	L. Marks, Kenilworth	24 00	
115	" "	G. Hood, Guelph....	24 00	
116	" Shropshires............	" "	24 00	
117	" "	....		
118	" Merino....	G. Hood, Guelph	24 00	252 00
	SWINE.			
	BERKSHIRE—			
1	Boar	Eli Gregory, Point Dalhousie	31 00	
2	"	W. C. Smith, New Hamburg	17 00	
3	"	Amos Cutter, Coldstream..	20 00	
4	"	T. Day, Cargill............	26 00	
5	Sow	M. Langdon, Kenilworth	16 00	
6	"	B. Hewson, Hamilton............	11 00	
7	"	W. Dickson Mildmay............	18 00	
8	"	J. Segmiller Walkerton............	10 00	
9	"	G. Thomson, Guelph	10 00	
10	Boar	John Hewer, Guelph	12 00	
11	"	R. Carrick, Blair Station............	20 00	
12	"	K. Montgomery, Kincardine	24 00	
13	"	W. Hull, Erin	30 00	
14	Sow	J. Hewer, Guelph	8 00	
15	Boar	W. Hull, Erin	8 00	
16	"	....		
17	"	....		
18	"	....		
19	Sow	....		
20	"	....		
21	Essex Sow............	John Hewer, Guelph	25 00	
22	Poland China Boar	J. Hewer, Guelph............	12 00	299 00
	DOGS.			
	SCOTCH COLLIE—			
1	Dog	R. Gibson, Delaware............	17 00	
2	"	" "	14 00	
3	"	Major Gray, Toronto............	14 00	
4	"	H. G. Joyce, O. A. C............	8 00	
5	Bitch	E. Bigbie, Guelph	11 00	
6	Dog	E. A. Saxton, O. A. C	9 00	
7	"	....		
8	"	....		
9	"	F. Hills, Delaware	8 00	
10	"			
11	Bitch	S. Beaty, Markham	14 00	
12	"	John Hope	13 00	108 00

ABSTRACT.

Cattle	$8,587 00
Sheep	2,754 00
Swine	299 00
Dogs	108 00
Total amount of sale	$11,748 00

As our clearing out sale has been of more than usual interest, I beg to append the pedigree catalogue.

SHORTHORNS.

Cows and Heifers.

Lot 1.—Rosallie 2nd [1582]. (*Ear Label 9.*)

Red and White. Bred at O. E. Farm; calved 23rd October, 1878.

	Got by	Duke of Bedford (36466)	H. M. The Queen.
Rosallie	"	Prince Albert 2nd (29558)	" "
Rosebud	"	Rajah (22670)	" "
Rosabella	"	Goldsmith (10277)	Mr. Torr.
Darling	"	Goldsmith (10277)	" "
Darling	"	Brilliant (8905)	W. D. Manning.

On the male side tracing through Lord Oxford 2nd (20215), Prince Saxe Cobourg (20576), Helmsman (8141) and Hurricane (4061).

In calf to Sir Leonard (45613)—due 17th December, 1883.

Lot. 2.—Louan of Guelph [1603]. (*Ear label 5.*)

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

	Got by	3rd Duke of Springwood [3087], 16926.	
Louan of Brant 5th	"	Knight of St. George [1630], 8472, (26544)	Mr. Carr.
Louan of Brant 2nd	"	Crown Prince of Athelstane [1507], 5487, (21512)	J. Douglas.
Louan 17th	"	Duke of Airdrie, 2473	Major J. Duncan.
Louan 3rd	"	John O'Gaunt (11621)	Mr. J. S. Tanqueray.
Louan 1st	"	Otley (4632)	Mr. Fawkes.
Cambria	"	Bertram 2nd (3144)	Col. Powell.
Virginia 2nd	"	Bertram (1716)	Mr. Whitaker.
Lucilla 2nd	"	Memnon (1223)	Mr. Whitaker.
Virginia	"	General (272)	General Simpson.
Rosemary	"	Flash (261)	Mr. Gibson.
Redrose	"	Petarch (488)	Mr. C. Collings.
Brighteyes	"	Alexander (22)	Mr. C. Collings.
Red Acomb	"	Traveller (655)	Mr. W. Jobbing.
——	"	Son of Bolingbroke (86)	Mr. C. Collings.
——	"	J. Brown's Red Bull (97)	Mr. J. Thompson.

In calf to Sir Leonard (45613), due January 2nd, 1884.

Lot. 3.—Louan of Wellington [1212]. (***Ear label 158.***)

Roan, bred at O. E. Farm; calved February 23rd, 1881,

	Got by	Prince Hopewell [7656]	J. & R. Hunter.
Louan of Brant 5th	"	Knight of St. George [1530], 8472, (26544).	

For remainder of pedigree see Lot 2.

In calf to Sir Leonard (45,613), due January 3rd, 1884.

Lot 4.—Lady Elizabeth [1580]. (Ear label 4.)

Roan, bred at O. E. Farm; calved May 11th, 1876.

	Got by	Cranberry Chief [2922]	J. S. Armstrong.
Martha	"	11th Duke of Thorndale, 5611.	
Alabama	"	Clarendon (2632).	

In calf to Sir Leonard (45,613), due April 19th, 1884.

Lot 5.—Cambridge Queen 2nd [1211]. (Ear label 173.)

Red, bred at O. E. Farm; calved March 13th, 1882.

	Got by	Baron Berkeley [968], ,22010, (36158).	
Cambridge 10th	"	King of the Ocean [1619], 8465	Mr. Chaloner.
Cambridge 7th	"	11th Duke of Thorndale, ,5611	" S. Thorne.
Cambridge 4th	"	The Moreton Duke [742]	" F. W. Stone.
Cambridge 3rd	"	Grand Duke [332], ,2292, (17993)	" F. W. Stone.
Cherry Pie	"	Lord of the North (11743)	" Jonas Webb.
Celia	"	3rd Duke of Northumberland (3647)	" Thos. Bates.
Cornflower	"	Bashaw (1692)	" Bower.
Columbine	"	Helmsman (2190)	" K. Sutton.
Columbia	"	Collumella (904)	" R. Booth.
Charlottina	"	Regent (544)	" R. Collings.
Charlotte Palatine	"	Palatine (478)	Major Bowers.
Charlotte	"	Palmflower (480)	Mr. Geo. Coates.
Crimson	"	Patriot (486)	" G. Coates.
Young Millbank	"	Driffield (223)	" G. Coates.
———	"	Mr. C. Holmes' Bull	" C. Holmes.

In calf to Sir Leonard (45613), due May 27th, 1884.

Lot 6.—Lady Leonard. (Ear label 203.)

Red, bred at O. E. Farm; calved 20th April, 1883.

	Got by	Sir Leonard (45613)	H. Aylmer, Eng.
Lady Elizabeth	"	Cranberry Chief [2922]	J. S. Armstrong.

For remainder of pedigree see Lot 4.

Sir Leonard is by Sir Wilfrid (37484) out of Countess 3rd by High Sheriff, etc., etc., one of the best lines of the Booth Stock.

Lot 7.—Rosailie 4th. (Ear label 209.)

Red, with white spots, bred at O. E. Farm; calved January 4th, 1883.

	Got by	Sir Leonard (45613)	H. Aylmer.
Rosallie 2nd	"	Duke of Bedford (36466)	H. M. The Queen.

For remainder of pedigree see Lot 1.

Lot 8.—Louan of Galt. (Ear label 211.)

Red, with white spots, bred at O. E. Farm; calved February 7th, 1883.

	Got by	Sir Leonard (45613)	H. Aylmer.
Louan of Guelph	"	3rd Duke of Springwood (3087), ,16926.	

For remainder of pedigree see Lot 2.

Bulls.

Lot 9.—O. A. C. [1006]. (Ear label 186.)

Red, with white spots, bred at O. E. Farm ; calved November 19th, 1883.

	Got by	Socrates	H. Aylmer.
Beta	"	Sir Wilfrid (37484)	T. C. Booth.
Beautiful Star	"	Hyperion (34196)	H. Aylmer.
Balmful	"	High Sheriff 26392	T. B. Booth.
Banter	"	Cerdie 19415	J. Peel.
Blithesome	"	Sir James 16980	R. Booth.
Bashful	"	Prince Imperial 15095	S. E. Bolden.
Blissful	"	Grand Duke 10284	T. Bates.
Bridget	"	Baron Warlaby 7813	R. Booth.
Bliss	"	Leonard 4210	R. Booth.
Yg. Broughton	"	Young Matchem 2282	J. Booth.
Broughton	"	Jerry 4097	T. Booth.
———	"	Young Pilot 4702	T. Booth.
———	"	Pilot 496	R. Colling.
———	"	Son of Apollo 36	T. Booth.

Sir Wilfrid 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. He is also of Lady Fragrant's family in the direct female line of descent, as well as of that of the celebrated bull King James 28971, sire of many prize winners at the Royal English and Irish Shows.

HEREFORDS.

Cows and Heifers.

Lot 10.—Princess Mary 2nd, Imported. (Ear label 49.)

Calved September 23rd, 1873.

	Got by	Prince George Frederick (4051)	H. M. The Queen.
Princess Mary	"	Ajax (1843)	H.R.H. Pr'ce Consort.
Maude	"	Windsor (1456)	" " "
Superb	"	Carlisle (923)	Earl of Radnor.
Stella	"	Venison 2nd (1442)	Mr. Stedman.

In calf to Hopedale (139) due 24th November, 1883.

Lot 11.—Heatherbell, Imported. (Ear label 50.)

Calved September 25th, 1873.

	Got by	Prince George Frederick (4051)	H. M. The Queen.
Calliope	"	Deception (2491)	James Rea.
Crown Princess	"	Ajax (1843)	H.R.H. Pr'ce Consort.
Juno	"	Maximus (1650)	" " "
Fanciful	"	———	

In calf to Hopedale (139), due October 30th, 1883.

Lot 12.—Princess Louise [*24*]. *(Ear label 48.)*

Bred at O. E. Farm ; calved April 23rd, 1878.

	Got by Duke of Connaught (4528).........	H. M. The Queen.
Princess Mary 2nd......	" Prince George Frederick (4051)....	" " "

For remainder of pedigree see Lot 10.

In calf to Hopedale (139), due May 29th, 1884.

Duke of Connaught, imported by the Ontario School of Agriculture in September, 1876, was got by Alexander (3653); dam Sultana by Prince Leopold (3351); grandam Princess Teck by Ajax (1843); g. grandam Lupa by Attingham (911), which was first in his class at Shrewsbury and Carlisle meetings of the Royal Agricultural Society ; g. g. grandam Grey Dahlia 2nd by Walford (871); which was awarded the gold medal as the best stock bull of any age or breed, at the International show at Paris in 1855, besides many first prizes in England.

Prince George Frederick was got by Deception (2491); dam Medea by Brecon (918); grandam Rose by Phantom (1035); g. grandam Rose, bred by the late Viscount Hereford.

Deception was got by Sir Benjamin (1387); dam Nonesuch by Wellington (1112); grandam Fairlass by Chieftain (930); g. grandam Fairmaid 3rd by Cholestry (217); g. g. grandam Fairmaid 2nd by Gallant (239).

Ajax was got by Maximus (1650), winner of the first prize at the Royal Society Show, held at Warwick and Battersea ; dam Zoe by Young Dewshall (1125); grandam Prettymaid by a bull bred by the late Mr. Tilly.

Maximus, winner of the first prize at the Royal Society Show at Warwick and Battersea, was got by Brecon (918); dam Superb by Carlisle (923); grandam Stella by Venison (1442); g. grandam Spec by The Duke (550), etc.

Windsor was got by Prince of Wales (1041); dam Zoe by Dewshall (1125); grandam Prettymaid, bred by Mr. Maybery's Brecon.

Carlisle was winner of the first prize in his class at the Carlisle Meeting of the Royal Agricultural Show ; also first at the Bath and West of England Show, at Cardiff. He was got by Vension (1442); dam Clara by the Duke (493), which was winner of the first prize at the Royal Society's Show in 1846.

Lot 13.—Princess Mary 4th. (Ear label 219.)

Bred at O. E. Farm ; calved 7th January, 1883.

	Got by Hopedale [139]..................	W. Horton.
Princess Mary 2nd......	" Prince George Frederick (4051)....	H. M. The Queen.

For remainder of pedigree see Lot 10.

Lot 14.—Heatherbell 5th [*142*]. *(Ear label 185.)*

Bred at O. E. Farm; calved October 18th, 1882.

	Got by Hopedale [139]	W. Horton.
Heatherbell (imported)..	" Prince George Frederick (4051) ...	H. M. The Queen.

For remainder of pedigree see Lot 11.

Lot 15.—Little Lady [*143*]. *(Ear label 190.)*

Bred at O. E. Farm; calved October 25th, 1882.

	Got by Hopedale [139]	W. Horton.
Princess Louise	" Duke of Connaught [138], (4528).	

For remainder of pedigree see Lot 12.

Bulls.

Lot 16.—Hopedale [139], Imported.

Calved March 26th, 1880; bred by W. Horton, England.

	Got by Nero (5477).
Miss Alice 2nd	" Hildebrand (4646).
Miss Alice	" Sir Roger (4990).
———	" Maximilian (3252).
———	" Jersey (976).
———	" Son of Young Ben (3609).
———	" Young Royal (1469).

To be sold subject to time of delivery. Weight, 2,020 pounds.

ABERDEEN ANGUS POLLS.

Cows and Heifers.

Lot 17—Haughton Lass. (Ear label 36.)

Bred at O. E. Farm; calved August 27th, 1878.

	Got by Gladiolus (1161)	Earl of Fife.
Leochell Lass 4th (1864).	" Hero of Boghead (417)	R. C. Farquharson.
Leochell Lass 3rd (1863).	" Aberdeen Bull....................	C. McCombie.
Leochell Lass 2nd (1861).	" Garribaldi of Haughton (707).	

Leochell Lass 4th gained first prize at Alford in 1876, beating Mr. McCombie, of Tillyfour, and other famous breeders. In calf to Meldrum (1759), (imported), due June 13th, 1884.

Lot 18.—Donside Lass. (Ear label 210.)

Bred at O. E. Farm; calved April 18th, 1882.

	Got by Gladiolus (1161)	Earl of Fife.
Leochell Lass 4th (1864).	" Hero of Boghead (417)	R. C. Farquharson.

For remainder of pedigree see Lot 17.

Lot 19.—Maid of Meldrum. (Ear label 212.)

Bred at O. E. Farm; calved June 19th, 1882.

	Got by Meldrum (1759)	Marquis of Huntly.
Haughton Lass	" Gladiolus (1161)	Earl of Fife.

For remainder of pedigree see Lot 17.

Lot 20.—Speyside Lass. (Ear label 204.)

Bred at O. E. Farm; calved May 21st, 1883.

	Got by Meldrum (1759)	Marquis of Huntly.
Haughton Lass	" Gladiolus (1161)	Earl of Fife.

For remainder of pedigree see Lot 17.

Bulls.

Lot 21.—Marquis of Huntly. (*Ear label 189.*)

Bred at O. E. Farm; calved November 7th, 1882.

	Got by	Meldrum (1759)	Marquis of Huntly.
Sybill's Darling 2nd (4611)	"	Etonian (1658).	
Sybill's Darling (4050) ..	"	Ballot (634).	
Freds' 5th Darling (2363)	"	Scotland (725).	
Freds' 2nd Darling (1045)	"	Reform (403).	
Sybill (974)	"	Black Prince of Bogfern (501).	
Ann of Bogfern (539) ...	"	Banks of Dee (12).	
Young Matilda (177).			

One of the families held in highest esteem in Scotland.

Lot 22.—Meldrum (*1759*)—(*Imported*).

Bred by the Marquis of Huntly; calved April 25th, 1880.

	Got by	Warrior (1291).
Madge (1217)	"	Major of Tillyfour (509).
Ruth of Tillyfour (1169).	"	Black Prince of Tillyfour (366).
Beauty of Tillyfour 2nd (1180)..............	"	Young Jock (4).
Favourite (2)..........	"	Grey Breasted Jock (2).

To be sold subject to time of delivery. Weight, 1,910 pounds.

DEVONS.

Cows.

Lot 23.—Nellie (*Imported*), [*872*].

Calved October 1st, 1874.

	Got by	Napier (888)	H. M. The Queen.
Violet 2nd	"	Saracen (520*a*)	" "
Snowdrop	"	Zouave (556)	———
Young Curley.			

In calf to General Wyndham [802], due

Bulls.

Lot 24.—2nd General Wyndham. (*Ear label 201.*)

Bred at the O. E. Farm; calved April 19th, 1883.

	Got by	General Wyndham (802)	J. R. Rudd.
Nellie	"	Napier (888)	H. M. The Queen.

For remainder of pedigree see Lot 23.

Lot 25.—3rd General Wyndham. (*Ear label 202.*)

Bred at O. E. Farm; twin with Lot 24, calved April 19th, 1883.

	Got by General Wyndham (802)	J. R. Rudd.
Nellie	" Napier (888)	H. M. The Queen.

For remainder of pedigree see Lot 23.

Lot 26.—General Wyndham (802).

Bred by J. R. Rudd, Guelph; calved March 10th, 1879.

	Got by Hartland [363].
Curley 2nd [577]	" Young Curley.
Curley [342]	" Samson 6th [310].
Daisy [11]	" Prince Albert [109].

To be sold subject to time of delivery. Weight, 2,100 pounds.

AYRSHIRES.

Cows and Heifers.

Lot 27.—Beauty of Drumlanrig (Imported).

Bred by the Duke of Buccleugh; calved April 10th, 1872.

	Got by Burnhouse	Duke of Buccleugh.
Grey Bess	" ———	

In calf to Stoncalsey (309), imported, due 22nd August, 1883. Beauty of Drumlanrig was fifth among forty cows in the Glasgow Derby of 1875.

Lot 28.—Flora 3rd of Drumlanrig (Imported).

Bred by the Duke of Buccleugh; calved 8th March, 1873.

	Got by Blood	Duke of Buccleugh.
Flora	" ———	" "

Flora 3rd gained second prize at Kilmarnock, and was fifth in the Glasgow Derby of 1876. In calf to Stoncalsey (309), due January 20th, 1884.

Lot 29.—Juno 2nd of Drumlanrig (Imported).

Bred by the Duke of Buccleugh; calved May 1st, 1874.

	Got by Castleburn	Duke of Buccleugh.
Juno 1st	" "	

Juno 1st was first at the Highland Society's Show at Glasgow in 1874. In calf to Stoncalsey (309), due January 26th, 1884.

Lot 30.—Beauty of Elora.

Bred at O. E. Farm; calved July 14th, 1882.

	Got by Stoncalsey (309).	
Beauty of Drumlanrig ...	" Burnhouse	Duke of Buccleugh.
Grey Bess	" ———	

Lot 31.—Flora of Guelph.

Bred at O. E. Farm; calved May 14th, 1878.

Got by Sir Walter .... Duke of Buccleugh.
Flora 3rd of Drumlanrig. " ——— .... " "

In calf to Stoncalsey (309), due March 20th, 1884.

Bulls.

Lot 32.—Stoncalsey 2nd.

Bred at O. E. Farm; calved July 16th, 1882.

Got by Stoncalsey (309).
Flora of Guelph .... " Sir Walter .... Duke of Buccleugh.
Flora 3rd of Drumlanrig. " Blood .... " "
Flora .... " ——— ....

Lot 33.—Stoncalsey 3rd.

Bred at O. E. Farm; calved December 19th, 1882.

Got by Stoncalsey (309).
Juno 2nd of Drumlanrig. " Castleburn .... Duke of Buccleugh.
Juno .... " ——— ....

Lot 34.—Stoncalsey 4th.

Bred at O. E. Farm; calved December 23rd, 1882.

Got by Stoncalsey (309).
Flora 3rd of Drumlanrig. " Blood .... Duke of Buccleugh.
Flora .... " ——— ....

Lot 35.—Stoncalsey (309), [1435]—(Imported).

Bred by A. Paton, Ayrshire; calved May 20th, 1879.

Got by Black Jock 2nd (122).
Rosie .... " Prince Charlie.

Weight 1,820 pounds.

This bull gained first prize at Symington, Ayrshire; second at Maryhill, Glasgow; first at Hamilton; first at Lanark, and medal for best bull of any age; first at Biggar, and cup for best animal of Aryshire breed.

JERSEYS.

Cows.

Lot 36.—Princess Alexandria (Imported).

Bred by S. B. Booth, Rochester, England; calved June 10th, 1879.
Got by Kisber (262) .... W. Amy, England.
Favourite .... " ——— .... P. de Fenore, Jersey.

In calf to Thalma, due

Bulls.

Lot 37.—3rd Prince Boulivot.

Bred at the O. E. Farm; calved March 15th, 1883.

	Got by	Oakland Rex 6839	A. I. C. C.
Princess Alexandria	"	Kisber (262)	W. Amy, England.
Favourite	"	———	———

Prince Boulivot, a whole colour bull, won second prize at the Essex Show at Manningtree, Jersey, in 1880; Kisber won third in the parochial prize at the Royal Jersey Agricultural Society's Show in 1878, Princess Alexandra won first at the Provincial Exhibition, Ontario, in 1881.

GRADE CATTLE.

Cows and Heifers.—Shorthorn Grades.

Lot 38.—Blythe.

Aged Cow, in calf to Hereford, due December 29th, 1883.

Lot 39.—Jennie.

Aged Cow, in calf to West Highland Bull; due March 28th, 1884.

Lot 40.—Phin.

Aged Cow, in calf to Hereford or Aberdeen Poll; due November 4th, 1883.

Lot 41.—Model Grade.

Seven year old Cow, in calf to , due

Lot 42.—Slappertongue.

Aged Cow, in calf to Hereford Bull; due March 16th, 1884.

Lot 43.—Rose.

Seven year old Cow, in calf to Aberdeen Poll; due September 30th, 1883.

Lot 44.—Taylor.

Five year old Cow, in calf to , due January 1st, 1884.

Lot 45.—Cherry.

Heifer, in calf to S. H. Sir Leonard; due February 11th, 1884.

Lot 46.—Lily.

Heifer, in calf to Sir Leonard; due January 3rd, 1884.

Lot 47.—Spotty.

Heifer, in calf to Sir Leonard; due March 16th, 1884.

Lot 48.—Woodbine.

Common Cow, aged, in calf to Hereford Bull Hopedale; due March 12th, 1884.

Lot 49.—Strawberry.

Common Cow, aged, in calf to .

Lot 50.—Simmy.

Common Cow, aged, in calf to Shorthorn; due May 22nd, 1884.

ABERDEEN ANGUS POLL GRADES.

Lot 51.—Brownie—five years old.

Ear label 123; out of high grade Shorthorn, by Aberdeen Angus Poll bull Gladiolus (1161); in calf to ; due

Lot 52.—Aberlour Lass.

Ear label 194; calved June 20th, 1882, out of Brownie; Lot 51 herewith, by Aberdeen Angus Poll bull Meldrum (1759).

This is a second cross of remarkable beauty.

Lot 53.—Experimental—(Bull).

Bull; ear label 205; calved April 26th, 1883, out of Brownie; Lot 51 herewith, by Aberdeen Angus Poll bull Meldrum (1759).

This second cross is offered for sale as an experiment, and the Government reserve power to withdraw it.

AYRSHIRE GRADES.

Lot 54.—Taylor.

Aged Cow, in calf to Ayrshire bull; due September 17th, 1883.

Lot 55.—Tom.

Heifer; ear label 170; in calf to Ayrshire bull Stoncalsey; due March 28th, 1884.

FAT CATTLE.

Lot 56.—The White Duke.

A pure bred Shorthorn Steer; white; calved May 6th, 1881; weight August 1st, 1,860 pounds.

SHEEP.

Rams.

Lot 1. Three shear Cotswold, "Aylmer, 1881;" imported from H. Aylmer, of Norfolk, England; weight, 370 pounds; clip, unwashed, 18 pounds.

Lot 2. Three shear Border Leicester, "K. W., 1881;" imported by Mr. Kelly, of Dumfries, Ontario; weight, pounds; clip, 14½ pounds.

Lot 3. Three shear Oxford Down, "Treadwell, 1881;" imported from J. Treadwell, Upper Winchester, Aylesbury, England; weight, 360 pounds; clip, 18 pounds.

Lot 4. Three shear Shrops, "Zetland, 1881;" imported from the Earl of Zetland, Scotland; weight, 255 pounds; clip, 12 pounds.

Lot 5 Three shear Southdown, "Colman, 1881;" imported from Mr. Colman, Norwich, England; weight, 245 pounds; clip, 12 pounds.

Lot 6. Aged Merino, "Ramboulet;" imported from the Royal Farm in France; weight, 240 pounds; average clip, unwashed, 18 pounds.

Shearling Rams.

Lot 7. Cotswold; ear number 544; out of Tombs' ewe by "Arkell" ram.

Lot 8. Cotswold; ear number 564; out of Tombs' ewe by Gillett's "Kilkenny Champion."

Lot 9.	Cotswold;	ear number	558;	out of Cole ewe	by Gillett's	Kilkenny	Champion."
" 10	"	"	584	"	"	"	"
" 11	"	"	775	"	"	"	"
" 12.	Oxford Down	"	807;	out of Brassy ewe	by "Treadwell, 1881."		
" 13.	Southdown	"	606	" O. E. F. ewe	by "Coleman, 1881."		
" 14	"	"	616	" "	"	"	
" 15	"	"	622	" "	"	"	

Cotswold—Ram Lambs.

Lot 16.	Ear No. 540.	Dam No. 187.	Sire, Gillett's	"Kilkenny	Champion."
" 17	" 257	" 505	"	"	"
" 18	" 261	" 223	"	"	"
" 19	" 521	" 373	"	"	"
" 20	" 522	" 438	"	"	"
" 21	" 523	" 571	"	"	"
" 22	" 526	" 189	"	"	"
" 23	" 527	" 570	"	"	"
" 24	" 529	" 199	"	"	"
" 25	" 531	" 513	"	"	"
" 26	" 535	" 505	"	"	"

Oxford Downs—Ram Lambs.

Lot 27.	Ear No. 541.	Dam No. 556.	Sire,	"Treadwell, 1881."
" 28	" 542	" 552	"	"
" 29	" 263	"	"	"

Shropshire Downs—Ram Lambs.

Lot 30.	Ear No. 251.	Dam No. 347.	Sire,	"Zetland, 1881."
" 31	" 259	" 96	"	"

Southdowns—Ram Lambs.

Lot 32.	Ear No. 264.	Dam No. .	Sire, "Coleman, 1881."
" 33	" 545	" 413	" "
" 34	" 546	" 345	" "
" 35	" 547	" 429	" "
" 36	" 256	" 414	" "
" 37	" 258	" 407	" "
" 38	" 524	" 415	" "
" 39	" 536	" 492	" "
" 40	" 537	" 417	" "

Cotswold—Ewe Lambs.

Lot 41.	Ear No. 528.	Dam No. 146.	Sire, Gillett's "Kilkenny Champion."
" 42	" 533	" 143	" " "
" 43	" 538	" 139	" " "
" 44	" 539	" 159	" " "
" 45	" 543	" 550	" " "
" 46	" 254	" 119	" " "
" 47	" 255	" 121	" " "

Leicester—Ewe Lambs.

Lot 48.	Ear No. 350.	Dam No. 386.	Sire, "K. W., 1881."
" 49	" 525	" 314	" "
" 50	" 530	" 737	" "

Oxford Down—Ewe Lambs.

Lot 51.	Ear No. 534.	Dam No. 553.	Sire, "Treadwell, 1881."
" 52	" 544	" 554	" "
" 53	" 548	" 561	" "

Shropshire—Ewe Lambs.

Lot 54.	Ear No. 549.	Dam No. 605.	Sire, "Zetland, 1881."
" 55	" 550	" 602	" "
" 56	" 260	" 301	" "

Southdown—Ewe Lambs.

Lot 57.	Ear No. 532.	Dam No. 401.	Sire, "Coleman, 1881."
" 58	" 252	" 404	" "
" 59	" 253	" 430	" "
" 60	" 262	"	" "

Cotswolds—Ewes.

Lot 61. Pair, Nos. 228, 119, three shear and aged, out of Lane ewes by Tombs' "Duke."

Lot 62. Pair, Nos. 438, 550, three shear, out of Lane ewes by Tombs' "Duke."
" 63 " 159, 187, aged, out of Tombs' ewes by "Lane, 1877."
" 64 " 505, 571, three shear, out of Lane ewes, by Tombs' "Duke."
" 65 " 143, 504, four shear, out of Lane ewes by Tombs' "Duke."
" 66 " 6, 191, aged, out of Tombs' ewes by "Lane, 1877."
" 67 " 561, 591, shearlings, out of Lane ewes by Gillett's "Kilkenny Champion."

Lot 68. Pair, Nos. 141, 436, four shear and aged, out of Cole ewes by "Lane, 1877."
Lot 69. Pair. Nos. 121, 148, three and four shear, out of Lane ewes by Tombs' "Duke."
Lot 70. Pair, Nos. 189, 223, three shear and aged, out of Tombs' ewes by "Duke."
Lot 71. Pair, Nos. 573, 150, shearling and aged, out of Lane ewes by Gillett's "Kilkenny Champion" and "Lane, 1877."
Lot 72. Pair, Nos. 193, 139, three and four shear, out of Tombs' ewes by "Duke."
Lot 73. Pair, Nos. 741, 570, shearling and three shear, out of O. E. F. ewes by "Sorby" and "Duke."
Lot 74. Nos. 127, 146, four shear and aged, out of Tombs' ewes by "Lane, 1877."
Lot 75. Pair, Nos. 592, 513, shearling and two shear, out of Tombs' ewes by Gillett's "Kilkenny Champion."
Lot 76. Pair, Nos. 600, 506, shearling and two shear, out of O. E. F. and Tombs' ewes by Gillett's "Kilkenny Champion."

Leicester—Ewes.

Lot 77. Pair, Nos. 66, 781, three shear, out of Waldie ewes by "Bosanquit, 1881.
Lot 78. Pair, Nos. 360, 383, three shear, out of Bow Park ewes by "Bosanquit, 1881."
Lot 79. Pair, Nos. 318, 311, aged, out of Kinnochtry ewes by "Kinnochtry, 1876.
Lot 80. Pair, Nos. 196, 327, three shear, out of Whitelaw ewes by "Bosanquit, 1881."
Lot 81. Pair, Nos. 386, 320, three shear and aged, out of Kinnochtry ewes by "Bosanquit, 1881."
Lot 82. Pair, Nos. 658, 737, shearling and three shear, out of O. E. F. ewes by "K. W., 1881," and "Bosanquit, 1881."
Lot 83. Pair, Nos. 331, 793, aged, out of Whitelaw ewes by "Kinnochtry, 1876."
Lot 84. Pair, Nos. 786, 369, shearling and four shear, out of O. E. F. ewes by "K. W., 1881," and "Tweedie, 1880."
Lot 85. Pair, Nos. 46, 441, out of O. E. F. ewes by "K. W., 1881."
Lot 86. Pair (Leicester and Cotswold), Nos. 314, 573, aged and shearling, "Kinnochtry, 1876," and "K. W., 1881," breeding.

Oxford Down—Ewes.

Lot 87. Pair, Nos. 553, 556, three shear, out of O. E. F. ewes by "Brassy, 1876."
Lot 88. Pair, Nos. 808, 512, shearling and two shear, out of O. E. F. ewes by "Treadwell, 1881."
Lot 89. Pair, Nos. 554, 561, four shear and aged, out of Brassy ewes by "Brassy, 1876."
Lot 90. Pair, Nos. 805, 739, shearling and three shear, out of O. E. F. ewes by "Treadwell, 1881," and "Brassy, 1879."
Lot 91. Pair, Nos. 562, 552, three shear and aged, out of Brassy ewes by "Brassy, 1879."

Shrops—Ewes.

Lot 92. Pair, Nos. 96, 603, aged, out of Nocks ewes by "Nocks, 1880."
Lot 93. Pair, Nos. 347, 605, aged, out of Nocks ewes by "Nocks, 1880."
Lot 94. Pair, Nos. 99, 756, three shear, out of O. E. F. ewes by "Nocks, 1880."
Lot 95. Pair, Nos. 764, 602, two shear and aged, out of O. E. F. and Nocks ewes by "Nocks, 1880."
Lot 96. Pair, Nos. 301, three shear, out of O. E. F. ewes by "Nocks, 1880."
Lot 97. (Shrops and Oxford), Nos. 811, 98, shearling and three shear, from "Nocks and Brassy blood."

Southdown—Ewes.

Lot 98. Pair, Nos. 415, 429, four shear, by "26 Throckmorton," and by "Walsingham 29."

Lot 99. Pair, Nos. 407, 409, aged, by "26 Throckmorton."
Lot 100. Pair, Nos. 401, 414, " " "
Lot 101. Pair, Nos. 345, 413, " " "
Lot 102. Pair, Nos. 404, 780, " " "
Lot 103. Pair, Nos. 418, 707, two and three shear, by "26 Throckmorton."
Lot 104. Pair, Nos. 417, 430, aged, by "26 Throckmorton" and "Walsingham 29."
Lot 105. Pair, Nos. 626, 800, shearlings, by " " " "
Lot 106. Pair, Nos. 432, 492, three shear, out of "Walsingham 29."

FAT SHEEP.

Two Shear Grade Wethers.

Lot 107. Pair Shrops, Nos. 700, 750; average weight, 278 pounds.
Lot 108. Pair Oxfords, Nos. 698, 699; average weight, 266 pounds.
Lot 109. Pair Oxfords, ewes, Nos. 444, 563; average weight, 254 pounds.
Lot 110. Pair Cotswolds, one shearling, Nos. 693, 872; average weight, 252 pounds.
Lot 111. Pair Leicesters, Nos. 447, 692; average weight, 310 pounds.

Shearling Grade Wethers.

Lot 112. Pair Leicesters, Nos. 694, 695; average weight, 230 pounds.
Lot 113. Pair Cotswolds and Southdowns, Nos. 442, 746; average weight, 160 pounds.
Lot 114. Pair Oxfords, Nos. 788, 790; average weight, 193 pounds.
Lot 115. Pair Oxfords, Nos. 696, 799; average weight, 185 pounds.
Lot 116. Pair Shrops, Nos. 697, 772; average weight, 180 pounds.
Lot 117. Pair Shrops and Merino, Nos. 777, 871; average weight, 155 pounds.
Lot 118. Pair Merino, one two shear, Nos. 765, 783; average weight, 180 pounds.

SWINE.

Berks.

Lots 1, 2, 3 and 4—Boar Pigs.

Farrowed May 2nd, 1883.

Got by (imported) "Sterling Value," 4691. Dam, "Guelph Lass, 8536."

Lots 5, 6, 7, 8 and 9—Sow Pigs.

Farrowed May 2nd, 1883.

Got by (imported) "Sterling Value." Dam, "Guelph Lass, 8536."

Lots 10, 11, 12 and 13—Boar Pigs.

Farrowed May 28th, 1883.

Got by "Sterling Value." Dam, "Lady Thompson, 8540."

Lots 14 and 15—Sow Pigs.

Farrowed May 28th, 1883.

Got by "Sterling Value." Dam, "Lady Thompson, 8540."

"Sterling Value," 4691, was bred by Walter Stewart, Gloucester, England, and imported by Snell Sons, of Brampton. He holds a fine pedigree, and took first prize at London in 1882, and second at Toronto Industrial in 1882.

Lots 16, 17 and 18—Boar Pigs.

Farrowed July 20th, 1883.

Got by (imported) "Sterling Value," dam, "Lady Derby, 8112;" sire, "Prodigal, 3835," dam, "Lady Kingscote, 8032;" sire, "Hornet, 3883," dam, "Wanwort;" sire, "Wootton," dam, "Miss Burnett."

Lots 19 and 20—Sow Pigs.

Farrowed July 20th, 1883.

(Same pedigree as Lots 16 and 18).

Lot 21.—Essex Sow "Sweet 17."

Farrowed September 4th, 1881.

Sire, "Black Prince," dam, "Mayflower;" sire, "Essex Prince," dam, "Queen of Clubs;" sire, "Zulu King," dam, "Black Empress;" sire, "Essex King."

Lot 22.—Poland China Boar.

Farrowed September, 1878.

Dam "Lady Morton's Pugh"	Got by "Perfection Bruce, 305."
" "Young Bess"	" "Zebede, 312."
	" ———

SCOTCH COLLIE DOGS.

Littered April 22nd, 1883. Dam "Luna," Sire "Bob."

Dogs.

Lot 1. "Laddie," black and tan, with white on chest.
Lot 2. "Jumbo," black and tan, with white on chest.
Lot 3. "Tweed," black and tan, with white on chest.
Lot 4. "Yarrow," black, with white on face, legs, chest and tail.

Bitch.

Lot 5. "Lassie," black, with white spots, and tail tip.

Littered April 27th, 1883. Dam "Lark," Sire "Bob."

Dogs.

Lot 6. "Esk," black and tan, with white neck ring and tail tip.
Lot 7. "Speed," black and tan, with white toes.
Lot 8. "Spey," black and tan, with white chest.
Lot 9. "Don," black and tan, with white chest.
Lot 10. "Minto," black and tan, with white chest.

Bitches.

Lot 11. "Snip," black and tan, with white chest.
Lot 12. "Grip," black and tan, with white chest.

Note.—Pedigree will be given with each. They are all from directly imported blood, and prize takers in Britain and Canada.

2.—Ontario Agricultural College Exhibits at Fairs.

We made the following exhibits at Toronto, Guelph, and Hamilton during the month of September :—

Farm Crops of 1883 in Sheaf.

Twelve varieties of winter wheat.
Six varieties of spring wheat.
Thirty-two varieties of oats.
Nine varieties of barley.
Six varieties of green fodder.
Seven varieties of grasses.
Seven varieties of clover.

From Manure Experiments, 1883 in Sheaf.

No. 1. Wheat from nitric acid.
" 2. " " ammonia.
" 3. " " organic nitrogen.
" 4. " " tri-calcic phosphate.
" 5. " " bi-calcic phosphate.
" 6. " " mono-calcic phosphate.
" 7. " " dried blood, sul. ammonia and nitrate of soda.
" 8. " " mineral superphosphate.
" 9. " " muriate of potash.
" 10. " " nitrate of soda.
" 11. " " nitrate of soda and superphosphate.
" 12. " " nitrate of soda and muriate of potash.
" 13. " " muriate of potash and superphosphate.
" 14. " " superphosphate, muriate potash and dried blood—$\frac{1}{3}$.
" 15. " " " " " "—$\frac{2}{3}$.
" 16. " " " " " "—full.
" 17. " " farm yard manure.
" 18. " " without manure.

Cattle.

Durham bull (Booth)	3 years,	9 months;	weight,	2150 pounds.
Aberdeen Angus poll bull	3 "	5 "	"	1910 "
Hereford bull	3 "	6 "	"	2020 "
Devon bull	4 "	7 "	"	2100 "
Ayrshire bull	4 "	4 "	"	1850 "
Jersey bull calf		6 "	"	

West Highland bull	1	"	6	"	"	900	"
Durham cow (Booth)	4	"			"	1390	"
Aberdeen Angus poll cow	3	"	6	"	"	1400	"
Hereford cow	10	"			"	1620	"
Devon cow	9	"			"	1080	"
Ayrshire cow	9	"	6	"	"	1110	"
Jersey cow	4	"	3	"	"	700	"
Durham grade cow	7	"			"	1650	"
Aberdeen Angus poll grade heifer, second cross.	1	"	3	"	"	900	"

Fattening Cattle.

Durham, pure bred steer, two years, four months; weight 2005 pounds.

Aberdeen Angus poll grade steers, first crosses, three head, averaging one year, two months; average weight 1030 pounds.

Hereford grade steers, first crosses, three head, averaging 1 year, 1 month; average weight 960 pounds.

Daily Food of Young Fattening Cattle.

Green fodder	40	pounds.
Peas	4	"
Oats	8	"
Oil cake	1	"
Bran	1	"

Daily Food of Bulls.

Green fodder or hay	25 or 10	pounds.
Oats	$2\frac{1}{2}$	pounds.
Peas	1	"
Oil cake	2	"

The cows are off grass.

Sheep.

Cotswold ram, three shear, and aged ewe	weight	370	and	250	pounds.
Leicester ram and three shear ewe	"		"	230	"
Oxford down ram, three shear, and three shear ewe	"	360	"	230	"
Shropshire down ram, three shear, and four shear ewe	"	255	"	215	"
South down ram, three shear, and three shear ewe	"	246	"	165	"
Merino ram, aged, and shearling ewe	"	240	"	90	"

Ewes off grass without grain.

Fattening Sheep.

Cotswold grades, first crosses, shearling and two shear wethers				weight	220	and	235	pounds.
Leicester grades	"	"	"	"	200	"	275	"
Oxford down grades,	"	"	"	"	170	"	265	"
Shropshire down grades,	"	"	"	"	195	"	285	"
Merino grades,	"	"	"	"	165	"	165	"

Food Daily of Fattening Sheep.

Ten pounds of green fodder or four pounds of hay.
One pound of peas.
One pound of oats.
One-quarter pound of bran.

Shearing Wool.

Lamb, Shropshire grade, shorn 12th July, weight of fleece three pounds.

Shearling, Shropshire grade, shorn 1st April, and 12th July this year, first clip eight pounds, second clip four pounds.

Wool in Fleece from Twelve Distinct Classes of Shearlings.

Weight and present value unwashed.

Merino grade, first cross	10 pounds	$2 70
Shropshire grade, first cross	12 "	2 08
Leicester grade, first cross	14 "	1 71
Cotswold grade, first cross	14 "	1 71
South down grade, first cross	9 "	1 60
Oxford down grade, first cross	13 "	1 56
Merino pure bred	9½ "	2 66
Cotswold, pure bred	15¾ "	2 05
Shropshire, pure bred	9 "	1 98
South down, pure bred	6¾ "	1 48
Leicester, pure bred	11¾ "	1 46
Oxford down, pure bred	11¾ "	1 46

The cross is made with a common Canadian ewe.

A Black Diamond.

Sybill's Darling 2nd (4611), bred by James Argo, of Cairdseat, Aberdeenshire, Scotland—the property of the Ontario Experimental Farm.

Calved March 27th, 1880. Sire, Etonian (1658).

Dam, Sybill's Darling, 4050, by Ballot (634).

" Fred's 5th Darling, 2363, by Scotland (725).

" Fred's 2nd Darling, 1045, by Reform (408).

" Sybil, 974, by Black Prince of Bogfern (501).

" Ann of Bogfern, 539, by Banks o' Dee (12).

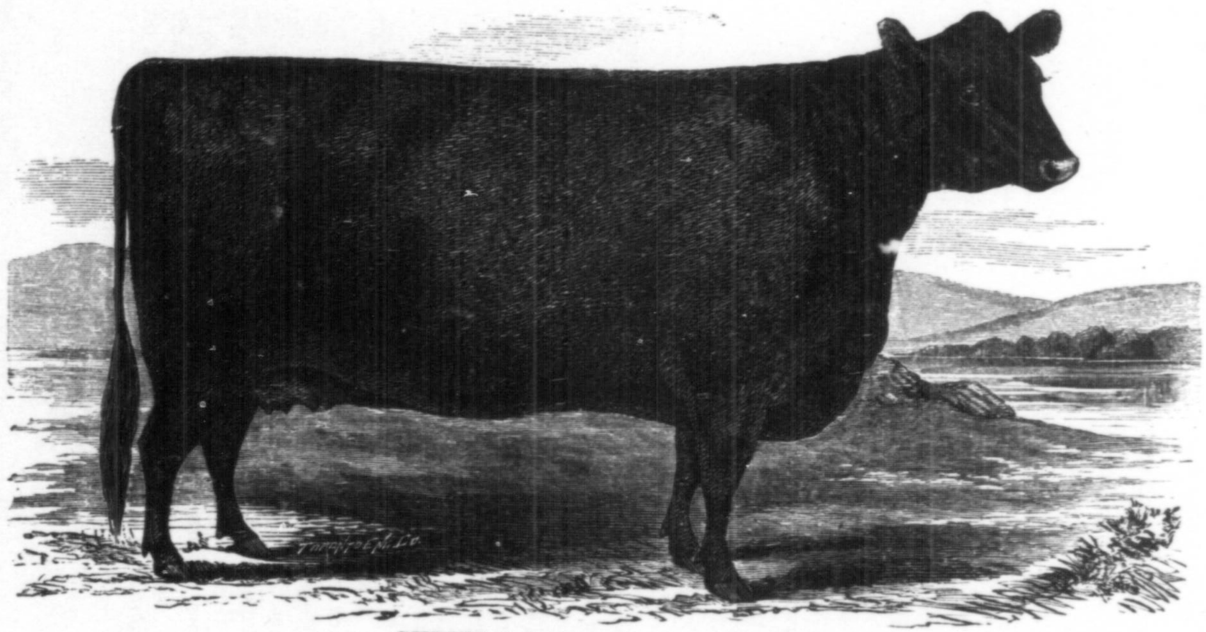
" Young Matilda, 177.

This young Aberdeen Angus poll cow, as selected for us by Mr. Hunter, of Alma, has already made her mark in breeding records,—her first calf, a bull, "Marquis of Huntly," by "Meldrum" (1759), brought $550 when ten months old, at our public sale in September last. She is an unusually even animal, with all the build of a model beefer—on the small side though—and so we were tempted with an offer of $2,000 for her, last year. Cost, delivered at Guelph from Scotland, was $373. But with all my respect for beefers, I think no cow is a cow unless she can raise her own calf. Now, neither this cow, nor the $1400 shorthorn imported at the same time can milk their own calves as they should be done. We cannot maintain beef without milk.

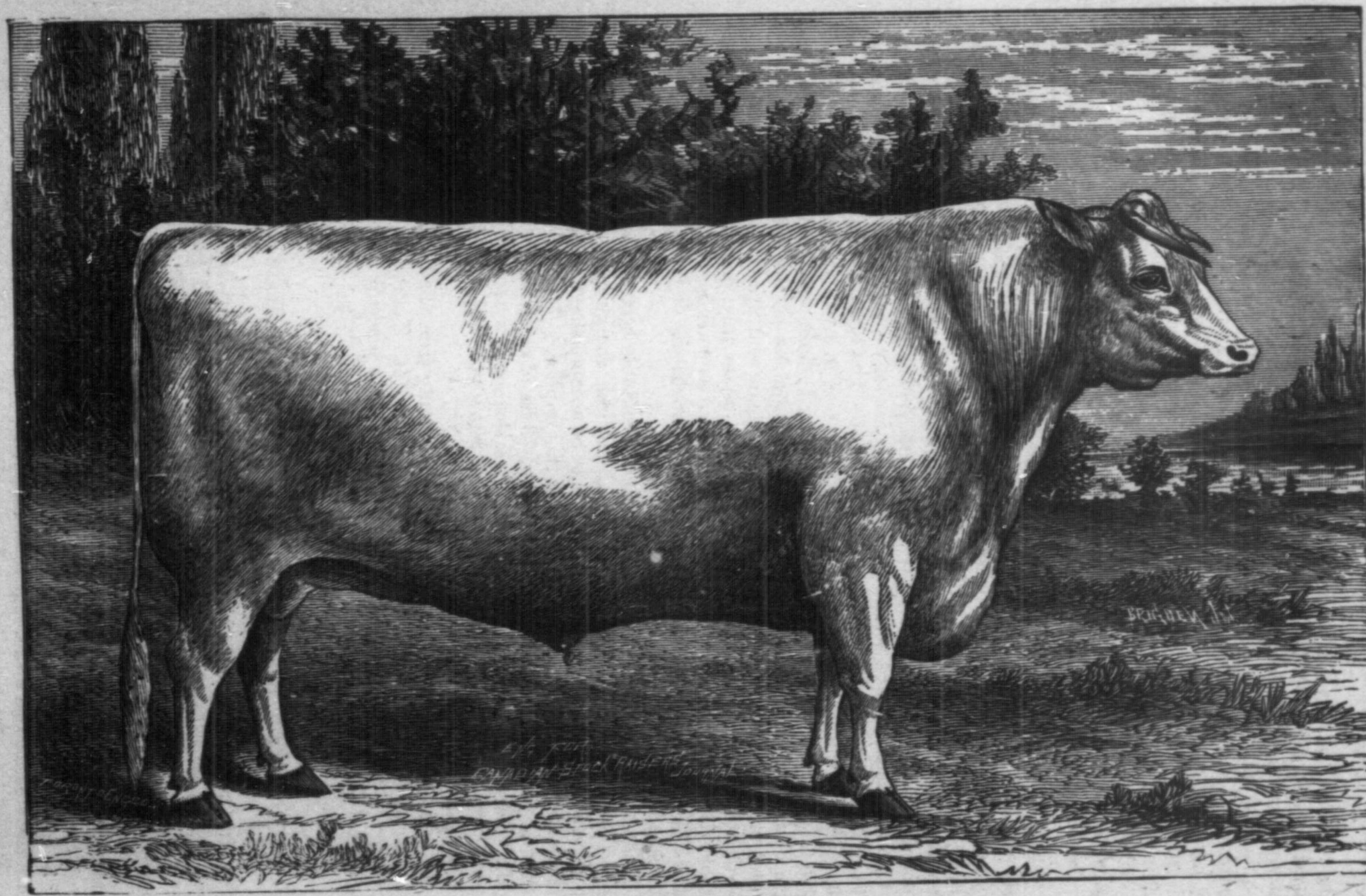
Early Finished Beef.

This is a very fair illustration of what was, according to all accounts, the heaviest steer of his age in Canada, and possibly even in the United States, or Europe, during 1883.

The question of the early maturing of beef cannot be too often held up to our farmers, and it is very satisfactory to find that Ontario is as alive in this as any other country. The animal in this example was a pure bred shorthorn, calved 6th May, 1881, bred by Mr. C. Hodgson, Whitevale, Ontario, and bought by us from Mr. Hope, of Bow Park, when nineteen months old, so all we had to do was to finish him. In build, "The White Duke," was by no means perfect, nor equal to some others from which he took honours in the show ring. Possibly no fault could be found with anything forward



SYBILL'S DARLING 2ND (4611).



THE WHITE DUKE.


THE WHITE DUKE.

of the loins, but he was decidedly deficient in width and depth of hind-quarters—(the illustration shows a better flank and hams than the animal possessed). In handling, and quality otherwise, he was a good average but nothing more, but in width and filling of fore-quarters, with a delightful head, nothing better could be desired. When killed at Toronto, on 17th December, 1883, this steer weighed 2,110 lbs, (having lost 85 lbs. by show handling,) and gave 72 lbs. of butchers' meat to every 100 lbs. of his live weight. With this very large proportion there was no coarseness, nor patchyness, but good moulding and fine graining throughout.

When asked, as I have often been, what we fed "The White Duke" upon, the best answer I could give was "ask me what he *did not get.*"

The following opinion upon this animal is by our practical beef expert, Mr. Woods:—

The famous steer fed at the Experimental Farm, when cut up more than sustained the reputation he won when alive. That he should attain the weight of 2,110 pounds in two years and seven months, no doubt suggested to many the suspicion that his carcase would be found to contain an undue proportion of fat. But notwithstanding his being the heaviest cattle beast for his age on the continent, the carcase shows an immense development of the juciest and most tender of flesh, and only a small proportion of fat.

Chine measurement at second rib shows 10½ inches; mixed meat or flesh 6½ inches; length of lean or marbled flesh along rib 7½ inches. The brisket measures 6½ inches cut on the square of the best mixed beef I have ever seen in a two year old steer. Neck, it may be said, he had none, as from point of shoulder to horn was filled level with a mass of rich beef. The marbling and regularity of lean and fat as the different joints lay on the table arrested the attention of every practical man who passed the stall. The flesh at the eighth rib is one foot thick, and the selvage, or fat only, one inch. In short every cut shows that intermixture of red and white known as marbling, in admirable development. The interstices of fat are thin, and the outer-coating of fat is laid on with great evenness, and never in too great quantity.

This animal is, in fact, as near the ideal of profitable beef, for butcher and consumer alike, as could be desired; with little bone, and flesh cherry red, juicy and fine, extending to the horns. The carcase shows what may be accomplished in securing early maturity and the large profit to the stock-raiser which this implies. It is interesting to note that this animal yields the extraordinary amount of 73 lbs of meat, dead weight, to 100 lbs. live weight. The average of good animals placed on the market is only 60 lbs. The very highest record at the recent Chicago Fat Stock Show was 69½ lbs., or three and a half lbs., less than White Duke's record.

The hind quarters were not cut, but as they hung from the hooks they looked like huge squares of flesh without one ounce of superfluous fat. Taking his age and live weight, and weight of dressed meat to live weight will probably place White Duke at the top of all steers yet raised.

The Great Beef Contest at the Ontario Experimental Farm.

Having now got over the initiatory work of establishing herds, and acclimatizing breeds, we are devoting considerable attention to the making of grades for milk and beef respectively. Our progress in milk experiments is in advance of the other as evidenced in previous reports. We make no excuse for this. Our past beefing experiments have been with high graded shorthorns, and the facts, to date, are sufficient to base upon in any comparison with other grades, as we will have to do when time calls; and what I wish to do in this chapter is to place on record what our Farm has on hand for such a purpose.

The same cows, well graded shorthorns, averaging six years, that have been used to produce the steers, with a thorough-bred shorthorn bull, were selected to mate with the Hereford and Aberdeen poll bulls. Necessarily, one of the difficulties is to arrange about equal birth-dates, and another is to get bull calves. We have been more fortunate with the latter than the former, as shown by the following list:

HEREFORD GRADE STEERS:

9th April, 1882, "*Huntingdon*," No. 184 (ear label).
6th October, 1882, "*Heathfield*," No. 193. "
28th Octoher, 1882, "*Hartford*," No. 191. "

ABERDEEN ANGUS POLL GRADE STEERS:

24th June, 1882, "*Aberdeen*," No. 183.
27th June, 1882, "*Aboyne*," No. 179.
2nd of August, 1882, "*Abernethy*," No. 182.

SHORT-HORN GRADE STEERS:

15th December, 1881, "*Dudley*," No. 285.
10th March, 1882, "*Derby*," No. 290.
16th March, 1882, "*Digby*," No. 292.

The Hereford and Aberdeen polls are of our own breeding; the Short-horns from George Moore, Esq., of Waterloo, and H. Henderson, Esq., of Guelph. It would have been more complete if all had been of our own breeding, but we had none of about equal stamp and age for such an important contest. They are from cows similar to those that gave the Hereford and Aberdeen poll grades, and food and management nearly eqnal to what they received. Taken altogether the Short-horn grades had not been so well done to, but not much less so.

These nine animals, representing the three greatest breeders of the world, are thus on hand for the most interesting and valuable contests of breeds we have had at the Farm. By such work we hope to add to the accurate knowledge of facts accumulating from various sources, and we do not know that anyone has ever had the same variety, sex, age and grading, under similar management at one place.

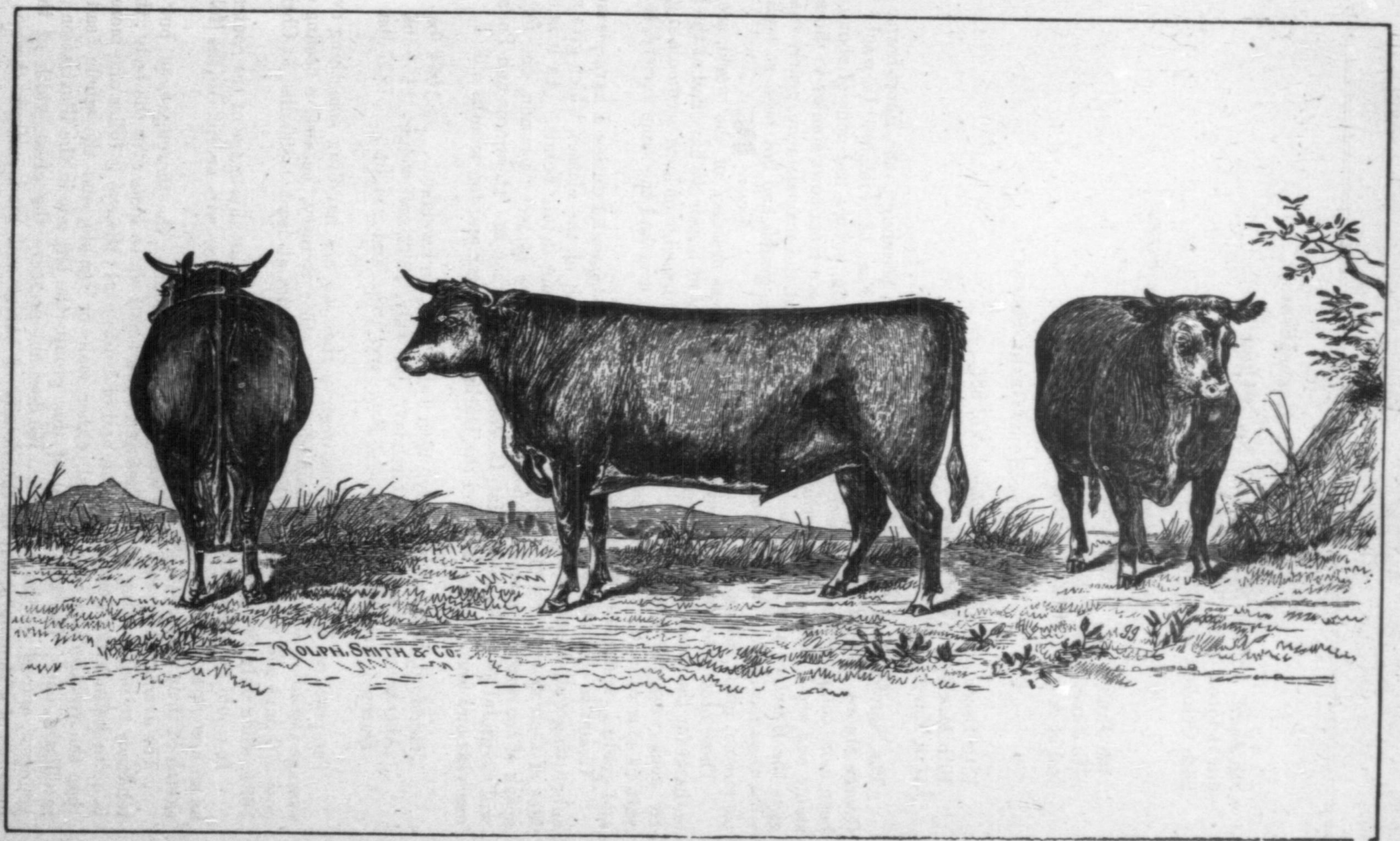
To add to the interest of this section of our experimental duties, I have pleasure in submitting well executed pencil sketch groups of each of the classes, which give a good idea of their general stamp, and indeed some of their detail points. As it is best to speak of the *average* animal, when weights and ages are under discussion, the following will be useful as applicable to 1st December, 1883, when the Herefords and Polls were one year and four months old, and the Durhams one year and ten months old:—

Hereford, average birthday, 17th July, 1882, and weight ......1054 lbs.
Aberdeen-Angus, average birthday, 15th July, 1882, and weight..1155 lbs.
Durham, average birthday, 1st February, 1882, and weight ....1237 lbs.

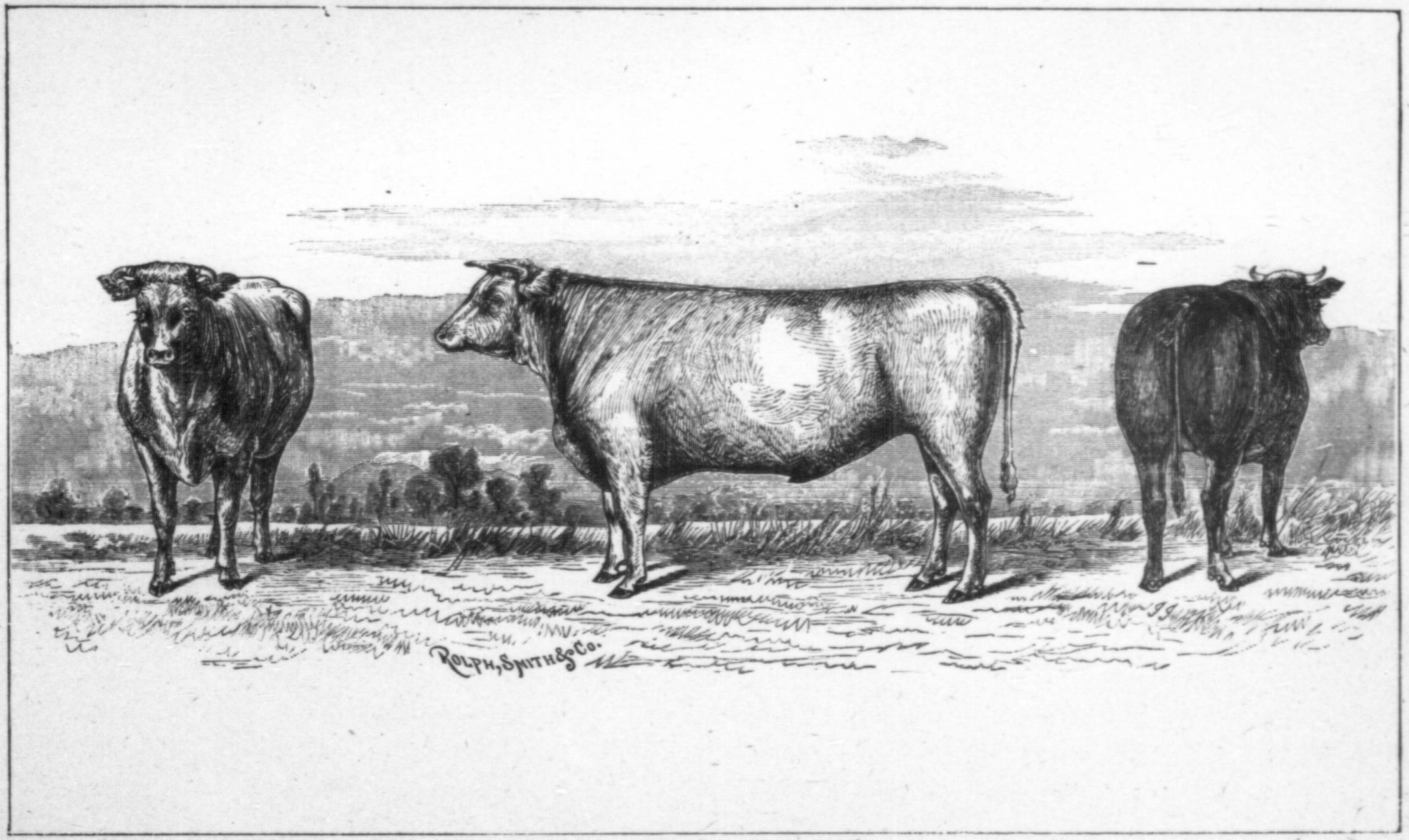
The practical feeder will at once observe that we are handling something over the average Canadian store steer, or indeed of any other country, because a beefing animal now 570 days old, and weighing 1,150 lbs., will scale at least 1,800 lbs. at Christmas, 1884, when only two years and seven months old.

It would be premature to make many comparisons at this stage of the contest, but, as an accompaniment to the illustrations, the keen reader will accept of the following sketch of their build, and general appearance.

The average Hereford is as well marked in colour as the thorough-bred, but with a tendency to red spotting in the face and a few small white spots over the body; the horn is quite distinct, not heavy, well set, and of a nice oval; the eye is fuller and more placid than the average pure bred animal, either male or female, and the whole head a very intelligent one. The top animal of this group (the left one in the illustration), is the youngest, and as yet the smallest. He does not preserve the great width of the fore-quarters of a shorthorn, but in the details of barrel and hind-quarters there is all the model of a beefer; the fullness, depth and width of twist and hams are simply perfect. There is not one of the nine equal to this in these respects. The Hereford grade *bone* here is not of that extra fineness found elsewhere, and the handling is just what it ought

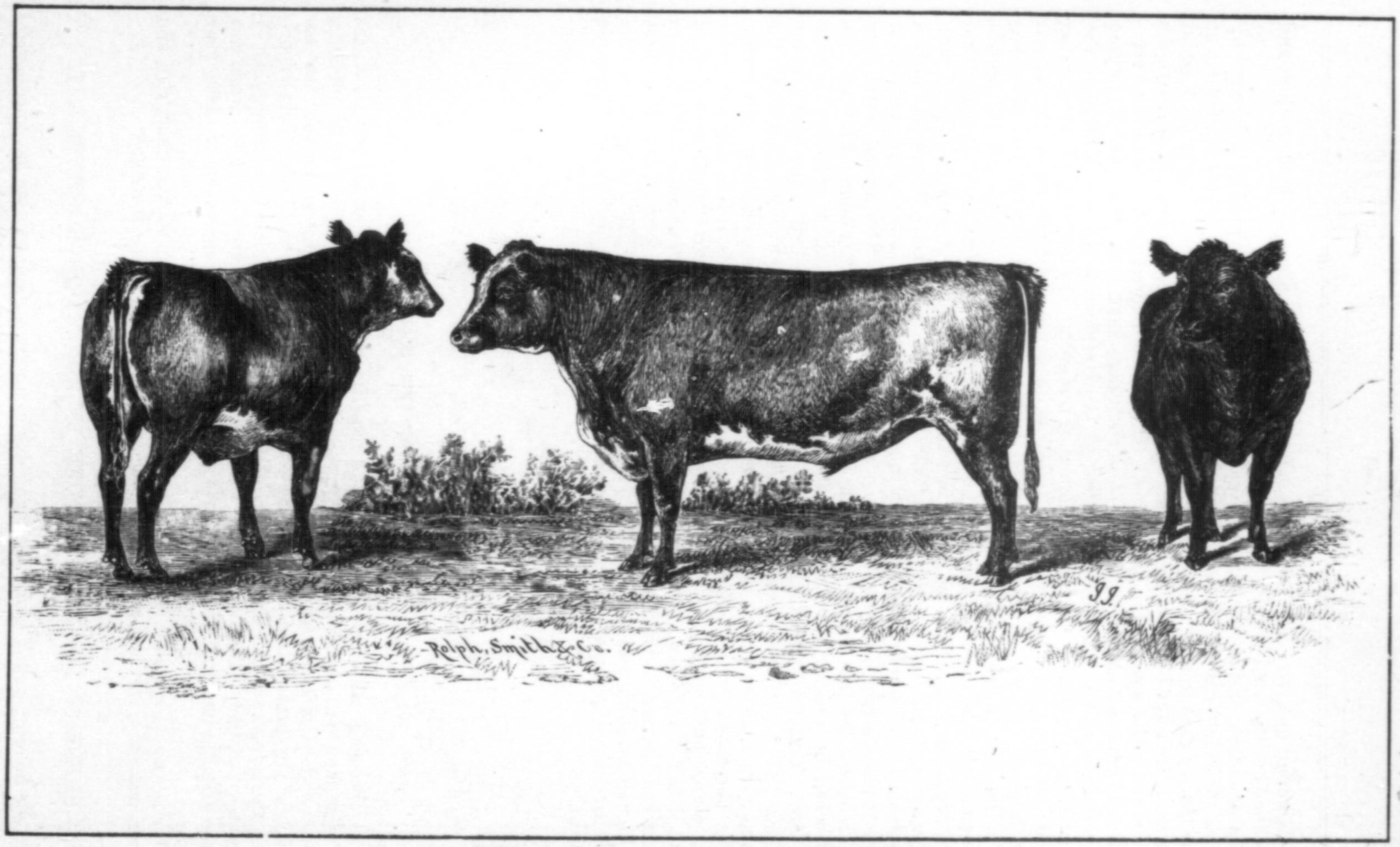


HEREFORD GRADE STEERS.



SHORT HORN GRADE STEERS.

SHORT HORN GRADE STEERS.



ABERDEEN ANGUS POLL GRADE STEERS

to be—Hereford quality. The chunky evenness and tidiness, strength with quality, and full fleshiness of the kind is very typical.

The Aberdeen Angus polls cannot be said, all over, to be so typical of their kind by colour, as the Herefords. The illustration shows a greyness in two, which remind me of splendid lessons I got from Mr. McCombie, of Tillyfour, in 1864, when some of his "grand ones" were of that hue. The other animal of this group is perfectly black all over, with the exception of a white spot on the under line. The second impression of these is a beefy-ness—a semi-grossness almost, a sort of dead language that says, "we know nothing about milk in our family, and the fat grazing of the Hereford or the stall feeding of the Shorthorn is all we want." The centre animal of the group may be taken as representing his kind: no horn, not even a fast scur to tell of his mother's side; a strong, prominent poll, with plenty of hair, a sleepy eye, and such a broad fine mouth and muzzle as delights the keen judge; a little flabbyness of skin under the jaw, and its perfect development on the bosom, which indicates quality with character; neck, shoulder, and forward depth, as well as the top width forward are first-class, but the loin falls off both in width and strength—not such a great deal, but yet not perfect. We should have a deeper flank, but in all other respects this individual is very even—a grand mellowness under a moderate skin, and plenty of bone without coarseness. The general stamp may be inferred from the fact that on the 28th September last we were offered $100 for this animal, when he weighed 1,020 lbs. at fourteen months; object, to exhibit at United States fairs. Some of our visiting critics think the black steer will come out best ere Christmas, 1884; he is more reachy and finer fleshed meantime, but does not indicate the open constitution of the other—what may be called the assimilating character of a beefer.

The Shorthorn grade steers are not supposed to be representative of any particular colour, two are pure white, the other roan, which is oldest by three months—a 15th of December calf. There is not a model among the three, the heaviest is both best in handling and heaviest in bone; the smallest is the more even all through, and the oldest is the highest standing and more wedgy. In saying "no model," I do not mean that the animals are under average, but that they do not come up to the well known Shorthorn standard.

IV.—THE EXPERIMENTAL DEPARTMENT.

1.—Feeding Experiments 1882-83.

In criticising the Live Stock feeding experiments of this station, we must not forget that however much they may appear to correspond in objects with others in Europe and the United States, some of the regulating conditions are so different that co-operation of any practical value cannot be established. It is the same with field experiments,—the co-operation is scientifically interesting but unreliable as practical guides—the one to the other. Our winters and summers are so characteristic as to demand a complete set of animal and vegetable experiments. Hence the prosecution of these, year by year.

During the past winter (1882-3) we have considerably extended our enquiries, and are again enabled to present materials of decided importance to the Province.

(a)—PRESERVING CORN FODDER IN A COMMON ROOT CELLAR.

In the fever of "silo" and "ensilage" during the past two years we have necessarily been most impartial note takers—having stood unconnected to any particular system and unwilling to experiment until British and American ideas were fairly afoot. Before we took any action one thing had been solved: That green, succulent vegetable matters can be easily preserved for an indefinite period, summer and winter, when proper measures are adopted; in no other respect have we found much agreement of experience anywhere, founded upon exact experimental data. One says, animals eat the ensilage greedily every time, another that they took only a certain quantity; one says it is always bitter or acrid, and others declare it is always sweet; several maintain that it keeps at a high temperature throughout in the silo, while others testify to a cooling down a certain number of days after closing. Animals get fat on it, say some, but others failed to uphold life with it alone. Milk and butter are improved in quantity and quality; both are injuriously affected, say others. And even chemists are not agreed as to any increase or diminution of nutritive properties.

Our first view of this subject was Provincial, with the question—granting the success of preservation, can the ordinary farmer make use of part of his present root cellerage for ensilaging? If a $1,000, or even a $300 silo is indespensable, many years must elapse before the practice becomes common. We agree with those who say that it matters comparatively litttle whether the fodder improves or looses in feeding value, it is enough, a grand thing, to be able to preserve it green and sound all along, and to be presentable to animals at all times, like regular roots. It would have been easy for us to build an expensive silo.

On the 28th and 29th September we cut and hauled from a field 500 yards distant, twenty-nine and one-fourth ($29\frac{1}{4}$) tons of green corn fodder, passing it immediately through a straw-cutter, driven by a ten horse-power portable engine, cutting into lengths that dropped into the cellar from the machine, and spread and packed as solid as possible by two men. The cost of this was:—

Engine and engineer	$5 00
Feeding straw-cutter	4 50
Men in silo	4 00
Team and driver	6 00
Field loader	2 25
Cutting fodder in field with mower	2 00
	$23 75

The old root cellar thus utilized, stands half under ground—being nine feet deep, and 18 x 15 feet—the walls consisting of stone and lime two feet thick, with a rough surface inside, and an earthen floor. A door in one corner admits on a level to the cattle stables. The newly packed material was at once covered with planed two inch boards, overlapped by half thickness, and loaded with 600 lbs. of stone to every superficial square yard. Heat evolved rapidly and continued strong for two weeks, as was readily ascertained through the planks that formed the doorway; in this time, also, the material settled down to its final depth of six feet. A strong, distinct brewery or beery smell continued during fermentation, and at all times when the ensilage was broken up with the hand. The silo remained untouched for sixty days. It was opened on the 1st November. About one foot in thickness all round adjoining the wall the fodder was rotten—perfectly eaten up by fermentation, thus showing the necessity of plumbing and smoothing the walls of a silo—inside of this decay the material was fresh, good upon the floor, and good everywhere except around the rough wall.

(b)—MILK IN QUANTITY AND QUALITY FROM ENSILAGED CORN.

In order to test the effects of corn thus preserved, upon quantity and quality of milk, we set aside four well balanced common cows that, on an average, were thirty days after calving. The experiment began on the 1st November, and ended 1st January, thus lasting sixty days. In order to check any unusual individual cow influence, and also distribute any other animal tendencies, the cows were alternated—those that received corn during the first half of the period being put to turnips, and those previously on turnips changed to corn. In all such experiments it is necessary to be able to compare the results of the, so to speak, primary food, with something else that may be naturally opposed to it—one green fodder again another—preserved corn fodder *versus* turnips for example. For want of such *simultaneous* tests, most of the records in this line of work in other places are practically useless, at least unreliable, and all true friends to ensilaging should insist on such duplication.

Each set of cows was allowed one week on its respective diet before note-taking began. It is almost unnecessary to say that those on turnips eat and behaved in the usual manner from such feeding—Swede turnips, hay, and bran being a diet older than Canadian history. At first the cows eat the corn greedily, taking as much as fifty pounds per day during the first week, without any additional material. Gradually, however, they tired of it, fell off in condition, and gave a reduced quantity of milk. At this time—ten days from the start—being satisfied that the animals were going back, hay and bran were added—the bran being mixed with the corn until the regular quantities of 8lb and 2½lb respectively, per head per day were settled upon—similar to what accompanied the turnips. At times, subsequent to this final bill of fare, the cows did not consume more than 12lb per head per day, at others 20lb, and taken all through the experiment, the average consumption was 30lb corn per head per day. At the middle of the term when cows changed places, very much the same experience was realized, a most marked keenness for the ensilage corn, and a gradual unrelish, the hay being generally taken first, and bran appearing to be indespensable as time went on. We several times gave other cattle a taste of the new fodder in the stable, which with any refuse thrown upon the manure pile, was always much liked, all classes and ages seeming to enjoy it.

By all the management, therefore, of this experiment, we obtained the following milk record, each milking being weighed, tested, and set during twenty-four hours for cream per centage, so that the figures represent the result of over 550 observations:

—	Milk per cow per day.	Specific gravity of milk.	Per cent. of cream.
	Lbs.		
From Ensilage Corn..........	28	108	12½
From Turnips..........	33	107	12

There are no striking differences between the two results; the only one, indeed, is that of quantity, and though this amounts to five pounds per cow per day against grain it is not such an extraordinary fact as may be anticipated. But yet it is a fact in this preliminary test, and must be retained for all future reference. We do not expect much, if any difference, in the specific gravity, by lactometer, of milk from cows of similar breed and general stamp as these were, but the percentage, or volume, of cream from the milk would be expected to vary considerably with food; not so here to any appreciable extent. Altogether, then, in regard to milk, the quantity was affected to the extent of 15 per cent. against ensilaged corn.

(c)—BUTTER FROM ENSILAGED CORN.

The previous chapters show in what manner cows were fed, and the quantity and quality of the milk obtained from them, and now finally in regard to the butter from the same milk. Four churnings were undertaken toward the end of the period, when, we thought, the effects of food would be the strongest. Of course the cream was taken in each case from corresponding days, and every possible extra-influence on any side guarded against. The common earthenware dash-churn was employed. Butter came on an average in thirty-five minutes, in a room temperature of 55°—everything being sweet and nice. I do not require to submit all details of management, weighing, and testings, and shall simply give the quantity of butter, with a few observations thereon.

BUTTER FROM 100 LBS. CREAM.

From Ensilaged Corn	35 lbs.
From Turnips	46 lbs.

I look upon this butter result as the most important of any obtained throughout the experiment. First it is another proof, added to many others, that the per centage, or volume, of cream is no criterion of its buttery properties—that the bulk of cream does not indicate how much butter it will give; in this example both kinds of milk registered twelve per cent. of cream, and yet the one turned out thirty per cent. more butter than the other—actually about *one-third* more. It is also additional evidence that food affects the quality as much, if not more than the quantity of milk. How the food affected, for and against, I cannot tell, nor possibly can anybody else, but it unquestionably did so in these examples.

But not only were quantity and quality of milk materially influenced, the *colour* of the butter was in every churning highly different, needing no practised eye to say so; that from Ensilaged Corn was of a pale yellow tinge and greasy appearance, as against the very decided and well known healthy looking yellowness of the other. During my visit to the Eastern and Western Dairymen's Associations this year, where samples of the butter were shown, very many good judges were surprised at the difference in colour.

It should be our duty next winter, not only to adopt different methods of preserving corn, but other green fodders, and at the same time carry out a more extended trial of their effects on animal life, as may be considered best for the interests of the Province.—*See chapter "Influences of Food on Dairy Products" in this Report.*

From the plain facts of this experiment we are justified in cautioning our cheese and butter manufacturers against the *exclusive* use, or even the large consumption per cow, of any preserved green fodder possessing a distinct *sourness*. It is no bold statement to question the possibility of such preservation without producing some fermentation, and therefore alcohol—and as milk, butter and cheese produced from the consumption of any form of alcoholic material is badly injured for the market, Ontario should be guarded.

(*d*)—DAMAGED WHEAT IN CATTLE FEEDING.

We grew in field 18 last year, thirteen acres of Diehl wheat, of which one-fourth had been winter killed, and though the crop presented a good early summer appearance, straw became badly rusted, grain did not fill, and harvest brought a miserably dried up, shrivelled, and damaged sample of Fall Wheat. Millers would not even take a present of it, and having no poultry to pamper we concluded to test part of it against other grains in the fattening of cattle.

The wheat was ground in our own mill to a size corresponding with the corn, and other kinds—neither fine, nor very coarse, but rather on the coarse side.

The animals used in the experiment were yearling and two-year old steers. Each had two weeks on wheat, alternating with other grain, as hereinafter recorded, so that the whole period of each set of four tests consisted of fifty-six days. In addition to grain, hay and roots were given, everything being weighed at each diet, and as usual any events accurately noted. It will be interesting to follow each animal:

"Ontario" consumed, from 10th January to 23rd January, 128 lbs. hay, 426 lbs. turnips, and 92½ lbs. wheat, entering at 922 lbs. and weighing 952 lbs. at finish, adding, therefore, 30 lbs. in fourteen days, or fully 2 lb. per day. "Prince Edward" eat, from 26th January to 6th February, 171½ lbs. hay, 667 lbs. roots, and 123½ lbs. broken wheat, and having entered at 1,038 lbs., and come out at 1,070; the addition of 32 lbs. gives 2¾ lbs per day.

"Ontario," again returned, from 7th to 20th February, consumed 141½ lbs. hay, 735 lbs. roots, and 143 lbs. wheat, increasing from 1,008 lbs. to 1,040 lbs. in fourteen days, and thus making a daily rate of 2¾ lbs. "Prince Edward," in his turn, from 21st February to 7th March, eat 140½ lbs. hay, 738 lbs. roots, and 134½ lbs. wheat; entry weight 1,091 lbs., and 1,106 lbs. at finish, or a daily increase of fully 1 lb.

Gathering these four tests together we have the following average result, with one animal:—

Daily Consumption of Food.			Daily Increase.
Hay.	Roots.	Wheat.	
lbs.	lbs.	lbs.	lbs.
$10\frac{1}{3}$	45	9	2

Therefore, a store steer, twenty months old, and weighing 1,030 lbs. on an average of time of experiment, consumed per day $10\frac{1}{3}$ lbs. of hay, 45 lbs. turnips, and 9 lbs. broken wheat, upon which, throughout an alternating trial of 56 days, it increased almost exactly two pounds every day.

It took 5 lbs. hay, 23 lbs. roots, and $4\frac{1}{2}$ lbs wheat, to add one pound to the live weight of the average of these animals, at a market cost—that is, the value of the materials on the market at the time, not the cost of producing them—of eight cents, the damaged wheat being reckoned worth one-half cent per pound. The cost per pound of added animal weight, according to the value of the food on the farm, or what it cost the farmer to produce it, may always be put at *one-half* of the market value, and this is the only proper method of charging animal food when the producer is the feeder. If market values are adopted, the feeder receives an immediate profit before the food is actually consumed.

(*e*)—RICE MEAL IN CATTLE FEEDING.

Messrs. Ross, Hall & Co., of Montreal, sent us one-half ton of their rice meal for the purpose of testing it in cattle feeding, with other grains under similar conditions. This form of feed is quite new to us. It is the "Moulie" of Quebec district when the rice is mixed with other materials. Rice, by itself, though high in feeding properties, is too *gritty*, even when ground, to make it most presentable to animals, hence the practice of adding some other grain. That sent us was the same as manufactured by Messrs. Ross, Hall & Co., for the trade, and consisted of

$$\left.\begin{array}{l}\text{4 parts rice}\\ \text{3 parts oats}\\ \text{1 part peas}\end{array}\right\}\text{all ground.}$$

We set aside four pairs of store steers, averaging 21 months old, and made up of Galloway grades, Hereford grades, Shorthorn grades, and Devon grades, allowing each a test period of twenty-eight days upon rice meal, barley meal, corn meal, and pea meal, alternating throughout the whole period of one hundred and twenty days. Thus each kind of food, and each set of cattle, had a turn of each other during that period, and the experiment in every respect was conducted accurately—every meal weighed, progress noted by weighing the animals every week, and anything in regard to health, or unconsumed food recorded.

In handling results it is best to speak of one animal as representing the average of all, or of a certain set. Every animal got as much as it would consume.

In the first term with rice meal, from 4th December to 1st January, the average cattle beast consumed 291 lbs. hay, 46 lbs. bran, 1,003 lbs. roots, and 167 lbs. of the rice meal. During these twenty-eight days it increased in weight, from 827 lbs. to 879 lbs., or a daily rate of 1·86 lbs.

During the second term, one of another set of steers, from 1st to 29th January, consumed 207 lbs. hay, 873 lbs. roots, 120 lbs. bran, and 110 lbs. of the rice meal, increasing from 764 lbs. to 800 lbs., which gives a daily increase of 1·30 lbs.

The third term, with other animals, from 29th January to 26th February, eat 301 lbs. hay, 121 lbs. bran, 1,076 lbs. root, and 207 lbs. meal.

The average animal entered at 1,118 lbs., and came out at 1,182 lbs., showing a daily increase of 2·28 lbs.

NOTE.—We had not enough rice meal to carry out the fourth set of this experiment.

Summarizing these results, we obtain the following as the grand average of one animal, through the record of six of them, by a triple set of experiments extending over eighty-four days :—

Daily Consumption of Food.				Daily Increase.
Hay.	Roots.	Bran.	Rice.	
lbs. 9½	lbs. 35	3½	6	1·81

So then a store steer, averaging from different grades, and weighing 908 lbs., on a mean of the time during which the experiment was conducted, consumed daily 9½ lbs. hay, 35 lbs. turnips, 3½ lbs. bran, and 6 lbs., rice meal, upon which its live weight increased one and eight-tenths pound per day.

Therefore, it took 5 lbs. hay, 19 lbs. roots, 2 lbs. bran, and 3½ lbs. rice meal, to add one pound to the live weight of this average steer. At market rates this cost 12 cents. Hay, $10 per ton ; roots, 9c. per bushel of 60 lbs. ; bran, $13 per ton ; and the rice meal $27.50, at Montreal.

(*f*)—BARLEY MEAL IN CATTLE FEEDING.

This is the first systematic trial given to barley meal by us in the fattening of cattle —much as we have previously used it to horses, and ewes after lambing. Its cheapness this winter induced the experiment now to be recorded.

The average steer from 4th December to 1st January, consumed 257 lbs. hay, 1,006 lbs. roots, 48 lbs. bran, and 269 lbs. barley meal, going in with a weight of 1,016 lbs., and finishing at 1,100 lbs., thus gaining 84 lbs. in 28 days—a daily increase of exactly 3 lbs.

On the second test other animals consumed on an average per head, 300 lbs. hay, 1,011 lbs. roots, 124 lbs. bran, and 225 lbs. barley meal. The entering weight was 1,061 lbs., and 1,106 lbs. at close, making a daily increase of 1·60 lbs.

The third trial consumed 220 lbs. hay, 964 lbs. roots, 121 lbs. bran, and 227 lbs. barley meal, and increased the average animal from 937 lbs. to 1,005 lbs. which is a daily rate of 2·43 lbs.

The fourth test of barley meal began on 25th February, and ended 26th March, during which the average animal eat 220 lbs. hay, 807 lbs. roots, 124 lbs. bran, and 197 lbs. of the meal, and increased from 875 lbs. to 918 lbs., being a daily rate of 1·53 lbs.

From these we have the following abstract :

Daily Consumption of Food.				Daily Increase.
Hay.	Roots.	Bran.	Barley.	
lbs.	lbs.	lbs.	lbs.	lbs.
12	46	5	11¼	2·14

The average store steer here weighed 947 lbs. during the mean time of the trial, and consumed daily 12 lbs. hay, 46 lbs. roots, 5 lbs. bran, and 11¼ lbs. barley meal, by which its live weight increased at the rate of 2·14 lbs. per day.

Consequently it took 6 lbs. hay, 25 lbs. roots, 2½ lbs. bran, and 6 lbs. barley meal to add one pound to the live weight of the same average animal, which at market rates cost 14 cents per lb—barley being put at one cent per pound.

(*g*)—CORN MEAL IN CATTLE FEEDING.

It is not because we can purchase corn cheap enough for making beef that we prosecute this branch of the work year after year, but because it is one of the great cereals of this continent, and may yet be common enough in Ontario for such a purpose.

The first set of steers, under this grain, opened on 4th December, and went out on the first of January. During that period the average animal consumed 231 lbs. hay, 845 lbs. roots, 42 lbs. bran, and 203 lbs. corn meal, and increased in weight from 704 lbs. to 764 lbs., thus making a daily mean of 2·14 lbs.

In the second set the consumption of food was 304 lbs. hay, 1,078 lbs. roots, 123 lbs. bran, and 293 lbs. corn. The average steer with this increased from 1,106 lbs. to 1,175 lbs., or a daily rate of 2·46 lbs.

By the third there was consumed 253 lbs. hay, 975 lbs. roots, 129 lbs. bran and 285 lbs. corn meal, by which the average animal rose from 1,004 lbs. to 1,067 lbs., and so made a rate of 2·32 lbs. per day.

Accordingly we obtain over the whole series:

Daily Consumption of Food.				Daily Increase.
Hay.	Roots.	Bran.	Corn.	
lbs.	lbs.	lbs.	lbs.	lbs.
9½	34	3½	9¼	2·31

By which it appears that the average animal, that weighed 970 lbs., consumed daily 9½ lbs. hay, 34 lbs. roots, 3½ lbs. bran, and 9¼ lbs. corn meal, and made a daily increase of 2·31 lbs.

It is thus shown that it took 4⅛ lbs. hay, 15 lbs. roots, 1¼ lbs. bran, and 4⅛ lbs. corn meal, to add one pound to the average animal of the trial, and at a cost of ten cents per pound, placing corn at 1¼ cents per pound.

(*h*)—PEA MEAL IN CATTLE FEEDING.

We have not lost any respect for Ontario's productive legumen, badly destroyed, as it still is, by the untiring bug, in many parts. Its universal application to feeding all classes of live stock—the horse, perhaps, excepted—will always make it welcome in our mixed husbandry. Let us see how it stood its ground in competition with the four other grains.

In the first trial, the average store steer consumed 337 lbs. hay, 1,000 lbs. roots, 48 lbs. bran, and 265 lbs. pea meal—increased from 963 lbs. to 1,061 lbs., and thus made a daily rate of 3½ lbs.

By the second one, the consumption was 230 lbs. hay, 1,005 lbs. roots, 123 lbs. bran, and 248 lbs. pea meal, when the increase rose from 879 to 937 lbs., and gave a daily rate of exactly 2 lbs.

The third trial consumed 196 lbs. hay, 917 lbs. roots, 123 lbs. bran, and 210 lbs. pea meal—increased from 800 to 963 lbs., and consequently made a daily rate of 2¼ lbs.

And in the fourth test, the average steer consumed 289 lbs. hay, 1,106 lbs. roots, 97 lbs. bran, and 244 lbs. pea meal, upon which it increased in live weight from 1,182 to 1,220 lbs. Here the daily rate was 1·36 lbs.

The grand average of these is—

Daily Consumption of Food.				Daily Increase.
Hay.	Roots.	Bran.	Pea Meal.	
lbs.	lbs.	lbs.	lbs.	lbs.
9⅓	36	3½	8½	2·28

Thus by the use of pea meal, the average animal of 988 lbs. consumed 9⅓ lbs. hay, 36 lbs. roots, 3½ lbs. bran, and 8½ lbs. meal, and gave a daily rate of 2·28 lbs.

So that it took 4⅛ lbs. hay, 16 lbs. roots, 1¼ lbs. bran, and 3⅔ lbs. meal to add one pound to its live weight, which cost—reckoning the pea meal at 1¼ cents—10 cents per pound.

(j)—COMPARATIVE RESULTS OF THESE FIVE GRAINS.

It will be readily understood that no comparison can be of much practical value unless every circumstance has been balanced, so far as lies in man's power. In this regard we secured well mated animals of different grades, the previous treatment was made alike, stabling, management, exercise, currying, modes of feeding, salt, water, and all other conditions were as uniform as possible, and as every set of animals was treated to the various grains alternately, the results are actually from no fewer than *eighteen* distinct experiments.

First, with reference to food, increased weight, per head, per day, and actual cost of production.

——	Hay. lbs.	Roots. lbs.	Bran. lbs.	Grain. lbs.	Daily Increase lbs.	Average Weight of Animal lbs.	Actual Cost of Production lbs.
Wheat, damaged.....	10⅓	45	..	9	2·00	1030	c. 4½
Rice Meal	9½	35	3½	6	1·81	928	7
Barley Meal	12	46	5	11¼	2·14	947	7
Corn Meal...........	9½	34	3½	9¼	2·31	970	5½
Pea Meal	9⅓	36	3½	8½	2·28	988	5
Mean.....	10	39	4	9	2·11	973	6

The first thing the practical feeder asks, is—what does it cost?—and although this is contrary to the natural line of inquiry, it is as well to make the lesson as coformable as possible to those for whose benefit these tests were undertaken.

I think the very first thing is to throw out the wheat altogether from the discussion.

When viewed from the world's standpoint, it has no place among the rougher grains for cattle feeding. Special circumstances only, similar to those that brought about the experiment, would warrant its withdrawal from the table of the people. At the same time it is certainly most interesting to find, as may be on record in other countries, though we have not seen it, that even *damaged* wheat produces cheaper beef than any of the other valuable grains. In this respect alone it is important to know that, not only poultry and pigs, but even cattle can make economical use of wheat, when properly presented. Had we made a fine flour of it, in place of breaking only, and thus maintaining a proper grittiness, the cattle beast could not have *mouthed* it for swallowing; the gummy nature of the wheat in a fine condition clogs the mouth and is more indigestible. It will be noticed that over the average quantity of hay and roots was consumed along with wheat, which was due, probably, more to the animal need of them in association with this grain than to the slightly larger size of the average steer. Had good wheat of the average price of $1 per bushel been used, and granting a somewhat better result from the good material, the cost of production of the beef would have stood about seven cents per pound.

Confining the comparison, therefore to the pea, corn, barley and rice, the cost of production is distinctly in favour of peas, charging each at the same price per pound, or one one-fourth cent. This must be owing to the less quantity of peas consumed, as the better daily increase is from corn and not peas, and the other foods in each example were about alike in quantities. In the case of barley and rice meal, the cost of production is very much higher than either corn or peas—thirty per cent. more—even though barley was cheaper, and less of the rice consumed. But much more barley was eaten than any other grain; the animals took it, required it, I have no doubt; not only so, but they actually consumed more hay, roots, and bran along with the barley than in any other cases, and consequently, although barley is charged at only one cent per pound, the cost of production is comparatively higher. The rice meal, as a producer of beef, costs as much as the barley, because although not more than half of it was consumed by the average animal, it costs more in the market and did not give such a large daily rate of increase. Were such a thing possible as equal results from the consumption of different quantities of different foods of like prices, the rice meal would take the lead, but the cattle did not eat so much—would not do it, and hence the greater cost and less daily rate per head.

The daily rate of increase per head forms a very interesting column of this comparative table, and requires little explanation. In this case it is different from those spoken of in Chapters XI. and XII., because the increase is purely applicable to the period of the experiment, and not from birth. The rates are large, and are evidence of several things—of a healthy lot of young growing animals; of Ontario winter conditions, continuously frosty weather especially, being favourable to stall feeding; of careful management, and also of rich foods. The order of this rate from greatest to least is, corn, peas, barley, wheat, and rice meal.

Another point of practical importance to the feeder is the quantity consumed by store cattle of a given weight. It is said that most animals eat in proportion to their weight under average conditions of age, surroundings, and fatness, and as our average cattle beast in this example is about 1,000 lbs., the proportion is readily noted.

In 10 lbs. hay, 39 lbs. turnips, 4 lbs. bran, and 9 lbs grain, kinds allowed for, there are 29 lbs. water, and 23 lbs. dry substances, so that we obtained one pound of flesh for every 11 lbs. nearly of these dry substances—this is half chemistry, but not too deep for our average farmer. The average animal of 1,000 lbs. say, was able to consume, and digest very advantageously, foods in which it obtained 4 lbs. of water to the 100 of its weight, and fully 2 lbs. of dry substance to each of these hundreds. Of course the animal drank additional water, and had all the salt it would take. We never limit the salt. So then a 1,000 lb. steer will consume daily, to advantage, a mixture of foods adapted to his growth, amounting to one-sixteenth of his weight. There is no danger, at any rate, in giving 1 lb. of grain to every 100 lbs. the animal weighs; equal quantities of grain and hay, twice their weight of roots, and one-fourth their weight of bran is liberal, healthy, and paying feeding.

With reference to some of our previous experimental cattle-feeding, Sir J. B. Laws, of England, writes me: "With regard to the large increase which you have obtained by feeding with pease instead of cereal grains, there is not sufficient data"—chemical—"existing in your information to draw a conclusion. As a rule, I should not be disposed to place a higher value upon pease or beans as food than upon cereals, and I am tolerably certain that food of the composition of the cereal grains contains as much nitrogen to the non-nitrogenous food as is necessary; but we have been making a large number of analysis of roots—turnips and mangolds—and we find that not more than one-third of the whole of the nitrogen they contain *may* be in the form of albumin; it is possible, therefore, that your diet might be very low in nitrogen when you did not use pease; on the other hand you might have quite as much difference in your increase even if your steers had all been fed with the same food. Your observation respecting the unusual consumption of water is fully confirmed here."

We shall be pleased for a continuation of such able criticism on our work here—particularly in regard to roots, as submitted in the following chapter.

(*k*)—SUGAR BEET, MANGOLDS AND TURNIPS IN THE GROWTH OF YOUNG CATTLE.

The position of roots in Ontario has always been a most important one, as they must always be where housing of live stock is imperative. No doubt, events may arise in agricultural practice—discoveries—that will bring about a complete revolution in the system of green fodders for winter use. For example, the present enquiries about the ensilaging of fodders may be one that will ere long narrow the root area of some countries, but even then, I am of opinion that turnips, mangolds, and sugar beet will remain as a distinct form of food, irrespective of ensilaging, not only because of their peculiar adaptability to live stock sustenance, but also as an almost indispensable crop in rotations.

The most of our farmers are familiar with turnips, some with mangolds, and comparatively few know much about the sugar beet. In chemistry they stand as follows:—

——	Albuminoids.	Crude Fibre.	Carbohydrates.	Fat.	Comparative Feeding Value.
Sugar Beet	1.0	.9	15.4	.1	.87
Mangolds	1.1	.8	9.1	.1	.63
Turnips, Swede	1.1	1.3	5.3	.1	.48

If these hold good in actual practice we will find the sugar beet much in advance for feeding purposes, and the mangold superior to the Swede turnip—all differing about thirty per cent.

I am not at all satisfied with the arrangement of this experiment as that to bring out the object in view, and yet I do not see how much alteration would have bettered. In order to ascertain the effects of a certain food, that food must be the overruling regulator throughout the trial, and no other kind should, if possible, accompany it so as to interfere materially with its special effects. This looks well theoretically, but in practice, can it always be done? For example, what would the effect have been with these fattening steers had hay and roots alone been fed, as is common with young cattle in Britain? In our winter conditions such food is not sufficient to maintain steady, not to speak of vigorous, growth, and to allow the animals to go back, or even keep their own, would vitiate all experimental issue. The animal system must, in all its functions be maintained and increased day by day, as otherwise the effect of any special food is overborne by the *wants* which exist through insufficient maintenance. Unless there be an even flow of all the animal life, no experimental work can be safely pursued. I say then that, in our circumstances at least, it is necessary to feed grain with the roots and hay, the grain was not in such quantity as to overrule everything else—being about two-thirds only of what is usually given in the ordinary feeding of such cattle. But, besides these considerations, I think the nature of the green fodders, called roots, in this case is one that, by *bulk*, and their different chemical composition, in association with so much water, must decide their power of influencing animal growth.

The experiment began on 4th December, and ended 26th February, the period being divided into three four-week terms so as to give each set of two animals a turn upon the three kinds of roots. I need not submit all the details of each term, but at once abstract the whole series, thus :

Result of 84 days' test of sugar beet, mangolds, and turnips in cattle feeding.

——	Hay.	Bran.	Grain.	Roots.	Average Weight of Animals.	Daily Increase Per Head.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Sugar Beet	$10\frac{1}{2}$	3	$6\frac{1}{2}$	52	1059	2.31=2.70
Mangolds....	$11\frac{1}{2}$	3	$6\frac{1}{2}$	55	1063	2.38
Turnips	12	3	$6\frac{1}{2}$	52	1061	2.30
Means................	$11\frac{1}{3}$	3	$6\frac{1}{2}$	53	1061	2.33

One of the cattle, while upon sugar beet during the third term, lost considerably in weight in consequence of sickness; were this term eliminated, the sugar beet daily increase would be 2·84 in place of 2·31, or were it brought up to the average of its own other two terms, the daily increase would be 2·70. It is but fair to keep this circumstance clearly in view in our criticism.

The general result of this experiment gives cause for serious reflection, when compared with others in this report. In the latter cases, animals of the same stamp and weight gave *less* results from thirty per cent. more grain, similar hay, and twenty per cent. *less roots*, than those under these root trials. What may be the cause of this ? The grain was pea meal, the effects of which are well-known to us, and the cattle got what roots they could consume. The very even quantities of food of all kinds consumed in this experiment is noticeable—the grain and bran were of course made so—but in others the animals got what they wanted. The result in the three kinds of roots, accords with chemical indications, as previously noted—Sugar beet being first, with a daily rate of 2·70 (allowance being made for sickness of one of the animals) ; mangolds next, with 2·38, and Swede turnips last, at 2·30 pounds per head per day.

(*l*)—EXAMPLE OF A DAILY INCREASE OF $2\frac{1}{2}$ LBS. PER HEAD.

In speaking of the weight of a fattened cattle beast we have to consider :

Breed,
Weight of Calf when dropped.
Food,
Management, and
Age.

The nearer birth the greater the daily rate until the calf weight is lost among the tens-of-hundreds. Thus, a calf weighing 750 lbs., is due about ten per cent. to its birth weight ; the yearling that weighs 1,000, seven and one-half per cent ; the two-year-old scaling 1,500, five per cent. ; and the finished, or rather the over-fed show beast of 2,000 lbs. can only record about three and three-fourths of its weight as obtained from the average birth weight of 75 pounds. Until the animal therefore is over 1,000 lbs., we should always remember the effect of its birth weight, thereafter it may be left out of calculation.

The example I wish to submit to our breeders and feeders now, is that of a pure white thorough-bred Shorthorn steer, calved 6th May, 1881, bred by Mr. Hudson, of Myrtle, and bought by us from Mr. Hope, of Bow Park. On the 9th April, when 703 days old, it weighed 1,710 lbs., which of course gives a daily rate of 2·43 lbs.; the calf weight from this would reduce the actual daily increase to 2·33 lbs.—something, no doubt, but not enough to interfere when understood in practice, as noticed above.

A yearling steer, over 1,700 lbs. is unquestionably a fine example of what breed, food and management can do, and if we do not spoil him, he should scale 2,000 lbs. when two years and four months old, at the Provincial Exhibition here on 25th September. The daily *summer* increase will be much less than the past record, however.

This animal was sold at the public sale on 28th September, for $270, when the weight was 2,010 lbs.

(*m*)—HEREFORD AND ABERDEEN POLL GRADE STEER CALVES.

Having now got over the initiatory work of establishing herds, and acclimatizing breeds, we are devoting considerable attention to the making of grades for milk and beef respectively. Our progress in milk experiments is in advance of the other as evidenced in previous reports, as also herewith. We make no excuse for this. Our past beefing experiments have been with high graded shorthorns, and the facts, to date, are sufficient to base upon in any comparison with other grades, as we will have to do when time calls; and what I wish to do in this chapter is to place on record what our Farm has on hand for such a purpose.

The same cows, well graded shorthorns, averaging six years, that have been used to produce the steers, with a thorough-bred shorthorn bull, were selected to mate with the Hereford and Aberdeen poll bulls. Necessarily, one of the difficulties is to arrange about equal birth-dates, and another is to get bull calves. We have been more fortunate with the latter than the former, as shown by the following list:

HEREFORD GRADE STEERS:

9th April, 1882, "*Huntingdon*," No 184 (ear label).
6th October, 1882, "*Heathfield*," No. 193. "
28th October, 1882, "*Hartford*," No. 191. "

ABERDEEN POLL GRADE STEERS:

24th June, 1882, "*Aberdeen*," No. 183.
27th June, 1882, "*Aboyne*," No. 179.
2nd August, 1882, "*Abernethy*," No. 182.

On the 9th of April, 1883, the earliest birth of the lot, when a Hereford was one year old, weights, ages in days, and daily rates were as follows:

——	Weight, 9th April, 1883.	Age in days.	Daily rate of Increase.
HEREFORD—	lbs.		lbs.
Huntingdon	790	365	2.16
Heathfield	552	185	3.00
Hartford	492	163	3.02
ABERDEEN POLL—			
Aberdeen	740	289	2.56
Aboyne	750	286	2.60
Abernethy	670	243	2.75

A mean of 2·73 for the Hereford, and 2·64 for the Aberdeen poll; practically equal, considering age, according to Chapter XI. herewith.

Now for Christmas, 1884.

(n)—TESTING MILK, CREAM AND BUTTER FROM TEN BREEDS OF COWS.

I have never seen, in all the necessary detail, a special work on the breeds of cattle most suitable for the dairy and creamery. The discussion of the subject is even not as plentiful as might be expected, amidst all the keenness and ability of our Agricultural Associations. Dairymen are either satisfied with what they possess, or may be, have been waiting for their Experimental Station to say something on such a big, irregular, and largely uncultivated field of inqniry. I think much of this indifference is only apparent, and not real, as *age* has not yet given Ontario opportunity to test what, under her conditions, are best for cheese and butter respectively.

To say that we cannot do better than follow what older nations are doing in this regard is admitting that the cow is but a machine devised to produce, irrespective of conditions that, we know, make and unmake higher animal life, and would at the same time be ignoring what we have already done in improving upon the practice of other countries in the making of cheese itself. It is our place as a young nation to prove as we grow, and establish nothing without a thorough test—again and again. That this has been much of our work at the Ontario Experimental Farm is well known, and now I have the honour of submitting what various breeds of cattle there have said to the Province during the last seven years—what we get, and what we cannot get from each.

And first of all I desire to put on record that there exists no such thing as a *General Purpose Cow*, as understood by many of us. There is no breed of cattle that will fill the butcher's stall, the milk pail, the cheese vat, and the butter can, as each should be done in these days—and must be done in order to the desired success. That some can do so to a greater measure than others we know, but that any one can, or ever will do so, and aggregate equal to the average of breeds, is just as certain as that cheese is not always cheese.

Even the world's work of these times is *specialities*, and not the one man fit to do many things well. Agriculture is speedily and surely dividing herself into grain, flesh, and wool, cheese and butter.

No two perfect and distinct products, as *now required*, can be got from any one breed of cattle or sheep under any sort of conditions, anywhere, however favorable.

I challenge any one to name a breed of cattle or sheep that gives an annual produce of two things equal to the like class of things, from two separate breeds that I will name. This provision of nature cannot be disturbed by all the science and art of man, and yet few things speak of the "Great Balancer" so beautifully as the well known fact that when we give proper market value for all the points of all classes of live stock, no one set of them overtops any other to any material extent, thus, then, it is knowing what we want, and securing it.

The question for Ontario in regard to adaptability of breeds is not exactly what characterizes them in their own lands, but what they are able to do after years of trial in the district requiring them. No influence is as strong as climate; food with Ontario is not a matter of any trouble, comparatively, but the ability of individual breeds and animals to withstand the extremes of temperature is the great regulator of settling down to business. Of course there are in every breed certain inherent properties that cannot be driven out by any form of unsuitability—whether climate, food or management, and consequently we can build upon their perpetuation in a new land, with almost unfailing certainty, yet other things submit to physical conditions—invariably deteriorating—rarely improving.

Ontario has had sufficient experience of several breeds to place them exactly either for beef, milk, cheese or butter, and yet we are weak in knowledge of others that hold a good name in other countries. I refer particularly to the Holstein and Guernsey. This

Experimental Farm should be in possession of these, in view of information similar to what I am now about to submit.

What are the requisites of a first-class dairy cow, is the question before us in this enquiry. Men differ in their likes of individual animals for particular purposes, and much of this will be found to arise from experience under various conditions—that such and such a stamp of cow has done well or poorly with either, where food, management, and the particular class of farm also differed. We forget this too often in comparing notes. The cow we want in Ontario for the dairy, on an average of all influences, should combine the following qualities:

An early maturer and breeder, giving her first calf when two and one-half years old, not to be a full milker before calving, necessarily, because of more trouble and deaths a particularly warm hearted mother is not wanted—a whole week is sometimes lost by fretting—breeds and individuals differing very much in this regard. We want both quantity and quality of milk for the dairy and creamery; the cow must be a free milker, as in a herd of fifty the loss of *time* alone in one season would amount to actually *twenty five days.* We should have nothing to do with a vicious cow whatever her points may, be as temper affects the very *quality* of the milk, not to speak of other drawbacks. We want, at least, twenty pounds of milk per day on an average, for two hundred days a year. A strict culling out to even this moderate standard would surprise us as a province. We hear often enough of the maximums, and sometimes of the averages per season, bnt never of the minimums. Specific gravity is no true indication of milk quality, and we have tried it by nearly three thousand observations on ten different breeds of cows within the last three years. More than this I do not require to say at present; neither is the *bulk* or volume—usually called per cent—of cream of much significance. The weight of the cream from one hundred pounds of milk, is the proper criterion, and our model dairy cow should always give eight pounds to the hundred. Then, again, nearly one-half of that cream should be butter—a high standard no doubt, but as several items that go to make rich milk are largely in our hands, such a proportion can be attained unquestionably. I submit to better experience than ours, what cheese should be got from every hundred of milk—if I said eleven pounds, or nine only, I might be asking what the management or the cow may not be able to influence.

All these desirable results require a certain machine, which we call a cow. Now just as we build iron and wood to do certain kinds of work, we find in nature most clear evidence of cow machinery—usually called breed, and individual constitution—making very different milk from exactly the same materials, under precisely similar conditions.

Some remarkably good cows seem to bid defiance to all sorts of standards of points, but this does not militate from the value of aiming at a standard that is known to average all the virtues of cow life.

I have pleasure in drawing attention to a table that is the result of nearly *five thousand observations* with ten breeds and grades of cows during the last three years upon seven years' experience of the Ontario Experimental Farm, which, though not full, is yet of such extent as must at least interest anyone desirous of reliable information.

RESULT OF NEARLY 5,000 TESTS ON BREEDS OF CATTLE FOR THE DAIRY AND CREAMERY.

BREED.	Average weight of cow.	Dur. of milking season.	Milk per season.	Sp. Gravity of Milk.	Per cent. of cream.	Cream by weight.	Butter from Milk.	Butter from Cream.	Cheese curd from Milk.	Value per Season of Milk.	Value per Season of Cream.	Value per Season of Butter.	Value per Season of Cheese.
		Days.	Lbs.			Lbs	Lbs	Lbs	Lbs	$	$	$	$
Shorthorn	1570	170	2550	97	10⅔	8⅔	4⅓	...	12	19	11	22	30
Shorthorn Grade	1450	220	3960	106	8¼	5	2½	46	11	30	10	18	42
Aberdeen Grade	1300	170	2380	111	7	6	3¾	40	11⅓	18	7¼	16	27
Aberdeen Poll Grade	1150	190	3040	109	4½	6⅓	..	....	....	23	9½	....	....
Hereford	1340	180	2340	97	5½	4½	2	50¼	11½	17	5¼	11	26
Hereford Grade	1100	200	3570	106	13¾	6½	2½	40	7	27	11½	18	26
Devon	1050	200	2800	113	7½	8	3½	....	16¼	21	11⅓	19	45
Galloway	1250	190	2470	105	2	6⅓	....	....	9⅓	18½	8	11	23
Ayrshire	1000	210	5250	101	6½	8	3½	....	11⅛	39	21	35	58
Ayrshire Grade	1030	220	4400	102	4⅜	5	....	....	....	33	11	....	....
Jersey	740	200	2500	103	34	37	....	....	..	19	57	....	....
Canadian	950	240	4800	95	6½	8	...	....	11⅓	36	19½	29	54

The great beefer of the world, the Durham, is neither a heavy nor a long milker, comparatively, on an average, although some individuals, in the experience of most breeders, are remarkable in both qualities; in the days of their early history they were unquestionably deep and true milkers, but management towards a different object has, during the last eighty years, changed their dairy standard. Though low in specific gravity, the proportion of cream is high, and the quantity of butter from milk the highest of what is illustrated, and possibly second only to the Jersey, which, as yet, we have not had opportunity to investigate *thoroughly*. Even in cheese the Shorthorn is among the best. With this high average we would expect similar characteristics by the use of this breed with the native cows of the country—whether one or more crosses, but the table shows no advantage in richness, though a very large increase to quantity of milk and duration of the season. This Shorthorn grade is undoubtedly the nearest approach we have to what is termed a general purpose cow.

In duration of season and quality of milk, the Aberdeen Poll is not equal to the Shorthorn with which it is comparable as a beefer, and indeed it is the lowest of any in quantity, yet giving by specific gravity the richest of all excepting the Devon. But in fact nobody would look to the Aberdeen Poll for the dairy, though when put to the Canadian, we obtain much more prominence in milking powers with a distinct reduction in per cent. of cream, and yet, curiously enough, a fully better *weight* of cream.

The great beef grazier of England, the Hereford, is in no way better than the Shorthorn and Aberdeen Poll in milk quantity, but of any in our experience giving the largest amount of butter from cream—fully one-half, weight for weight. Its grade is very prominently in advance of it, particularly so in proportion of cream, though one of the lowest in cheesy properties. I find on reference to a recent live stock text-book published in England, that the Ontario Experimental Farm is credited with placing the Hereford Grade as a creamer.

Note, thus far, in disposing of the three greatest beefing breeds of the world, that value in fair measure, could not be got except from the Shorthorn grade ($25), on an average of things, and $20.50 from the Hereford grade.

In all our experimental research, no breed can touch the Devon in registering a high specific gravity and weight of cheese from milk; both are unusually high, and should be accounted for by the dairy expert. I now ask for this explanation. The Devon is also a good average in duration of milking, and, for its size, fair in quantity of milk, and over an average of things, gives $25 per annum—hence possibly the cause of its patronage in the States.

Scotland's hardy beef grazier, the Galloway, has made, in our comparatively small experience of it, at least one unusual record as a milker. I refer to the two per cent. of cream, which of course is a very low proportion, but it must be explained that the line between milk and cream was a very indistinct one, much cream stood below this line and always rose slowly, and much never separated from the milk; evidence, I believe, in any breed of rich milk; so judgment in this case should be cautiously handled.

We have thus gone through what may be called the mixed field of beef and milk, and found but one example that would meet the dairyman's order.

The Ayrshire is unquestionably a heavy milker, long as well as deep, and on an average will give five times her own weight in milk per season. Observe the somewhat low specific gravity of it, however, and indeed I may ask here how it is that all our true milkers—the Ayrshire, Ayrshire grade, Jersey and Canadian—record an average specific gravity of exactly 100, as against the prevailing high record of the beefers and their grades! From 5 to 13 per cent. is a big difference in this respect. It does not mean thinness necessarily, for want of cream as in skimmed milk, gives a higher specific gravity, and pure cream, as is known, will go as low as fifty and thirty. The Ayrshire does not give off cream, however, but stands above the average in cheesyness; thus then, with its great quantity of milk, we get an average value, supposing we desire to obtain a milk, cream, butter, and cheese mean, of $38 a year, and, by a specialty as in cheese alone, of $58 a year.

The Ayrshire with the Canadian, making its grade, is not improved in any respect, in our experience, except one, that is, it continues longer in milk, making, however, a well-balanced dairy cow, on the hardy side, and suitable for some of our districts.

And now, what about the world's great creamer—the Jersey? The great point of this breed is that one-third of its milk, both in volume and weight, is cream, and so, on the basis of valuing milk at ¾c. per lb., cream at 5c., butter at 20c., and cheese at 10c. per lb., the Jersey equals the Ayrshire in giving $57 per annum. We have no experience of butter from Jerseys, but allowing the average of 44 lbs. of butter from the 100 lbs. of cream, as in our experiments, the Jersey would give $88 for butter according to ordinary price; but as Jersey butter is gold, it would fetch actually $250 in place of $88! Shall we say then that this may be the only class where *thoroughbreds* would pay at high prices for ordinary use?

It is not because the Canadian cattle—if there be such a thing really—are native, only that they are placed last in this list. I contend, without any fear of being unseated, that by a proper selection of this class of cows we obtain a higher annual produce for our ordinary dairy purposes than from any other in this record, and that they are best adapted to the present system of management. As a natural result of general agricultural progress—not special progress always—this special class of cattle will gradually disappear, and unless we supplement with something else—perhaps the Holstein, the Guernsey, or may be a less beefy stamp, by careful selection, of the Shorthorn grade, our dairy interests will suffer. I claim for what is called the Canadian cow, a better defined position, and a higher status than has hitherto been accorded to her. "Pedigree" is well; "blood" is good; but *milk*, at a dairy or creamery, is better than either of them.

(*o*)—WOOL AND MUTTON.

We grow systematically every year, on this farm, *twelve* distinct classes of wool and mutton. As a crop liable to change very readily by conditions of temperature, winter food, general management, soil, herbage, and exposure, the wool thus produced must have a uniformity well suited for comparison as against its production separately under a variety of these influences. It is not necessary to describe an average fleece of each of these now to be submitted, that is with reference to length, texture, density, lustre, and general stamp; the real point of importance to the Province is their respective values in the present market. In order to set aside any doubts, as regards such values, in the minds of those who have few opportunities of handling, comparing, and pricing with the manufacturers or their agents, I have pleasure in submitting the report of three judges, at a public meeting of farmers and woollen manufacturers, held at Guelph, on the 17th April, 1883, when fleeces of all the classes named were exhibited. The judging, as was done by an extensive woollen manufacturer, a large buyer, and a farmer, well known to be experts at such work, may be taken as thoroughly impartial—without reference to breeds, any particular interest, or other influences. The fleeces were unwashed, but values were given for washed, as ordinarily obtained from farmers.

PRICES OF WOOL, WASHED, FROM SHEARLINGS, APRIL 17TH, 1883:—

Merino, French	42c. per lb.
Merino, French, grade	40 "
South Down	32 "
Shropshire Down	32 "
South Down grade	26½ "
Shropshire Down grade	26 "
Cotswold	20 "
Oxford Down	18½ "
Leicester	18½ "
Oxford Down grade	18 "
Leicester grade	18 "
Cotswold grade	18 "

The fleeces were as much representative as could be obtained, and yet, necessarily, at such a public meeting, patrons of different breeds gave opinions for and against, as their individual feelings bid them, but taken altogether no strong objections were taken to any one class.

We have, therefore, *four* classes of wool by present market prices; the highest being the French Merino, with its grade, averaging 41c. per lb.; the South and Shropshire Downs at 32c.; the South and Shropshire Down grades at 26½c.; and the Cotswold, Leicester, and Oxford Down, with their grades, making the lowest class, at an average of 18¼c. per lb.

It must not be forgotten that the present market is low for all kinds of wool, and particularly low for long wools.

A grade here means the first cross of the rams of each of the pure breeds with the common ewes of the country—said ewes being very much Leicester.

After prices per pound, we naturally look for average weight of fleeces, and in this matter the following may be taken as close figures:—

WEIGHT OF SHEARLING FLEECES, UNWASHED:—

Merino, French, grade	10 lbs.
South Down grade	9 "
Shropshire Down	12 "
Oxford Down grade	13 "
Leicester grade	14 "
Cotswold grade	14 "

It is not necessary in this enquiry to handle the fleeces of the thoroughbreds—the point being to ascertain what they can give us through the common ewes, which alone will offer quantity and cheap production.

Taking these two data as fair, we now obtain the important items of value of wool per head. It is a pity that all farmers do not see how much it is to their interest to leave all wool unwashed. I have written upon this before, and can but repeat that by the present rule of deducting *one-third* for unwashed, every grower of wool must be a loser. I have the conscientious testimony of several of our best manufacturers on the same question, who say that while they prefer to have the washed wool, they are satisfied, as between man and man, that the farmer makes nothing whatever by washing before clipping.

The value, then, of wool unwashed per head from the various grades may be closely estimated as:

Merino grade	$2 70
Shropshire grade	2 08
Leicester grade	1 71
Cotswold grade	1 71
South Down grade	1 60
Oxford Down grade	1 56

I am sure this will surprise some, disappoint some, satisfy others, and convert, maybe, a few. By this table we find again four classes of wool by price per fleece; the highest and very isolated being $2.70 for the Merino (French) grade; the second, that of the Shropshire grade, at $2.08; the third, consisting of Leicester and Cotswold grades, giving $1.71 each; and the South Down and Oxford Down grades nearly equal, at $1.58.

But wool is not everything in this line of our profession—we are not yet Californian or Australian enough to disregard weight, quality, and early maturity of mutton. Our farm has made fully more clear evidence in these than upon wool, and having in previous reports discussed all the stamp and standing of the various grades for the butcher, it is only necessary here to submit weights and prices.

AVERAGE WEIGHT AND VALUE OF MUTTON PER CARCASE: SHEARLINGS.

——	Weight, Live.	Price per Pound.	Value per Carcass.
Shropshire Down grade	165	5½	$9 10
Leicester grade	180	5	9 00
Cotswold grade	180	5	9 00
Oxford Down grade	170	5¼	8 90
South Down grade	160	5	8 85
Merino grade	150	5	7 50

Finally, therefore, in gross value of annual produce we obtain:

Shropshire Down grade	$11 18
Cotswold grade	10 71
Leicester grade	10 71
Oxford Down grade	10 46
South Down grade	10 45
Merino grade	10 20

These are the most reliable indications in our experience, to date, of the annual value of wool and mutton, without reference to cost of production. The equality of the six grades in this respect is remarkable and interesting.

(p)—LESSONS OBTAINED FROM 1882-83 EXPERIMENTS.

These briefly, and with the view to convenience several readers.

1. Corn fodder newly cut and drawn from the field when green, cut into inch lengths, packed into a common rough stone root cellar half under ground, and weighted with 600 pounds per superficial square yard can be preserved, except adjoining such a wall, for an indefinite time in a condition fit for animal food, at a cost not exceeding $1 per ton—exclusive of cultivation.

2. In competition with Swede turnips, ensilaged corn fodder gave fifteen per cent. less milk, thirty per cent. less butter, and a poorer marketable butter in colour.

3. *Damaged Wheat* can be very economically used in the fattening of cattle—nine pounds per head per day, gave a daily increase of two pounds per head per day, at a cost of $4\frac{1}{2}$c. per pound to the live weight.

4. *Rice Meal*, in the fattening of cattle, gave a daily increase of 1·81 pounds per head per day, by the use of six pounds per head per day, at a cost of about seven cents per pound.

5. *Barley Meal* in cattle fattening requires a large amount of other foods in association, and $11\frac{1}{4}$ pounds per head per day gave a daily increase of 2·14 pounds per head per day, at a cost of seven cents per pound live weight.

6. *Corn Meal* took the highest place in a daily rate of increase in the fattening of cattle; nine and one-fourth pounds per head daily gave 2·31 pounds per head per day, at a cost of $5\frac{1}{2}$c. per pound of the added animal weight.

7. *Pea Meal* gave the second best daily rate of increase at the least cost of all the regular cattle feeding grains. Eight and one-half pounds per head daily gave a rate of 2·28 pounds, at a cost of five cents per pound of the weight added to the animal.

8. A pure bred Shorthorn steer can be brought to a weight of 1,700 pounds when one month under two years old, or a daily rate of increase equal to $2\frac{1}{2}$ pounds per day.

9. Hereford grade steer calves can be made to average 611 pounds in 238 days, or a rate of $2\frac{3}{4}$ pounds per day.

10. Aberdeen Poll grade steer calves can be made to average 720 pounds in 273 days, or a rate of $2\frac{2}{3}$ pounds per day.

11. During winter, a 1,000 pound steer will consume daily ten pounds hay, thirty-nine pounds turnips, four pounds bran, and nine pounds of a mixture of grain, upon which it will add 2·11 pounds to its live weight.

12. One pound of added weight to a 1,000 pound steer can be obtained from the use of various materials that contain eleven pounds of dry substances, chemically.

13. By a large variety of experiments with several classes of cattle, and many kinds of food, we find the actual cost of adding one pound to the live weight of a 1,000 pound animal is six cents to the feeder who grows his own materials, and nearly twelve cents when the food is bought in the regular market—manure and management not considered.

14. *Sugar Beet*, weight for weight with mangolds and turnips, and in association with equal kinds and quantities of other foods, gave the highest returns in feeding cattle, or 2.70 pounds per head per day.

15. *Mangolds* gave 2.38 pounds per head per day under similar conditions to the sugar beet.

16. *Turnips* (*Swede*) added 2.30 pounds per day to the average steer that weighed 1,061 pounds under conditions similar to mangolds and sugar beet.

17. There is either a simple natural reason, or a hidden chemical one, in the fact that by the use of less grain and more roots, cattle gave a greater daily return in live weight. See special chapter herewith.

18. The present market for wool and mutton in Ontario is best supplied to the

profit of the farmer by the Shropshire Down shearling grade, which gives annually fourteen per cent. more value than any other in our experience.

19. There is a remarkable uniformity in the annual value of wool and mutton from grades of Cotswolds, Leicester, Merino, Oxford Down and South Down, resulting from differences in weight and value of both products.

20. From nearly 5,000 observations, the following notes have been obtained as evidence of peculiarities, characteristics, or other indications of breeds of cattle:—

(*a*) That there is no such class as a "general purpose" breed—one to do the best for the dairyman and the butcher.

(*b*) An average cow for dairy purposes should give 20 lbs. of milk per day during 200 days of every year; 8 lbs. of cream for every 100 lbs. of milk; 45 lbs. of butter from every 100 lbs. of cream, and fully 10 lbs. of cheese for every 100 lbs. of milk.

(*c*) Bulk, volume, or per cent. of cream is no safe criterion of the quantity of butter in that cream; weight alone is the proper mode of judging.

(*d*) *Breed*, as much, if not more than *food*, affects the quantity and quality of milk, cream, butter, and cheese.

(*e*) In Ontario Experimental farm experience the Shorthorn is an average milker, short in duration per season, low in specific gravity, high in per cent. of cream, proportionately high in butter, and also high in cheese production. The grade of this breed approaches the nearest of any others to what is called a "general purpose cow."

(*f*) The Aberdeen Poll is low in quantity of milk and the second highest of any in specific gravity. The grade of this breed is much improved in milking properties, giving a greater weight of cream, though a lower per cent. of it.

(*g*) The Hereford is not more prominent than the Shorthorn and Aberdeen Poll in regard to milk, except in proportion of butter from cream, in which it is highest. The grade is very prominently in advance, particularly in proportion of cream, but one of the lowest in cheese.

(*h*) The Devon is most distinct in highest specific gravity of milk, and the weight of cheese from milk. We have no experience with the grade of this breed.

(*i*) The Galloway milk appears to be of a peculiar texture—rich, or so small in butter globules as to rise very slowly and very indistinct in the test tube.

(*j*) The Ayrshire is a particularly heavy, long milker, giving five times her own weight per season. The milk is somewhat low in specific gravity, and per cent of cream, but is over the average in cheese production. The Ayrshire grade is not improved in any respect except in duration of milking season.

(*k*) The Jersey is remarkable for proportion of cream, averaging thirty-seven per cent. and giving a value of dairy products, incomparable to any other breed in our experience.

(*l*) The Native, or Common cow of Ontario, not Canada properly, because Quebec in particular stands distinct in her class of dairy cows, takes a high place in value of annual produce for ordinary dairy purposes, and, along with the Shorthorn grade, is peculiarly the dairy cow for the country.

2.—CATTLE FEEDING EXPERIMENTS, 1883-4.

The Series for 1883-4.

We had a grand opportunity this year to arrange an extensive and varied series of feeding experiments with cattle and sheep, and we took advantage of it. The clearing out by the public sale gave stable room for fifty head of cattle, and as many sheep. We had no difficulty in knowing what to feed with; the difficulty consisted in obtaining an even lot of animals, for we had but ten of our own breeding. I am glad to be able to say it is not now a difficult thing to find well balanced store steers for general feeding, but when an individual equality in breeding, age, size, quality, condition, disposition, and general stamp is made a system in selection, the task is not a small one indeed. But Waterloo and Wellington counties were equal to the occasion, so that by 1st October all were on hand for preparatory feeding. In order thoroughly to place every animal on an equal footing by management previous to actual experimental feeding, they were allowed the range of the pastures two weeks, succeeded by two weeks on hay, roots, and bran in the stall. The students were then detailed to report upon the placing of three animals in each set of experiments, and as there are sixteen sets in this division—that is, exclusive of breeds and cows—and the reporting papers contained six principal points as guides for valuation, there resulted 2884 distinct reccommendations, which, in the hands of thirty second-year and special students—the seventy first-year students not having had the same experience—there were necessarily nearly 9,000 observations to guide this part of the work. The good old cattle judge will say: "I could have made as good a subdivision alone in half an hour, without paper." True, Mr. Oldschool; but, as a school, we have to educate, and this was a capital opportunity to test our old lessons. Every animal has a numbered ear label; every article for every meal, and all the water drank, is carefully weighed, and what remains unconsumed is weighed back. The animals are weighed every week, at the same time of day, and each set of animals is given a change each month, of four weeks. In this manner, each set will go through the whole series of experiments before the middle of June, which will very thoroughly eliminate any set or individual, or unseen peculiarities, which is no inconsiderable element in feeding. The class of steers is Shorthorn grades, from eighteen to thirty months old.

Each student is provided with a copy of monthly results, upon which he is subject to examination at Easter, 1884.

As a matter of interest, the following is a copy of the manner in which the monthly reports are kept, the daily weighings, and other facts, having other forms for abstract file.

Weekly Report of Feeding Experiments at the Ontario Experimental Farm.

(Winter, 1883-4).

Cattle. *Week Ending* *188*

EXPERIMENTS.	Weight on Entry.	Weight on	Weight at Date.	Total Increase.	Weekly Increase.	Daily Increase.	Food Consumed During the Week.				Water, total per Week.
							Hay.	Roots	Meal.	Bran.	
Corn .... 3 head											
Peas .... "											
Oats .... "											
Barley—*white* .... "											
" —*black* .... "											
Mixture .... "											
" with Oil Cake. "											
" " Thorley .. "											
Steamed											
Dry .... "											
Fodder .... 9 head											
Shorthorn Grade ..... 3 head											
Hereford " "											
Aberdeen Poll .... "											
Ensilage .... "							En'age, lbs. Bran, lbs				
Hay .... "							Hay " " "				
Roots .... "							" " .. " Roots, lbs..				

	Milk.		Cream.	Butter.	
	By Measure'nt	By Weight.	Per cent. from Milk by Weight	Per cent. from Milk and from Cream.	
Cows fed on Ensilage					
" " Roots					
" " Hay					

STABLE TEMPERATURE.

Highest temperature during week	....
Lowest " " "	....
Mean " " "	....
Day of highest temperature	
" lowest "	....

PRICE OF FOOD.

All Grain	1 cent per lb.
Hay	$\frac{1}{2}$ " "
Roots	$\frac{1}{8}$ " "
Oil Cake	$1\frac{1}{2}$ " "
Thorley	6 " "
Bran	$\frac{1}{2}$ " "

In addition to these 48 cattle, we have a most interesting contest between nine head—three each of grade Durhams, Herefords, and Aberdeen polls—as to which, see special chapter herewith. And further, in order to gather more light, on the value of preserved green fodder in the production of milk, cream and butter, in winter, we purchased six cows of the common Canadian stamp, which are being handled as elsewhere detailed.

Thus then altogether we have 63 cattle engaged in experimental feeding this winter.

As an item of study for the uninitiated, allow the memorandum that at the end of the experimental period, the number of weighings of materials etc. will be about 200,000 for cattle alone.

The next explanation is in regard to FOOD,—what and why?

CORN, because a cheap American product that should be more extensively cultivated in Canada, and is used in this contest as one of the standards.

PEAS, because one of the most important coarse grains of Ontario, and usually taken as the Canadian Standard.

OATS, because always reliable with us, and particularly suitable for certain stages of animal life.

BARLEY (Common), because a sure cropper, and peculiar in some of its feeding influences.

BARLEY (Black). This is not yet much cultivated in Canada, but where so, has given such satisfactory results both in produce and weight per bushel, that our testing is important. It has no skin, is very uniform, coarse in texture, and weighs over 60 lbs. per bushel.

MIXTURE (Corn, Peas, Oats and Barley,) as subject for comparison against individual kinds.

MIXTURE with OIL CAKE, for the purpose of ascertaining whether, irrespective of manure value and better handling of the animals, it actually pays to give this standard cake along with other high class grains.

MIXTURE with THORLEY, in order to ascertain the precise effect of this condiment in cattle feeding.

STEAMED Food as a direct test against the same in a dry uncooked state.

DRY, or uncooked, against the steamed.

FODDER, (1) Ensilage. (2) Hay, (3) Roots, separately, with Bran in the production of beef.

With these, the contest was opened on 3rd November, 1883, and will be closed on 14th June, 1884, so as to give a complete circle of tests.

These experiments are under the immediate superintendence of the following gentlemen—students representing their respective classes:

2nd Year, W. Little, of Co. Simcoe, for grain feeding.
1st Year, McKay, of Nova Scotia, " "
2nd Year, Mathewson, of Montreal, for Fodder feeding.
1st Year, Weatherston, of Toronto, " "
2nd Year, Austin, of Ottawa, for steamed food.
1st Year, Butler, of England.
2nd Year, Major, of England, for Dairy.
" " Ballantyne, of Stratford, for Dairy.
1st Year, Henry, of Simcoe Co., for "
" " McIntyre, of Paisley, " "

As a foretaste of what may be expected in our Advance Report of next year, let us criticise the results of the first two months which are already on hand, and necessarily any results are simply provisional.

(a) CORN.—During the 1st month, the average animal entered with 965 lbs., and came out with 1045 during twenty-eight days, thus giving a daily increase of 2·84 lbs. The average animal consumed daily 8½ lbs. hay, 23 lbs. roots, 4½ lbs. Bran, 9 lbs. Corn, and 39 lbs. water. The stable temperature for the month—and of course this applies to all the other testing of the same period—was a mean of 46½°, the highest 62° and lowest 27°.

During the 2nd month, Corn, with animals that came from Barley, entered with an average weight of 1006 lbs. per head and left an average of 1073, or a daily increase of 2·38 lbs. as obtained from 9 lb. hay; 24 lbs. roots: 4½ lbs. bran; 9 lbs. corn, and 40 lbs. water. The temperature of the stables for the period was a mean of 41°, 56° as the highest, and 26° as lowest.

Thus then for two months ending 22nd December, Corn, as a regulating grain in association with other forms of food, gave a daily increase of 2·61 lbs. to an average 1022 lbs. steer, tied up in a mean temperature of 44° but getting one half hour's exercise every day, well groomed and systematically attended to in every respect.

(*b*) Peas.—During the first term the average steer began with 974 lbs. and ended with 1032 lbs., which is a daily increase of 2·07 lbs. The daily consumption of food was 6⅓ lbs. hay; 18½ lbs. roots; 3½ lbs. bran, 7 lbs. peas, and 36½ lbs. water.

For the second term the animal went in at 1045, and scaled 1085 lbs. at finish, which gave a daily average increase of 1·44 per head. This was from 9 lbs. hay; 23 lbs. roots; 4½ lbs. bran; 9 lbs. peas, and 40 lbs. water.

The two terms of eight weeks under peas as a leading food, gave a daily gain of exactly 1½ lbs. to the live weight of a 1034 lbs. store steer.

(*c*) Oats.—These, for the first term, gave a daily rate of 2.90 lbs. the animals having began with 1029, and closed with 1111 lbs. per head. The food consumed daily was 8½ lbs. hay; 22½ lbs. roots; 4½ lbs. bran; 9 lbs. oats, and 42 lbs. water.

The second term, with different animals of course, gave an increase of ·98 lbs. (hardly one pound)—the entrance weight having been 1048 lbs., and 1076 at closing. In this example the food, daily, consisted of 8½ lbs. hay; 23 lbs. roots; 4½ lbs. bran; 8⅙ lbs. oats, and 29 lbs. water.

We obtain therefore an average daily rate of 1·94 lbs. from Oats as the staple food in a course of eight weeks' fattening of yearling, and two year old steers, the average weight of the animal having been 1066 lbs.

(*d*) Barley (six rowed).—For the first term the entrance weight of the average steers was 915 lbs., and its closing weight 1006, thus giving a daily increase of 3·26 lbs. This resulted from a daily consumption of 8½ lbs. hay; 23 lbs. roots; 4½ lbs. bran, 9 lbs. Barley, and 44 lbs. water.

During the second term the steer entered at 969, and stood at 1015 lbs. when finished. This gives a daily rate of 1·79 lbs. The food was 8½ lbs. hay; 24 lbs. roots; 4½ lbs. bran; 8⅓ lbs. Barley, and 34 lbs. water.

Barley to date then, indicates a daily rate of 2·53 lbs. per head, in the growth of a store steer averaging 979 lbs.

(*e*) Black Barley.—The average weight of the store steer on entering upon this food was 905 lbs., and at the expiry of the first term of twenty-eight days it weighed 969 lbs., so that we get a daily rate of 2·26 lbs. The consumption of materials was 8⅓ lbs. hay; 22 lbs. roots; 4½ lbs. bran; 8 lbs. Barley, and 37 lbs. water.

For the second term the entry was 1111 lbs., in the closing weight 1146 lbs. or a daily increase of 1·28 lbs. per head. Food consisted of 9 lbs. hay; 27 lbs. roots; 4⅓ lbs. bran; 8½ lbs. Barley, and 40 lbs. water.

This record, to date, shows a daily rate of 1·77 lbs. per head, with steers that average 1033 lbs.

(*f*) Mixture, equal parts of Corn, Peas, Oats, Common Barley, and Black Barley, all ground and mixed.

During the first term, the average animal here consumed 9 lbs. hay; 23 lbs. roots; 4½ lbs. bran, and 9 lbs. of the mixture with 45 lbs. water, by which it increased in weight daily at the rate of 3·28 lbs. weight—919 and 1041 lbs. at entry and closing respectively.

During the second term another set of cattle gave an average product of 2·40 lbs.

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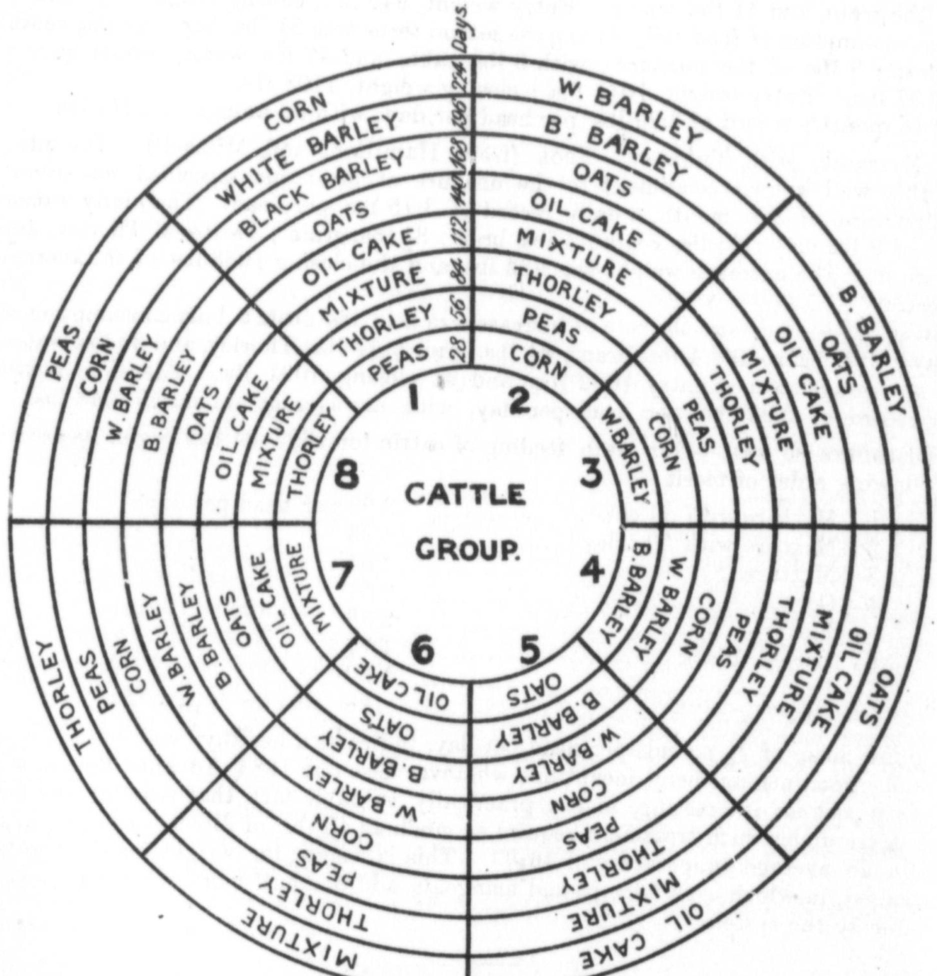
GRAIN-FEEDING CARD

From 3rd November, 1883, to 14th June, 1884.



1.—Eight groups of cattle, 3 head each=24 cattle.

2.—Eight kinds of grain=64 distinct tests.

3.—Twenty-eight days of each group on each grain=224 consecutive days.

4.—Seventy-two rations per day=16,128 rations.

5.—Each ration having four kinds of food=167,536 separate weighings.

6.—Fifty pounds average daily food per head=134 tons of food.

7.—Average value of food, ½ cent per pound=$1,340 for period.

8—Result: 32,400 lbs. of beef; value, $2,100 on foot, and experimental knowledge gained= TEN cents for each cattle feeder of Ontario: say, $10,000.

per day, from $8\frac{1}{2}$ lbs. hay ; 23 lbs. roots ; $4\frac{1}{2}$ lbs. bran, and 9 lbs. of the mixed grain, with $40\frac{1}{4}$ lbs. water, weighs 1087, and 1155.

Thus, the record for this preparation is 2·84 lbs. per head per day with an average store steer of 1058 lbs.

(*g*) Mixture, with Oil Cake.—The same proportion of Corn, Peas, Oats, and the two Barleys, with the addition of Linseed, or Oil Cake, gave, during the first term, a daily rate of 3·52 lbs. In this were consumed $8\frac{1}{2}$ lbs. hay ; $22\frac{1}{2}$ lbs. roots ; $4\frac{1}{2}$ lbs. bran, 9 lbs. of the grain, and 44 lbs. water. Entry weight, 949 lbs., closing weight 1045 lbs.

The consumption of food daily during the second term was $8\frac{1}{2}$ lbs. hay ; 23 lbs. roots; $4\frac{1}{2}$ lbs. bran ; 9 lbs. of the mixture ; with 3 lbs. cake, and 47 lbs. water, which gave a rate of 2·37 lbs. Entry weight, 1041 lbs. ; closing weight, 1108 lbs.

A two month's record of 2·99 lbs. per head per day, with an animal of 1036 lbs.

(*h*) Mixture, with Thorley's Food (from Hamilton, and Mitchell).—The addition of this well known condiment to the mixture of grain just specified has given, for the first term of one month, a daily record of 3·75 lbs. per head. The daily ration consisted of 9 lbs. hay ; 23 lbs. roots ; 4 lbs. bran ; $8\frac{1}{2}$ lbs. grain ; $1\frac{1}{2}$ lbs. of Thorley, and 46 lbs. water. The entrance weight was 982 lbs. and the closing 1088 lbs. of the average store steer.

During the second term the rate of increase was 2·11 lbs. from a daily consumption of 8 lbs. hay ; $22\frac{1}{2}$ lbs. roots ; 4 lbs. bran ; $8\frac{1}{3}$ lbs. grain ; $1\frac{1}{2}$ lbs. Thorley, and 35 lbs. water. Weight of average steer at entry 1032 lbs., and at closing 1091 lbs. Therefore a two month's record of 2·93 lbs. per head per day, with an average animal of 1048 lbs.

(*j*) Results so far.—Our grain feeding of cattle for 1883–84 has begun its record in the following order of merit :—

1—Mixture with oil cake	2.99	per head per day.
2—Mixture with Thorley	2.93	" "
3—Mixture	2.84	" "
4—Corn	2.51	" "
5—Barley	2.53	" "
6—Barley, Black	1.77	" "
7—Peas	1.50	" "
8—Oats	.98	" "

A grand mean of $2\frac{1}{4}$ pounds per head per day, indicates a healthy, well doing, lot of cattle, under good management, meantime, whatever else our 1884 Advance Report will show. Is it not an interesting, and a practically valuable fact, that yearling and two year old steers under such treatment require as much as 40 lbs. of direct water per head per day in an average temperature of $46\frac{1}{2}$° ? This is weight for weight for the regular food consumed, in which even turnips and mangolds add one half more of what is nearly direct water to the system.

3.—SHEEP FEEDING EXPERIMENTS, 1883–84.

I desire here simply to place on record that as part of the large series of experiments this winter, we set aside six pens, of three head each, of wether lambs, Oxford and South Down grades; for the purpose of testing food. The regulating foods are :—

Peas.
Beans.
Clover Hay.
Pea Straw.

In addition we are trying the effect of food in the production of wool, by the "high" feeding of one pen, and the "low," or moderate feeding of another, in which of course there will be no exchange of positions.

This set of experiments is in the hands of the Special Live Stock Class.

4.—INFLUENCE OF FOOD ON MILK.

By the end of March, first, we should be in possession of a very important series of observations on the influence of food of various kinds upon the quantity of milk and its quality, as evidenced by cream, butter, and cheese. On 10th November, last, we set aside six common grade cows, purchased specially for this experiment, and selected, of course, as to evenness of age, grade, size, time after calving, and otherwise the stamp of a milker; they are certainly very common cows in the eyes of a beef breeder, but for our purpose have proved most suitable.

We decided to test four forms of feeding milch cows, giving twenty-eight days to each kind, by two cows, and each group of cows a turn of each form of food, thus securing a thorough and systematic experiment throughout a period of five months. Some would be satisfied with one set of cows to each kind of food, but we are determined to duplicate both the cows and the food, so as to ensure greater reliability.

The foods are classified as—

"Ordinary," and consists of hay, roots, and bran.

"Bran," consisting of bran and hay.

"Roots," consisting of roots, hay, and bran.

"Ensilage," consisting of oat fodder ensilage, hay, and bran. The quantities of each will be found in abstract table in these notes.

I find so much already interesting from the results of the past three months, that it is due to the Province and ourselves to make an advance report, with the understanding of its subjection to the fuller notes of the extended period. In these, no reference is necessary to many details, nor to the particular conduct of the different groups of cows, which will come in better afterwards, and accordingly an abstract table with comments will suffice meantime.

But before submitting our testing to this date, there are some things that must not be forgotten:—

1. A primary idea in all strict food testing is the influence a particular food possesses over others, and in order to this it must be given in *over-ruling quantity.*

2. Winter butter is usually paler, and not so good in quality as that from rich pasture, though there is said to be more solid fat in winter than in summer. Quality, therefore, in this reference, may be owing to the existence of certain natural colouring matters more than to any change in chemical composition of the fat.

3. The animal (breed and individuals) influences quantity and quality more than food does.

4. Milk is not simply a secretion, but is actually *part* of the animal, so to speak, a liquified organ, regulated by the detail construction of the particular animal system.

5. As the quantity and quality of milk depends, in the first place, then, on the development of the milk glands, the importance of repeated tests with a variety of cows is evident.

6. But the rapid growth of new cells in the milk glands is kept up by the proper supply of food, and as milk is made up, both in its milk proper, fat or cream, and part of the sugar of *albuminoids*, we must supply them to the animal.

7. The protein or albuminoid increases also the *solid* matter of milk.

8. Quality is less dependent on food than quantity. Feeding cannot convert a *cheese* breed into a butter breed.

9. Is it a fact that the *relative quantities* of the several *solid ingredients* (dry) of milk remain almost constant—quantity of milk and its percentage of *dry* matter varying only?

INFLUENCE OF FOOD ON DAIRY PRODUCTS.

RESULT OF 1,265 EXPERIMENTAL TESTS DURING NOVEMBER, DECEMBER, AND JANUARY, 1883-4.

COW GROUP.	Regulating Food.	Milk per head per day.	Specific Gravity of Milk.	Per cent. of Cream by Bulk.	Cream by Weight from 100 lbs. Milk.	Butter from 100 lbs. Cream.	Butter from 100 lbs. Milk.	Cheese Curd from 100 lbs. Milk.	FOOD COST OF PRODUCING 1 lb. Milk.	1 lb. Cream.	1 lb. Butter.	1 lb. Cheese.
		lbs.			lbs.	lbs.	lbs.	lbs.				
1 and 2 . .	Ordinary.	$16\frac{3}{4}$	102	11.5	$11\frac{3}{5}$	$28\frac{3}{5}$	$3\frac{1}{3}$	$12\frac{3}{5}$	6 mills	3 cts.	13 cts.	7 cts.
2 and 3 . .	Bran	$14\frac{3}{4}$	102	13·4	$14\frac{1}{10}$	28	$3\frac{1}{3}$	$10\frac{4}{5}$	5 "	2 cts.	7 cts.	5 cts.
1 and 3 . .	Roots	17	103·5	11·9	$13\frac{1}{5}$	27	$3\frac{1}{4}$	$14\frac{3}{5}$	6 "	$2\frac{1}{2}$ cts.	9 cts.	4 cts.
2 and 3 . .	Ensilage .	15	103	15·0	$15\frac{1}{2}$	$25\frac{1}{2}$	4	15	9 "	3 cts.	11 cts.	6 cts.
Mean . .	. . . .	16	103	13	$13\frac{1}{3}$	$27\frac{1}{4}$	$3\frac{1}{2}$	$13\frac{1}{4}$	$7\frac{1}{2}$ m.	$2\frac{3}{4}$ cts.	10 cts.	$5\frac{1}{2}$ cts.

FOOD.—"Ordinary" consisted of 15 pounds hay, 24 pounds turnips, and 9 pounds bran, per head per day.
"Bran" consisted of 12 pounds hay and 15 pounds bran, per head per day.
"Roots" consisted of 15 pounds hay, 36 pounds turnips, and 6 pounds bran, per head per day.
"Ensilage" consisted of $18\frac{1}{2}$ pounds oat fodder ensilage, $15\frac{1}{2}$ pounds hay, 9 pounds bran, per head per day.

NOTE.—The value of skim milk is deducted, at half the cost of new milk, from cost of producing cream.

Taking this table as it stands, and assuming the figures to be a true representation of each subject, let us examine the results of each of the Foods that regulated the diets.

(a) FROM "ORDINARY" FOOD.

Nearly seventeen pounds of milk per cow per day, or seven quarts, by two milkings is a very ordinary quantity, even for November and December, on an average of cow conditions, and as we have to base comparisons upon what the "ordinary" did, it is well to remember the importance of this paragraph. The common Lactometer gave an average specific gravity of 102 at a temperature of 60° Fahr.; the extremes were 98 and 108. The produce of cream by volume or bulk, as set in large test tubes, shows $11\frac{1}{2}$ per cent. to the milk, which, putting aside the Jersey, is a very high proportion, as, by reference to our 1882-83 work, elsewhere submitted in this report, 7 per cent. seems to be a fair average among many breeds. It is not necessarily the *bulk* of cream that gives value. Observe next that from 100 lbs. of this milk we obtain $11\frac{3}{5}$ lbs. of cream, an almost exact correspondence, by the way, with its volume. Then again, when butter is wanted, only $3\frac{1}{3}$ lbs., from the 100 lbs. of milk, and $28\frac{3}{5}$ lbs. from the 100 lbs. of cream, is the average result. Our previous experiments gave no more from the milk, but a very much greater proportion from the cream. In regard to cheese, the amount of *dried curd* amounts to $12\frac{3}{5}$ lbs. from the 100 lbs. of sweet milk, and I presume the quantity of ripened cheese would be five per cent. less; this is large—the average of Ontario factories being a little over 10 lbs.

These, then, are the indications of 56 days, by two sets of cows, that consumed daily per head, 13 lbs. hay, 24 lbs. turnips, and 9 lbs. of bran. With this compare,—

(b) FROM BRAN FEEDING.

By this is meant that wheat bran was given in such extra quantity as to regulate both quantity and feeding value, namely: 15 lbs. of bran, and 12 lbs. of hay per head per day.

From this unusually large allowance of bran we get two lbs. less milk per day, with an equal specific gravity to that of "ordinary" feeding. But the volame of cream is 2 per cent. more, and the weight of cream no less than nearly 3 per cent. greater than from the standard diet. On the other hand the butter was, for all practical purposes, equal, and the cheese 10¾ lbs. from the 100 lbs. of milk—just a little over the average we are accustomed to look for, and therefore fully 1½ per cent. less than from our "ordinary" form of food.

(*c*) From Roots Regulating the Diet.

These were Swede turnips 36 lbs., and 15 lbs. hay, with 6 lbs. bran per cow per day. From these we have a somewhat higher specific gravity, and the best of the four in weight of milk, however, only ¼ lb. per day more than from "ordinary." The volume of cream is but slightly higher than our standard, and in weight comes between it and the bran, being 13⅓ lbs. from the 100 lbs. of milk. Roots have, as yet, given us the least quantity of butter, both per milk and cream, but the unusual quantity of 14⅔ lbs. of cheese per 100 of sweet milk.

(*d*) From Ensilaged Oat Fodder.

The oat fodder ensilage, as elsewhere described, was the regulating food in this diet, of which 18½ lbs., on an average, were consumed by each cow per day, along with 15½ lbs. hay, and 9 lbs. bran. From this the milk produced was 15 lbs., or nearly 2 lbs. less than from "ordinary" feeding, and an average specific gravity. The per cent. of cream, both by volume and weight is very much higher than any of the others—higher by 20 per cent. than the other three, and 13 per cent. over the mean of all. So, also, the 4 lbs. of butter from the 100 lbs. of *milk* is 23 per cent. greater than from others, but curiously enough, the proportion of butter from cream is considerably less than from others—eight per cent. less. We have most carefully checked all these figures, and so far as testing has gone, are satisfied of the facts. As if to make up for this, we obtain, on the other hand, the very large proportion of 15 lbs. of cheese curd from the 100 lbs. milk, although we may be told that fat has little to do with cheesy properties, which, however, is a mistake.

These, the result of 1265 observations, to date, must, to some extent, indicate the influence that food has upon milk, and while we look to June next to place us in a much better position to criticize, there need not be anything misleading in doing so now with the materials on hand, and it will serve to whet our appetites for the more reliable.

And first examine the condition of the butter—samples of which will be kept for examination at the Eastern and Western Dairymen's Association meetings in February next.

(*e*) The Butter Criticized.

That from roots is the highest coloured, just the colour liked by both the merchant and consumer, and as it has been coloured by the food, and not artificially, its genuineness stands the market, but its flavour, both by smell and taste is slightly, only slightly, high for some people. The butter from "Mixed" food is rich in colour, not much less than that from roots, but yet a tinge less yellow, having a fine even texture, and perhaps the most pleasant taste and smell of any. That from bran is third in colour, distinctly less than the mixture, but with all the flavour of first class, sound butter.

The butter from Ensilage has, for the second season, taken a very distinct position in our experience. I have to the best of my ability given the public a full account of everything connected with the experiments undertaken during the winter of 1882–83, as well as those now in progress. We have invited any form of inquiry and criticism on all hands, we have changed cows and food in every way likely to test thoroughly, and we have taken the preserved fodder, the milk and the butter, to public meetings and private parties. We have read and listened to much upon the properties of Ensilage during the past two years, but we have never seen the products nor specific details of thorough and impartial tests. Why do not Ensilage experts favour the public with such results? When they say that two sets of cows, one fed on Ensilage and the other on ordinary diet, gave results in favour of quality of milk, to the former, they do not say that the cows were exchanged, or that they received no grain with the fodder; in all we have read considerable quantities of grain, in addition to bran, were allowed. Now this is not true first experimental work, for only such quantity should be mixed with the fodder as just to favour its consumption, but not to overrule its influence. We contend that in order to have the full effect of Ensilage, or any other food, it is absolutely necessary to free it as much as possible from any other food. We want the facts on the public table, with a full account of the proceedings, and until that is done we must doubt the reports.

The butter from Ensilaged food is again and again with us a most distinct pale, almost colourless, and semi-greasy appearance—altogether a thing by itself; such a colour as whatever its other properties, condemns it in the best markets. Why is this?—the same cows, same accommodation, management, similar season, time of churning, and in short having no different influence except food? Why is it? Corn fodder and oat fodder, green from the field, are first-class milk producers, and full of all good things for cow-life, but "Ensilage" them, make then sour, or tart by confinement in a pit—*and no one has ever yet been able to produce entirely sweet, or untainted green fodder by such a process*—and the influence upon the animal system is strikingly evident. The *warm* milk smells differently, the cream is not so rich, and is pale in colour, and the butter a very vinegar-washed looking substance that needs no expert to say so.

(f) Cost of Production by Food.

This branch of the enquiry is one of the most important, the least understood, and upon which so little information exists either in European or American experience. Of course this is no case of pasturing, but of housed winter conditions, and should therefore be valuable for creameries, city milkmen, and butter merchants,—not much to the cheese division, necessarily as a business, and meantime I shall only discuss the average of the three commoner kinds of food—leaving the Ensilage to further development.

The average cow, weighing 1075lbs consumed daily 44lbs of a variety of food that cost *on the market* eighteen cents, and cost the farmer eleven cents to produce them. In discussing profits we shall set aside at once the fact that in feeding hay and roots produced by himself, and bran he buys at eleven dollars per ton, the farmer makes an immediate profit on the former if he charges his cows at market rates. Let it be understood that these foods are to be charged at the price they cost the farmer to produce them: hay at one-fourth cent per pound, roots at one-twelfth cent and bran at one-half cent per pound.

Milk.

By what we call "ordinary feeding," it costs a little more to produce milk than by a large quantity of bran or of roots respectively; bran produced milk in somewhat less quantity, but did so cheaper than from "ordinary" food and a little less even than from turnips. Milk that costs by food alone in winter as much as an average of fully seven mills per pound, means nearly $1\frac{3}{4}$ cents per quart, so that the retailer at five cents per quart has some margin to meet expenses. As a whole, quantity and cost of production are in favour of Roots, but observe how uniform the cost is by the three forms of feeding.

Cream.

In this we have marked figures in favour of bran and roots—against "ordinary"—as much as forty per cent. Cream from food regulated by bran is, meantime, in our experience, cheaper than that from either Roots or "ordinary," owing to the larger proportion of cream obtained from the milk—that from roots is but a little more. It seems to be a fact that milk that costs by feed alone in winter $7\frac{1}{2}$ mills per pound, and that gives on an average, from three kinds of it, thirteen pounds of cream from every 100 pounds, wants $2\frac{3}{4}$ cents per pound for that cream, and in this calculation credit is allowed for the skimmed milk at one-half the cost of the sweet milk: were this not done the cost of the cream would be doubled. There is a hint in these figures for creameries that make butter in winter.

Butter.

In looking at the cost of producing butter in winter there are necessarily two methods; its relation to the milk, and its more di ect position to cream. In receiving and paying for new milk at 7 or 8 mills per pound for the purpose of raising or removing cream to make butter, we should have to credit the butter with the value of the skim-milk, and as we have already referred to this system, it is only necessary to speak of butter as made by those who purchase the cream, or those who produce the milk. By "ordinary" feeding butter costs as high as thirteen cents per pound, seven cents from Roots, and nine cents from bran. It is not altogether the superior quality of the milk or cream that makes this difference in price, for the proportions of cream from milk, and of butter from cream are not very wide apart, but the cost of producing the cream that makes the butter regulates the price in these examples, and the general average of ten cents per pound as the *food cost* of producing one pound of butter in winter, will be an important item to compare with the experience of creameries.

Cheese.

While in these advance notes, there may not be much practical value to the professional cheese manufacturer in regard to the winter production of his subject, it is at any rate interesting to observe that it costs about 5½ cents per pound for the food that goes to sustain the cow that gives the milk, that makes the one pound of cheese, on an average—a cost probably four times greater than from pasture.

Throughout all these preliminary contests, it is of very considerable importance to find wheat bran holding a distinct place, and one in producing either milk, cream, butter, or cheese, that is twenty per cent cheaper than roots, and sixty per cent cheaper than by "ordinary" feeding.

We wait for the Midsummer Report with some interest.

(*g*) CHEMICAL COMPOSITION AND NUTRITIVE RATIO OF THESE EXPERIMENTAL FOODS.

The following table shows the relative standing of our four milk rations to each other, and to the well known Wolff standard. This standard of Wolff can, of course, be made up of whatever materials are cheapest and suitable to the animal system, for the purpose in view, that is, in this case, the production of the greatest quantity of the best milk. It is a good guide, if not always a reliable one, and is based on what good pasture does. It seems then that we should aim at giving in winter the milch-cow per day that weighs 1000lbs., two and one-half pounds of albuminoids, nearly one-half pound of fat, twelve and one-half pounds of Carbohydrates, with twenty-four pounds of what is called dry matter; these give a nutritive ratio of 1 : 5.4, or one of Albumen to nearly five and one-half of Carbohydrates. The ratio we call "ordinary" is exactly Wolff's standard, and hence these experiments are based upon exact practical and scientific data, with the ordinary winter feeding materials of the country, hay, roots, and bran; these are our standard in this contest, and agreeing as it does with Wolff's, the comparisons are the more interesting and valuable.

"*Bran*" as a prominent part of a ration, gives a higher feeding ratio than the standard, and is the highest of any on this list, which is important to remember in connection with the results already obtained.

"*Roots*" on the other hand, are somewhat lower than the standard—as much as four per cent, though the figures seem to differ so little, and at the same time they represent the exact mean of the four rations.

"*Ensilage*"—and we are at present most interested in this material—is, if we are correct in placing it chemically—decidedly much lower in nutritive ratio, some twenty per cent lower than the standards. This is not owing to less fat, for it is next to bran in that respect, nor is it owing to the Albuminoids, which though low, are not so low as Roots, but it is owing to the smaller proportion of the Albuminoids to the Carbohydrates. I presume I am also correct in saying that the higher amount of dry matter is also evidence of a less rich diet in the case of the Ensilage.

CHEMICAL COMPOSITION AND NUTRITIVE RATIO OF FOOD EXPERIMENTED WITH.

—	Albuminoids. lbs.	Fat. lbs.	Carbhydrates. lbs.	Dry Matter. lbs.	Nutritive Ratio.
Wolff's standard for Cows weighing 1000 lbs.	2.5	0.4	12.5	24.0	1:5.4
"Ordinary" (O. A. C. Cows aver. 1075 lbs.)	2.17	.48	10.6	21.	1:5.4
"Bran" (O. A. C. Cows aver. 1075 lbs.)	2.38	.63	10.4	22.	1:5.0
"Roots" (O. A. C. Cows aver. 1075 lbs.)	1.98	.39	10.1	22.	1:5.6
"Ensilage" (O. A. C. Cows aver. 1075 lbs.)	2.14	.49	12.5	27.	1:6.5
Mean	2.17	.50	10.9	23.	1:5.6

5.—CONDUCT OF THE ONTARIO EXPERIMENTAL FARM SILOS, 1883-84.

As the second season of our experience in this very important enquiry—for it is but yet an enquiry all over the world—we determined to leave little unattempted in the way of economical experiment.

First of all, in August last we were employed two weeks in testing the keeping properties of various green fodders in a portable form. We considered it would be a good thing to be able to show that live stock could be fed on green fodder, either when importing from, or exporting to Britain, summer and winter. For this purpose we took ordinary sized oak barrels, as also larger barrels, such as are used for beer, and lastly a very large oak tun—capacity 60 cubic feet.

We found it very difficult to fill a barrel solidly round the edges with screw power, as the material tends toward the centre and leaves empty space adjoining the circumference, even when the fodder is in inch lengths. Thus we had to pack with the hand and lever power in addition to the screw. This was the first trial.

The second consisted in the same size of barrel, but fitted inside with a square box, so as to allow of the screw pressure being equal on all parts. This necessarily diminished the capacity for fodder, as vacancies remained between the box and the barrel. In order therefore to obtain an ordinary barrel capacity along with the inside box, a larger barrel was employed, as our third example; and, still further to insure success, the vacant spaces were packed very solidly with earth—earth also being placed beneath the box, and on top of fodder when finished; so that we had green fodder completely enclosed—first by an air-tight box, second, surrounded by a six-inch packing of loamy soil, and third, outside, by an air-tight, hardwood barrel.

In each of these three forms we used cut and un-cut fresh clover, rye grasses, and permanent pasture—very succulent, and none of them near maturity; the plants were so tender, that the strong screw abrased and discoloured them, as well as pressed out the natural sap to a considerable extent.

The fourth portable silo was the large tun referred to, which we placed in a corner of the cattle stable for convenience. It was fitted inside with a seven sided box, and filled with one ton of fodder—one-third green oats (similar to the largest silo yet to be described), and the remainder permanent pasture. Filling was done on the 3rd October, and was opened on the 29th December, having thus remained untouched for 86 days. The lid was covered with one foot of earth, and the screw kept taut every day. This material gave no indication of heating, and was perfectly cool when opened. The permanent pasture has a green-brown color, a strong sour taste and smell—a very heavy putrid scent difficult to describe—and yet the fibre is sound even in the case of delicate clover. The whole body of the pasture was so full of sap as to be easily pressed out with the hand, when removed from the silo. The oat fodder, on the other hand, turns out sound, sweet, and as palatable as from the large silo. The pasture in the small barrels was similar in condition to that just described in the tun.

The character of our largest silo is explained herewith under the chapter, "Preserving Corn Fodder in a Common Root Cellar." It failed to preserve properly, by reason of irregular walls and insufficient loading—nothing else. This year the floor was cemented with a drainage to the doorway—not to the centre as in most other silos; the walls were also cemented, and in every respect made suitable for an air-tight covering, and easy access by door on level to cattle, at a cost of $28. All our corn fodder was destroyed by the severe frost in August, and had to be composted; fortunately, we had ten acres of late oats that were purposely made late for a trial of self-binders during the last week of September. This trial did not take place, and, it being impossible to mature the crop at that time of the year, we decided to ensilage it. Most of the field was green, both in stalks and leaves, while others were tinging with white and the leaves decaying, so that we selected the most unripe parts. The material may be said to have been on the mature side for this purpose, and yet we understand it is better to have it so than in the immature condition.

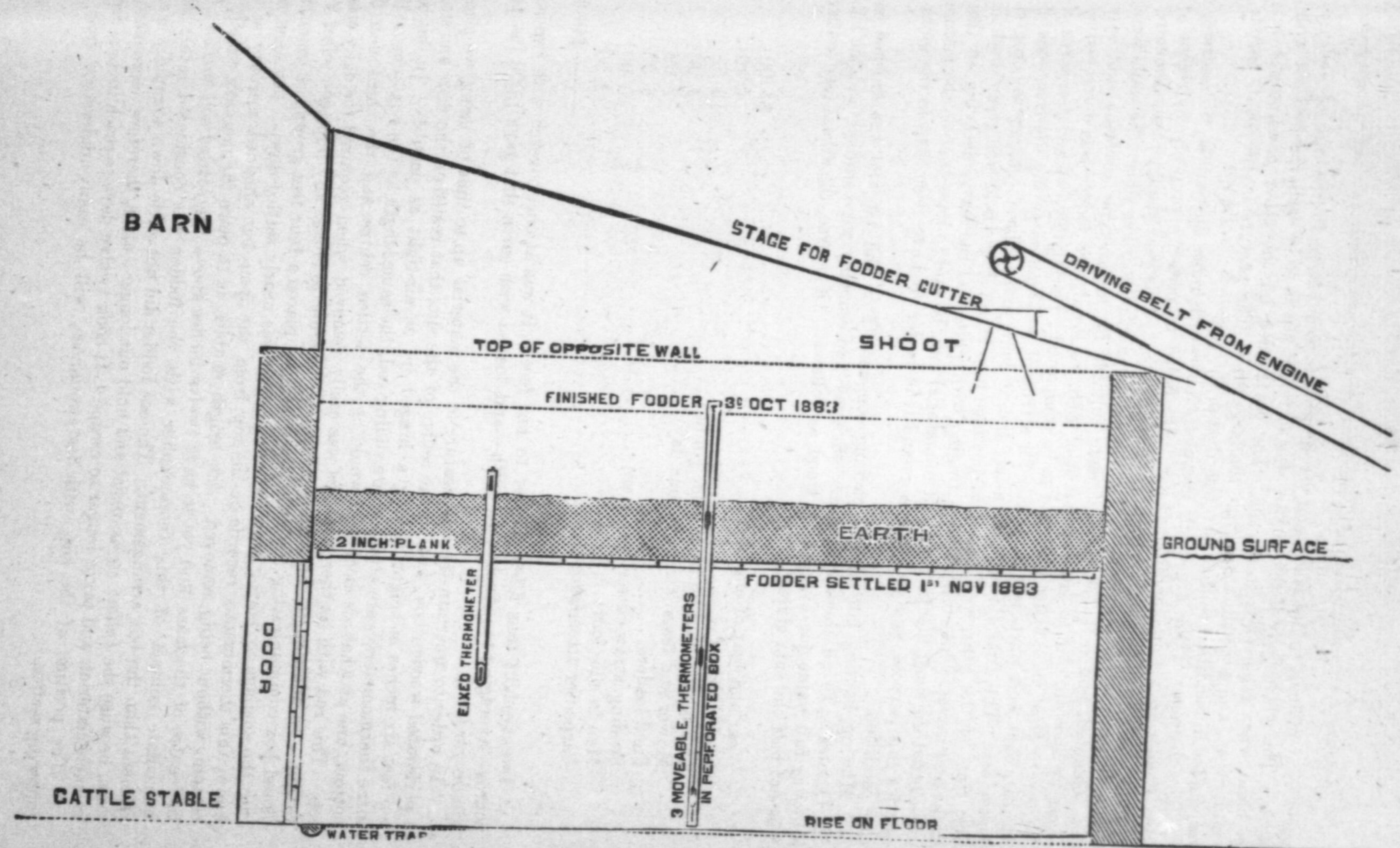
Mowing, hauling, cutting and packing commenced on the 1st, and was finished on 3rd October. In all these operations efficiency and economy were studied, and the bill, allowing full value for everything, stood as follows. Of course, the actual cash outlay was not half the sum given:

Wear and tear of engine	$3 00	
Engine driver	4 50	
Two teams (hauling from field, ¼ mile)	12 50	
Mower and team (full time, one day)	3 00	
Field loaders	7 00	
Feeding straw-cutter (two men)	6 00	
Men in silo (four)	10 00	
Carpenter attendance	2 00	
		$48 00

Twenty-eight tons filled the pit to ten feet. It was at once covered with two-inch boards—averaging nine inches in width—and loaded with earth that gave 1,000 lbs. per square yard.

In order to ascertain the temperature of the material up to time of using, we placed a perforated wooden box, 4x4, in the centre of the silo, that rested on the floor and stood ten feet six inches in height, having a hinged lid as air-tight as possible. In this box three thermometers were attached to a sliding rod, the same length as the box—one at the bottom, one at what we calculated would be the settled centre, and the third near the top. This rod with its thermometers was easily removed when required for daily observation. In addition to this arrangement, and in order to check any improper effect of a closed box communicating with the open air, we placed a four feet ground thermometer into the ensilage by boring a hole after the mass was nearly settled down. As some may know, this thermometer records on the top from the open but shielded mercury at the bottom, without being removed. Its length enables us to place the mercury exactly in the centre of the mass, and yet to have twelve inches above the settled soil surface; the immediate contact of this thermometer with the fodder was considered rather more efficient than the box arrangement. The oat fodder did not settle down so rapidly as corn does, because the *hollow stems* resist and hold out longer; air is, therefore, more plentiful in such material, and takes longer to escape. It took twelve days to reach its final depth.

The position of the silo, with its appliances, will be easily understood from the following section:



SECTION OF ONTARIO EXPERIMENTAL FARM SILO.

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We have arranged to feed milch cows and store cattle with this ensilage, commencing 1st January and continuing throughout the winter. Final results will consequently not be obtained until the issue of our Advance Report in June or July next, but, meantime, two very important facts are set at rest, and these I shall now sketch.

The silo was opened to-day (31st December, 1883), being eighty-nine days after finishing, or practically three months. It affords me great pleasure to record a most gratifying success. With the exception of three inches adjoining the door, the fodder is one body of sweet, well-coloured oat-stalks, leaves and heads. The greenness is more prominent immediately touching the planks; elsewhere the material has a brown, but not dark, tinge, very slightly spoiled by fermentation or other form of decay, and when taken out in its temperature of about 70° Fahr., smells actually sweet and tastes slightly salt (no salt was used in pitting), neither sour nor bitter, but exposure to the air very soon brings a distinct smell and taste. There are some spots that are not so sweet as others. The hollow stalks are all flattened and form a close mass with the leaves and heads. While it may be argued that we would have had a more juicy or succulent material had the oats been less matured, it is clearly obvious that the greater the maturity, consistent with *crisp greenness* at the time of pitting, the greater will be the success in holding freshness and sweetness all winter.

Then we are further enlightened, and somewhat surprised in addition, as regards the conduct of the silo under the temperature which we have been enabled to record so satisfactorily every day. Take the following abstract with its analysis:

Temperature of the Ontario Experimental Farm Silo, during three months ending 31st December, 1883.

T.—Top. C.—Centre. B.—Bottom.	1st Week.			2nd Week.			3rd Week.			4th Week.			5th Week.			6th Week.			7th Week.			Last Week.
	T.	C.	B.	T.	C.	B.	T.	C.	B.	T.	C.	B.	T.	C.	B.	T.	C.	B.	T.	C.	B.	
Highest	° 71	° 92	° 65	° 67	° 91	° 65	° 62	° 88	° 64	° 59	° 93	° 68	° 64	° 89	° 66	° 56	° 87	° 67	° 56	° 84	° 66	Centre 73°
Lowest	63	89	64	53	86	63	53	86	63	58	92	67	57	79	64	46	81	64	54	78	63	
Mean	67	91	65	51	88	64	55	87	63	58	92	67	60	84	60	52	84	62	55	81	64	
Mean outside...	52°			40°			42°			41°			39°			25°			43°			26°

Average of Top for period .... 58°
Average of Centre for period .... 87° } 68° general mean.
Average of Bottom for period...................... 61°

We have in this table, and with the facts already given, undoubted evidence that a high temperature does not destroy the green moist material in a silo; that the average temperature of 87° Fahr. continued for three months, and that much less, would spoil fodder under other conditions is well known, both in hay-making, shocking of grain in the field, and manure heaps, and why it does not do so in *confinement* is the question in the present issue. That a temperature ranging from 46° to 93° existed in a mass of green fodder during three months of winter is evidence of several things which neither the farmer nor the chemist can well explain: Did it do no harm because of its stationary condition; was the ventilation insufficient to move enclosed atmospheric particles that we know is necessary to bring about decay in ordinary open condition with the like material; has the gaseous state of the enclosed mass a preserving instead of a destroying property; yet why was there a certain amount of destruction as evidenced by the brownish colour, and what gave the occasional acidity irregularly throughout the mass?

From week to week there was no particular diminution, or increase even, of temperature on an average from top to bottom. The mean temperature of the first week was 74° all throughout, and it appears to have settled down to a normal of 68° during the second week, for, observe that from this week onwards the mean of the weeks is exactly 68°. All this, remember, independently of the outside variations of temperature. Then there is other evidence given by the temperature that the silo was sealed up and had practically no ventilation; heat did not rise from the centre to the top, nor was it distributed from the centre to the bottom. The ruling temperature of the centre was 87°, the top 61°, and the bottom 58°.

We look with considerable interest to the produce of milk, butter, cheese and beef from the feeding of this Oat Ensilage, now under experiment at our station.

The butter will be exhibited at the February meetings of the Eastern and Western Dairymen's Associations.

6.—WOOL AS A BI-ANNUAL CROP, AND THE CLIPPING OF LAMBS.

The knowledge of wool is not so full any where as it should be. England still remains indifferent in regard to this product within her own bounds, and while all other civilized countries have paid more attention to wool than mutton, this very prominence has made men careless about its better cultivation. There is no doubt that every such free offering is looked upon as a matter of course—needing little or no attention, and handled practically as if it were unsusceptible of any improvement in its growth and harvesting.

There is one thing in connection with this subject that I think is well worth careful consideration, and that is, the clipping of lambs once, and of all other sheep *twice* a year. The practice is not unknown in several parts of the world, where climatic conditions are thought to be most favourable, but I am not aware of any practical suggestions, and have not heard of any actual experiments in the Northern States or Canada, where, of course, seasons are very much the reverse of the others referred to. Before submitting the experiments made on this farm during the past summer with several sheep, it is best to give the theoretical and practical arguments in favour of the proposal.

Sheep in very large numbers together, for cheap production, can be maintained only when frost is but a friendly visitor to check more abundant vegetation, eradicate diseases and freshen animal life. The Middle States, California, Australia, and parts of Europe are examples of such winters, where, nevertheless, diseases are most abundant as against much more severe winters, such as occur in the Northern States and Canada. The former is the natural home, the latter is very much the unnatural home of sheep. When nature is so propitious to vegetation and sheep life, the prevalence of disease is due as much to mismanagement, or to a superabundance of good things, and, in any case as the animals are comparatively in a state of nature, being neither subject to extremes of climate, nor to high pressure in feeding, it is found that experience agrees with nature in offering, and taking one crop of wocl once a year only, partly because of nature desiring relief, and partly as brought about by the habit of shearing. Wool would come off if not removed by man. Were wool clipped twice in Britain, for example, the animals would suffer severely in the early autumn by wet and chills, and the second growth would not be sufficiently vigorous to defend from the winters, however mild.

On the other hand when sheep have six months of summer and six of winter, with the unavoidable artifiical conditions of the latter season, the wool is a very different crop. As this fact may be doubted by some, it is desirable to explain that sheep in the Northern States and Canada, when well fed and sheltered, grow as much weight of wool as during the previous summer. During the great heat wool lengthens and takes strength, but in the extreme cold the field sends up more plants, and finer, the yolk increases, and density, lustre, and soundness increase as well, so that ere the month of March, when the mean temperature is really high, the well-fed animal suffers considerably, the whole surface fleece is almost continuously wet by arrested vapour from the rich fat soil that supports it. Under such conditious the "best of everything" is not obtained, the mutton suffers and the wool is not benefited. In a word, our winters with their good feeding, and summers with their natural pressure, can grow two crops of wool with benefit to the animals and good profit to the owners.

But without example, precept is not so valuable, and accordingly I have pleasure in reporting what we did during the past season.

On an average, our lambs come in the middle of March and are weaned in the middle of July, ordinary clipping about the middle of May.

On 12th July we clipped a Shrops. grade wether lamb that was dropped 12th March, and secured 3 lbs of washed wool. (Ear label 343.)

On same date clipped a Shrops. grade shearling fattening wether that was formerly shorn on 1st April of the same year; first clip weighed nine pounds, second clip four pounds, both washed; (ear label 772).

We took the Shrops. grade as best to represent both the long and the short classes of wool, as either extreme might influence for or against.

Thinking that a particular season—a moist one—might influence a later clip, we again, on the 16th August shore two lambs, Cotswold grade ram (ear label 529), and a South Down grade wether (ear label 341), each gave exactly three and three-quarter pounds of washed wool.

The new crop of wool, on lambs and the shearling, did not, as under any circumstance it never does, appear to make much progress for three weeks, but the pile thickened and grew in strength so much that when dirt made colour similar to the other sheep, the visiting eye could not detect the difference between the shorn and unshorn lambs, nor between the once shorn and the twice shorn wethers. Not only so, but we kept impartial note, taking from July to October, and found a most marked better progress in the growth and vigour of the animals themselves.

When winter began to speak on 31st October our notes were:

Ear No. 343, wool, two and one-half inches on average, dense, and the animal well covered all over.

Ear No. 772, wool, two and one-half inches, somewhat open in comparison with 343, but well covered.

Ear No. 529, wool two and one-half inches, and a good crop of its kind.

Ear No. 341, wool average two inches, a beautiful close pile.

The second year students were with me at this examination, many of whom are farmers' sons, and they expressed surprise at the uniformly close coat, that on an average was as well able to protect as others of the flock. Not the least reflection was left on our minds as to any unpreparedness for winter, and to-day (19th January), the animals are as comfortable and doing as well as, if not better than, the others. Thus much for the present.

What does it mean financially?—for while it is yet too early to state anything definite, it is not difficult to prejudge pretty closely.

Take a flock of 1000 ewes of medium wool, under management that always does best—

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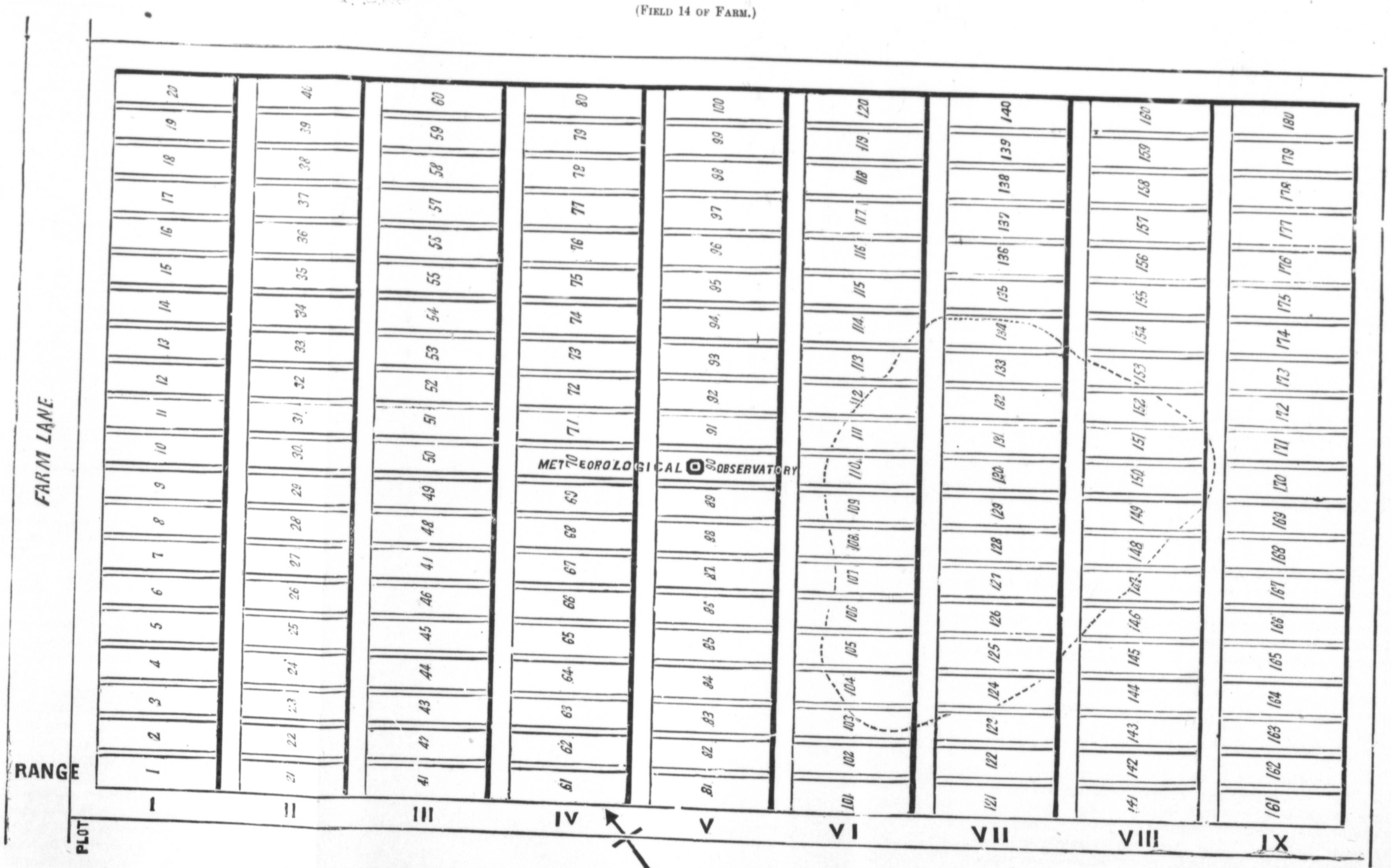
ONTARIO EXPERIMENTAL FARM.

EXPERIMENTAL FIELD PLOTS.

(FIELD 14 OF FARM.)



Area of each Plot—$\frac{1}{10}$ of an acre.
Width of Range Roads—20 feet.
Width of Plot Paths—4½ feet.

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Ranges VI. to IX.—Gravelly Loam.
Within dotted line—Vegetable Mould.

SCALE—One inch to 132 feet.

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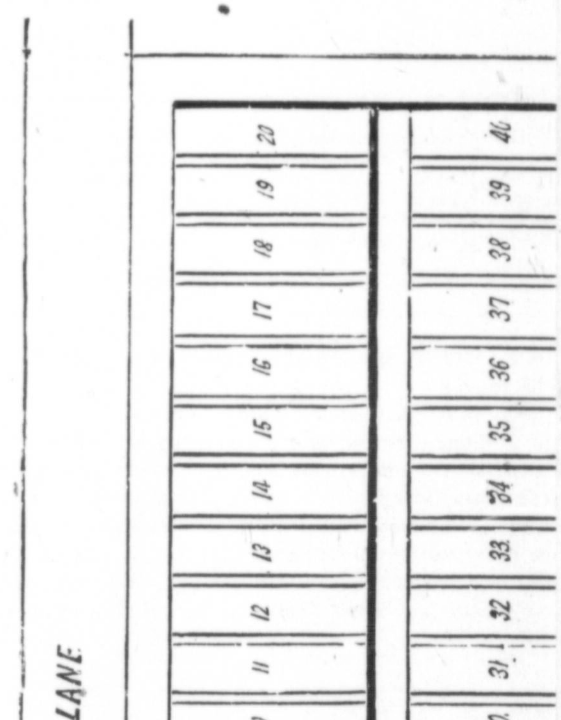

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liberal but not profuse—one-half of the previous year's lambs having been kept to fatten, as shearlings.

	Present System.	Proposed Plan.
Clip of 1000 common Canadian Ewes, 6 lbs., unwashed, at 15 cents, 15th April...	$900 00	$900 00
Clip of 500 Shearlings, 8 lbs., @ 17 cents, "	680 00	680 00
Second clip of 1000 ewes, 3 lbs., @ 17 cents		510 00
Second clip of 500 shearlings, 4 lbs., @ 18 cents		360 00
Clip of 1200 lambs, 3 lbs., @ 18 cents		648 00
Per annum....................................	$1,580	$3,098

Of course against the $3,098 would stand expense of clipping, and the following memoranda would also hold good:

1. We would secure eighty per cent. more wool.
2. Sheep would be more healthy and attain greater weight in the same time.
3. The wool would suit the average manufacturer better, bring more money per pound, and improve in texture and weight.
4. The sheep would consume less food in winter.
5. Lambs wool fetches more money per pound.
6. And the greater care required would necessitate an improved sheep husbandry.

I think the Experimental Station should continue the enquiry.

1.—OPENING OF THE NEW EXPERIMENTAL FIELD PLOTS.

I believe it to be the wish of all interested, that Ontario should possess the most complete and practically valuable experimental station, it is possible to command in the light of these days. What we have done, and are still prosecuting with animals is elsewhere submitted, and what we have in view to do with *plants* is the subject of this chapter.

Field fourteen of the farm has been chosen as the extended plots, for the following reasons:—It is the most uniform in exposure and aspect of any convenient to the College; it is one of our largest fields, almost twenty-four acres, has been recently drained, and possesses soil of three different characters as shown on the accompanying plan.

In preparation for 1882-83 work, this field was thoroughly fallowed by four ploughings during the summer of 1882 the removal of any obstacles to the plough, the levelling of parts adjoining fences, and the digging of all the ground close to the fences where the plough could not reach. On the north-east side a row of maples has been planted; horse chestnut on the south-east end; mountain ash on the south side; and European linden on the north-west end, with a view to a certain amount of shelter and ornament.

In considering the sub-division of this field into plots suitable for any purpose, we saw no reason to depart from our old area of *one-tenth of an acre*, as to which see my report of 1876. This, of course, implies an easy making of a fifth, or a twentieth, or even a fortieth of an acre, if necessary. The field has been divided into nine ranges, containing each twenty plots, so that there are actually as many as *one hundred and eighty plots.*

Each range is separated by a twenty feet road, and between each plot there is a four and one half feet path. Thus, all over, we think we are up to times in regard to area, form, and position of plots. The form of 132 feet by thirty-three feet lying north-west and south-east is one well adapted to receive the full measure of sunshine—beginning with the morning broadside, the noonday sweep, and the evening touch, each in its largest measure. There is a road over twenty feet in width round the field, between fence and plots. One objection to this form of plot is the greater length of boundary, as against a square—364 feet and 264 feet. It is a well known fact in practice that in any field, plot or bed, the *outside* plants are stronger, by reason of the better light, air, and sunshine; so then, the greater the boundary line the heavier the crop, proportionately to inside area; this is so plainly a fact in experimental work—often overlooked however—that the difference of one hundred feet to a small area, such as one-tenth of an acre, might overbalance a fine point between two fertilizers, and certainly, as one hundred feet is to one-tenth there must be at least 1,000 feet to an acre, and accordingly multiplying to a very serious extent—for experimental accurateness.

There are three distinct classes of soil in our new experimental field; from range two to range five, inclusive, it is a clay loam of average texture, with a yellowish subsoil of a sandy character; the remainder of the field, with the exception of the swampy part—is of a lighter, sharper class, which we call a gravelly loam; and about two and one-half acres, as indicated by the dotted line on plan, are a swamp that has been drained, burned, thoroughly cultivated by ploughing and harrowing, cleaned of all roughness, and is now a spot of virgin soil—never having been cropped—of the vegetable mould type.

Such is our new experimental field proper, on which, in future years, may depend much of the status of Canadian Agriculture.

The cropping of these plots has been a matter of some study—just what to do in connection with the existing, or the probable future, requirements of Ontario's rural economy. Of course our past experience has indicated several things, and by reference to what Europe and the United States are doing in the same line, we have concluded upon the following plan:—

i.—Soils.

Two plots to be divided into eight parts, each to be made up to the depth of two feet with the following soils: (1) Heavy clay; (2) clay loam, (3) loam; (4) sandy loam; (5) swamp; (6) gravelly; (7) marly; (8) sand. These to test manures under the like conditions of management and climate—the physical conditions of soils affecting manures very differently.

ii.—Cultivation.

1. Rotations, three sets	One plot to each.
2. Cultivating cereals, say wheat	1 plot.
3. Non-cultivation,	1 "
4. Subsoiling,	1 "
5. Drainage, effects of rain in withdrawing manures	2 "

iii.—Seeding.

1. Thick seeding	1 plot.
2. Thin "	1 "
3. Drilling "	1 "
4. Broadcast "	1 "
5. Deep "	1 "
6. Shallow "	1 "

iv.—Cropping.

1. Winter Wheats, varieties	10 plots.
2. Spring Wheats, "	10 "
3. Oats "	10 "
4. Barley "	10 "
5. Rye "	10 "
6. Peas "	2 "
7. Roots—mangolds, turnips, carrots—varieties	11 "
8. Potatoes, varieties	5 '

9. Corn, varieties	
10. Grasses and clovers, separately	4 plots.
11. Green Fodders	20 "
12. Permanent pastures, various mixtures	6 "
13. Sundry crops	3 "
14. Sugar beet	2 "
15. Sugar cane	1 "
16. Crop after crop of wheat upon virgin soil (Clay loam)	2 "

v. Unmanured Plots.

Unmanured plots	4

vi.—Manuring.

1. Farm-yard manure, best management of, from uncovered court	1 plot.
2. Farm-yard manure from covered court	1 "
3. Farm-yard manure from poorly fed animals	1 "
4. Farm-yard manure from well fed animals	1 "
5. Fertilizing by sheep (diff. soils)	2 "
6. Farm yard liquid (diff. soils)	2 "
7. Clean straw, rotting on surface	1 "
8. Clean straw, ploughed under	1 "
9. Compost (diff. soils)	2 "
10. Clover (diff. soils)	2 "
11. Bare fallow (diff. soils)	2 "
12. Sewage from College (diff. soils)	2 "
13. Marl (old and new)	2 "
14. Phosphate (apatite)	1 "
15. Superphosphate	1 "
16. Bones, fine ground	1 "
17. Bone superphosphate	1 "
18. Gypsum	1 "
19. Leached ashes	1 "
20. Lime (var. soils)	1 "
21. Salt (var. soils)	2 "
22. Mixtures of several manures	5 "
23. Various *quantities* of several manures	5 "
24. *Special* manures	3 "
25. Fall *vs.* spring manuring	4 "
26. Manures applied at various stages of growth, same season	2 "
27. Duplications of several	5 "
28. Nitrate of soda	

vii.—Modes of preventing and curing diseases of farm crops.

viii.—Special potash and nitrogen experiments in co-operation with the United States series.

Dr. Hare, our chemist, is now associated with me in the management of this department, and we are still in possession of the valuable services of Mr. Shuttleworth, as immediate Superintendent of all operations connected therewith.

Before reporting upon the cropping of 1883, I beg to submit what is being done in providing scientific appliances for this department.

As we could no longer delay the thorough analysis of any form of materials, apparatus for this purpose have been obtained, and are in possession of Dr. Hare, who will report on what he has already done.

2.—APPLIANCES FOR EXPERIMENTAL PLOTS.

Plot 90 has been set aside for the purposes named on plan herewith. The *meteorological* frame contains the ordinary instruments as recognized by the Toronto Observatory, to which we are associated and make returns.

We have nine *ground thermometers* registering the temperature of as many different depths, ranging from two inches to four feet beneath the surface.

There are six lycimeters, or *Drainage Cylinders*. These are the ten-thousandth of an acre in area and three feet deep, with outlets into the rain gauge cellar. The object with them is to ascertain the amount of evaporation and drainage from different soils, and from like soils under different forms of cropping. This is specially necessary in our conditions of great special falls of rain, that wash so much natural and special manures beyond the reach of ordinary cultivated plants. The analysis of any drainage from these lycimeters will be the duty of the chemist. "Receiving cylinders" to each will be placed in the cellar named, and all necessary minor appliances made good.

The *great rain gauge* occupies the centre of the plot, and is almost an exact copy of that at Rothamstead, England. The receiving area is the one-thousandth of an acre, and in all its "fixings" and detail build is well worth the study of every scientist. No pains have been spared to make this gauge a very complete one—its stone walls and steps, cemented floor, four water cylinders, registering the *one-thousandth of an inch* of rain fall—a quantity so small as to be incapable of record except by such an application of cylinders, but here so distinct as to be easy of observation with the naked eye; the framing of the surface receiver, in wood, lead, and glass and generally the whole simplicity and efficiency of this important rain measurer is a matter of some satisfaction. It is something to say that it is the second of its kind in existence—Sir J. B. Lawes having set the example.

Thus equipped, our experimental field plots are now ready for work.

The cropping of 1883 was as follows:—

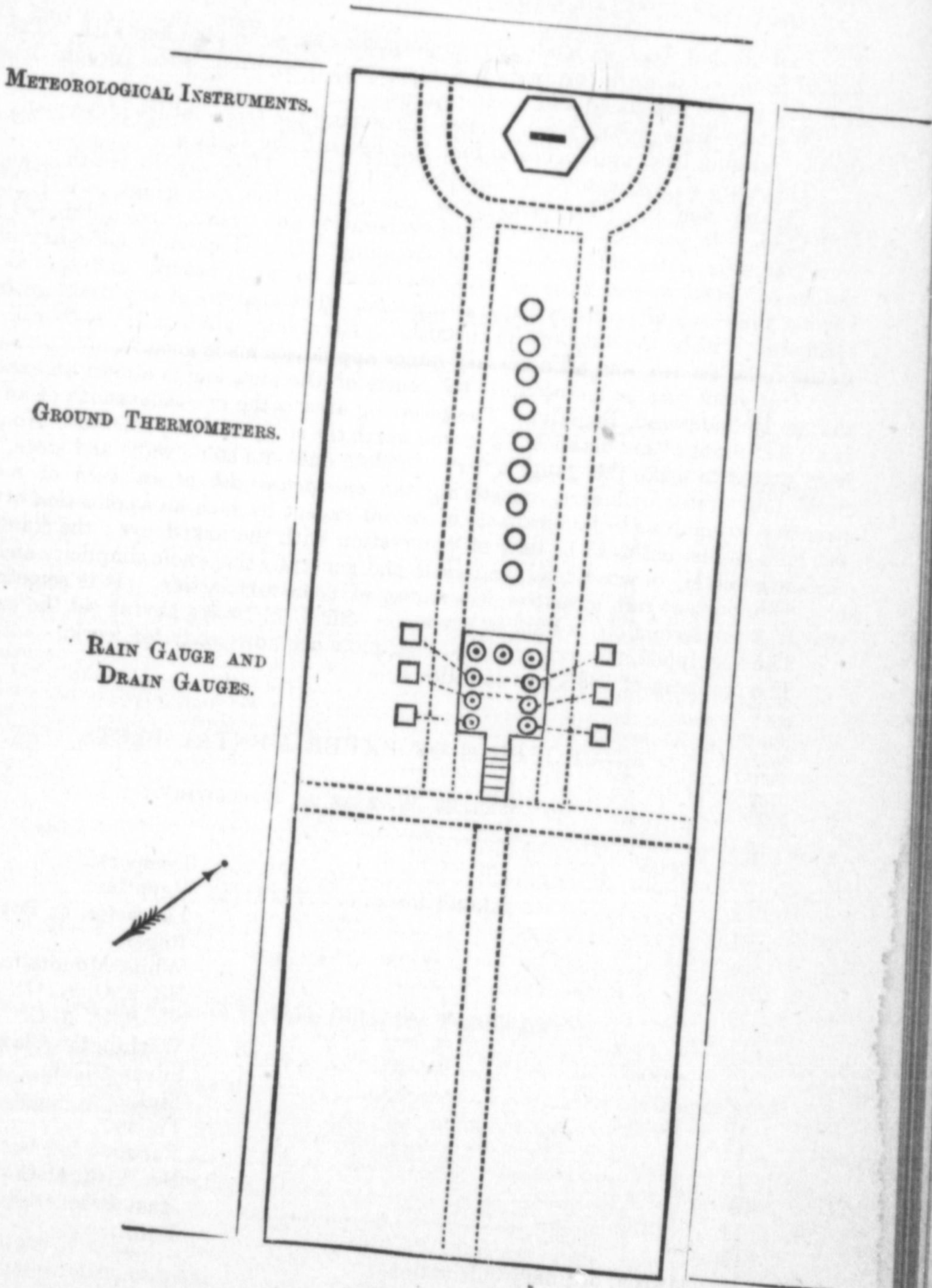
3.—CROPPING OF EXPERIMENTAL PLOTS.

(*a*) Winter Wheats in Opposition.

Plot.	Variety.
1	Democrat.
2	Egyptian.
3	Lancaster, or Boyer.
4	Roger.
5	White Mountain.
6	No. 9, O. A. C.
7	No. 8, O. A. C.
8	Washington Clawson.
9	Silver Chaff.
10	Fluke.
11	Finlay.
12	Fultz.
13	No. 3, O. A. C.
14	Rust Proof.
15	Deihl.

16 Clawson, ordinary cultivation.
17 Clawson, manure ploughed under.
18 Clawson, carbonized saw dust as a top dressing.
19 Clawson, without manure
20 Clawson, manure ploughed under.

The sowing of these winter wheats was undertaken from the 19th to the 21st of September, 1882. The ground was summer fallowed with four ploughings and harrow-



EXPERIMENTAL PLOT APPLIANCES.

ings, and gave a
was plenty of sno
April and May n
was no actual sm
water did much
May the remaini
very vigorous, u
By 10th of July
and three days a
distinctly red.
tender character

PLOT.	
1	Democrat
2	Egyptian
3	Lancaster
4	Rogers …
5	White Mo
6	O. A. C.
8	Silver Cha
10	Fluke …
12	Fultz….
13	O. A. C.
14	Rust Proo
15	Diehl ….
16	Clawson .
17	"
18	"
19	"

These have b

21 { Nitrate / Minera / Muriat

22 { Nitrate / Minera / Muriat

23 { Nitrate / Minera / Muriat

24 { Minera / Muriat / Dried b

25 Farm y

ings, and gave a very mellow open seed-bed. Braiding was not very vigorous. There was plenty of snow cover up to February, when rain made a hard packed crust. In April and May many parts were water-lodged and covered with ice. We think there was no actual smothering of the plants during winter, but the cold spring, with stagnant water did much harm. On 30th of April all the plots looked patchy, but ere the 25th May the remaining plants had made good progress. Up to the 23rd June growth was very vigorous, under an unusual amount of moisture and the usual high temperature. By 10th of July rust on leaves and straw was very profuse on every one of the kinds, and three days afterwards a shower washed off so much of the rust as to color the ground distinctly red. The Deihl was a complete failure from the cause named and its more tender character for our position.

Fall Wheat, per Acre.

Plot.	Kind.	Grain.	Straw.
		Bushels.	Pounds.
1	Democrat	$8\frac{1}{4}$	3150
2	Egyptian	$8\frac{3}{4}$	3840
3	Lancaster	9	3730
4	Rogers	$8\frac{3}{4}$	3530
5	White Mountain	$8\frac{1}{2}$	3420
6	O. A. C. No. 9	$14\frac{1}{2}$	2580
8	Silver Chaff	$8\frac{1}{3}$	3040
10	Fluke	$7\frac{1}{2}$	2400
12	Fultz	5	1640
13	O. A. C. No. 3	$4\frac{3}{4}$	2880
14	Rust Proof	$4\frac{3}{4}$	1260
15	Diehl	Failure	Failure
16	Clawson	$10\frac{3}{4}$	2960
17	"	$16\frac{2}{3}$	3580
18	"	$9\frac{1}{2}$	2370
19	"	$7\frac{1}{2}$	2090

(b) Fertilizers on Grain.

Plots 21 to 60.

These have been set aside to test the following Fertilizers :

		lbs.	
21	Nitrate of soda	300	per acre.
	Mineral superphosphate	400	
	Muriate of potash	200	
22	Nitrate of soda	300	per acre.
	Mineral superphosphate	400	
	Muriate of potash	135	
23	Nitrate of soda	300	per acre.
	Mineral superphosphate	400	
	Muriate of potash	70	
24	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Dried blood	660	

25 Farm yard manure ....15 tons per acre.

		lbs.	
26	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Dried blood	440	
27	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Dried blood	220	
28	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Sulphate of ammonia	340	
29	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Sulphate of ammonia	225	
30	Without manure		
31	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Sulphate of ammonia	115	
32	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Nitrate of soda	450	
33	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Nitrate of soda	300	
34	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
	Nitrate of soda	150	
35	Mineral superphosphate	400	per acre.
	Muriate of potash	135	
36	Nitrate of soda	300	per acre.
	Muriate of potash	135	
37	Nitrate of soda	300	per acre.
	Mineral superphosphate	400	
38	Muriate of potash	135	per acre.
39	Mineral superphosphate	400	per acre.
40	Nitrate of soda	300	per acre.
41	"Nitrogen mixture," equal parts nitrate of soda, sulphate of ammonia, and dried blood	300	per acre.
42	Mineral superphosphate	400	per acre.
43	Muriate of potash	135	per acre.
44	"Nitrogen mixture"	300	per acre.
	Superphosphate	400	
45	Without manure		
46	Muriate of potash	135	per acre.
	Superphosphate	400	

		lbs.	
47	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
48	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Superphosphate, dissolved bone black	200	
49	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Superphosphate	400	
50	Farm yard manure	15 tons per acre.	
51	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Superphosphate	600	
52	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Precipitated phosphate	200	
53	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Precipitated phosphate	400	
54	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Precipitated phosphate	600	
55	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Bone dust	200	
56	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Bone dust	400	
57	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Bone dust	600	
58	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Sulphate of lime	75	
59	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Sulphate of lime	150	
60	"Nitrogen mixture"	300	per acre.
	Muriate of potash	135	
	Sulphate of lime	225	

Produce Per Acre.

Plot.	See above for Manures.	Grain.	Straw.	Weight per Bushel.	—
21		23½	5312	54½	
22		17	4777	55	
23		17¾	4362	54⅔	
24		17¼	4362	54⅓	
25	Farm Yard Manure................	16¼	4720	53	
26		16¾	4302	54	
27		16¾	4007	55	
28		15½	2987	54	
29		15⅕	3532	55	
30	Without Manure....................	8¼	2457	51	
31		11⅕	3020	54⅓	Damaged by wet.
32		....	....	....	
33		....	....	....	
34		....	....	....	
35		8½	2237	52⅔	
36		15⅓	3377	51	
37		12¾	3182	55	
38		11⅓	2870	47⅓	
39		11	2762	54½	
40		9⅓	2512	50	
41		18½	4085	53	
42		19½	3787	54½	
43		18	4010	50	
44		16¼	3697	52½	
45	Without Manure....................	15⅕	3422	53	
46		22½	4785	55	
47		19¾	4345	53½	
48		17¼	4072	52½	
49		20½	3925	56	
50	Farm Yard Mannre............	22	4075	54⅓	
51		17⅔	3260	55	
52		17½	3522	55⅓	
53		19	3502	55½	Damaged by wet.
54		25	4405	55½	
55		19⅓	3492	54⅓	
56		17	3360	51	
57		15¼	3142	49½	
58		17¼	3182	58	
59		16¾	3170	50	
60		17½	3297	52	
	Means......	17	3665	53	

Sown, May 1st and 2nd; Fertilizers applied, May 3rd; Headed, July 12th, on average; Harvested, on average.

The crop was White Russian Spring Wheat, seeded by drill at the rate of six pecks or 90 lbs. per acre. Vegetation came above ground on 15th of May on an average.

I do not know what our Professor of Chemistry will say to the Province on the whole question of this first year's cropping of such an important series of manural tests, but from the stand-point of a practical farmer, I am of opinion that any comparative note-making has been swept away from us by the very unusual amount of rainfall. The continuous drenching, flooding, and even the presence of stagnant water on several plots, must have largely counteracted the efforts of, at least, the more active forms of these special fertilizers. How much has been carried off by surface washings, how much beyond the reach of cultivated plants, how much has been assimilated by the first crop, and how much still remains in the root area of the soil will never be known.

In leaving the scientific bearings of this to our chemist, I desire to draw attention to the following facts, as they would strike any reasoning, accurate, impartial and practical critic:

1. Soil that gave twelve bushels of spring wheat per acre, *without manure*, (plots 30 and 45) cannot have been in poor condition, and plot 30 was badly damaged by the wet season.

2. Soil that gave an average of 17 bushels of spring wheat per acre, by the application of 650 lbs. per acre on an average, of many forms of fertilizers, could not have been largely benefited by them.

3. Soil that produced 19$\frac{1}{4}$ bushels of spring wheat per acre, with the help of Farmyard manure (plots 25 and 50)—or two bushels more than from special manuring—must have acted differently, or have been more suitable than the specials, either through weather or other influences.

4. Soil that did not respond one bit to 400 lbs. of Mineral Superphosphate, 135 lbs. Muriate of Potash, and 660 lbs. of dried blood per acre (plot 24), under all the previous favourable conditions, must have a queer story to unearth as regards both air food, and soil food.

5. Soil that gave but two bushels less than the average, by the minimum application of special fertilizers, (plots 38 and 43) is evidence of its own well-doing or of the poor doing of others.

6. Soil that seems to have responded to precipitated phosphate (plot 54) may have been influenced by particularly favourable physical conditions in itself, and perhaps even good previous chemical conditions.

7. Grain that should weigh 60 and only weighs 53 lbs. per bushel, must have come through unfavorable filling and maturity. The heaviest weighing of plot 58 does not appear to have been from special manuring; the unmanured grain weighs equal to the whole average.

8. Plants that usually give 4000 lbs. straw, and that on a particular occasion gave 3665, per acre, cannot have had unfavorable straw conditions, either in soil or climate.

These questioning notes are meant to show how much the value of fertilizers is subject to physical conditions of soil and climate, and in this example to climate particularly, and how much more light is needed, both by chemist and farmer.

(c) Spring Wheats in Opposition.

In this we are but keeping the enquiry open until something substantial is done in securing new kinds from Europe.

VARIETY.	Plot.	Grain—Bushels.	Straw—Lbs.	
Arnautka	66	18$\frac{1}{8}$	3865	Bearded.
White Fife	67	13$\frac{1}{2}$	2915	Bald.
Club	68	20$\frac{1}{2}$	1855	Bald.
Black Sea	69	20$\frac{1}{8}$	1140	Bearded.
Red Fern	70	10	2750	Bearded.
Mean		16$\frac{1}{2}$	2505	

The Black Seed was obtained from Wm. Rennie, Toronto; it has a somewhat fine head and weak straw, but, it is worthy of note that with the Club it has given a very much larger proportion of grain, per acre, as well as per straw.

(*d*) Barley.

PER ACRE.

VARIETY.	Plot.	Grain—Bushels.	Straw—Lbs.	
Canadian	71	37	3220	Six rowed.
Russian....................	72	33⅔	3160	Six rowed.
Black	73.141	78⅓	8070	Six rowed.
Chevalier	74	33⅔	3820	Two rowed.
"Spring"....................	75	43⅔	4560	Six rowed.
Probestier....................	142	45½	5320	Two rowed.
Potter's Prize	143	35⅓	4100	Two rowed.
Hallet's Pedigree....................	144	32	4210	Two rowed.
Hulless	145	24⅔	4110	Two rowed.
Mean........		40½	4507	

Seeding 5 pecks or 70 lbs. per acre, on 7th "May ; headed" 6th July, Harvesting 16th August. The Canadian has short straw comparatively, that lodged this year, but did not break down. The Russian has a short head and weak straw ; the Black, which is hulless, has short thick straw, as well as a short plump head. With all its virtues, newly got from England, the Chevalier, this season, has been on the delicate side. The two rowed Probestier has very long, strong straw, and for the season must have produced less grain than drier conditions would have done.

(*e*) Thick and Thin Seeding.—plot 77.

Spring Wheat.

Though a very simple, this will be an important experiment if prosecuted through a variety of conditions, and the 1883 growth is suggestive enough, as follows: The quantities used were 4 pecks, and 7 pecks, respectively.

PER ACRE.

—	Grain.	Straw.	Per cent. of Grain.
Thin Seeding	11⅓	2730	19
Thick "	12½	2885	22

(*f*) Deep versus Shallow Seeding.

(plot 80.)

Spring Wheat sown 8th May, headed 22nd July, and harvested 28th August. Deep seeding by drill was four inches, shallow 1½ inch. On 11th July the shallow seeding was strongest, as it has been all along, though the difference in brairding was only three days. Result as follows:

—	Grain, Bushels.	Straw, Lbs.
Deep	11⅔	2,820
Shallow	12⅓	2,560

So many conditions influence this kind of enquiry that it will be well to accumulate more facts before making comments.

(*g*) Permanent Pasture.

(Plots.)

A prominent Senator of the Dominion of Canada has placed on record with the management at Guelph, that what has already been done by the Experimental Department in placing reliable facts before the country with reference to permanent pasture goes a long way to meet the whole expense of the Institution. He is setting the example on a large scale and has succeeded much beyond his expectations.

In the establishment of these new plots we have given considerable space to a mixture of grasses and clover. The best mixture per acre recommended according to past experience is

Timothy grass		7 lbs.
Orchard "		4 "
Italian Rye grass		2 "
Perennial Rye "		2 "
Tall Oat "		2 "
Red Top "		2 "
Meadow Fescue grass		3 "
Creeping Bent "		1 "
Kentucky Blue "		2 "
Grasses		25 lbs.
Lucerne Clover	4 lbs.	
White "	3	
Alsyke "	1	
Red "	1	
Yellow "	1	
		10
Per acre		35 lbs.

Remembering the peculiar season of 1883, it is not so surprising as it would otherwise be, that these as sown without grain, on 17th May of the same year, had to be cut twice in order to save from the risk of smothering and killing out certain of the plants. Our Superintendent made the interesting note that at one time—previous to 12th July—the rate of growth was equal to 117 lbs. per acre per day.

(*h*) Green Fodders.

These as usual, are given a place in view of more information, to form a better base for farmers' use.

Plot.	Kind.
85	Lucerne.
86	Rye.
87-2	Sainfoin.
87-1	Red Clover.
88-1	White Clover.
88-2	Crimson Clover.
89-1	Canadian Blue Grass.
89-2	Alsyke Clover.
83	Prickley Comfrey.
82	Corn.
81	Tares and Oats.

(*i*) Grasses.

We have sown the following as a base for future work: seeding 15th May.

Plot.	Kind.	Condition.
	Grasses:	
91-1	Orchard	Heavy, ground well covered.
91-2	Timothy	Heavy, ground well covered.
92-1	Italian Rye	Very strong, and rapid, eighteen inches long.
92-2	Perennial Rye	Very strong, and rapid, eighteen inches long.
93-2	Fine leaved Fescue	Quicker than the Fescues.
93-1	Large leaved Fescue	Slow, and bunching.
94-1	Tall Fescue	Quick grower, strong, and twenty inches long.
94-2	Hard Fescue	Slow, and in bunches.
95-1	Red Fescue	Slow and bunchy.
95-2	Sheeps' Fescue	Slow and bunchy.
96-1	Meadow Foxtail	Slow, but spreading, broad leaved.
96-2	Various leaved Fescue	Slow, thick bunching, fine leaves.
97-1	Wood Meadow	Slow, thick, seems hardy.
97-2	Rough stalked Meadow	Slow, thick, seems hardy.
98-1	Tall Oat	Quick, tillers well, eighteen inches, hardy.
98-2	Yellow Oat	Very slow, not yet prominent.
99-1	Sweet Vernel	Delicate, short and thick.
99-2	Crested Dog's-tail	Slow, and doubtful.
100-1	Creeping Bent	Ground well covered.
100-2	Red Top	Thick, strong, five inches.

(*j*) Potatoes.

(Plots 102 and 103.)

Planted 5th June, ridged 3rd July, harvested 11th September.

PER ACRE.

Variety.	Good.	Small.	Decayed.	Total Produce.
	Bushels.	Bushels.	Bushels.	Bushels.
Snow Flake	152	35	5	190
Dempsey	121	3	⅓	124⅓
White Elephant	161	7	..	168
Early Rose	123	9	5	137
St. Patrick	148	7½	..	155½
Eureka	164	3½	4	171½
Early Ohio	110	3	2	115
Brownell's Ver. Beauty	123	8	2	133

(*k*).—Rotations in Cropping.

One of the most difficult, and yet one of the most important agricultural enquiries is the effect of a certain class of crops in rotation, upon certain soils in particular climates and through a particular line of seasons. We have hitherto done nothing in this, but with the hope that the country will see this station maintained thoroughly in many years to come, we have instituted the following:

A	B	C
Plot 116.	Plot 117.	Plot 118.
1. Roots.	1. Bare Fallow.	1. Clover, with Oats.
2. Grass Seeds, with Spring Grain.	2. Grass Seeds with Winter Wheat.	2. Clover, ploughed under.
3. Hay.	3. Hay.	3. Winter Wheat.
4. Hay.	4. Hay.	4. Peas.
5. Pasture.	5. Pasture.	
6. Peas.	6. Peas.	
7. Oats.	7. Oats.	

Briefly, the experiment will be *Roots* versus *Bare Summer Fallowing*, and *Clover*, the three forms of manuring and cultivation most common anywhere.

(*l*).—Oats.

(plots 61-65 and 155-159).

	Bushels per Acre.
Bullman's Black	29¼
Canadian	20½
Blue Blade	23
Black Tartarian, destroyed by wet	
Potato	34¾
Egyptian	62
Halifax	22
New Zealand	24
Spanish	43½
Fort William	49
Swiss	29
White Straw	39½
Sparable	24
White Blade	37
Norway	36
Surprise	37

V.—THE MECHANICAL DEPARTMENT.

We have no department that does so much that is not seen; the very nature of the work makes it so. What has been done during the past season is fully given in Mr. McIntosh's report to me herewith. By the plan of re-arrangement of the grounds, the present shop will have to be removed, and when this comes about we should have a larger, a better arranged, and a fuller equipped mechanical department.

Mr. Brown,

Dear Sir,—In submitting the ninth annual report of the Mechanical Department in connection with the Ontario Agricultural College, by examining the records I find that the work has been of a very miscellaneous and mixed character; while we have not had any formidable piece of work to accomplish, yet when taken in detail, each day has had its own duty and requirements. After opening the session our first attention was partly taken up by completing fences at fields 10 and 16 (reported last year) and at the same time erecting a house for portable engine 12x24 ft., with a number of repairs in and about the stables, such as grain boxes, feed boxes, stalls and bindings; removing supporting columns and putting up new ones and making a number of boxes for experimenting with soils. The first and second weeks of November we commenced to repair and put the winter windows on the College. I here remark that this work takes up both time and expense in the way of repairing broken glass, which is damaged in some way that I am unable to explain. There were also made for this purpose several long ladders, and this has to be repeated every year, as they are so much used about the farm and buildings and are often broken. For the experimental field there were made 1000 pins 2 in. by 2 in., 24 in. long, painted and numbered for staking out the plots, and also nine range posts and sign-boards in connection with the same. About the first of May there was erected about thirty rods of post and board fence, along the south side of this field, and likewise a new patent gate at north entrance. I am frequently asked by students and others as to the comparative cost of board and wire fence and I herewith submit a statement on an average as I have reckoned. In the field board fence we have not to any extent departed from the generally adopted plan, viz., five boards, one twelve inches wide, two eight inches wide, and two seven inches, making in all with face pieces and caps at joints

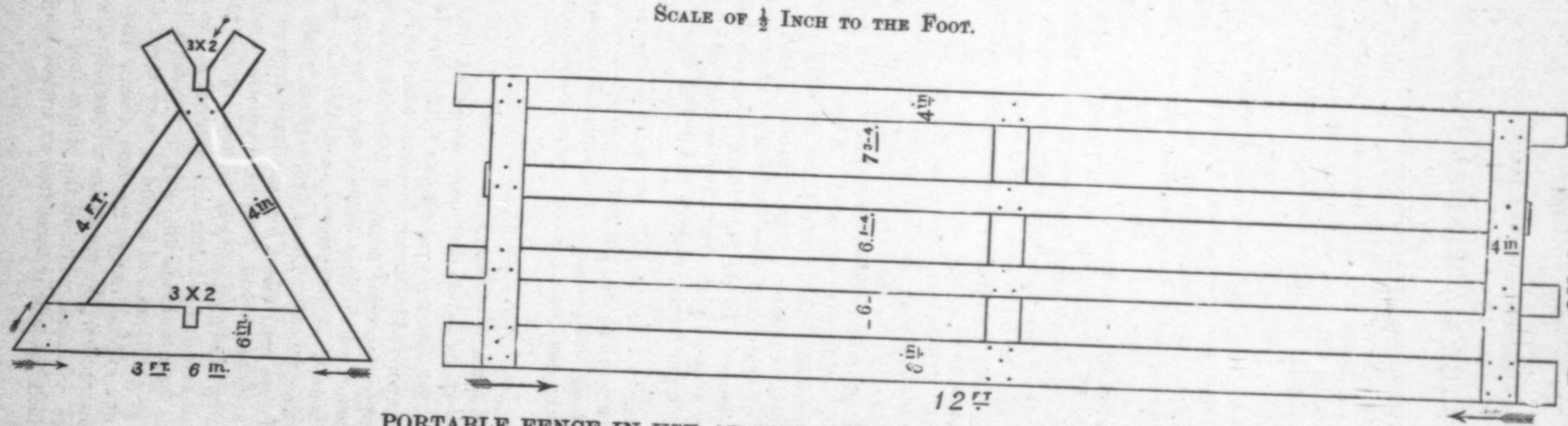
60 ft. of lumber per rod @ $12 per m.	72	cents.
Posts 7 ft. apart @ $12\frac{1}{2}$ cts., per rod	28	"
Nails, per rod @ 3 cts.	3	"
Cost of erecting, per rod	28	"
	$1.31	cents per rod.

Compare with a seven wire fence:

Seven rods of No. 8 galvanized wire weigh $8\frac{1}{2}$ lbs. @ $6\frac{1}{2}$ cts. per lb. $= 8\frac{1}{2} \times 6\frac{1}{2} = 55\frac{1}{4}$; two posts @ $12\frac{1}{2} = 25$cts; wire staples 4cts; cost of erecting 28c per rod, in all \$$1.02\frac{1}{4}$, leaving 28cts per rod in favour of seven wire fence.

We are to all appearance far removed from the time when fences can be dispensed with and it is a matter worth some consideration to the general farmer what will be efficient and at the same time inexpensive, and this can be to some extent accomplished by portable or movable fences. There are various kinds in use, of those there are two that we have found very convenient for practical purposes, one of them we have used for a number of years and which you, I think, were the first to introduce into this part of Canada; for durability and simplicity it supersedes the mortise hurdle (or sheep flake;) and any farmer with saw and hammer and material can easily construct it. I have on a number of occasions been solicited not only by students but likewise by farmers in the neighbourhood, to give diagrams of it, and it may serve a good purpose to give a representation of it in our annual report for this year. The accompanying cut will give a good idea of the construction; the pieces are all one inch thick, of common pine or pickings, the lower pieces are six inches wide, all the others four inches, the head being an equilateral triangle of which the base is three feet six inches long, the standing pieces are four

SCALE OF $\frac{1}{2}$ INCH TO THE FOOT.



PORTABLE FENCE IN USE AT THE ONTARIO EXPERIMENTAL FARM.

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feet long with notches cut as shown for receiving the ends of panels, which are twelve feet long, three feet two inches high, and nailed together on three uprights with two and a half inch wrought nails, it will be seen that when in position the fence is three feet five inches high and I have never heard any complaint of cattle or sheep getting over it.

The other fence I have reference to was reported upon a year ago; a model of it was sent to the College by Mr. Greene, of Oakville, Ont.; it is more complicated in its construction, but in some conditions preferable. To any one interested, by communicating with that gentleman no doubt he will give the information respecting it.

For the months of January, February, and part of March the Day Journal records such as the following, viz.: making wheel-barrows, double and whiffle-trees, land-rollers, gravel waggon-boxes, watering-troughs, class room blackboards and in repairing sleighs, waggons and carts, forks and hose, etc.. On an average there is one student from the department each day repairing breakages in College, such as beds, chairs, desks, doors and windows.

After Easter recess the winter windows were taken down and stowed away, all seeding implements were examined and put in trim, field fences overhauled, a few new gates were made and put up, and a quantity of portable fencing; there were also put up around the new cottages a quantity of the Merchants' Union flat steel fencing.

It became a necessity to erect some sort of a shed to stow away buggies and other like vehicles when not in use; this building 24x42 ft. is of a primitive description but serves the purpose so far.

About the first of July you stated to me a want that was often felt, for some kind of a conveyance to transport heavy animals to the railway station or other places. After due deliberation we concluded that a low four-wheeled lorry, rigged with suitable box for loading and unloading, would be the best contrivance. In this we have succeeded, as it gives the utmost satisfaction to all who have occasion to use it, which has been to a considerable extent, especially during the time of the Provincial Exhibition and the fat cattle show.

The next thing I will call your attention to, which of late years has assumed some importance: I refer to the annual sale of farm stock, etc., which brings increased preparation to all departments, and to none more so than the mechanical. After the stock was arranged and the sale bills printed, we found that there were somewhere about one hundred and eighty shipping-boxes required for sheep, pigs, and dogs which were all provided by time of sale.

There were also erected in connection with the sale a large tent or marquee 34x64 ft. the canvas and ropes being purchased from the Dominion Tent Manufacturing Company, Ottawa, the masts, wall poles, stakes, pins and benches manufactured by this department.

In a former report I endeavoured to urge on the attention of the Government the necessity there is for at least one permanent assistant in this department. The reason for this is obvious, if it is to be educational, as it has been from the commencement, and the work so far as it is done should be done properly. I would ask how it is possible for one man to oversee, to instruct, and to plan for from nine to twelve boys at one time, all endeavouring to do something; when, be it remembered, that two-thirds of those students never worked at all till they came here, and the time of the same class under my care is only about four hours per week. Would it not be advisable to have a special instruction division in the department, and time given to instruct more thoroughly in the proper use of the tools and how to work them, at the same time to show and see that they be kept in good working order? Something of this kind would make the Mechanical Department more effective and useful than it has hitherto been. Hoping that this matter will be attended to.

I am,

Sir,

Your obedient servant,

JAMES McINTOSH.

VI.—MISCELLANEOUS.

1.—Mutton and Wool in Nova Scotia and New Brunswick.

The better and more extensive pasturing of live stock is one of the prominent agricultural features of to-day with us by reason of its non-existence, except in the North-West. Under all the irregular and overheated speculation of the pioneers in this trade, our ranches will come out refined and well marked. If winter conditions be to some extent unfavourable to continuous occupation, the summer itself will suffice to make rich, and the coming and going that may be necessary with the herds, from district to district, will add to employment and a stricter system of jurisdiction, in which I am of opinion mutton and wool will take a large place. But it is not necessary to leave our older Provinces to seek for pastures. It is not difficult to see that the growing prominence of general agriculture is making more prominent the unapprehended resources of the country. Not only in arable culture, but certainly in actual letting alone of nature's gifts, in the form of grass, is Eastern Canada losing herself. Are we taking all the care under ordinary easy conditions at our own doors in New Brunwick and Nova Scotia, for example? Allow me to speak very seriously upon this subject.

Great stretches of these eastern Provinces consist of valley, hill side, upland and mountain—part covered with wood or brush and much bare of any timber, where grasses and white clover actually luxuriate. The whole aspect of the country, and the soil particularly, reminds me of much of the highlands of Scotland, which is less sheltered and has less valuable herbage than the other. The Scotch grazings produce the beef and mutton so much liked in England. What are ours doing? Allow a fiercer sun, there is the shelter: admit the greater summer drought, there are numerous rivers, streams and lakes; the soil is equal and the continuous growth is superior here. History, past and present, shows that with such a sunshine as ours some nations would be in possession of an enormous agricultural wealth by the simple economy of that sunshine in the production of repeated crops of fodder plants in one season—even from a bed of sand. Aside from irrigation in any form, we have at our own doors this moment a wool and mutton field that, properly developed, would astonish the most sanguine. Why is it being let alone? Because of two things—want of knowledge of the subject, and plenty fatness elsewhere. We feel no want, and so are largely dead to what we could do for others. I do not say that we are all dead. I have letters from several, in response to a feeler that I put out last April on this subject in the Ontario press. They are from leading practical men, acknowledging the correctness of my position, describing what they know and asking what should be done. The first thing is to show that it can be done—to do it. We require no Government help, but a Government example; there is both money and enterprise enough with individuals. They simply want the guidance of an "old hand" at the business; he alone knows how to choose variety of subject so essential to sheep life, the caring of them in all their likes and dislikes, as well as to improve the grounds most effectually at the least cost. It is clearly the duty of the Governments of New Brunswick and Nova Scotia to let the world know what field they possess in this particular. If the settlers themselves are so well off, or indifferent, or if local enterprise from St. John and Halifax as centres, is also disinterested, then legislatures must step in. It is not an old story, however, in every progressive country that Government help and example are frail things to lean upon unless thoroughly well handled by able and independent men.

The people of New Brunswick and Nova Scotia, it seems to me, do not know the resources of their own country, and acting, as I do now, quite independently of them or any other person, I charge both provinces with a great amount of shortsightedness and want of push. British Columbia excepted, they hold now the only extensive and naturally suitable lands in the Dominion for the cheap production of wool and mutton. At a rough under estimate, there are in New Brunswick and Nova Scotia some 2,000,000 acres of sheep runs, outside of all arable, bush, rock, water, meadow and the richer cattle grazing of the valleys. These should carry such a number as to produce annually, not maintain, but to sell off every year, 40,000,000 pounds of mutton and 2,000,000 pounds of wool—an annual gross revenue of, say, $2,800,000. This is no wild speculative calculation, but one based upon my own handling of the same subject in Scotland and Ontario, and upon the experience of other Canadian flock masters. The subject has two aspects—an inside one and an outside one; the system of breeding, rearing and finishing all the flock, or the bringing from a distance and finishing on the runs during October. On the former there may not yet be sufficient arable area to produce fodder and grain for winter maintenance to give encouragement to large enterprise—that is, thousands in place of hundreds of sheep on one range, this would be the independent, and provincially, the most progressive and wealthy, plan.

But it is not the one for immediate speculation and greatest profits. If sufficient blocks of land of the right stamp can be had to rent or purchase, at reasonable figures, I am satisfied the migratory system would be best. From Scotch experience of a similar character, as well as knowledge of what can be done with sheep in Ontario, and making allowance for all possible contingencies, a capital of $12,000, properly handled, would make the following annual history :—

SHEEP GRAZING IN NEW BRUNSWICK AND NOVA SCOTIA.

(Area required, 6,000 acres.)

Cost of 2,000 shearlings in Ontario, averaging 100 lbs., 1st May at $5.50		$11,000
Expense of purchasing and concentrating		500
Freight, 15 cars, Toronto to Moncton		1,200
Food by rail		100
Capital required		$12,800
Two shepherds, six months		400
Assistance shearing		160
Freight to seaboard, 1st Nov.		300
Grazing, 50c. per head		1,000
Interest on capital		500
Incidentals		200
Total debit		$15,350
Clip of 2,000 head, 15th May, medium wool, $7\frac{1}{2}$ lbs. at 17c.	$ 2,850	
Value of 1,940 (60 deaths) at seaboard, averaging 140 lbs. at $5\frac{1}{2}$c.	14,838	
Total credit		17,388
Balance, being clear profit, per annum		$2,038

Double the rent, if you choose, and allow for greater loss than I have done, and there would still remain a large margin of profit—so large as to throw doubts on the whole character of the estimate. Need I say that in this, as in some other things in the physical world, we do not see the wealth at our own feet so clearly, but seek for it away among the clouds.

2. Where to find the Best of Everything Among Sheep.

When men ask us what to recommend as best in wool and mutton, the answer is not a difficult one when taken up in the light of these days.

We are sure first of all that however suitable any particular district or farm may be for a particular breed, there cannot possibly result the success desired unless the party interested believes in his subject. With all its great value, practical knowledge is second in importance to that thorough confidence which places the object as superior to any thing else in the same line. When a man is thus satisfied in his own mind—right or wrong it may be for others—that nothing can touch his favourites as bread winners, the practical knowledge necessary will follow, though necessarily at greater risk, until practice becomes full.

In the next place we are most clearly of opinion that there is money in the proper assorting of breeds of sheep to the physical conditions known to be best for them, even to a fine point as between the extremes, which of course are not difficult to name. There is a steady unseen deterioration among sheep when long upon a run that is very different from what gave them their characteristics. A few years do not always suffice to show the back-going, and the best management in every respect cannot cope with such an irresistible agency.

Then again we think it is necessary to know only two breeds of sheep well in order to an acquaintance with all other breeds of known prominence. Among the thirty different breeds of the world, there are but *eight* of such a standing as to require a world wide recognition. This latter position must be clearly understood in this sketch, because other breeds are unquestionably the best for particular British localities that, at the same time, so far as present knowledge stands, could not leave their homes with any chance of success.

The eight leading breeds of the world are :—Lincoln, Cotswold, Leicester, Oxford Down, Hampshire Down, Shrops Down, South Down, and Merino. Now, as a matter of fact, the Leicester and South Down represent nearly all, if not all, the good things possessed or desirable in any of the six others, or for that matter of it, in any breed whatsoever. To substantiate this position it is necessary to agree upon what is wanted in an average position to meet the average market of the world.

In our opinion, the mutton and wool field in all its requirements is provided for under the following heads :—

1. Early maturing.
2. Weight of Fleece.
3. Permanency of Character.
4. Quality of Wool.
5. Weight of Flesh.
6. Constitution.
7. Freedom from Disease.
8. Impressive Powers.
9. Reliable Breeding.
10. Hardiness.
11. Uniform Fleece.
12. Quality of Flesh.
13. Prolificness.
14. Foraging.
15. Disposition.
16. Good Mothers.
17. Least Offal.
18. Wool length.
19. Cost of Production.

These are given in the order of their importance as understood by us, and their respective values are elsewhere submitted. That men differ to a considerable extent in valuing the points of any class of live stock is admitted, but we think few will dispute the list of requirements thus given. What we call the characteristic build of the frame of different breeds is a necessary accompaniment of what otherwise characterises them, so that no separate valuation of carcass points is required in this issue. We are not judging individual merit, but the standing of the breed.

In the order of classification by wool the following table will convey the explanations thus far :—

Standing of Leading Breeds of Sheep, as Recognized in 1884.

Points.	Maximum Value.	Lincoln.	Cotswold.	Leicester.	Oxford Down.	Hampshire Down.	Shropshire Down.	South Down.	Merino.
1. Early Maturing	200	150	140	200	180	170	170	180	75
2. Fleece Weight	150	150	140	130	135	130	125	80	100
3. Permanency of Character	80	40	50	35	30	60	55	75	80
4. Wool Quality	70	40	37	48	50	60	58	65	70
5. Flesh Weight	50	50	45	40	38	35	33	25	20
6. Constitution	50	25	40	40	45	35	30	50	20
7. Freedom from Disease	50	33	33	20	30	45	40	50	25
8. Impressive Power	40	20	25	35	15	30	27	40	33
9. Reliable Breeding	40	23	25	20	40	35	35	38	15
10. Hardiness	40	20	30	15	30	35	35	40	25
11. Uniform Fleece	40	30	28	20	25	35	33	35	40
12. Flesh Quality	30	15	18	12	22	28	28	30	10
13. Prolificness	30	18	20	15	30	25	25	28	10
14. Foraging	30	15	18	10	20	23	23	30	25
15. Disposition	20	12	10	18	20	15	15	13	7
16. Good Nursing	20	12	12	9	18	15	15	20	7
17. Little Offal	20	7	9	20	12	15	15	10	8
18. Wool, Length	20	7	8	10	12	15	15	18	20
19. Cost of Production	20	7	10	20	18	15	15	15	12
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We consider therefore that in view of the many requirements demanded by the average sheep runs of the world, from early maturing through to cost of production, the South Down will meet the bill better than any other. In constitution, freedom from diseases, impressive power, hardiness, quality of mutton, and making a good lamb, this breed stands unequalled; of course, in other things it is not so strong, and particularly is not up in weight of flesh and wool, but we are looking for something of everything, and not a specialty. We hold that the South Down represents most of the good things among sheep and at the same time is the type of all other Downs. On the other hand the long wools are led by the Leicester, which, with its many weaknesses, is so strong in others as to take an unchallenged position in this competitive card. It is also interesting to note that the value, 717, of the Leicester is nearest the mean of all the eight breeds (735), which may indicate the cosmopolitan character claimed by its admirers.

The study of this card is also interesting in other respects. A breed such as the Hampshire Down that takes not one first-class position, is yet the second best in all the contest, and unquestionably it is due much of this to its most recent improver—the South Down. The same remarks apply to the Shrops.

History says that in the modelling of the Oxford Down, man had in view to "obtain the *carcass* of the Leicester, the *constitution* of the South Down, and the *wool* of the Merino." How far these have been realized this Table helps to show; the failure lies in wool, in other respects the breed stands high.

For the "best of everything among sheep," take a pencil and trace a line from each to each of the highest points, and it results as a matter of fact in experience that we want the early maturing, the large proportion of butchers' meat, and the small cost of production of the Leicester; the weight of flesh and wool of the Lincoln; the permanency of character, quality of wool, and uniform fleece of the Merino; the constitution, freedom from disease, impressive power, hardiness, quality of flesh, foraging and good nursing, of the South Down, with the reliable breeding, prolificness, and disposition of the Oxford Down.

3. Standing of Leading Breeds of Cattle, as Recognized in 1884.

This is certainly no new subject to the average reader and practical cattle-man. Indeed, otherwise, it may be getting threadbare in the view of many, as well as muddled, and at any rate, not one whit more reliable, some may think. The agricultural press of Europe, Australia and America has of late years given a great deal of valuable information on the various breeds of cattle as experienced in particular districts, for special purposes. But men remain unsatisfied. So long as the live stock interest holds the place it now occupies, there will always be some of us who "want to know" what experts at least, if not every advanced farmer, already know, in regard to the conduct of both cattle and sheep.

This form of knowledge has been very prominently brought home to this Experimental Farm during the last two years for several reasons, and particularly in connection with the education of our "Special Live Stock Class." Our acquaintance with breeds is supposed to be of the widest character, and as the class in question, with increasing numbers, is of that intelligent keenness which delights the teacher, no effort is being left to further their study of such an interesting field. In furtherance of these ends we have asked the Government to provide us with those breeds of cattle and sheep generally recognized as the best. We think that at the present time they are limited to *nine* of each. The sheep are discussed in another chapter herewith, and this shall therefore be confined to cattle.

With one exception, it is not necessary to leave the British Isles for what any one wants in any line of cattle life, and curiously enough, the same remark applies to sheep. We have no time at present to show what way the characteristics of breeds have been cultivated and established, nor to what particular purpose each is best adapted in Canada. We shall, for the present, meet a good deal of the demand by giving a list of points embracing all the field, with a valuation according to the best of our knowledge. Of course men differ in opinion as to both the order of merit and the special valuation of points. The character of the controversy may be imagined, were an admirer of each breed to be appointed to value such a table as we now present to the country. It could not be done by them, and is clearly more safe in the hands of such as ourselves, whose only interest is, in this regard, that of everybody's. We are aware of the danger of such a position, but having had to taste as much vinegar as this during the last nine years it would be weak to withdraw now.

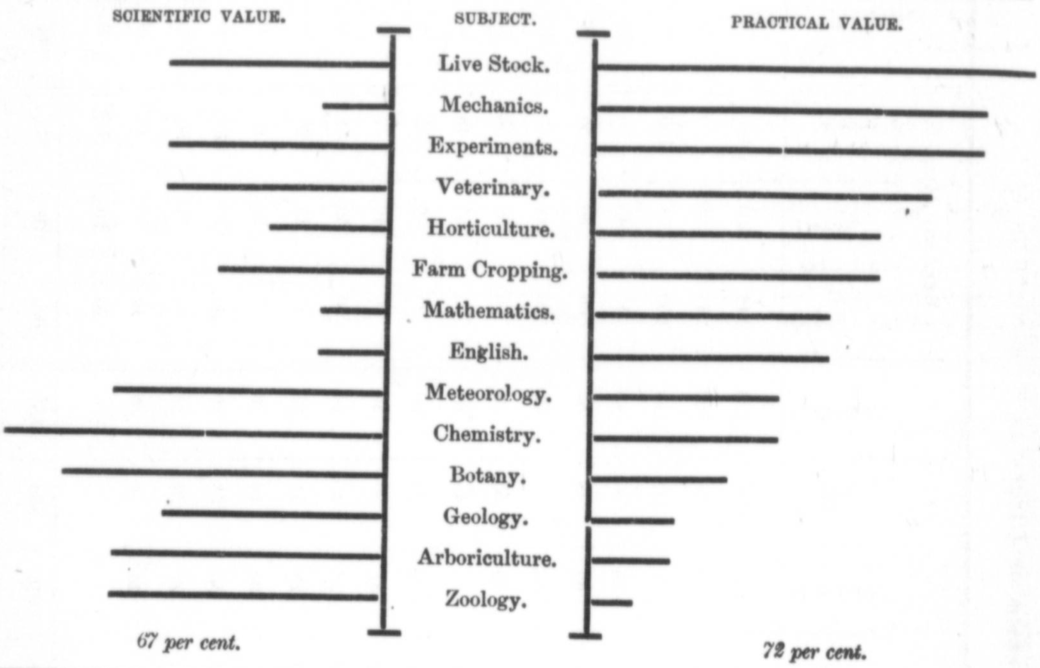
We think there are three distinct types of cattle, practically considered, and as exemplified by special characteristics. These characteristics can only lead to flesh and milk, the working ox being not only a third rate, but also a thing of education to any class. We still hold the position taken a few years ago, that no one breed of cattle or sheep can give the like value of everything that two other breeds can by an equal valuation of points. There appears to be a contradiction to this assertion in the case of this table. For example, the best for beefing *under every possible circumstance* is the Hereford at 916, and the best in milking is the Dutch at 918; the mean of these two is 917, which is not equal to the Devon that takes a valuation of 938 as a breed possessing both beefing and milking properties. But, the Devon with the Norfolk and Suffolk Polls is valued upon a separate basis from the *special* beefer and milk breeds, and therefore cannot properly be compared with either. Were the Devon placed as a beefer only, or as a milker only, it would occupy a comparatively low position, but, taken for what it can do in its own field, it stands high. Or in other words, it may be said that any breed prominent both for beef and milk is not worth a valuation scale of 1000. In other respects the valuation will be easily understood.

STANDING OF LEADING BREEDS OF CATTLE AS RECOGNIZED IN 1884.

Points.	BEEF. Max. Value.	Short-horn.	Hereford.	A. A. Poll.	Galloway.	BEEF AND MILK. Max. Value.	Devon.	N. & S. Polls.	MILK. Max. Value.	Dutch.	Ayrshire.	Jersey.
1. Early Maturity	200	200	180	195	125	140	130	140	75	75	60	55
2. Permanence of Character	100	80	90	68	100	85	85	70	70	63	65	70
3. Weight of Flesh	150	150	134	143	110	100	85	100	70	70	50	35
4. Condition	50	40	50	36	46	50	45	50	50	50	43	30
5. Freedom from disease	60	50	60	48	57	60	60	55	60	60	50	57
6. Impressive power	40	40	35	35	33	40	40	25	40	40	33	35
7. Reliable Breeding	60	48	60	50	58	60	60	54	60	60	55	56
8. Hardiness	60	40	55	45	60	55	55	48	50	45	50	30
9. Quality of Flesh	30	18	22	24	30	25	20	25	20	13	20	18
10. Foraging	40	27	37	30	40	40	40	37	40	34	40	27
11. Disposition	35	35	28	33	24	50	50	38	60	55	48	60
12. Good Mothers	25	20	25	21	23	25	25	20	25	23	19	25
13. Least Offal	20	17	20	18	20	15	13	15	10	10	9	8
14. Quantity of Milk	60	60	55	53	50	130	110	130	200	200	185	100
15. Quality of Milk	25	25	20	22	20	65	65	50	100	50	30	100
16. Cost of Production	45	42	45	44	36	40	35	40	40	40	35	28
17. Long use						20	20	17	30	30	25	20
	1000	892	916	865	832	1000	938	914	1000	918	817	754

4. What we are Teaching.

This, as a variety in form of presentation, is easily understood by a simple diagram—and while, of course, the relative value and importance of each subject may be disputed, it must be remembered that the lines of value, as follows, are affected by the appliances and opportunities on hand, as well as what is considered to be their relative importance :—



Scientifically and practically combined, therefore, we have a good idea of the work of the College and Farm as at present conducted.

I have the honour to be,

Sir,

Your obedient servant,

W. BROWN.

APPENDIX.

INVENTORY AND VALUATION OF LIVE STOCK AND IMPLEMENTS ON HAND DECEMBER 31st, 1883.

Horses.

13 working horses	$2,350 00

Cattle.

1 Shorthorn bull	
1 Shorthorn bull calf	400 00
1 Shorthorn cow	200 00
1 West Highland bull	400 00
1 Polled Angus cow	100 00
1 grade heifer	1,000 00
8 milch cows	75 00
9 steers (not on experimental feeding)	320 00
	648 00

Experimental Cattle.

35 steers	1,732 50
5 heifers	227 70

Sheep.

2 Merino shearling ewes	
22 experimental wethers	40 00
5 wether lambs	110 00
	25 00

Pigs.

2 boars, Berkshire and Essex	150 00
4 sows for breeding	200 00
15 young pigs, various ages	150 00
Scotch collie dogs	50 00
	$8,178 20
Value of farm implements per inventory	$5,000 00
Value of garden stock and implements	1,380 00
Value of experimental stock and implements	1,026 00
Value of carpenter shop, tools, etc	310 00
	$15,894 20

PART VII.

REPORT

ON

HORTICULTURE AND ARBORICULTURE.

To the Honourable, the Commissioner of Agriculture:

SIR,—In briefly reporting on the practical Horticultural work of this Institution for the year about to close, I beg to say that, notwithstanding a peculiar and somewhat precarious season for crops, in other respects it has been specially favourable for many of our operations on hand, particularly for spring work, transplanting, sodding, etc., and on the whole, average crops have been secured, and considerable progress has been made in the direction of the object sought to be attained.

Our principal work during the summer months has been the improvement of the grounds, in accordance with a plan adopted by the Government in 1882, and the work commenced in the latter months of that year; but comparatively little was accomplished until this season, when operations commenced about the first of April, or as early as practicable from the depth of snow, by transplanting a number of evergreens, consisting of Norway spruce and Austrian pine, the largest of which were prepared in the fall by digging a trench about eighteen inches wide around and partially underneath the tree, severing all the large roots and leaving a ball from one to two tons in weight, according to size of trees, filling the trench with straw, or stable manure, to prevent the frost getting underneath, but allowing the ball to get frozen solid. In this state they were moved in a stone-boat drawn by a span of horses, into holes previously prepared for them. These trees, over one hundred in number, which had been growing on the grounds from eight to ten years, being planted at or soon after the origin of the Institution, and now varying from six to sixteen feet in height, were thus successfully moved into desirable positions without a solitary failure. This may readily be attributed to the unusually favourable season for such operations, and we willingly admit that the cool season and extra amount of moisture throughout the early summer months had much to do with the success, but the experiment clearly proves that our Canadian climate affords an opportunity of thus moving large and valuable ornamental trees that cannot so readily be done by any other modes. In the further prosecution of the work, the principal drive leading to the College was completed, also the drives and walks connected with the new buildings erected the previous year, the design for flower garden laid out, involving an amount of sodding, bounding the walks and beds to the extent of many hundred square yards, and I may here say that the flower beds when furnished with plants, looked exceedingly well, and were admired by all throughout the season.

With the exception of about three acres around the new building, which were seeded down in the spring (and have done well), the whole ground has been kept in a cultivated state during the summer, all necessary grading and levelling being carried on at the same time, to the full extent of the means appropriated for that purpose, leaving the land, as it now is, in good condition for seeding down in the spring, and planting, as intended and as provided for in the plan, an arboretum, consisting of all the trees and shrubs (native or exotic), deemed sufficiently hardy to stand this climate, arranged in groups according to their respective families or natural orders. This idea was conceived and a selection made by a committee of the Fruit Growers' Society, sanctioned by the Government, and commenced in 1880, and considerably increased the following year, but to admit of the grading and leveling required in the improvement of the grounds, it was found necessary to lift the whole of the plants, which was done with all possible care in the fall of 1882, and last spring, with a good many additions, they were planted in rows in a small nursery half an acre in extent, established in the experimental ground, partially arranged according to their respective families. The collection now amounts to over four hundred distinct varieties of deciduous and evergreen trees and shrubs, representing over fifty natural orders, to be planted in the spring, as above stated.

There is also much to be done in the way of heavy transplanting from the overcrowded borders, in many instances three or four trees occupying the space required by one, and, unless speedily relieved, the whole will be injured. At this work we were engaged until the winter set in.

Kitchen Garden.

In this department we have had both success and failure. Many of the culinary vegetables were plenty in quantity and excellent in quality. The crops of asparagus, beans, peas, spinach, beets, carrots, onions and celery were above the average, and all that could reasonably be desired. Early potatoes, although a heavy crop, and proving good throughout the months of July and August, about the end of the latter month, disease made its appearance and spread steadily and so rapidly, that by the end of September, the crop was comparatively worthless. Of twelve or fifteen varieties, all seemed to suffer alike. Corn, cauliflower and winter cabbage, were somewhat late, and only about two-thirds matured sufficiently for use. Cucumbers, melons, citrons, squash and tomatoes although very promising throughout the summer months, proved all but a failure. The almost unprecedented severity of the frost, coming so early as the first week in September, cut them completely down, so that they were serviceable only as an addition to the compost pile.

The fruit trees in the kitchen garden are just coming into bearing, and a few good samples of apples were produced this year; also a few cherries and plums, but I regret to say that "black knot" has made its appearance in the latter to such an extent, that in using the only known remedy, viz., the knife, we have already mutilated some of the best trees.

Orchards.

Of the fruit department generally, I need say but little, it being under the supervision of the Fruit Growers' Association, whose committee will report, and I have no doubt will give all due prominence to this branch, which they have done so much to foster and forward, and whose object and wishes, it need hardly be said, I have endeavoured, to the best of my ability, to carry out.

It may be permissible, however, to say that all fruit trees and shrubs stood the past winter remarkably well, being mostly protected by a deep covering of snow from the latter part of November to the first of April.

Small fruits—gooseberries, currants and raspberries—were fairly productive, and the plants made a good average growth.

Strawberries, although promising well in the early spring, were attacked by a blight during the flowering season, and, consequently, but a poor crop of very indifferent fruits was secured.

Grape vines, on account of the cool and rather wet season, were somewhat backward, especially the young vines planted last spring, which made but a small and delicate growth. Yet they are nearly all alive, and, we expect, have made considerable root growth. The older vines, however, now planted three years, made a more vigorous growth of wood, and showed quite a few bunches of fruits, but, from the lateness of the season, were unlikely to ripen. The severe frosts, however, referred to as coming so early, put an end to all doubts, by completely destroying both the fruit and the foliage and killing back the unmatured wood, in some cases to near the ground, but still sufficient wood remains to shew, with a favourable season for fruit next year, a variety of sorts seldom met with on an equal space, which will be understood when I say that the ground under three acres in extent, with about five hundred vines in all, contains a variety of over eighty different sorts (a list of which was given in last year's report), each having claim to some distinctive property or merit, according to the tastes or prejudices of those who have introduced them, and, growing side by side under equal conditions they cannot fail to prove instructive to students as well as to visitors who are interested in grape culture.

APPLE ORCHARD.—Of the old apple orchard adjoining the College Buildings, which has done good service in past years, little can now be said. During the last two years it has been so reduced by the changes taking place on the grounds that only a few trees on the south side now remain, which have given a few apples this season, and they in their turn will also soon have to give way for required alterations.

But I am glad to say that the young orchard continues in a thriving condition, and promises in the course of a few years to make up for all deficiencies. It is now about eighteen acres in extent, and contains over twelve hundred fruit trees, including one hundred and thirty varieties of apples, fifty-five of pears, thirty of plums and eighteen varieties of cherries.

About two acres of ground yet remain to be planted, intended principally for new varieties from time to time as presented, a committee of the Fruit Growers' Society making the selection, a few vacancies have occurred during the year, some of them incidental to cultivation, which it is intended to fill up in the coming spring. A shelter belt or wind break was completed last spring, along the north side of the orchard, by planting over two hundred Norway spruce from four to six feet in height, all of which are growing without a single failure. Indeed, all planting and transplanting operations, on account of copious and timely showers throughout the growing months, has this season been specially successful.

NURSERY.—The nursery ground already referred to, is divided into five plots, each to be bounded on the north and south sides by hedges composed of different shrubs. When completed they will be ten in number, intended as permanent specimen hedges. Four of these only are planted, viz., white cedar, Norway spruce, barberry and buckthorn. The various plots now contain, besides the material intended for arboretum, from two to three thousand seedling forest trees, consisting of black walnut, butternut, hickory, white oak, birch, ash, elm, several varieties of maple, Norway and native spruce, etc., some of which have been raised from seed in the garden or experimental ground, and intended for the farther extension of forest tree clumps on various parts of the farm, as from year to year may be decided on, for the double purpose of effect in breaking views and showing the growth and progress of the trees under cultivation.

A clump of each of the following trees is already planted: black walnut, butternut, sugar maple and larch, native and European; also a mixed clump, containing ash, elm, birch, linden, larch, walnut and butternut, etc.

The first of these were planted three years ago, under the superintendance of Professor Brown. They are now well established, and last year have made a large and healthy growth.

GREENHOUSES.

I regret to say that in this department but little progress has been made during the year, although a few new plants have been added to our collection, and sufficient material secured to keep up the stock of bedding plants, etc. The buildings still remain in the unsatisfactory and unsafe state as reported for the last three years, and, although we have no desire to grumble, this remains our principal grievance. The many and pressing demands for alterations and repairs are postponed from time to time, fully expecting each year that the present structure will no longer be necessary, from the decayed and shaky condition of the whole fabric, externally and internally; with its defective heating flues, it is only with the greatest care and attention that plants can be kept in anything like a healthy state through the winter, and if we are to keep pace with the requirements, I cannot urge too strongly the necessity for having the proposed new buildings erected the coming season.

The present potting shed and workshop is also very unsightly in the position it occupies, as well as unsuitable for the purpose required, it being little better than an open shed which cannot be heated, is very incommodious and uncomfortable for the students at times when inside labour only is practicable.

In the winter months, as heretofore, a course of practical instruction, consisting of root and top grafting, budding, layering and the various modes of propagating plants, was given, and practised by all the students taking their routine in this department.

For the senior or second year students a further course was pursued, including the general care and management of greenhouse and half-hardy plants, the various systems of heating, the ventilation, temperature and moisture required, the composition of desirable soils, the potting, growing hybridising and selection of plants generally.

The construction of hotbeds, their utility and necessary care, with the usual means of success and the common causes of failure, some of the insect pests and diseases, with their cause and cure. Also the common and technical names of the plants we have, with the natural orders to which they belong.

And I have pleasure in saying that the majority of the students taking this course passed a very creditable examination at the close of the session.

The following is a list of the greenhouse and bedding plants that we have in stock.

JAS. FORSYTH,
Superintendent.

LIST OF GREENHOUSE PLANTS.

ACANTHACEÆ.

Justicia carnea	flesh-colored Acanthad.
" magnifica	large-flowered "
" pumila	dwarf "
Labonia floribunda	free-flowering Labonia.
Sanchezia nobilis	noble Sanchezia.

AMARANTACEÆ.

Alternanthera achyrantha	chaff-flowered Alternanthera.
" procumbens	trailing "
Achyranthus tricolor	three-colored Achyranthus.
Iresine accuminata	acute-leaved Amaranth.
" Lindenii	Lindens "
Amaranthus tricolor	three-colored "
" Caudatus	love lies bleeding "
Celosia cristata	crested Cockscomb.
" compacta	compact "
" pyramidalis	tall-feathery "

AMARYLLIDACEÆ.

Amaryllis Belladonna	Belladonna Lily.
" Blanda	Charming "
Agave Americana	Am. Aloe or Century Plant.
" Yuccæfolia	Yucca-leaved.

APOCYNACEÆ.

Allamanda Cathartica	cathartic Allamanda.
" Schotti	Schott's "
Dipladenia accuminata	pointed Dogbane.
" Splendens	shining "
Nerium carneum	flesh-colored Oleander.
" alba flore pleno	white double-flowered Oleander.
Vinca major variegata	large variegated Periwinkle.
" minor	smaller "
Rhyncospermum jasminoides	Jasmine-like Dogbane.

ARACEÆ.

Collocasia metallica	metal-like Collocasia.
" gigantea	large "
Caladium esculentum	esculent caladium.
" bicolor	two-colored "
" tricolor	three " "
Philodendron magnificum	large Philodendron.

ARALIACEÆ.

Hedera helix	common English ivy.
" canariensis	Irish "
" folis aurea	golden-leaved "

ASCLEPIADACEÆ.

Hoya carnosa	flesh-leaved wax plant.
" bella	beautiful "
" fruticosa	shrubby "
Stephanotis florabunda	free-flowering Stephanotus.

ASTERACEÆ.

Artemisia argentea	silvery wormwood.
" abrotanum	Southernwood.
Centaurea candidissima	very compact centaurea.
" argentea	silvery "
" gymnocerpa	cut-leaved "
Cineraria multiflora	many-flowered Cineraria.
" maritima	sea-side "
" admiration	hybrid "
Chrysanthemum aureum	golden chrysanthemum.
" hybrida	hybrid "
Gazenia spleudens	showy gazenia.
" subulata	awl-leaved "
Gnaphalium albescens	white cudwort.
" obtusifolio	blunt-leaved cudwort.
Pyrethrum flore-pleno	double white feverfew.
" aureum	golden "
Stevia serrata	saw-leaved stevia.
" incanescens	hoary "
" variegata	variegated "
Tussilago discolor	two-colored coltsfoot.
" farfarafolis	variegated "
Eupatorium pubescens	downy eupatorium.
" chamdærifolia	germander-leaved "
" odoratum	scented "

Ageratum Mexicana	Mexican ageratum.
" angustifolia	
" Nana	narrow-leaved "
Othonna linifolia	dwarf "
	flax-leaved ragwork.

BEGONIACEÆ.

Begonia fuchsoides	
" Rex	fuchsia-like Begonia.
" bulbilifera	foliage "
	bulb-bearing "

BRASSICACEÆ.

Alyssum maritima	
" flore pleno	sea-side alyssum.
" variegata	double-flowering alyssum.
Mathiola purpurea	variegated "
" alba flore pleno	purple stock.
	double white stock.

CARYOPHLACEÆ.

Cerastium tomentosus	downy mouse-ear.
Dianthus caryophloides	carnation pink.
" Japonicus	Japan "
" Chinensis	China or Indian pink.
" " flore-pleno	double "

CACTACEÆ.

Cereus grandiflora	
" nigra	night-blooming Cereus.
" polygonus	black "
Epiphyllum truncatum	many-angled "
" fragrans	Indian-fig cactus.
	fragrant "

CELASTRACEÆ.

Euonymus Japonica	
" aurea variegata	Japan Spindle Tree.
	golden variegated.

CINCHONACEÆ.

Bouvardia splendens	
" pubescus	shining Bouvardia.
Gardenia flore-pleno	downy "
" Florida	double-flowered Cape Jasmine.
Ixora arborea	flowery "
" coccinea	tree-like Ixora "
	scarlet " "

COMMELINACEÆ.

Tradescantia divaricata	
" zebrina	straggling spiderwort.
	striped "

CORNACEÆ.

Aucuba Jopanica	blotch-leaved Japan Aucuba.

CRASSULACEÆ.

Crassula ericoides	heath-like house leek.
" ramosa	branchy "
Echeveria grandiflora	large-flowering "
" retusa	blunt-leaved "
" metallica	metal-like "
Sedum glacum	milky stonecrop.
" variegata	variegated stonecrop.
Sempervivium stellata	starred house leek.
" tectorum	roof "

CYCADACÆ.

Cycas angulata	sharp-cornered sago tree.
" revoluta	rolled-backed-leaved.

EHRETIACEÆ.

Heliotropium corymbosum	corymbed Turnsole.
" incarnum	hoary "
" linifolium	flax-leaved "

ERACACEÆ.

Erica formosa	handsome heath.
" fragrans	fragrant "
" globosa	globe-flowered heath.
Azalea arborescens	tree-like azalea.
" florida	flowery "
" alba flore pleno	double-white azalea.
Rhododendron ponticum	rose bay rhododendron.
" hybrida	hybrid var. "

EUPHORBIACEÆ.

Euphorbia jacquinifolia	milkweed or spurgewort.
" splendens	shining "
Croton rosmarinifolia	rosemary-leaved croton.
" angustifolia	narrow-leaved "
" discolor	two-leaved "
Poinsittia pulcherrima	very pretty poinsittia.
" plenissima	very double "

FABACEÆ.

Chorozema angustifolia	narrow-leaved chorozema.
" ilicifolia	holly-leaved "
" cordata	heart-shaped "
Coronilla glauca	milky-green coronilla.
" variegata	variegated "
Genista umbellata	" broom.
" Scoparius	Scotch "
Mimosa pudica	sensitive plant.

GERANIACEÆ.

Geranium canescens	hoary-leaved crane's bill.
" argentium	silvery "
" incanescens	many-cleft "

Geranium flora pleno	double-flowering crane's bill.
Pelargonium speciosum	showy stork's bill.
" Andrewsii	Andrew's var. Stork's bill.

GESNERACEÆ.

Achimenes formosa	handsome achimenes.
" grandiflora	large-flowering "

GRAMINACEÆ.

Eulalia Japonica variegata	variegated eulalia.
" " zebrina	striped "
Panicum variegatum	variegated panic-grass.
" tricolor	three-colored panic-grass.

HYDRANGEACEÆ.

Hydrangea Japonica	Japan Hydrangea.
" speciosa	showy "

JASMINACEÆ.

Jaeminum odoratissima	sweet-scented Jasmine.
" grandiflora	large-flowered "

LAMIACEÆ.

Coleus barbatus	bearded Foliage Plant.
" Blumi	Blume's "
" hybrida	hybrid var. "
Salvia splendens	showy Sage.
" patens	spreading Sage.
" coccinea	scarlet "
Thymus aurea variegata	golden variegated Thyme.
" argentea "	silver " "
Lavandula pubescens	downy Lavander.
" spica	common Lavander.

LILIACEÆ.

Lilium auratum	gold-tipped Lily.
" Japonicum	Japan "
" Lancifolium	lance-leaved "
" " rubrum	white and red "
Aspidistra lurida	lurid Aspidistra.
" variegata	variegated "
Cordyline Australis	Australian Club-Palm.
Dracæna Australis	Australian Dragon-Tree.
" purpurea	purple "
" gracilis	slender "
" Cooperii	hybrid var. "
Hemerocallis flava	yellow Day-lily.
" speciosa	showy "
" variegata	variegated "
Scilla villosa	Sea-leek or Squill.
" hyacinth	hyacinth-leaved "
Yucca filamentosa	thready Adam's needle.
" aloifolio	aloe-like "
" gloriosa	glorious "

LOBELIACEÆ.

Lobelia gracilis	slender Lobelia.
" erinus	blue "
" speciosa	showy "

LYCOPODACEÆ.

Lycopodium denticulatum	toothed club-moss.
" stoloniferum	runner-bearing club-moss.
" densum	dense "

MALVACEÆ.

Abutilon striatum	striped flowering Maple.
" Thomsoni	Thomson's "
" Boule de Neige	large white "
Hibiscus coccinea	scarlet Mallow.
" heterophyllus	various-leaved Mallow.

MARANTACEÆ.

Maranta bicolor	two-colored Arrowroot.
" zebrina	striped-leaved "
Canna gigantea	largest Indian shot.
" Indica	Indian "
" atropurpurea	dark purple "

MORACEÆ.

Ficus elastica	elastic-gum India-rubber tree.
" macroylla	large-leaved Fig tree.

MYRTACEÆ.

Eucalyptus globulus	Australian blue Gum tree.
" myrtifolio	myrtle-leaved "
Punica Albescens flore-pleno	double-white Pomegranate.
" rubrum	red "

MUSACEÆ.

Musa cavendishii	Cavendish's Banana.

OLEACEÆ.

Olea fragrans	fragrant Olivewort.
Forsythia viridissina	very green "
" suspensa	hanging "

ONAGRACEÆ.

Fuchsia fulgens	glowing Fuchsia.
" splendens	showy "
" avalanch	hybrid var. "

ORONTIACEÆ.

Calla Ethiopica	Egyptian or Calla Lily.

OXALIDACEÆ.	
Oxalis Brasiliensis	Brazilian wood-sorrel.
“ multiflora	many-flowered “
PALMACEÆ.	
Borassus flabelliformis	fan-leaved Palm.
PHILESIACEÆ.	
Lapageria rosea	rose-flowered Lapageria.
PASSIFLORACEÆ.	
Passiflora alata	winged-stalked Passion flower.
“ quadrangulata	square-stemmed “
PIPERACEÆ.	
Peperomia	stained Peperomia.
PINACEÆ.	
Cupressus Australis	slender-branched Cypress.
“ pendula	drooping “ “
Sequoia gigantea	gigantic pine of California.
PLUMBAGINACEÆ.	
Plumbago capensis	Cape Leadwort.
“ Mexicana	Mexican “
POLYGALACEÆ.	
Polygala gracilis	slender Milkwort.
“ purpurea	purple “
POLYMONIACEÆ.	
Cobœa scandens	climbing Cobœa.
“ variegata	variegated “
Coccoloba uvifera	grape-bearing Coccoloba.
POLYPODIACEÆ.	
Dicksonia scandens	climbing Fern.
“ arborescens	tree-like “
Adiantum pedatum	Am. maiden hair Fern.
“ capillus veneris	British “ “
Pteris tremula	trembling “
“ cretica	creton “
Struthiopteris Germanica	German Ostrich Fern.
“ Pennsylvanica	Pen. “ “
Cystopteris bulbiferum	bulb-bearing “
“ fragilis	fragile “
PRIMULACEÆ.	
Primula Japonica	Japan Primrose.
“ sinensis	Chinese “

Cyclamen Persicum	Persian Sow-bread.
" Odoratum	scented "
" hederifolia	Ivy-leaved.

RANUNCULACEÆ.

Clematis Americana	American Virgin's-bower.
" flamula	sweet-scented "
" Jackmanii	hybrid var. "

ROSACEÆ.

Rosa damascena	damask Rose.
" muscosa	moss "
" Borboniana	Bourbon "
" Indica	China "
Rubus Japonicus	Japan Bramble.
" " flore-pleno	double-flowering Bramble.

SAXIFRAGACEÆ.

Saxifraga tomentosa	woolly London pride.

SCROPHULARACEÆ.

Alonsoa acutifolia	acute-leaved Alonsoa.
" grandiflora	large-flowered "
Browallia elata	tall Browallia.
" speciosa	showy "
Linaria cymbalaria	Toad's flax.
" reticulata	net-leaved Toad's flax.
Maurandya Barclayana	Barclay's Maurandya.
semperflorens	ever-flowering "
Mimulus tricolor	three-colored Monkey-flower.
" lutens	yellow "
" moschatus	musk plant.
Pentstemon pulchellum	pretty Pentstemon.
" campanulatum	bell-flower "
Veronica dianthifolia	pink-like Speedwell.
" gracilis	slender "

SMILACEÆ.

Smilax sagittæfolia	arrow-leaved Smilax.
" sarsaparilla	sarsaparilla "

SOLONACEÆ.

Datura arborea	tree-like Thorn Apple.
" fatuosa	proud "
Cestrum auranticum	orange-colored Nightshade.
" latifolium	broad-leaved "
Fabiana imbricata	imbricated Nightshade.
" stricta	erect "
Habrothamnus elegans	" "
" tomentosus	downy "
Nierembergia gracilis	slender "
" aristata	awned-leaved "
Petunia maxima	large flowering Petunia.

Petunia fimbricata

Solanum macrocarpum .... fringed flowering Petunio.

" pseudo-capsicum .... large-fruited Jerusalem Cherry.

.... bastard Capsicum.

TERNSTROMIACEÆ.

Camellia Japonica ....

" alba flore-pleno .... Japan Rose.

.... double white Camellia.

VERBENACEÆ.

Verbena diffusa ....

" hybrida .... spreading Vervian.

Aloysia citriodora .... hybrid var. "

Lantana salviæfolia .... sweet-scented Verbena.

" multiflora .... sage-leaved Lantana.

" coccinea .... many-flowered "

Clerodendrum Balfordii .... scarlet "

" fragrans .... Balford's Clerodendrum.

" flore-pleno .... fragrant "

.... double-flowering "

URTIACEÆ.

Pilea muscosa .... mossy pistol plant.

VITACEÆ.

Cissus discolor .... two-colored vinewort.