ELEVENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

FOR THE YEAR ENDING 31ST DECEMBER,

1885.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY WARWICK & SONS, 26 & 28 FRONT STREET WEST.
1886

CONTENTS.

PAGE.

41
41

43
44
45
1
71
82
7
88
98
100

101
175
184
218

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

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To the Honou

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PART I.—T
PART II.—T
PART III.—T
PART IV.—T

PART V.—T
PART VI.—T

REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

GUELPH,

FOR THE

YEAR COMMENCING THE 1st JANUARY AND ENDING 31st DECEMBER,

1885.

GUELPH, January 2, 1886.

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

DEAR SIR,—I have the honour to submit herewith for your perusal a brief statement of the work and statistics of the Ontario Agricultural College and Experimental Farm for the year 1885.

Our account of the year's operations is presented in six parts:—

PART I.—THE REPORT OF THE PRESIDENT.
PART II.—THE REPORT OF THE PROFESSOR OF GEOLOGY AND NATURAL HISTORY.
PART III.—THE REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.
PART IV.—THE REPORT OF THE PROFESSOR OF AGRICULTURE AND FARM SUPERINTENDENT.
PART V.—THE REPORT OF THE FOREMAN OF THE HORTICULTURAL DEPARTMENT.
PART VI.—THE REPORT OF THE PROFESSOR OF DAIRYING.

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

JAMES MILLS,
President.

PART I.

REPORT OF THE PRESIDENT.

INTRODUCTION.

Before proceeding to report on our work and attendance for the past year, I wish to say a word regarding agricultural education in the Dominion of Canada.

For many years the Province of Ontario—not to speak of the other parts of the Dominion—has had a good school system. We are proud of this system and congratulate ourselves on its excellence.

Public Schools.

Our public schools are among the best in the world. We do not say that they are faultless; but in many respects I think they are as nearly perfect as we can make them. We may differ somewhat about the programme of studies, but as regards the division of the country into sections, uniformity of text-books, the training and licensing of teachers, the system of inspection, and the means of support, I do not think there is much room for improvement; and, as regards the course of study, we must admit that it embraces all the essentials of an elementary education, and that the boy or girl who masters it will be fairly well equipped for the duties and responsibilities of Canadian life. The instruction also is, generally speaking, thorough, and it is always within the reach of the poorest in the land.

High Schools.

Our high schools also, distributed all over the Province, will compare favourably with schools of the same grade in other countries. They have done good work since 1860, but especially within the last ten years, they have furnished an excellent type of intermediate education. The course of study in these schools is broad, the teachers are generally well equipped, and the teaching is good, so that, within a few miles of home, the young women of every county in Ontario can get an education which will fit them for the varied duties and responsibilities of their sphere in life; and the young men can readily qualify themselves for mercantile life, for any of the learned professions, or for the university—all without charge, or for a very small fee.

So in regard to these two classes of schools, the Province of Ontario has more or less ground for claiming to be in advance of most other places on this continent; but in the matter of

Technical Schools

we must admit that we have very little to boast of. In almost every State in the American Union there is, at least, one school or college maintained "to teach such

branches of learning as are related to agriculture and the mechanic arts, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." In the Province of Ontario, and I may add in the whole Dominion of Canada, we have no schools of any kind for instruction in the mechanic arts, and very few for instruction in agriculture.

The people of this country seem never to have seriously thonght of doing anything to develop the inventive faculties or improve the mechanical skill of young Canadians; and they have been slow to admit that instruction in the principles of agriculture would be of advantage to us. Hence, we have not as yet made much progress in this department of education.

Agricultural Education.

Speaking more particularly of agricultural education, I beg to say that, in my opinion, there are two or three circumstances which have hitherto prevented us from advancing so rapidly as we might have done in this direction: first, the unfortunate fact that those among us who have talked and written most on agriculture have not always been the most successful farmers; in too many instances their practice has very greatly discredited their teaching. Secondly, men without any practical knowledge of farm work, have occasionally undertaken to manage farms according to the instruction given in books, and have nearly always failed. Hence, the cry against "book-farming," and the wide-spread conviction that the more a man reads and studies, the less likely he is to succeed as a farmer.

Certainly, it is much to be regretted that men do not always practise what they preach, even in agriculture; and it is a misfortune that persons sometimes invest money in land, and undertake to farm with no other preparation than mere book knowledge; but all this has very little to do with the question of educating young men for the farm; and those who sneer at agricultural education, as if it were synonymous with "book-farming," make a mistake. They fail to distinguish between things which differ, and their vigorous thrusts are altogether wide of the mark; for no advocate of agricultural education has ever maintained that mere study, even of books on agriculture, will fit a young man for farming. Far from it. We are well aware that nothing can take the place of a thorough apprenticeship in every department of farm work, and that no amount of theoretical, or even practical knowledge of the minutest details can attain success, without good management, and the constant exercise of industry, prudence and economy. What we do maintain is, that neither theory nor practice should stand alone; but that they should go hand in hand, and the farm apprentice receive instruction in both. In fact, we are unable to see how any one can doubt the statement, that the young man who has chosen agriculture as his occupation, will be benefited by acquainting himself with the experience of the most successful farmers, by studying their practice, and discussing the principles and maxims which guided them on the way to success.

Further, the first settlers in this country, the men who cleared the farms which we now occupy, were nearly all from the middle and lower classes of society in Great Britain and Ireland. They represented a variety of occupations, but very few of them had either a theoretical or practical knowledge of agriculture. Most of them could truthfully say that they had started in the woods with little or no money, and a very meagre education; but they had gone to work with a will, and were successful. Having virgin soils to cultivate, they raised large crops from year to year, till they made themselves comfortable homes, and acquired considerable wealth. All this without any preparatory training, and when such a thing as a school to teach agriculture had not found a place in their most visionary speculations. They had got on well without such help, and, naturally enough, they concluded that nothing of the kind was necessary. In fact, they set it down as a self-evident truth that the only requisites for success in farming were physical strength, industry, prudence and economy.

In view of these facts, it is not at all surprising that the Public and High Schools of our Dominion were long in successful operation, before anything was done to provide for instruction in the principles of agriculture and the branches of learning relating thereto.

Dr. Ryerson's Work.

In the Province of Ontario the first step in this direction was taken by the Rev. Dr. Ryerson, Chief Superintendent of Education, in the year 1870, when he published an elementary work on agriculture and recommended it for use in the High and Public Schools. But then, as now, the fixed programme of studies was sufficiently heavy for both masters and pupils. Hence no place was found for this or any other optional subject, and the Chief Superintendent's recommendation never resulted in any practical benefit to the class whose interests it was intended to promote.

Agricultural College Established and Primer on Agriculture Authorized for use in Schools.

In 1874 the Ontario Agricultural College was established, and in 1882 the Hon. Adam Crooks, late Minister of Education, authorized Professor Tanner's "First Principles of Agriculture" for use in the Public Schools of Ontario, and "Elementary Lessons in Agricultural Science," by the same author, for use in the High Schools: and since that time the Council of the Agricultural and Arts Association has prescribed a course of reading for farmers' sons, and has held two examinations for second and third class certificates in agriculture.

This is the sum total of what we in Ontario have done in the line of agricultural education; and what has it amounted to?

The authorization of Professor Tanner's books has not led to any practical results, because the teachers are not qualified to give instruction in agriculture, and the programme of studies is already crowded.

The laudable efforts of the Board of Agriculture to induce farmers' sons to spend a portion of the long winter evenings in reading something which will make them more intelligent and efficient workers have been fairly successful. The course of reading is comprehensive, but strictly confined to the principles and practice of agriculture in its various branches. The examinations are held annually, in the month of July, at the same time and places, and subject to the same rules and regulations as the High School examinations for teachers' certificates; and the papers are examined by a special committee which is appointed by the board. The number of candidates has not been so large as could be desired; but eighteen third and three second class certificates have already been granted, and there is reason to hope that the number will gradually increase.

Then, as to the Ontario Agricultural College, what shall we say? The institution was founded to give instruction in the theory and practice of agriculture, horticulture, and arboriculture, and to conduct experiments relating thereto. It has been in operation for a little over eleven years, and I think has fairly well fulfilled the purpose for which it was established. It may not have done all that the farmers expected; but I believe that the work which it has accomplished will compare favourably with that of any similar institution in the same time on this continent or elsewhere. There have been 858 students in attendance since the college opened in 1874—some for a short time, and others for the period of two years or over. We have made no effort to swell the list of graduates, but have rather insisted on a somewhat rigid adherence to the standard laid down in our public announcements. Hence, many who have studied inside and laboured outside the full time necessary for graduation, have gone away without diplomas. We grant no degrees, but a diploma admitting to the status of associate of the college; and the number of those who have succeeded in taking this diploma is 101.

Even those whose confidence we have not hitherto enjoyed, generally admit that the Ontario Agricultural College is an institution at which a farmer's son can get a fairly liberal education in the line of his own occupation, without any risk of acquiring a distaste to farm work; and no one will deny that the instruction given and the experiments made here for the last few years have contributed in a large degree to the development of an interest in agriculture throughout the country. But, after all is said and done, we must admit that there is need of some more extended effort in the line of agricultnral education in this Province.

Agricultural Schools in Quebec.

The Province of Quebec has three agricultural schools which are maintained in part by public funds, and three private establishments, which give instruction in agriculture, without any assistance from the State. The Provincial schools are at St. Anne Lapocatière, L'Assomption and Richmond ; and the private ones are at Oka, Wentworth and Sorel.

For a description of these schools and the work they are doing, I cannot do better than quote from a report which Mr. E. A. Barnard made on the subject in February, 1885, to the Hon. J. J. Ross, Commissioner of Agriculture for Quebec.

St. Anne and L'Assomption.

"In 1873," says Mr. Barnard, "I examined minutely the schools of agriculture at St. Anne's and at L'Assomption. This year (1885), I found that a sensible improvement had taken place in the cultivation of the farm at L'Assomption, though there is much still to be desired. When this school was opened, the land attached to it—a too frequent case in the Province—was covered with weeds, and as poor as possible. To-day, the crops are clean and fairly satisfactory. The live stock, too, is greatly improved since 1873. On the whole, I cannot praise too highly the persevering efforts of Mr. Marsan, the professor of agriculture and director of the farm, in spite of the numerous difficulties which he has had to contend with from the foundation of the school to the present time.

"The school at St. Anne had, in 1873, been established for several years, and in that year I called attention to an evident improvement in the crops grown on the school farm when compared with the crops in the neigbourhood.

"The present manager, Mr. Roy, is a skilful and practical man, who is evidently devoted to agriculture. He seems to be determined to place the farm in the best possible condition. The wheat crop appeared to me excellent, the root crops extensive and well grown ; the pastures were good, and the yield of oats, barley, etc., promising. The garden is large and full of produce ; the cattle were in good breeding condition, the calves, especially, were wonderfully good, though reared with the strictest economy.

"To say the truth, the practice in both these schools is on the road to excellence. With a little more encouragement the cultivation may become really a model, and the present managers seem to be capable of attaining this point, if means are granted to them, together with guarantees for the future.

"Unfortunately, during the last eleven years, these schools have made no progress in the number and style of their pupils—they are still fed and taught gratuitously by the state. The present pupils are almost children, and a large proportion seem to have mistaken their vocation, for they do not appear at all suited to a farmer's life. This fact is abnormal, and deserves your attention.

"No one can pretend that our people refuse all agricultural instruction, since, only last year, hundreds of applications were received for admittance into the school farm at Rougemont. The rarity of pupils in the schools at St. Anne's and L'Assomption, then, must be attributed to the little encouragement given to the pupils by the agricultural authorities, and to the fact that these schools have been constantly threatened with abolition from the time of their foundation. It is easy to see that the farming population are not likely to view with favour institutions which are always on the point of being suppressed, to be replaced by others.

Richmond.

"The school at Richmond I saw for the first time last winter ; I returned there recently, and visited every part of the establishment : the older fields, the newly cleared fields, and the bush. In spite of all the troubles through which this school has passed, it is the most promising of the three, and for this reason : the farmers of the district now recognize its utility, and send their youths there as pupils in fair numbers. Not only are all the scholarships offered by Government taken up by competent students, but, in addi-

tion to these, a good number of temporary students frequent the school during the winter, and attend assiduously the course of agriculture.

"Still, the cultivation at Richmond is not more advanced than in our other two colleges, and the whole system followed is to-day in a transition state. In spite of this, the neighbouring farmers, many of whom I saw at the dairy meeting held at Richmond last winter, seem unanimous in saying that the system followed at the school is deserving of public support. Indeed the progress already made is striking, and the utility of the school will be placed beyond doubt as soon as its promoters shall be convinced that their pains will not be thrown away in the future. The manager informed me that the capital for the permanent improvements necessary to make Richmond an establishment of the first class, will not be wanting, as soon as there is no longer a possibility of our present schools being abolished to make room for others, and as soon as a gurantee to that effect is given by Government. Mr. Ewing is waiting for this guarantee to begin some important alterations.

One School, or Three?

"For my part, while pointing out certain important reforms, I do not hesitate to say that our three schools of agriculture ought to be maintained, and I believe it to be very advisable that Government should at once give a guarantee of their maintenance for the future, with conditions acceptable to all parties.

"Few things, comparatively, are wanting to enable the Province to obtain from these schools the best results: they are all three situated at the centres of the three principal districts of the country; they differ, the one from the other, in the nature of their soil, in their climate, in their markets, and even in the customs of their people. All, or almost all, the farmers of the Province are interested in the success of these institutions, and they ought to be able to find, in one or other of these schools of agriculture, information and instruction fitted to their peculiar wants. With this view, the public has a right to expect from each of them: 1. That their system of farming should be veritably a model system; that is, that it should show itself to be really profitable in money-returns, while the soil is kept in a gradually improving state, instead of being harassed to death—the common condition of our farms; 2. That all desirable permanent improvements shall be made gradually, but year by year, bearing always in mind the profitable expenditure of the funds employed therein, as well as the precious lessons to be derived from the proper execution of such works of improvement; 3. That the instruction of the pupils shall be well suited to the circumstances of our farmers, and in agreement with the funds at their disposal; 4. That necessary means be employed to show our farmers how much they are interested in the work carried on in these schools.

"On their side, the schools have a right to demand; 1. A grant of funds in proportion to the expenses they are obliged to defray in order to furnish to the pupils and the farmers of the country the instruction the schools are expected to afford; 2. A guarantee of the permanency of the grants, to recoup, later, the outlay necessitated by the improvements of the farm—expensive work always—which is always an indispensable condition of sound instruction, even if elementary; 3. An understanding and a control, as direct as possible, between the government and these schools and their managers.

"In justice, it must be admitted that none of the above conditions have been fully demanded or granted on either side up to the present time. No surprise then need be felt at the schools not being perfect.

"Some persons, with, doubtless, good intentions, have, from time to time, strongly recommended the abolition of our present schools, for the purpose of replacing them by one single school, conducted on the same principle as the College at Guelph, Ont., and Lansing, Michigan. After much thought, and after having carefully examined these institutions and studied the course of lectures given there, I have come to the conclusion that the project is both unjust and impossible of realization. Unjust, because our present schools have vested interests, and do not deserve to be abolished. Impossible of realization; 1. Because one single school, however good, cannot give to our whole agricultural population, the practices of which are so varied, the instruction which three district

schools can give, schools situated in totally different circumstances, following plans based on the respective wants of their particular districts, and offering by their system of cultivation those precious teachings which well managed model-farms are able to present. This latter point is the less to be despised, since our agricultural population does not possess the advantages common in Ontario and in the United States, where the farms of skilled European agriculturists offer models of cultivation to every passer by. For this reason, Ontario especially may well content itself with one institution, based rather on the study of the sciences attaching to agriculture and on new experiments in cultivation, than on sound practice only, such practice as all good farmers are supposed to follow on their respective farms; 2. Still more difficult of realization, because Lansing and Guelph cost at first a sum of money almost inconceivable to us (about $500,000 and $350,000 respectively), and still cost for their annual expenses a sum equal to four times as much as our three schools together cost this Province; 3. Not to be realized, since our people do not yet feel the need of, and consequently do not desire an agricultural education, rather scientific than practical, such as is given to the sons of English and Scotch farmers, who are, for the most part, accustomed from their childhood to view daily the best practical cultivation in Europe; and lastly, because of the two distinct peoples of which the population of this Province is composed—different in religion, in language and in habits—differences which would render impossible, or nearly so, the proper direction of such an establishment.

Private Schools at Oka, Wentworth and Sorel.

"I cannot finish this report without expressing the pleasure I felt during my visit to Oka, Wentworth, and Sorel. I do not hesitate to say that our Province has just been enriched with three institutions where agriculture of the most advanced and most profitable, and therefore of the most model kind, is put in practice, to the benefit of the neighbouring people and even of the whole Province.

"The Trappist Fathers, at Oka, and the Marianite Fathers at the Agricultural Orphanage at Notre-Dame de Montfort, have not yet been two years in the Province. Nevertheless, any one passing near these establishments must see at once that the good *fathers* are thorough masters of agriculture, and that they hold this art in high esteem; for the *fathers* themselves work for a great part of the day in the fields, while the *brothers* labour still longer than our most earnest farmers, in addition to the time spent in their religious duties. The progress they have made since their arrival in the country is quite astonishing, and promises much for the future.

"I can say the same of the farm attached to Lincoln College, Sorel. Mr. Jenner Fust, our very able editor of the *English Journal of Agriculture*, took the management, only last spring, of a farm of sandy soil, excessively foul and completely worn out by frequent cropping. He has already transformed it to such a point that one sees there a great and successful variety of hoed crops; there are plants quite new to the country, such as *rape* for fattening sheep, and new varieties of cereals, the success of which shows how well our editor understands the wants and the circumstances of this Province. Already a considerable number of pupils attend, of their own accord, the very interesting course of lectures which Mr. Jenner Fust continues to give at the College.

"Later on, I will return to the instruction which these three last institutions afford us. In the meantime, the whole country may well be glad to see the precious gift it has received in the establishment of such places, devoted to the teaching of the best agricultural processes without the expenditure of a single dollar of the public funds."

This is the substance of what Mr. Barnard says regarding the Quebec schools of agriculture. He understands their working thoroughly, makes several suggestions for their improvement, and closes his report with a strong appeal for the immediate establishment of a good dairy school.

Everywhere the need of such schools is felt by the most progressive farmers, and so great is the demand for instruction that Mr. Barnard himself is now starting a private experimental farm at his own expense near Three Rivers.

Maritime Provinces.

These Provinces are all very much interested in the question of agricultural education, and with limited resources are doing what they can to provide for it in their public schools, and otherwise. There has been some agitation for a union of New Brunswick, Nova Scotia, and Prince Edward Island, in the matter of an agricultural school with attached farm and experimental station; but as yet it has not amounted to anything practically.

New Brunswick has a live stock farm under provincial control, about fifteen miles from St. John, on the line of the Intercolonial Railway; but it has not been managed in such a way as to command public confidence. One of their own people says "it is a poor affair, which has had its recognized place in the domain of politics, and is about to be removed or got rid of."

The Nova Scotians have no provincial farm, stock or experimental; but at the last session of their Legislature, they passed an Act which displays a good deal of sound common sense, and is likely to be very helpful to the farmers of that Province. It is entitled "An Act to encourage agricultural education." It was passed in April, 1885, and reads as follows:—

Be it enacted by the Governor, Council, and Assembly:

1. The Council of Public Instruction shall have power to appoint a Lecturer on agriculture in connection with the Provincial Normal School.

2. It shall be the duty of the Council of Public Instruction to define particularly the duties of the aforesaid Lecturer, with reference to the following general objects:

a. Instructing the pupil teachers in Agricultural Chemistry and the sciences bearing on Agriculture, according to the provincial standards of examination, as announced from time to time.

b. Conducting a regular course of lectures on Agricultural Science, with experiments and laboratory practice, for the benefit of young men generally who may wish to fit themselves for the successful prosecution of agriculture, and with a view of training teachers for the special schools provided for in this Act.

c. Inspecting and reporting upon any schools receiving special grants under authority of this Act, so far as the teaching of Agriculture is concerned.

d. Delivering public lectures on Agriculture throughout the Province, so far as his other duties will permit.

3. Any male teacher of the first class (grade A or grade B), who shall have attended the course of lectures above provided for, and shall have passed a satisfactory examination on the subjects thereof, shall be entitled, subject to the conditions hereinafter named, to receive, when teaching school, in addition to the ordinary grant of his grade, a special grant of one hundred dollars for the school year, or ratably, according to the time he may have taught.

4. It shall be the duty of the Council of Public Instruction to frame regulations as to the outfit and management of schools in charge of teachers holding an agricultural diploma, and claiming the special grant aforesaid; and without the due observance of such regulations by both trustees and teacher the special grant shall in no case be paid.

5. To encourage teachers to qualify themselves as agricultural instructors, the Council of Public Instruction is authorized to distribute annually a sum not exceeding two hundred and fifty dollars, as prizes among the five teachers who shall pass the best examination on the subjects of the course.

6. The grants authorized by this Act shall be paid out of the moneys appropriated annually by the Legislature for Education,

Since the passing of this Act a lecturer on agriculture has been appoined, and is now actively engaged in carrying out the provisions of the Bill.

Prince Edward Island, like New Brunswick, has a stock farm, which is situated near Charlottetown, and is noted more for the breeding of horses than anything else. This

farm is not generally reckoned among the educational appliances, but it has a tendency to develop a taste for a better class stock, and is indirectly helpful to the cause of education.

Some of the leading men of Prince Edward Island, such as the Hon. Donald Ferguson, are amongst the best informed and the ablest advocates of agricultural education that can be found anywhere. They are fully abreast of the times, and I have no doubt it is largely due to their influence that a place has been found for a primer on the first principles of agriculture in the schools of that Province.

British Columbia has done little or nothing in the matter of agricultural education; but Manitoba has already voted a sum of money to assist in establishing an agricultura school or college within its bounds; and our Federal Government at Ottawa is at the present time collecting information with the view of founding somewhere an agricultural college or experimental station for the whole Dominion, or it may be one in each of the Provinces.

In view of all this it is evident that the interest in agricultural education is growing; and I think the day is not far distant when this branch of study will receive something like the attention which its importance demands.

Suggestions for Ontario.

After careful consideration of the subject, with some experience in teaching, I am of opinion that the first principles of agriculture could and should be taught in the rural schools of this Province. Underlying, as it does, the prosperity of every class in the community, agriculture claims consideration and a place on the programme of studies before anything and everything else, except those elements of a general education which we all insist on as the first and most important work of every public school.

If we could by any means give such information to the rising generation of farmers in Ontario as would induce them to raise a better class of animals than their fathers have raised; or enable them to grow five or six bushels per acre more than their fathers are growing; or make good butter everywhere, instead of the wretched stuff which has almost ruined our reputation as butter-makers at home and abroad—if, I say, we could only effect all or any one of these changes, the beneficial effects on every profession, trade, and department of business would be marvellous. No one, I think, can gainsay this conclusion; and hence, I maintain that whatever is done to make labour on the farm more productive is not for one, but for all classes of the people.

Now, there is no doubt that a young man on a farm will work to better advantage in any of the lines mentioned above, and will produce more wealth in a given time, if he is at the outset made acquainted with some of the principles that underlie the best agricultural practice in this and other countries. Consequently, I claim, on behalf of the whole population, that steps should, as soon as possible, be taken to introduce and make compulsory the teaching of the first principles of agriculture in all our rural Public Schools. A good primer on the subject might be used. The one now authorized would serve the purpose. I am, of course, aware that some persons have a prejudice against primers, aud I am quite willing to admit that they are not the best books to unfold the secrets of a subject; but when written in plain, simple language, stripped of technicalities as far as possible, they are pleasant reading for beginners, and often excite an interest which leads to the perusal of more extensive works.

The mere reading of a book on such subjects as the origin, nature and constituents of soil; the relation of plants to the soil, the atmosphere and the animal; tillage operations, the rotation of the crops, stock-raising, etc.,—I say the mere reading of a book on such subjects, without any teaching whatever, would be a benefit to our farmers' sons. It would excite their curiosity, and, as Hugh Miller says, teach them to make a right use of their eyes in noticing the common objects and scenes of every day life; would foster in them a love of nature, and lead to the formation of most valuable habits of observation; would cause them to think and enquire into the causes of things; and, above all, would develop in them a taste for reading books and papers that treat of the operations which they are called on to perform in the daily routine of farm life.

In this way, a desire for agricultural education would be created, and before long the Minister of Education would be justified in establishing in every agricultural district, and, after a time, in every county, an agricultural High School, with a good laboratory, where young men could get instruction in agriculture, live stock, veterinary science, chemistry, geology, botany, reading, writing, spelling, arithmetic, English literature and composition. And why should not the farmers of Ontario have such High Schools? They greatly outnumber all the other professions put together; and the preparation for farming is no less difficult than for other occupations; but, in spite of all this, we are maintaining over a hundred High Schools to prepare boys for various other pursuits, and not one in which a young man can get the kind of training which he needs for life on the farm. This, I hold, is a mistake. It is impolitic. It is not for the best interests of the state; and something should be done to remove the anomaly as soon as possible. Even the High School masters admit that we have a greater number of the ordinary High Schools than are necessary. Hence, it would not be a grievance or injury to any one to convert some of these schools into agricultural High Schools, such as I have described. The arts universities and this college would furnish suitable teachers for these schools; so there would be very little difficulty in making the change, whenever it might be required.

But, in order to prepare the way for the introduction of the subject into the Public Schools, the Normal Schools at Toronto and Ottawa should do something towards preparing the teachers for the work which will, ere long, be required of them; and I venture to suggest, that to the teachers in training at the Normal Schools, a course of lectures should be given every session on agriculture, live stock, dairying, forestry, the beautifying, etc.; and that lectures on the same subjects should be delivered at convenient centres throughout the Province, on Saturdays, for teachers who have already passed through the Normal Schools.

If such changes are ever made, I venture to predict that they will prove a great benefit to the community at large.

THE ONTARIO AGRICULTURAL COLLEGE.

Considering the importance of dairying, and the eager and widespread interest which all classes of the Canadian people seem to take in that branch of farming, we might almost speak of the past year as an era in the history of our college; for not until 1885 did we make any special provision for giving our students instruction in that subject. In April last it was added to our list of studies; and a professor was appointed to lecture to the students, to take charge of the creamery, and, when his other duties permit, to hold meetings among the farmers at convenient centres throughout the Province.

Management.

The management of the institution was slightly modified when the department of dairying was added. Since that time the authority has been vested in the President, the Farm Superintendent, the Gardener and the Professor of Dairying. Each of these officers is supreme in his own department, and is directly responsible to the Commissioner of Agriculture.

WORK OF THE COLLEGE.

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

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

The routine of each of these varies very little from year to year. The course of instruction remains nearly the same, there is not much change in the buildings, and the general business is subject to but slight variation.

I.—THE COURSE OF INSTRUCTION IN THE COLLEGE.

Before alluding to the work of 1885, I may give the terms into which the year is divided, a list of the subjects taught, and the names of the professors and lecturers, with the work allotted to each. Afterwards, I shall speak briefly of the year's operations, as a whole, and then of each term separately.

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

Sessions.

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

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

Terms.

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

Subjects Taught.

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

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

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

Method of Instruction.

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

THE STAFF.

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

English Literature and Political Economy.

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

Agriculture, Live Stock, and Arboriculture.

3. R. B. Hare, B.A., Ph. D. (Lately Deceased).

Inorganic, Organic, Agricultural, and Analytical Chemistry.

4. J. Hoyes Panton, M.A., F.G.S.

Geology, Meteorology, Botany, Horticulture, Zoology, and Lectures on English.

5. F. C. Grenside, V.S.

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

6. S. M. Barré.

Dairying.

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

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

THE YEAR 1885.

An institution is generally prized in proportion as it fulfils the purpose for which it was founded; and, whatever its true character may be, if it falls far short of its founders' expectations, men are disposed to question its usefulness.

The object of an agricultural college is, not to prepare young men for mercantile or professional life, nor to train them for any of the mechanic arts, but to educate them for the farm. If it accomplishes this object satisfactorily, its growth in public confidence may be slow, but the value of its work and its ultimate success are beyond doubt.

What, then, of the Ontario Agricultural College? Is it fulfilling the purpose for which it was founded, in educating young men for the farm and developing in them a taste for agricultural pursuits? We leave the public to answer, but venture to state one or two facts: First, at least ninety-five per cent. of those who have come to us from the farm, have returned home with increased interest in their work and are now engaged in active farming. This would seem to show that there is no influence here, nor anything in our system of teaching, which tends to develop a distaste to manual labour, or wean young men from the farm—nothing which suggests any other pursuit as preferable to agriculture. Secondly, a very considerable proportion of the young men who have come to us from towns and cities, have become real practical farmers, more or less efficient, and are now engaged in agricultural pursuits. This, we think, is not an unimportant testimony in favour of the College.

One difficulty, however, we have experienced in common with other agricultural colleges, and from it have suffered more or less in public estimation. It is this: A city lad who has an aversion to books and cares but little for the fashion and formality of city life, takes a run into the country to visit an uncle or a friend, sometime in the delightful month of May, when everything is fresh and beautiful; or later on, in June or July, when the air is fragrant with newly mown hay and the waving forests look so stately in their robes of varied green. He rides, drives and enjoys the utmost freedom; works a little, has splendid fun with the farmer's sons, and soon concludes that farming is a glorious occupation.

This young man decides to be a farmer and comes to the Agricultural College. He goes to work in October and appears to enjoy it very much; but after a while he is called on to pick potatoes, pull turnips, haul out manure, and a variety of equally pleasant jobs in all kinds of weather—cold and hot, wet and dry. He works away and says little; but he begins to realize that farming is not what he thought it was. He is sorry he came, and wishes he had not paid his tuition fee; but, having done so, he decides to put in one session as best he can. He spends his time in idleness or mischief; and, at the expiration of six months, he returns home to seek another occupation.

Such instances have not been rare; and the injurious effects on the College become so obvious that we made

A Change in the Terms of Admission

last spring, to discourage city boys in this Province and young men in England from coming here to make experiments, so discouraging to themselves and damaging to us. We

wish them, before coming to us, to go to work on a farm long enough to learn what farming really means; and, with that object in view, we have fixed our charges for tuition as follows:—

1. Residents who are farmers' sons, or produce satisfactory certificates of having served at least one year's apprenticeship on a farm, $20 a year.
2. Residents who have not served an apprenticeship of one year on a farm, $30 a year.
3. Non-residents who produce satisfactory certificates of having served at least one year's apprenticeship on a Canadian farm, $50 a year.
4. Non-residents who have not served an apprenticeship of one year on a Canadian farm, $100 for the first year and $50 for the second year.

Change in Outside Work.

From the opening of the College in 1874, till the 1st October, 1885, all our students were required to spend from three and a half to five hours a day at manual labour, throughout the lecture season (1st October to 30th June); and nine and a half hours a day, during the Summer Term, *i. e.*, in the months of July and August. To the latter part of the arrangement no one objected. All were willing to work outside, when there were no studies demanding their attention inside. In the lecture season, however, it was different. City boys who did not care to study, were satisfied; but farmers' sons, who are generally more in need of education than practice in farm work, found the time for study too little. They could not keep up with the classes; and the result was that not a few of them, being unable to do the lecture-room work satisfactorily in the time allotted to study, became discouraged and left, without completing the short course of two years. Hence, at a meeting of the Experimental Union, held here last spring, a resolution was passed by the students and ex-students of the College, recommending, among other things, that the amount of manual labour required of students during the lecture season, be reduced by one-half. The Commissioner of Agriculture at once adopted the recommendation; and the fact was announced in our new circular.
Coulter

Routine for the last Three Months.

This change in regard to labour took effect on the first of October last, and since that time the daily routine has been as follows: Twelve students go out in rotation every morning from seven to eight to feed cattle, etc.; from eight to nine we have drill three times a week; and from nine to twelve the whole school is at lectures in the class room. For the afternoon, the students are divided into two equal divisions, which work and study alternately. One of these divisions goes out to work for three and a half to four hours, according to the season of the year, and the other studies in the class-room from 1.30 to 4 o'clock in charge of a master or professor, and *vice versa*.

After three months' trial of this arrangement, I must say that I consider it a great improvement on the former plan. It is better for all concerned, especially for farmer sons. They now have time enough for study and work enough for exercise.

Attendance.

The attendance is not quite so large as it was in 1884, but we never before had so fine a class of students as we have at the present time—so industrious, law-abiding, and easy to manage.

The roll given below contains the names of those who have been here during the year, making a total of 175, and representing the following places: Ontario, 103; Quebec, 14; England, 30; Ireland, 5; Scotland, 5; Jamaica, Turkey, Wales, and the Island of Jersey, 1 each.

Of this number there have been 91 in attendance during the past term (1st October to 22nd December).

COLLEGE ROLL FOR 1885.

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Acres, A.	Ottawa	Carleton, Ont.
Baillie. W.	Shooter's Hill, Mt. Olivet	Jamaica, W. I.
Beament, H. J	Ottawa	Carleton, Ont.
Bent, E. H	Belleville	Hastings, Ont.
Birdsall, W. G	Birdsall	Peterborough, Ont.
Bishop, W. R	Brussels	Huron, Ont.
Black, C. C	Amherst	Nova Scotia.
Bowie, T. M	Mount Forest	Wellington, Ont.
Bradley, G. R.	Manotick	Carleton, Ont.
Brodie, C. J	Bethesda	York, Ont.
Broome, A. H	Henley-on-Thames	England.
Brown, C. R	Norwood	Peterborough, On
Browne, W. M	Ottawa	Carleton, Ont.
Brownjohn, N. S	East Lydford, Somerton	England.
Brush, G. H. R	Clifton, Bristol	England.
Burwash, H. A	Underwood	Bruce, Ont.
Butler, G. C.	London	England.
Byers, W. F	Gananoque	Leeds, Ont.
Calvert, S.	Rochdale	England.
Carden, J	Rowan Wood, Toronto	York, Ont.
Carman, H. D.	Sarnia	Lambton Ont.
Carlaw, C. M	Warkworth	Northumberland, Ont.
Carr, G. P	Natherly, Cheltenham	England.
Carr, L. H	Elmhurst, South Croyden	England.
Chadsey, W	Wellington	Prince Edward, Ont.
Chipman, S. B	Halifax	Nova Scotia.
Casswell, A. B.	Ingersoll	Oxford, Ont.
Cobb, C.	London	Middlesex, Ont.
Coutts, W. F	Glammis	Bruce, Ont.
Craig, D. J	Edinburgh	Scotland.
Craig, H	Carsonby	Carleton, Ont.
Craig, J. A.	Russell	Russell, Ont.
Creelman, G. C	Collingwood	Grey, Ont.
Davidson, F. L	Southfields	England.
Davidson, J. F	Peterborough	Peterborough, Ont.
Dennis, J. E.	Cheapside, London, E.C	England.
Denton, E.	London	Middlesex, Ont.
Donald, J. C	St. George	Brant, Ont.
Donaldson, F. N.	Mobarnane, Tipperary	Ireland.
Donaldson, H. W	Mobarnane, Tipperary	Ireland.
Donnelly, P. E	Montreal	Quebec.
Dunn, J. G.	St. John	New Brunswick.
Eby, J. R.	Sebringville	Perth, Ont.
Etherington, C. B	Farquay, Devon	England.
Ewing, W.	Mulmur	Dufferin, Ont.
Farlinger, T.	Dundee	Quebec.
Fee, J. J	Toronto	York, Ont.
Fortune, G. R.	Muir Cambus, Colinsborough	Scotland.
Fraser, G	Stratford	Perth, Ont.
Furness, D	Toronto	York, Ont.
Gibaut, E. D	St. Heliers	Jersey.
Gilbert, W. J.	Shediac	New Brunswick.
Glass, J. M	Montreal	Quebec.
Graham, G. M.	Penzance, Cornwall	England.
Green, C. W	Ottawa	Carleton, Ont.
Guest, James	Ballycroy	Simcoe, Ont.
Haldimand, E. M	Montreal	Quebec.
Hall, H. B	St. John	New Brunswick.
Hannah, J	Egmondville	Huron, Ont.
Harkness, A. D	Irene	Dundas, Ont.
Hart, J. A	Berwick	Nova Scotia.
Hart, J. W	Bridgetown	Nova Scotia.
Haslam, G. T	Dublin	Ireland.
Hay, W. H	Stratford	Perth, Ont.
Hay, D. D	Stratford	Perth, Ont.
Hayman, J. M	Aldingham Rectory, Ulmerston	England.
Higinbotham, H. B	Guelph	Wellington, Ont.
Hipwell, J. R	Thompsonville	Simcoe, Ont.
Hirsch, J	Manchester	England.

COLLEGE ROLL—*Continued.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Holtby, R. M	Manchester	Ontario, Ont.
Horsman, J. V	Ingersoll	Oxford, Ont.
Howes, J. S	Harriston	Wellington, Ont.
Idington, P. S	Stratford	Perth, Ont.
Jeffrey, J. S	Toronto	York, Ont.
Johnston, J. F	Ottawa	Carleton, Ont.
Jones, T. L	Aberystwith	South Wales.
Jones-Bateman, H	Stratford	Perth, Ont.
Kemmis, J	Waterloo Road, Dublin	Ireland.
Kennedy, J. R	St. Mary's Vicarage, Leeds	England.
Kenyon, J. O	Thedford	Lambton, Ont.
Kernighan, J. N	Benmilleo	Huron, Ont.
King, R. E	Decewsville	Haldimand, Ont.
Knowlton, S. M	Newboro'	Leeds, Ont.
Lane, H	Guelph	Wellington, Ont.
Lane, H. R	Surbiton, Surrey	England.
Lea, H. F	Toronto	York, Ont.
Leavens, D. H	Belleville	Hastings, Ont.
Ledingham, A. M	Turriff, Aberdeen	Scotland.
Leslie, J. P	Georgetown	Halton, Ont.
Ledyard	Toronto	York, Ont.
Lick, E	Oshawa	Ontario, Ont.
Livesey, E. M	London	England.
Lloyd, O	Gormley	York, Ont.
Lobb, E. W. F	St. John's Wood, London	England.
Loblaw, W. F	Elm Grove	Simcoe, Ont.
Lyster, G. R	Cape Cove, Gaspé	Quebec
MacAlister, F. G	Kingston	Frontenac, Ont.
MacFarlane, A. D	Wallace	Nova Scotia.
MacDonald, F. J	Montreal	Quebec.
MacDonald, P	Caughnawaga	Quebec.
MacVicar, A. F	Sarnia	Lambton, Ont.
Madge, R. W	Brucefield	Huron, Ont.
Magee, F. P	St. John	New Brunswick.
Malcolm, H	Toronto	York, Ont.
March, H	Rochdale	England.
Marcon, Y	Windsor	Essex, Ont.
Marsh, G. F	Thornbury	Grey, Ont.
Marsh, T. J	Clarksburg	Grey, Ont.
Maude, F. S	Bournemouth	England.
McCallum, E. G	Martintown	Glengarry, Ont.
McIntosh, W. W	Toronto	York, Ont.
McIntyre, D. N	Paisley	Bruce, Ont.
McKay, J. B	Stellarton	Nova Scotia.
McKay, J. G	Underwood	Bruce, Ont.
McLean, R. M	Ottawa	Carleton, Ont.
McNiven, W	Mountsburg	Wentworth, Ont.
Meikle, W. F	Morrisburg	Dundas, Ont.
Menzies, R. M	Almonte	Lanark, Ont.
Mill, J. S	Maria, Bonaventure	Quebec.
Miller, J. R	Mabon	Cape Breton.
Moberly, G. E	Erith, Kent	England.
Moodie, J. W	Toronto	York, Ont.
Morgan, J. H	Kerwood	Middlesex, Ont.
Muir, J. B	North Bruce	Bruce, Ont.
Mytton, R. P	Guelph	Wellington, Ont.
McPherson, A	Montreal	Quebec.
Notman, C. R	Toronto	York, Ont.
O'Doherty, E. J	Ottawa	Carleton, Ont.
Orsman, C. P	Bathurst	Lanark, Ont.
Owen, W. H	Hull	England.
Pady, W. J	Barnstaple, Devon	England.
Page, F. E	Amherst	Nova Scotia.
Paget, H. A	Loughborough	England.
Paterson, B. E	Ottawa	Carleton.
Paterson, J. W	Constantinople	Turkey.
Paton, N. F. W	Edinburgh	Scotland.
Pettingill, C	Wellington	Prince Edward, Ont.
Poe, J. P	Callan	Ireland.

College Roll—*Concluded.*

NAMES.	P. O. ADDRESS.	COUNTY, ETC.
Power, R. H.	Barrie	Simcoe, Ont.
Quinn, E. C	Orillia	Simcoe, Ont.
Raynor, T.	Rose Hall	Prince Edward, Ont.
Reid, Peter	Montreal	Quebec.
Renfrew, W. C.	Quebec	Quebec.
Ridings, H. L	Grafton	Northumberland, Ont.
Ritchie, H	Toronto	York, Ont.
Robertson, D.	Kircudbright	Scotland.
Robinson B.	Wheatley	Kent, Ont.
Roome, H	London	England.
Ross, J	Whitechurch	Bruce, Ont.
Routh, P. G	Toronto	York, Ont.
Rowat, J. T	Hillsdale	Simcoe, Ont.
Schofield, E. A	St. John	New Brunswick.
Scott, J. A.	Stoke, Devonport	England.
Scrughan, J. G.	Toronto	York, Ont.
Sharp, W.	Killyleagh	Simcoe, Ont.
Skaife, F. W.	Montreal	Quebec.
Slater, H.	Taunton	England.
Sleightholm, F.	Humber	Peel, Ont.
Smith, A. H.	Simcoe	Norfolk, Ont.
Smith, E. P.	Port Hope	Durham, Ont.
Smith, J.	Guelph	Wellington, Ont.
Smithers, A. S.	Montreal	Quebec.
Sturge, E.	Penzance, Cornwall	England.
Thompson, W. D.	Guelph	Wellington, Ont.
Thompson, H.	Cheltenham	England.
Walter, J. R.	Wellington, Somerset	England.
Watts, W. G	Dockenfield, Surrey	England.
White, S. A. K.	Ottawa	Carlton, Ont.
Whitehead, E. A.	Montreal	Quebec.
Wiggins, G. C.	Windsor	Nova Scotia.
Williams, J. B.	Perth	Lanark, Ont.
Williams, L.	Leaksdale	Ontario, Ont.
Wilson, C. J.	Dunkeron	Simcoe, Ont.
Workman, J. R.	Guelph	Wellington.
Zavity, C. A.	Coldstream	Middlesex.

Analysis of Roll.

Counties, etc.	Students.	Counties, etc.	Students.
Brant	1	Jersey	1
Bruce	6	Kent	1
Carleton (including Ottawa)	11	Lambton	3
Dufferin	1	Lanark	3
Dundas	2	Leeds	2
Durham	1	Middlesex (including London)	4
England	30	New Brunswick	5
Essex	1	Norfolk	1
Frontenac	1	Northumberland	2
Glengarry	1	Nova Scotia	9
Grey	3	Ontario	3
Haldimand	1	Oxford	2
Halton	1	Peel	1
Hastings	2	Perth	6
Huron	4	Peterborough	3
Ireland	5	Prince Edward	3
Jamaica	1	Quebec (Province)	14

ANALYSIS OF ROLL—*Concluded.*

Counties, etc.	Students.	Counties, etc.	Students.
Russell	1	Wellington (including Guelph)	8
Scotland	5	Wentworth	1
Simcoe	8	York (including Toronto)	15
Turkey	1		
Wales	1	Total	175

Ontario Students	103
Non-residents	72
Ontario Counties represented	32

RELIGIOUS DENOMINATIONS.

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

Episcopalians	63	Christians	2
Presbyterians	48	Brethren	1
Methodists	34	Friends	1
Baptists	10	Reformed Episcopals	1
Congregationalists	10		
Roman Catholics	5	Total	175

CLASS-ROOM WORK.

Lectures began, as usual, on the 1st October, 1884, and continued till the 30th June, 1885, which latter date is the end of the scholastic year, 1884-85.

The following syllabus of lectures will convey some idea of the field covered by the several professors in the nine months just mentioned :—

FIRST YEAR.

Fall Term—1st October to 22nd December.

DEPARTMENT 1.—AGRICULTURE.

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

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

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

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

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

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

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

Department 2.—Natural Science.

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

Inorganic Chemistry.—Scope of subject; elementary and compound substances; chemicel affinity; symbols; nomenclature; combining proportions by weight and by volume; atomic theory; atomicity and basicity; oxygen and hydrogen; water—its nature, functions, decomposition and impurities; nitrogen; the atmosphere—its composition, uses and impurities; ammonia—its sources and uses; nitric acid and its connection with plants; carbon; combustion; carbonic acid and its relation to the animal and vegetable kingdom; sulphur and its compounds; manufacture and uses of sulphuric acid; phosphorus; phosphoric acid and its importance in agriculture; chlorine—its bleaching properties; bromine; iodine; silicon; potassium; calcium; magnesium; iron, etc.

Human Physiology and Hygiene.—Description of the different tissues in the body; alimentary system; circulatory system; nervous system; importance of ventilation and the influence of food on the body; remarks on the proper care of the body and attention to its surroundings in order to keep it in a continual state of health.

Zoology.—Distinctions between animate and inanimate objects; distinctions between plants and animals; basis of classification among animals; leading characters of each sub-kingdom, with special reference to classes of animals connected with agriculture.

Department 3.—Veterinary Science.

Anatomy and Physiology of the horse, ox, sheep and pig; osseous system, muscular system, syndesmology, plantar system and odontology.

Department 4.—English.

Composition.—The sentence, paragraph, and period; capitals and punctuation. Exercises in composition.

English Classics.—Critical study of Gray's "Elegy."

Department 5.—Mathematics.

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

Mental Arithmetic.—Calculations in simple rules.

Book-keeping.—Subject commenced.

FIRST YEAR—(Continued).

Winter Term—22nd January to 16th April.

Department 1.—Agriculture.

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

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

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

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

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

Department 2.—Natural Science.

Inorganic Chemistry.—Subject continued from fall term.

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

Zoology (Continued).—Sub-kingdoms further described; detailed account of some injurious parasites, such as "liver fluke," "taperworm," "trichina," etc.; insects; their influence on plant life; corals and mollusks as agents in the formation of soil; vertebrates with special reference to those of importance in the economy of the farm.

Lectures illustrated by specimens and diagrams.

Department 3.—Veterinary Science.

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

Department 4.—English.

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

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

Department 5.—Mathematics and Book-keeping.

Arithmetic.—Equation of payments; percentage; profit and loss; stocks; partnership; exchange.

Book-keeping.—Business forms and correspondence; general farm accounts; dairy, field and garden accounts.

FIRST YEAR—(Continued).

Spring Term—17th April to 30th June,

Department 1.—Agriculture.

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

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

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

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

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

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

Department 2.—Natural Science.

Geology.—Connection between geology and agriculture; classification of rocks—their origin and mode of formation, changes which they have undergone after deposition; fossils—their origin and importance; geological periods and characteristics of each.

Geology of Canada; with special reference to the nature and economic value of the rock deposits; glacial period and its influence on the formation of soil.

Lectures illustrated by numerous specimens and diagrams.

Botany.—Full description of the seed, roots, stem, leaves and flower. Plants are brought into the lecture-room and analyzed before the class so as to render students familiar with the different organs and their use in the plant economy.

Lectures also illustrated by excellent diagrams.

Department 3.—Veterinary Science.

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

Department 4.—English.

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

Department 5.—Mathematics.

Mensuration.—Mensuration of surfaces—the square, rectangle, triangle, trapezoid, regular polygon, circle. Special application to the measurement of lumber. Mensuration of solids; special application to the measurement of timber, earth, etc.

SECOND YEAR.

Fall Term—1st October to 22nd December.

Department 1.—Agriculture.

Experimental Plots.—The results of last season's experiments with wheat, oats, barley, peas, grasses, clovers, roots, etc,; liability to disease; effects of various manures on different crops; growth of plates, etc.

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

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

Department 2.—Natural Science.

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

Horticulture.—Ontario as a fruit-growing country; the natural divisions into which it may be divided for growing fruit; detailed account of the operations, layering, grafting, budding, pruning, etc.; laying out and cultivation of an orchard; list of fruits best suited for general purposes, with best methods for their cultivation; remarks on gardening as a source of profit; plants best adapted for the purpose of bedding and potting.

Lectures illustrated by practical work in the garden and specimens in the class-room.

Department 3.—Veterinary Science.

Pathology.—Osseous System.—Nature, causes, symptoms, and treatment of diseases of bone, as splint, spavin, ringbone, etc.

Muscular System.—Nature, causes, and treatment of flesh wounds, etc.

Syndesmology.—Nature, causes, symptoms, and treatment of curb, bog-spavin, and other diseases of the joints.

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

Odontology.—Diseases of the teeth and treatment of the same.

Department 4.—English.

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

Department 5.—Mathematics.

Dynamics.—Motion, forces producing motion, momentum; work; the simple machines, etc.

Drainage.—General principles; how to lay out a system of drains; how, where, and when to commence draining; depth of drains and distances apart; grades; cost of draining.

SECOND YEAR—(Continued).

Winter Term—22nd January to 16th April.

Department 1.—Agriculture.

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 of sheep, etc., etc.

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

Department 2.—Natural Science.

Agricultural Chemistry.—Subject continued from Fall term.

Entomology.—Importance of the subject to agriculturists; beneficial and injurious insects—their habits, and the best means of checking the ravages of the latter.

Lectures illustrated by specimens.

Meteorology.—Relation of Meteorology to agriculture; composition and movements of the atmosphere; description of the barometer, different kinds of thermometers, pluviameter, anemometer, and how to read them; temperature, its influence on agriculture; the elements which are to be considered in the discussion of climate; the principles considered in forecasting the weather.

Lectures illustrated by instruments referred to.

Department 3.—Veterinary Science.

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

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

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

Urinary System.—Nature, causes, symptoms, and treatment of inflammation of the kidneys, etc.

Nervous System.—Nature, causes, symptoms, and treatment of lock-jaw, string-halt, etc.

Sensitive System.—Nature, causes, symptoms, and treatment of the diseases of the eye and ear.

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

Tegumental System.—Nature, causes, symptoms, and treatment of scratches, sallenders, mallenders, parasites, and other diseases of the skin.

Department 4.—English Literature and Political Economy.

English Classics.—The critical study of Shakespeare's "King Richard the Second."

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

Department 5.—Mathematics.

Statics.—Theory of equilibrium; composition and resolution of forces; parallelogram of forces, moments; centre of gravity, etc.

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

Book-keeping.—Review of previous work.

Spring Term.—16th April to 30th June.

Department 1.—Agriculture.

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

Department 2.—Natural Science.

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

Quantitative analysis of soils, manures and farm produce.

Systematic and Economic Botany.—Classification of plants and characters of the most important orders.

This course is illustrated by a large collection of plants in the college herbarium; and also by analysis of several plants collected in the fields and woods of the farm,

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

Department 3.—Veterinary Science.

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

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

Department 4.—English.

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

Department 5.—Mathematics.

Surveying and Levelling.—Fields surveyed with chain and cross-staff; measurements of heights.

Road Making.—Determination of proper slopes; shape of road bed; drainage of roads; friction on different roads; various road coverings; the maintenance of roads; cost, etc.

FARMERS' INSTITUTES.

From time to time prior to the fall of 1883, I had suggested the propriety of making such a change in the College vacations as would enable the professors to assist in holding Farmers' Institutes at convenient centres throughout the Province, for the discussion of agriculture, live stock, dairying, forestry, the beautifying of country homes, and other matters of interest to the farming community. The proposal was approved of; but it was deemed inexpedient to make a change so soon after passing the Act of February, 1880.

Again, in the fall of 1883, just after the present Minister of Agriculture took office, I laid the matter before him; and he at once adopted the suggestion. He seemed in favour of the proposal, and forthwith agreed to introduce a bill striking out the Easter vacation of sixteen days and adding the same length of time to the Christmas vacation, in order to relieve the professors at that season of the year in which farmers have most leisure for attention to public business.

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

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

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

We assisted in holding twelve institutes last winter, and had to refuse applications for as many more. The farmers of the several localities read and discussed papers with great freedom, and entered so heartily into the work that the meetings everywhere were both interesting and profitable. The following is the list of the places: Smithville (Welland), Kingsville (Essex), Wyoming (Lambton), Cold Stream (Middlesex), Woodstock (Oxford), Clinton (Huron), Hamilton (Wentworth), New Lowell (Simcoe), Meaford (Grey), near Whitby (Ontario), Oshawa (Ontario), and Kingston (Frontenac).

DISTINGUISHED VISITORS.

Among the most pleasing incidents of the year were the visits paid us by His Honour Lieutenant-Governor Robinson, and His Excellency the Marquis of Lansdowne. The former, with about thirty members of the Ontario Legislature, spent a day with us in the month of February; and the latter came to Guelph in the early part of August, for the express purpose of inspecting our college and farm. Both of these visits were gratifying to the officers of the institution, and, we trust, not altogether without interest and profit to the distinguished men who made them.

CHANGES IN THE STAFF.

In reviewing the events of the year, it becomes our melancholy duty to chronicle the death of Dr. Hare, our late Professor of Chemistry. For three years and a half, Dr. Hare discharged the duties of the department of chemistry with marked ability, and in such a way as to win the esteem of his students and command the respect of all with whom he came in contact. Dr. Hare's kindly disposition, generous nature, and enthusiastic love of science, will long be remembered by all that came within the sphere of his influence. By his death we have lost a warm friend, an able chemist, and an enthusiastic worker, whose place it will be difficult to fill.

WINTER TERM, 1885.

22nd January to the 16th April.

The students in attendance were those who had entered at the beginning of the Fall Term in October, 1884, or previous to that date—108 in number; and the work was to a large extent a continuation of the subjects begun at that time.

CLASS-ROOM WORK.

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

First Year.—30	lectures,	one hour each,	on Agriculture and Live Stock.
32	"	"	Chemistry.
20	"	"	Natural History.
21	"	"	Veterinary Anatomy.
20	"	"	English Literature.
10	"	"	English Composition.
29	"	"	Arithmetic and Book-keeping.
172			

Second Year.—15	lectures,	one hour each,	on Agriculture and Live Stock.
5	"	"	Arboriculture.
31	"	"	Agricultural Chemistry.
11	"	"	Entomology.
21	"	"	Political Economy.
20	"	"	English Literature.
21	"	"	Veterinary Pathology.
21	"	"	Statics, Hydrostatics, and Book-keeping.
145			

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; and the second year men spent six hours on general agriculture, five hours on arboriculture, and eleven hours in handling, judging, and comparing the different breeds and varieties of sheep and cattle. Under the last head, the method of instruction was the same as usual, and may be described as follows:—

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

breed in regard to shape of frame, quality of flesh, feeding, beefing, milking, hardiness, and other properties. Much the same course is pursued with the different breeds of sheep. Cotswolds, Leicesters, Southdowns, Oxford Downs, Shropshire Downs, Hampshire Downs, and Merinos are frequently examined in the class-room, and compared with one another as regards carcass, constitution, wool, mutton, feeding, hardiness, etc. Thus the instruction in this department is made in the strictest sense definite and practical.

Department 2.—Natural Science.

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

In the winter of 1885, our first year students spent a few weeks in completing the Inorganic Chemistry which they had studied throughout the Fall Term, and then took up the more difficult, but no less interesting subject of Organic Chemistry. They had a full course of lectures from Dr. Hare on the most important organic compounds, and gave special attention to the nature and sources of starch, sugar, oils, fats, the albuminoids, or flesh-formers, and other substances which have a more or less direct bearing on general agriculture and the feeding of animals. At the same time they attended Professor Panton's lectures on Zoology, to get a general knowledge of the animal kingdom as a whole, and thereby fit themselves for becoming more intelligent and appreciative students of particular parts of that kingdom under the heads of Entomology and Veterinary Science.

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

A detailed acconnt of the work in the sub-department of Natural History will be found in Professor Panton's report in part II of this volume.

Department 3.—Veterinary Science.

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

The work of the year in this department embraced not merely the lectures in the College, but also the medical treatment of all the stock kept on the farm.

See Dr. Grenside's report in part III.

Department 4.—English Literature and Political Economy.

We spend no time on any foreign language; and not much on anything which has not a direct bearing on the duties of a Canadian farmer. We give all the subjects of the

programme a fair share of attention, but lay most stress on Agriculture, Live Stock, Chemistry, and Veterinary Science. Our primary aim is to make good practical farmers; but we are not forgetful of the fact that it is no less important to make good citizens—to add some of the graces of a broader culture, and thereby fit our students for filling positions of trust, influence, and responsibility in Church and State.

The kind of an education which enables a man to make the most of his abilities in the social circle, the municipality, or the political arena, is got, not by confining the attention to any single subject, but by reading, writing and conversation, 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 1885, the first year students spent one hour a week on exercises in composition, and two hours in the critical study of Goldsmith's "Traveller." The second year men read Shakespeare's "Julius Cæsar," and "King Richard the Second," and committed to memory the best passages in each. They also devoted two hours a week to the discussion of such questions as are usually considered under the head of Political Economy—land, labour, capital, the production and distribution of wealth, strikes, lock-outs, etc.

Department 5.—Mathematics and Book-keeping.

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

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

Special Live Stock and Veterinary Class.

A special class was organized in October, 1884, as in the two previous years, for those who wished to devote their whole time during the winter months to the study of live stock and veterinary science.

There were eighteen applicants for this class—three new students and fifteen from the regular course; but, for some reason or other, they dropped off, one by one, till the number was reduced to thirteen by Christmas; and there were only eight who remained for the examinations at Easter.

This dropping out before examination day is not as it should be, and seems due to the fact that when students have but little to do and are left to themselves they are apt to spend their time in idleness, become demoralized, and accomplish so little that they soon give up in disgust.

Easter Examinations.

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

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

Examiners.

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

John Hobson, Esq., Mossboro', (Wellington) ..... Stock-Breeding.
James Phin, Hespeler, (Waterloo) ..... The Feeding of Animals.
S. C. Smoke, B.A., Toronto ..... English Literature.
Wm. Douglas, B.A., Toronto ..... Political Economy.

Honours.

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

Honour Certificates

Granted on the Results of the Easter Examinations, 1885.

First Year.

Agriculture and Live Stock—

Natural Science—

1. Madge, R. W ..... County of Huron, Ont.
2. Sturge, E. ..... Muskoka, Ont.
3. Owen, W. H. ..... Hull, England.
4. Zavitz, C. A. ..... Coldstream, Middlesex, Ont.
5. Fee, J. J ..... Toronto, Ont.
6. Calvert, S. ..... Rochdale, England.

Veterinary Science—

1. Owen, W. H. ..... Hull, England.
2. Madge, R. W ..... County of Huron, Ont.
3. Sturge, E. ..... Muskoka, Ont.
4. Fee, J. J ..... Toronto, Ont.
5. Eby, J. R. ..... Sebringville, Perth, Ont.
6. Zavitz, C. A. ..... Coldstream, Middlesex, Ont.

English Literature and Composition—

1. Sturge, E. ..... Muskoka, Ont.
2. Owen, W. H. ..... Hull, England.
3. Madge, R. W ..... County of Huron, Ont.
4. Calvert, S. ..... Rochdale, England.
5. Zavitz, C. A. ..... Coldstream, Middlesex, Ont.

Mathematics and Book-keeping—

1. Madge, R. W ..... County of Huron, Ont.
2. McKay, J. G ..... Underwood, Bruce, Ont.
3. Eby, J. R. ..... Sebringville, Perth, Ont.
4. Jeffrey, J. S. ..... Toronto, Ont.
5. Zavitz, C. A. ..... Coldstream, Middlesex, Ont.

Second Year.

Agriculture and Live Stock—

1. Raynor, T. ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B. ..... North Bruce, Ont.

Natural Science—

1. Raynor, T. ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B ..... North Bruce, Ont.
3. Butler, G. C. ..... London, England.
4. McKay, J. B. ..... Stellarton, N. S.
5. Macpherson, A. ..... Montreal.
6. McIntyre, D. N ..... Paisley, Bruce, Ont.

Veterinary Science—

1. Muir, J. B ..... North Bruce, Ont.
2. McKay, J. B ..... Stellarton, N. S.
3. Raynor, T. ..... Rose Hall, Prince Edward, Ont.
4. Butler, G. C. ..... London, England.
5. Macpherson, A. ..... Montreal.

English Literature and Political Economy—

1. Butler, G. C. ..... London, England.

Mathematics and Book-keeping—

1. Raynor, T. ..... Rose Hall, Prince Edward, 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 matriculation examinations in the year—one on the 1st of October and the other on the 17th of April. The number of applicants in April of last year was nineteen ; seventeen were admitted, and two rejected.

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.

Class-room Work.

While particular prominence was given to the work outside, the 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 Inor-

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

Midsummer Examinations.

The midsummer examinations on the work of the Spring Term (16th April to 30th June) began on the 20th and ended on the 23rd June; and immediately thereafter came the

Closing Exercises of the College.

These exercises took place on the 30th June, and were attended by His Honour Lieutenant-Governor Robinson, James Laidlaw, M.P.P., and a number of ministers and other visitors from Guelph and elsewhere, who came to witness the presentation of the diplomas, medals, and prizes that had been awarded on the results of the year's work.

Nine young men, having completed the regular course of study and apprenticeship, were presented by the president of the college for diplomas, which were granted by His Honour the Lieutenant-Governor of the Province.

Medals and Medallists.

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

Last year the competition was keen, and the results may be stated as follows:—

(1) Christmas Examinations.	(2) Easter Examinations.	(3) Midsummer Examinations.
1. Raynor, T	1. Raynor	1. Raynor
2. Butler, G. C	2. Muir	2. Muir
3. Muir, J. B	3. Butler	3. Butler

GENERAL PROFICIENCY.

1. Raynor, T. (Gold Medallist) ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B. (First Silver Medallist) .... North Bruce, Ont.
3. Butler, G. C. (Second Silver Medallist) .. London, England.

All these medals were presented by His Honour Lieutenant-Governor Robinson, and the other prizes were distributed as follows :—

Honour Certificates.

MIDSUMMER EXAMINATIONS, 1884.

First Year.

Agriculture and Live Stock—

1. Zavitz, C. A. ..... Coldstream, Middlesex, Ont.
2. Madge, R. W ..... County of Huron, Ont.
3. { Brown, C. R ..... Norwood Peterborough, Ont.
   { Sturge, E ..... Muskoka, Ont.

Natural Science—

1. Madge, R. W ..... County of Huron, Ont.
2. Brown, C. R ..... Norwood, Peterborough, Ont.
3. { Sturge, E ..... Muskoka, Ont.
   { Zavitz, C. A ..... Coldstream, Middlesex, Ont.
5. Holtby, R. M ..... Manchester, Ontario County, Ont.

Veterinary Science—

1. Sturge, E ..... Muskoka, Ont.
2. Madge, R. W ..... County of Huron, Ont.
3. Zavitz, C. A ..... Coldstream, Middlesex, Ont.

English Literature and Composition—

1. Madge, R. W ..... County of Huron, Ont.
2. Brown, C. R ..... Norwood, Peterborough, Ont.
3. { Sturge, E ..... Muskoka, Ont.
   { Zavitz, C, A ..... Coldstream, Middlesex, Ont.

Mathematics—

1. { Madge, R. W ..... County of Huron, Ont.
   { Zavitz, C. A ..... Coldstream, Middlesex, Ont.
3. Marsh, G. F ..... Thornbury, Grey, Ont.
4. Brown, C. R ..... Norwood, Peterborough, Ont.
5. Holtby, R. M ..... Manchester, Ontario County, Ont.

Second Year.

Agriculture –

1. Muir, J. B ..... North Bruce, Ont.
2. Raynor, T ..... Rose Hall, Prince Edward, Ont.
3. Butler, G. C ..... London, England.
4. Macpherson, A ..... Montreal.
5. McIntyre, D. N ..... Paisley, Bruce, Ont.

Natural Science—

1. Raynor, T ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B ..... North Bruce, Ont
3. Macpherson, A ..... Montreal.
4. Butler, G. C ..... London, England.

Veterinary Science—
1. Raynor, T ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B ..... North Bruce, Ont.
3. Owen, W. H ..... Hull, England.
4. McIntyre, D. N ..... Paisley, Bruce, Ont.

English Literature—
1. Butler, G. C ..... London, England.
2. Macpherson, A ..... Montreal.
3. Raynor, T ..... Rose Hall, Prince Edward, Ont.
4. Owen, W. H ..... Hull, England.

Mathematics—
1. Raynor, T ..... Rose Hall, Prince Edward, Ont.
2. Muir, J. B ..... North Bruce, Ont.
3. Broome, A. H ..... Henley-on-Thames, England.
4. Butler, G. C ..... London, England.
5. Reid, P ..... Montreal.
6. Macpherson, A ..... Montreal.
7. McIntyre, D. N ..... Paisley, Ont.
8. Poe, J. P ..... Callan, Ireland.

Prizes Awarded on the Results of the Easter Examinations.

REGULAR COURSE.

First Year.

Agriculture and Live Stock—

Natural Science—
1st. R. W. Madge.
2nd. E. Sturge.

Veterinary Science—
1st. W. H. Owen.
2nd. R. W. Madge.

English Literature and Composition—
1st. E. Sturge.
2nd. W. H. Owen.

Mathematics and Book-keeping—
1st. R. W. Madge.
2nd. J. G. McKay.

General Proficiency—
1st. R. W. Madge.
2nd. E. Sturge.
3rd. W. H. Owen.

Second Year.

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

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

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

Eng. Lit. and Political Economy—
1st. G. C. Butler.

Mathematics and Book-keeping—
1st. T. Raynor.

General Proficiency—
1st. T. Raynor.
2nd. J. B. Muir.
3rd. J. B. McKay.

SPECIAL CLASS.

First Year Students—
1st. H. B. Hall.
2nd. J. R. Walter.

Second Year Students—
1st. H. L. Ridings.
2nd. A. B. Casswell.

Silver Medal—H. L. RIDINGS, Grafton, Ont.

Associates of the College.

1881.

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

1882.

Blanchard, M. G	Windsor, Nova Scotia.
Charlton, G. H	St. George (Brant), Ont.
Chase, Oscar	Cornwallis, Nova Scotia.
Dawson, J. J	South Zorra (Oxford), Ont.
Dennis, James	Weston (York), Ont.
Elworthy, R. H	Jamaica.
Fotheringham, James	St. 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. (Second Silver Medallist)	Eden Mills (Halton), Ont.
Shuttleworth, Arthur (First Silver Medallist)	Mt. Albert (York), Ont.
Silverthorne, Newman	Sommerville (Peel), Ont.
Stover, J. W	Norwich (Oxford), Ont.
Wettlaufer, Frederick (Gold Medallist)	Tavistock (Oxford), Ont.
White, C. D	Hereford, England.

1883.

Fotheringham, W (Second Silver Medallist)	St. 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. (Gold Medallist)	Wanstead (Lambton), Ont.
Schwartz, J. A	Quebec.
Torrance, W. J	Ottawa (Carleton) Ont.
Willis, W. B. (First Silver Medallist)	Whitby (Ontario), Ont.

1884.

Black, P. C	Windsor, Nova Scotia.
Carpenter, P. A. (Gold Medallist)	Collingwood (Simcoe), Ont.
Lehmann, A. (Second Silver Medallist)	Orillia (Simcoe) Ont.
Major, C. H	Croydon, England.
Powys, P. C	Fredericton, N.B.
Saxton, E. A	Nantwich, England.

Slater, H. (First Silver Medallist)	Taunton, England.
Steers, O	Ottawa, Ont.
Tucker, H. V	Toronto, Ont.
Wark, A. E	Wanstead (Lambton) Ont.
Wroughton, T. A	Bangalore, India.

1885.

Butler, G. C. (Second Silver Medallist)	London, England.
Macpherson, A	Montreal.
McIntyre, D. N	Paisley, Bruce, Ont.
McKay, J. B	Stellarton, Nova Scotia.
Muir, J. B. (First Silver Medallist)	North Bruce, Ont.
Raynor, T. (Gold Medallist)	Rose Hall, Prince Edward, Ont.
Reid, P	Montreal.
Smith, E. P	Port Hope (Durham), Ont.
Thompson, W. D	Guelph, Ont.

Live Stock Certificates.

The following members of the Special Live Stock and Veterinary Class, having passed the prescribed examinations, have received special certificates :—

1884.

Carlaw, C. M	Warkworth, Northumberland, Ont.
Cowley, E. A	Windsor, London, England.
Holcroft, H. S	Orillia, Simcoe, Ont.
Hubbard, W. W	Burton, N. B.
Keil, C. A	Chatham, Kent, Ont.
McGregor, J	Colborne, Northumberland, Ont.
Sharman, H. B	Stratford, Perth, Ont.
Sharman, G. C	Stratford, Perth, Ont.
Skaife, F. W	Montreal.

1885.

Casswell, A. B	Ingersoll, Oxford, Ont.
Hall, H. B	St. John, New Brunswick.
Hannah, J	Egmondville, Huron, Ont.
Hayman, J. M	Aldingham, Ulverston, England.
Ridings, H. L	Grafton, Ont.
Rowat, J. T	Hillsdale. Simcoe, Ont.
Walter, J. R	Somerset, England.

Smokers and Non-Smokers.

In my last report, I alluded to the effect of smoking upon young men at college. A very considerable number of our students smoke, and not a few of them are confirmed in the habit. At present I shall not discuss the question, but simply state one or two facts regarding the record of smokers and non-smokers in this institution.

In 1884 and 1885, fifty-eight of our students received departmental honours ; and forty-five of these were non-smokers. Within the last five years, sixty-seven have taken diplomas ; and forty-eight of them have been non-smokers ; fourteen have won medals ; and twelve of them have been non-smokers and non-drinkers.

SUMMER TERM.

(1st July to 31st August).

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

FALL TERM.

Commencement of a New Scholastic Year—1st. October, 1885.

Forty-two old students returned at the beginning of the Fall term, and fifty-nine new ones were admitted, making a total of 91. Their names, post-office address, and other information regarding them having been given in the college roll and analysis on a previous page, I need not trouble you with a repetition at this point. I shall simply refer to one or two particulars and pass on.

Ages of Students.

The ages of our students during the Fall Term, which ended on the 22nd December, ranged from 16 to 27 years, as follows:—

5	at the age of	16	years.	7	at the age of	22	years.
24	"	17	"	3	"	23	"
17	"	18	"	2	"	24	"
18	"	19	"	1	"	25	"
6	"	20	"	2	"	26	"
4	"	21	"	2	"	27	"

The average age is 19¼ years.

Class-Room Work.

The time table in Appendix I. indicates the subjects which are taken up in the Fall Term, and the number of hours allotted to each. Lectures began on the 5th October, and continued without interruption till the 17th December.

Regular Students.

The first-year students received three lectures a week on the characteristic points and peculiarities of the different breeds of cattle; had a full course of lectures with experiments on Chemical Physics and Inorganic Chemistry; and spent two hours a week in studying the Anatomy and Physiology of the horse. Under the head of English and Mathematics, they read Coleridge's "Ancient Mariner," gave some time to the practice of Composition, 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 Horticulture, and a full course on Agricultural Chemistry—the composition of different plants in relation to the soils on which they grow; the preservation and renovation of soils, the chemical composition and value of different manures, the superphosphates, double silicates, and other substances which furnish plant food. They spent two hours a week at lectures on Veterinary Pathology, and one in handling and examining horses for spavin, ring-bone, splint, founder, and other diseases, all under the eye and direction of our veterinary surgeon, Dr. Grenside; they also read Shakespeare's "Julius Cæsar," and devoted some time to the study of drainage and book-keeping.

Special Students.

There were only five applicants for the special Live Stock and Veterinary class last fall, which would seem to show that this clas is not needed. These five are still in attendance, and are likely to remain till Easter.

Fat Stock Show.

One of the benefits which young men get from attending our college, results from the opportunities which they have of inspecting the best beef cattle in the Province of Ontario; for in the neighbourhood of Guelph we have, not only some of the finest thoroughbred herds in the country, but the very best specimens of fat cattle.

On the 15th and 16th December last, the Guelph Fat Stock Club held its annual show in the City of Guelph; and the directors kindly arranged so as to give our students an opportunity of examining, comparing, and judging the animals on exhibition. Every student was required to write out a special report on the show for the Professor of Agriculture.

Terminal Examinations.

The examinations on the work of the Fall Term took place on the 17th, 18th and 19th December. The subjects were as follows:—

First Year—
- Live Stock,
- Inorganic Chemistry,
- Veterinary Anatomy,
- English Literature,
- English Composition,
- Arithmetic,
- Book-keeping,

Second Year—
- Agriculture,
- Live Stock,
- Agricultural Chemistry,
- Veterinary Pathology,
- English Literature,
- Draining,
- Book-keeping.

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

BOARDING HOUSE AND COLLEGE BUILDINGS.

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

College Buildings.

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

In the building, as it now stands, there are one hundred and twenty-two rooms—three class-rooms, a reading-room, a library, a laboratory, three offices, a public reception-room, sixty-two students' dormitories, a large dining-hall, a servants' dining-room, a store-room, pantery, kitchen, scullery, laundry, drying-room, eight bath-rooms, nine bedrooms for servants, the messenger's room, a parlour and bedroom for 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, a spare room, an officers' dining-room, a sitting-room for students, a smoking-room, two wash-rooms, an engine-room, and a coal house.

Repairs and Alterations.

During the past year, we have not done so much as usual under this head. A portion of one of the wash-rooms, on the first floor, has been partitioned off, fitted up, painted and furnished for a smoking-room; and one of the old wash-rooms, on the ground floor, has been re-floored, papered nicely, painted, and furnished for a students' sitting-room. That is all, except the papering of the spare room.

Additions.

The chief additions for the year are a stone walk in front of the college, and a small stone building for the earth closets in the rear. These closets have been in use for two months, and are doing fairly well; but it is too soon to pronounce an opinion on their merits as compared with water-closets.

Boarding House.

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

Daily Routine.

In regard to the surroundings of our students in the college, and the duties required of them, I may say that their bedrooms are furnished with beds, bedding, bureaus,

mirrors, washstands, study tables, and chairs. They sleep separately, two in a room, and in a few instances three. The daily routine during the Fall, Winter and Spring Terms, is as follows :—

All rise at six to get ready for breakfast and put their rooms in order. Breakfast is at half-past six; and at seven, or half-past seven, according to the season of the year, twelve or fourteen go out to feed and clean the cattle, horses, sheep, and pigs. This number is selected in rotation throughout the lecture session (1st October to 30th June). At 7.45, those who are not working outside go to drill for an hour; and all assemble in the class-room for roll-call and prayers at 8.45. From nine to twelve the whole school is at lectures in the college.

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

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

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

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

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

Discipline.

I am pleased to be able to say that we have not had any serious case of discipline during the past year. Everything has gone on quietly and without the slightest friction anywhere. The change from some former years is very striking. All the students are respectful, obedient, and apparently anxious to make a right use of their time. This results from several causes, which I need not enumerate, but chiefly from the change in the hours of work, and from the fact that we have a better class of young men than we ever had before.

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 enquiries about terms of admission, course of study, duties of students, cost of board and tuition, books used, books recommended, etc.; and now there is added a new department, which occupies quite an amount of time and involves a good deal of letter-writing, that is, the Farmers' Institute work. During the last few months I have had to do the correspondence and arrange the programmes for twenty-four Institutes at different centres throughout the Province, as well as the writing to sixteen other places which we have had to refuse.

Books and Accounts.

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

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

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

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

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

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

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

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

General Business.

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

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

Finances.

Revenue.

The college revenue in 1885 amounted te $7,885.90, and was made up of the following items:

(1)	Tuition fees	$4,152 50
(2)	Balances paid for board after deducting allowances for work done in the outside departments, including also a few fines imposed for violation of rules	3,672 90
(3)	Amount paid for supplemental examinations	60 50
	Total revenue in 1884	$7,885 90

Expenditure.

No. 1.—*College Maintenance.*

The total sum voted for college maintenance last year was $25,520; and from this was deducted the sum of $9,000, which the Legislature estimated as the probable college revenue for the year. So the net amount voted under this head was $16,520. (See Estimates for 1885, page 30.)

The total expenditure for college maintenance during the twelve months has been $23,536.48, and from this we have deducted the sum of $7,885.90, which is the actual college revenue for the year. So the net expenditure under this head for 1885 has been $15,650.58. Stated briefly as follows:—

Net sum voted for college maintenance in 1885	$16,520 00
Net expenditure for college maintenance in 1885	15,650 58
Balance unexpended under this head	$869 42

No. 2.—*Maintenance and Repairs of Governmental Buildings*—furniture, repairs and alterations, fuel, light, and water—

The sum voted under this head was $6,100 (see estimates for 1885, page 33); and the expenditure was $5,735.09, as follows:—

Sum voted for maintenance and repairs of buildings in 1885	$6,100 00
Expenditure for " " " 1885	5,735 09
Balance unexpended under this head	$364 91

Summary.

Total sum voted, less the estimated revenue, under both the above heads for 1885	$22,620 00
Total sum expended, less actual revenue, under both the above heads for 1885	21,385 67
Balance unexpended in 1885	$1,234 33

DETAILED STATEMENT OF COLLEGE EXPENDITURE IN 1885.

No. 1.—College Maintenance.

(1) Salaries and wages	$11,492 93	
(2) Food—		
Meat, fish and fowl	3,759 36	
Bread and biscuits	968 19	
Groceries, butter and fruit	3,591 41	
(3) Household Expenses—		
Laundry, soap and cleaning	158 50	
Women servants' wages	1,793 52	
(4) Business Department—		
Advertising, printing, postage and stationery	741 05	
(5) Miscellaneous—		
Chemicals and apparatus for laboratory	55 03	
Library and reading-room (books, papers and periodicals)	366 37	
Unenumerated	610 12	
		$23,536 48
Less revenue		7,885 90
Net expenditure for college maintenance		$15,650 58

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

(1)	Furniture and furnishings	$ 696 51	
(2)	Repairs and alterations	434 47	
(3)	Fuel	2,959 62	
(4)	Light	1,094 49	
(5)	Water for college and farm (rent paid to Guelph water-works)	550 00	
			$5,735 09
	Total net cash expenditure in 1885		$21,385 67

Taking into account the produce, etc., received by the college from the farm and garden, and the amount paid by the college for labour of students on the farm and garden, we have the entire expenditure of the college for the year, as follows :—

Cash expenditure of college, as above	$21,385 67	
Produce, etc., from farm and garden (see appendix 4)	1,412 25	
	$22,797 92	
Amount paid by college for labour of students on farm and garden	3,696 29	
Entire net expenditure of college in 1885		$19,101 63

CONCLUSION.

Hitherto I have reported on the library, reading-room, and museum, and have given a list of the papers and periodicals that have been furnished by the college, or sent free by the publishers; but by the new by-laws, issued a few months ago, Professor Panton is recognized as librarian, and as curator of the museum, and is made responsible for everything pertaining to the library, reading-room, and museum. Hence, I beg to refer the reader to to Professor Panton's report in Part II. of this volume, for information regarding that part of our educational appliances.

Literary Society.

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

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

Recommendations.

Being much pressed with examinations and institute work, I shall close my report of 1885 with a mere repetition of the most urgent wants of the institution at the present time :—

(1) The removal of the old barns, sheds, and stables, or what is left of them after the fire of last September, and the erection of suitable farm buildings at a greater distance from the college, on the site selected by Mr. Miller, of Philadelphia.

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

(3) A botanical laboratory, with suitable green and propagating houses.

(4) A building for gymnasium and drill-room.

(5) A cottage on the college grounds for the Professor of Geology and Natural History.

(6) An addition to our coal house.

I have often urged the need of some of these items, especially the first three. The circumstances would justify another appeal; but I forbear. In view of the fact that the institution has been in existence for nearly twelve years, I think the mere mention of most of these wants is sufficient to commend them to your most favourable consideration.

I have the honour to be, sir,

Your obedient servant,

JAMES MILLS,

President.

APPENDIX I.

TIME TABLE FOR FALL TERM.

The following Time Table indicates our class-room work from the 1st October to the 22nd December.

TIME TABLE.

2ND YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
9-10	English Literature.	Dairying.	Agriculture.	Agriculture.	Draining.
10-11	Agricultural Chemistry.	Agricultural Chemistry.	English Literature.	Book-keeping.	Horticulture.
11-12	Veterinary Pathology.	English Literature.	Agricultural Chemistry.	Veterinary Pathology.	Practical Horse.

1ST YEAR.

Hours.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
9-10	Agriculture.	9. Arithmetic. 9.40. Book-keeping.	Arithmetic.	Composition.	Agriculture.
10-11	Agriculture.	10.20. Dairying.	Inorganic Chemistry.	Veterinary. Anatomy.	Veterinary Anatomy.
11-12	Inorganic Chemistry.	Natural History.	English Literature.	Inorganic Chemistry.	English Literature.

APPENDIX 2.

ONTARIO AGRICULTURAL COLLEGE.

EXAMINATION PAPERS.

I. PAPERS SET AT THE MATRICULATION EXAMINATIONS, EASTER, 1885.

ARITHMETIC.

Examiner: E. L. HUNT.

1. The fore wheel of a carriage is 11 feet in circumference, and the hind one 13 feet. How many more revolutions will the one make than the other in one mile?

2. How far will the carriage go when the same spots which were on the ground at time of starting will be on the ground again at the same instant?

3. Simplify $\frac{5}{12}$ of $\frac{36}{49} - \frac{2}{7} + \frac{7}{15} \div \frac{14}{25}$

4. Divide .00169 by 1300, and subtract the quotient from .5.

5. A can do a piece of work in 24 days. B in 22 days, and C in 20 days. How long will it take all three working together?

6. A field is 30 rods, 4 yards, 2 feet long, and 20 rods, 3 yards, 1 foot, 8 inches wide. Find the cost of wire required to fence it, if the price of wire is 8 cents a rod and the fence is 7 wires high.

7. A farmer buys 10 steers for $350, being $3\frac{1}{2}$ cents per lb.; he keeps them for 6 months, paying 15 cents a day each for feed, and then sells them for $680, being 5 cents a lb.

(*a*) Find the average daily increase in weight of each steer (30 days in a year).

(*b*) Find the farmer's gain.

ENGLISH GRAMMAR.

Examiner: JAMES MILLS, M. A.

1. Give the principal divisions of Grammar, with a definition or explanation of each.

2. Define the terms *voice*, *mood*, *case* and *person*.

3. Name the moods of English verbs, and state briefly the uses of each.

4. Write out the plural number of *bandii*, *erratum*, *genus*, *medium*, *cherub*, *sheep*, *formula* and *species*; also the feminine gender of *lad*, *beau*, *stag*, *hart*, *earl*, *marquis*, *abbot*, *friar*, *czar* and *hero*.

5. Decline *I*, *who* and *she* in singular and plural.

EASTER EXAMINATIONS, 1885—Continued.

6. Give the principal parts, and write out the Future Indicative, interrogative form, in all the persons and numbers of the verbs *to be* and *to sing*.

7. Divide the following passage into simple sentences, stating the kind and connection of each, and parse the italisized words:

The sun *had scarcely begun to shed his* beams upon the summits of the snowy *mountains which* rise above Grenada, *when* the christian camp *was* in motion.

8. Correct the following sentences, giving reasons:

(*a*) Who were you speaking to?

(*b*) Can I go to my room?

(*c*) I dislike those sort of questions.

(*d*) It was us who did the work.

GEOGRAPHY.

Examiner: J. HOYES PANTON, M. A.

1. Define plateau, watershed, meridian, estuary and tide.

2. Name the Provinces of the Dominion and give their relative positions.

3. Where and what are:—Assiniboine, Elgin, Simcoe, Thames, Regina, Frontenac, and Collingwood.

4. Name the cities of Ontario, and the counties in which they are located.

5. Some parts of Ontario are said to be well adapted for fruit culture, others for the raising of cattle, and some for wheat growing. State where such districts are.

6. Draw a sketch map of Lake Erie, naming the counties around it and the rivers which flow into it.

7. Why is the snow so much longer in passing away from the vicinity of Stratford than it is around Toronto?

ENGLISH COMPOSITION.

Examiner: J. MES MILLS, M.A.

1. Write a composition on money, or a description of your home and its surroundings.

DICTATION AND READING.

Examiner: J. HOYES PANTON, M.A.

DICTATION.—Fourth Reader, p. 122—"To this casual.....turn to speak."

READING.—Fourth Reader, p. 133—"The voices of his.....hearthstone;" and p. 135—the last three stanzas.

II.—PAPERS SET AT THE SESSIONAL EXAMINATIONS, EASTER, 1885.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. What do you understand to be the principles and importance of a rotation in cropping?

EASTER EXAMINATIONS, 1885—Continued.

2. Define a manure, classify them, and indicate the principles that should guide us in the application to soils and crops.

3. Describe the best management of farm yard manure.

4. Judge the accompanying sample of wheat.

FIRST YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. Give some of the principal facts connected with the establishment of the Short Horn breed of cattle, and the Leicester breed of sheep.

2. Draft pedigree of a bull with five removes—using the English, American, and the two Canadian Herd Book Signs.

3. Compare the Hereford and Aberdeen Poll breeds of cattle.

4. What are the essentials to secure in a fattening steer, irrespective of particular breed?

5. Describe a model milch cow, and place her among breeds known to you.

6. Report upon the sample of wool herewith.

7. Compare the Southdown and Shrops breeds of sheep.

FIRST YEAR.

JUDGING CATTLE (ORAL).

Examiner: WM. BROWN.

1. Give your opinion of the cow.

2. Compare the steers.

3. Which steer gives evidence of being the best breeder.

FIRST YEAR.

JUDGING SHEEP (ORAL).

Examiner: WM. BROWN.

1. Which is the best fleece? Give reasons.

2. Name the breeds of the rams, and say which is the best of its kind, giving reasons.

FIRST YEAR.

INORGANIC CHEMISTRY.

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

1. Explain the following terms chemists use:—Chemical combination, chemic force, acids and bases, salts, solution, combining proportions, atomic theory, molecular weight, and quantivalence.

2. Write down the formulæ of the chlorides, chlorates and hypochlorites, sulphates, phosphites and hypophosphites, nitrates, hyponitrites, arsenites, arsenates, silicates, silicofluorides, and carbonates of some of the principal metals.

EASTER EXAMINATIONS, 1885—Continued.

3. Illustrate by formulæ the chemical action that occurs when goods are bleached—
(1) By chlorine.
(2) By sulphur dioxide.

4. The following elements and compounds are in labelled vessels placed before you, and you are required by characteristic experiments to illustrate the physical and chemical properties of each. How would you begin and end your experiments in each case: hydrogen, nitric acid, laughing gas, ammonia, carbon monoxide, carbon dioxide, ethene, chlorine, hydrochloric acid, sulphur, sulphuretted hydrogen, silicon tetrafluoride, phosphuretted hydrogen, arsenic trioxide and iron.

5. Describe the occurrence, preparation and properties of the element carbon.

6. How would you quickly distinguish the metal potassium from sodium, calcium from magnesium, and iron from manganese.

7. How many cubic centimeters of laughing-gas, measured at 20° C. and 790 m. m. pressure, can be obtained by heating 20 grammes of ammonium nitrate.

FIRST YEAR.

ORGANIC CHEMISTRY.

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

1. Illustrate by formulæ the difference that exists:
(*i*) Between the paraffins and the olefines.
(*ii*) The monotomic, diatomic and trivalent alcohols.

2. Formulate the relation that exists between an alcohol and the aldehyde acid, and ether obtainable from it. In illustration of your meaning take examples from the monotomic, diatomic and trivalent alcohols.

(3) Indicate by chemical formulæ the action that occurs in the manufacture
(*i*) Of oxalic acid from saw-dust.
(*ii*) Of soap from fat.
(*iii*) Of tartar emetic from antimony trioxide.

4. The organic compounds, methane, ethene, ethyl alcohol, ether, formic acid, acetic acid, glycerine, and turpentine, are placed before you in separate unlabelled bottles, how would you determine the composition of each bottle?

5. Illustrate by *structural* formulæ the relation the *lactic acid* series and the *oxalic*, bear to the diatomic alcohols.

6. Give composition and properties of the leading members of the albuminoid and carbohydrate groups.

7. Indicate by structural formulæ the composition of benzol, aniline, and succinic acid.

FIRST YEAR.

NATURAL HISTORY.

Examiner: J. HOYES PANTON, M. A.

1. Give the most characteristic distinctions between animals and plants.

2. Name the sub-kingdoms into which animals are divided, and give the characters of the third.

3. Name the different orders of birds, and state in which the most useful are found.

4. To what extent have worms been of use in the preparation of soil? Name animals from at least three sub-kingdoms which have been important factors in the formation of the earth's crust.

EASTER EXAMINATIONS, 1885—Continued.

5. Give the leading characters of Echinodermata.

6. Describe the life history of the so-called Liver fluke.

7. Name the classes into which Vertebrates have been divided, and describe the heart in each.

8. Give the principal stages in the development of a tape-worm.

9. Name the chief distinctions between reptiles and mammals.

10. Identify the specimens before you, stating the sub-kingdom, class and order to which each belongs, and describe the peculiar characters of Number 4.

FIRST YEAR.

VETERINARY ANATOMY.

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

1. Describe the stomach of the horse.

2. Mention the organs that take part in the process of chylification.

3. Describe the ileo-cæcal value, and mention its function.

4. Describe the rectum, and how defæcation is accomplished.

5. Describe the Trachea and Bronchi.

6. Describe the course of the Urine, from its point of secretion to that of excretion.

7. State how the circulation of erectile tissue differs from that of other tissues and the organs in which it is found in either sex.

8. Describe the œsophageal canal.

9. Describe the process of rumination.

10. Describe the course of the circulation of the blood.

FIRST YEAR.

ENGLISH LITERATURE.

Examiner: J. HOYES PANTON, M.A.

1. Write brief notes on the life of Goldsmith, and name some distinguished literary characters who lived about the same time.

2. Explain the terms—verse, epic, metre, didactic, and elegaic as applied to poetry.

3. "Some village Hampden, that with dauntless breast
The little tyrant of his fields withstood;
Some mute, inglorious Milton here may rest,
Some Cromwell, guiltless of his country's blood."

(*a*) Explain the allusions in this extract.

(*b*) "Inglorious," "guiltless," "village." Explain.

4. "Full many a gem * * * * * "
Complete the stanza.

Write explanatory notes on urn, lyre, glebe, rustic, and heath.

5. What is the object of the *Traveller*, and what poet is Goldsmith said to have taken for his model?

6. What countries are referred to throughout the poem? Give brief description of each according to Goldsmith.

EASTER EXAMINATIONS, 1885—Continued.

7. "All evils here contaminate the mind,
That opulence departed leaves behind;
For wealth was theirs, not far removed from date,
When commerce proudly flourished through the state.
At her command the palace learned to rise,
Again the long-fall'n column sought the skies,
The canvas glowed beyond e'en nature warm,
The pregnant quarry teemed with human form,
Till, more unsteady than the southern gale,
Commerce on other shores displayed her sail."

(*a*) To what place is reference made in the lines quoted?

(*b*) Explain: evils, palace, canvas, warm, quarry, southern.

(*c*) "Other shores." What shores? Why the decay in commerce?

8. "Thine, Freedom, thine * * * * "
Complete this apostrophe to Freedon. At what part of the *Traveller* is this introduced, and to what scenes does it likely refer?

9. Give the meaning and derivation of:—Ambition, plethoric, churlish, mansion, zephyr; and write brief notes on Idria, Loire, Apennine, Arcadia, Luke's iron crown.

10. Explain the figures:—Metaphor, alliteration, metonymy, hypallage, and apostrophe. "Dull as their lakes;" "yea lakes." Name them.

FIRST YEAR.

ENGLISH COMPOSITION.

Examiner: JAMES MILLS, M.A.

1. Define the terms *sentence* and *paragraph*.

2. Quote the rules for punctuating—

(1) Adverbial phrases.

(2) Complex sentences.

3. Give as many rules as you can to guide one in the arrangement of phrases in a sentence.

4. Enumerate the various methods of securing variety of expression in English composition.

5. Lord Chatham said: "I rejoice that the grave has not closed upon me—that I am still alive to lift up my voice against a great wrong." Change this quotation into the indirect form of speech.

6. Give two examples illustrating the difference between the grammatical and the rhetorical order.

7. Explain what is meant by *style*, *synonym*, *euphemism*, *redundancy*, and *tautology*.

8. "The excellence of a sentence depends on two things."

(1) State what these two things are.

(2) Enumerate and explain the requisites necessary to secure either of them.

9. Write a composition on *money*, or a short biography of some person whose history you know.

EASTER EXAMINATIONS, 1885—Continued.

FIRST YEAR.

ARITHMETIC.

Examiner: E. L. HUNT.

1. A wire fence is to be made 120 rods, 3 yds., 2 feet, 8 inches long and, 6 wires high.

(*a*) Find cost of wire at 8 cents a rod.
(*b*) How many posts are required if they are 9 feet apart.

2. Find the simple interest on $8,450 for 3 years 6 months, at 7 per cent.

3. Why are taxes levied upon property?

(*a*) After paying an income tax of $2\frac{1}{4}$ cents on the $ on all his salary over $400, has $1,182 left. Find his salary.

4. A merchant buys 7,500 lbs. sugar for 8 cts. a lb.; he pays a *specific* duty of $\frac{1}{2}$ cent per lb., and an *ad valorem* duty of $\frac{2}{5}$ per cent., and $15 freight. Find—

(*a*) The amount of duty.
(*b*) The selling price that he may make a profit of 5 per cent.

5. A has 900 bushels of wheat; B offers him 78 cents cash; C offers him 80 cents to be paid at the end of 6 months. Which is *now* the better offer and by how much, money being worth 5 per cent.

6. If A accepts the latter offer, and gets C's notes discounted at bank July 19th at 5 per cent., find the discount charged; also, the banker's gain.

7. $2,000. GUELPH, June 1st, 1884.

One year after date I promise to pay R. Bruce, or order, one thousand dollars, with interest at 10 per cent. per annum.

Endorsed as follows:—Sept. 1st, 1884, $400.00.
Nov. 1st, 1884, $15.00; Dec. 1st, 1884, $500.00.
What amount remained due June 1st, 1885?

8. A merchant sends to his agent wheat, and cash, to the value of $6,300 with instructions to sell the wheat and invest the whole proceeds and the cash in buying goods (after deducting his commissions). The agent charges 4 per cent. for selling wheat and 5 per cent. for buying goods; his whole commission amounts to $500. Find amount of cash and value of wheat sent.

FIRST YEAR.

BOOK-KEEPING.

Examiner: E. L. HUNT.

1. Distinguish a non-negotiable note and one negotiable without endorsement; write a form of each.

2. Explain the purpose of general labour and farm produce accounts.

3. State fully how the ledger is classed.

4. You have 7 cows valued at $320; make out and close an account with cows for the year 1884.

5. How would you enter the following in your books:—

(*a*) Bought a wagon, $75.
(*b*) I sell H. Thomas one ton of hay, $10, and 50 lbs. of butter at 25 cts. a lb.; he charges me $8 for repairing reaper and gives me balance in cash.

EASTER EXAMINATIONS, 1885—Continued.

(*c*) Paid $16 taxes for 1884.
(*d*) Sold a horse, $175.
(*e*) Paid $11 for threshing wheat.
(*f*) Sowed 25 bushels oats in field No. 4 kept from last year and now worth 45 cents a bushel.
(*g*) Sowed timothy seed in same field, for which I paid $10 cash.
(*h*) Gave J. Bruce (hired man) $15 on account, and at same time an order on R. Jones, general merchant, for goods to the value of $20 to be charged in my account.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. What principles should guide us in the arrangement and construction of farm buildings?

2. Name and explain some of the detail arrangements for such buildings.

3. The cultivation and manuring of land in the fall, in preparation for succeeding crops, is found to be beneficial; what are the facts that bring about such a result?

4. Give a concise yet full statement of the value of permanent pasture, showing how it should be associated with the present system of farming in Ontario.

5. Give names and quantities per acre, of grasses and clovers, for such pasture.

SECOND YEAR.

LIVE STOCK.

Examiner: WM. BROWN.

1. In preparing for the winter keep of all classes of Live Stock, what should guide you in estimating the kinds and quantities of food?

2. In view of the increasing importance of dairying—in what manner and to what extent is it advisable to change the present system of farming in Ontario? Refer briefly to the principal circumstances that influence this subject.

3. In what respects do the production of thoroughbred cattle and sheep for others, their production for immediate consumption, and their maintenance for dairy purposes, as separate branches for Ontario, influence the general system of the best of mixed farming?

4. Place the Holstein, Ayrshire, and Jersey breeds of cattle in connection with question 2 hereon.

5. Compare the Shropshire and Hampshire breeds of sheep as suitable for Canadian purposes.

SECOND YEAR.

ARBORICULTURE.

Examiner: WM. BROWN.

1. What are the main objects of the study of this subject in Canada?

2. Sketch briefly the management of trees in the Nursery.

3. Indicate the importance of enclosing, draining, and cultivation, in connection with forest trees.

EASTER EXAMINATIONS, 1885—Continued.

4. Report, very briefly, on the management of a plantation, from planting up to maturity. What is maturity here?

5. Show the financial position of a properly established and maintained ten acre plantation of mixed trees at the end of fifty years.

SECOND YEAR.

JUDGING CATTLE (ORAL EXAMINATION).

Examiner: WM. BROWN.

1. Judge the Short Horn Cows, giving 1st, 2nd, and 3rd places, with reasons.
2. Which is the most typical of the Cows? Give reasons.
3. Which of the Cows, irrespective of breed, gives the best milking indications as regards (1) skin, (2) veins, (3) escutcheon, (4) udder.

SECOND YEAR.

JUDGING SHEEP (ORAL).

Examiner: WM. BROWN.

1. Name and criticise the two down rams, acccording to their classes.
2. Judge the fleeces of the Hampshires.
3. Criticise the two shorn grade wethers from a Leicester standpoint.

SECOND YEAR.

AGRICULTURAL CHEMISTRY.

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

1. Classify and chemically describe the combustible and incombustible constituents of the animal body.
2. In theory and practice state briefly
   (1) The constituents which determine the character of the food.
   (2) The conditions which enable the animal most fully to use these constituents.
   (3) To what fodder will the addition of starch or sugar diminish digestibility.
   (4) Give "Frankland's" heat-producing power of starch, fat and albumen.
3. Name the foods which when fed to animals make the manure of these animals richest in valuable constituents.
4. In making cream, skim-milk, butter, buttermilk, cheese and whey from the milk of a cow, briefly give the principles that would in each case influence you in foddering.
5. When and how would you drain your soil?
6. The following *digestible fodder* is given you, and you are required to fatten an ox of 1,000 pounds live weight. What ration of each fodder would you use?

	Albuminoids.	Carbohydrates.	Fat.
Red clover	7	38.1	1.2
Wheat straw	0.8	31.9	0.4
Turnips	1.1	5.3	0.1
Potatoes	2.1	20.6	0.3
Peas	20.2	49.9	0.7
Wheat bran	10.9	37.6	3.4
Linseed cake	28.7	29.4	4.0

EASTER EXAMINATIONS, 1885—Continued.

7. Briefly describe some of the latest improvements German experimenters have made in the subject of cattle feeding.

SECOND YEAR.

ENTOMOLOGY.

Examiner: J. HOYES PANTON, M.A.

1. Name some of the most common insecticides and the methods of application.

2. Describe the common bark louse, and give remedies.

3. To what orders do the following destructive pests belong:—Cut worms, white grubs, wire worms, and canker worms. Describe the larvæ of each, and give a method for their destruction.

4. Compare the pupa condition of the following:—Pieris rapæ, sphinx drupiferarum, saperda candida, samia cecropia.

5. Name at least four insects injurious to the grape, two to the potato, three to wheat, and six to the apple. Give the remedies for those affecting the wheat.

6. Name the most important orders of insects, and give the names applied to the different stages through which they pass during development.

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

8. Describe the following insects in their complete condition:—Hyperchiria Io, Bruchus pisi, Haltica striolata, agriotes mancus, and name the plants they affect.

9. Distinguish a butterfly from a moth, and give three examples of each, stating in each case the plants they affect.

10. Identify the insects before you; name the orders to which they belong, and the plants upon which they feed. Give a remedy in each case.

SECOND YEAR.

METEOROLOGY.

Examiner: J. HOYES PANTON, M.A.

1. What information is necessary in order to form an idea of the climate of a place?

2. Describe the instrument used for measuring rainfall. Is the rainfall of the North-west Territories more or less than that of the Winnipeg district? Give reasons for your answer.

3. Find the mean of the following readings;—15°, + 6°, + 24.6°,—21.2°, + 14°,—13°; and give the total precipitation from the following observations on rainfall:—Snow, 4. 2. $\frac{1}{2}$, 5 inches; rain, $\frac{1}{2}$, 4, 2, $1\frac{1}{4}$ inches.

4. Name the different kinds of clouds, and state which is a precursor of storms. Give brief notes regarding the method adopted in forecasting storms.

5. Name the different kinds of thermometers, and the purposes for which they are used. It is repeatedly remarked that low readings of the thermometer in Manitoba do not indicate so cold weather as the same readings here. How do you account for this?

6. Explain why it is that a body of water has an influence upon the climate of a locality. To what extent will its depth affect the results? Give Canadian examples in connection with your answer.

7. Classify winds, and name localities in which they occur. Describe the anemometer and state its use.

EASTER EXAMINATIONS, 1885—Continued.

8. How do you account for mists in a valley? State in what way this is of practical importance.

9. Why is the Northern Hemisphere warmer than the Southern, though surrounded with less water?

10. Read the instrument before you.

SECOND YEAR.

VETERINARY PATHOLOGY.

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

1. Mention the four kinds of wounds usually met with; state which is the most dangerous, and name the usual sequels.

2. Give the symptons of choking in a cow, and the various methods of relief in such a case.

3. Describe the following conditions, pointing out the consequences of their presence, and the proper manner of dealing with them, viz., Lampas, Wolf Teeth, and Parrot Mouth.

4. Give the reasons why horses are more prone to intestinal troubles, while cattle suffer more frequently from gastric derangements. Explain the common causes of digestive disorders in horses.

5. What attitude does a horse assume in Pneumonia, and what class of medicines are contra-indicated in this affection.

6. Give the symptoms, causes, and treatment of "Weed."

7. Give the symptoms, causes, and treatment of White Scours in foals, calves, and lambs.

8. Give the symptoms of spasmodic colic, rupture of the stomach, and treatment of actue indigestion.

9. Give the symptoms and causes of Azoturia.

10. Give the symptoms of Strangles.

PRACTICAL HORSE (ORAL).

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

1. Show how twitch should be applied, and how to give a ball.

2. Take pulse in horse and cow, and drench.

3 Point out the situation of splints, ringbones, spavins and sidebones, curbs and thoroughpins.

4. Point out the conformation most desirable in the middle-piece.

5. Describe the most desirable formation of knee and parts below it in the horse.

SECOND YEAR.

POLITICAL ECONOMY.

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

NATURE OF WEALTH.

1. Name a common error as to what constitutes wealth.

2. Illustrate the following:—Whether a commodity is wealth or not depends on *where* it is, *how much* we have of it, and *when* we have it.

EASTER EXAMINATIONS, 1885—Continued.

3. In what way should we measure an increase in the wealth of the world, by quantity, by value, or by what? Give illustration.
4. Illustrate from Canadian farm life the "law of succession in wants."

PRODUCTION OF WEALTH.

5. When people resort to the best locations for their supplies, work in the best manner, adopt the best machinery, *et. cet.*, what are they seeking to secure, and what are they seeking to avoid? Answer in two short sentences.
6. Why is it we can buy a newspaper for a cent?
7. Name six methods adopted to render labour more productive.

DISTRIBUTION OF WEALTH.

8. Are strikes generally against a reduction of real or of nominal wages?
9. Against which should strikes be, if they are any use at all?
10. Against which one of the three claimants to the product are strikes generally directed?
11. What effect would a universal strike inevitably have on real wages?
12. Whose share of the product increases without effort?

FALLACIES.—Prove the fallacies in the following statements, and state the doctrines in which they are involved:—

13. Work is wealth.
14. High wages depend on high prices.
15. One country's wealth means another's impoverishment.
16. Wealth depends on *where* we get our supplies and not on *how much*.
17. Increase of debts means an increase of wealth.

SECOND YEAR.

ENGLISH LITERATURE.

RICHARD II. AND JULIUS CÆSAR.

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

I.

1. As in a theatre the eyes of men,
After a well-graced actor leaves the stage,
Are idly bent on him that enter next,
Thinking his prattle to be tedious;
Even so, or with much more contempt, men's eyes
Did scowl on gentle Richard; no man cried "God save him!"
No joyful tongue gave him his welcome home;
But dust was thrown upon his sacred head,
Which with such gentle sorrow he shook off,—
His face still combating with tears and smiles,
The badges of his grief and patience,——
That had not God for some strong purpose, steeled
The hearts of men, they must perforce have melted,
And barbarism itself have pitied him.
But heaven hath a hand in these events,
To whose high will be bound our calm contents.
To Bolingbroke are we sworn subjects now,
Whose state and honour I for aye allow.

EASTER EXAMINATIONS, 1885—Continued.

(*a*) Write a prose paraphrase of this passage.
(*b*) Scan verses 6, 10, 11, 13 and 14 of the extract.
(*c*) *Honour.* State which spelling you prefer, *honour* or *honor*, and give the reasons for your preference. State your view as to the desirability of a general change in English spelling in the direction of making it phonetic, giving your reasons.
(*d*) *Combating.* When should the final consonant of a verb be doubled before an affix? Write the present participle of *regret*, *benefit*, *profit*.
(*e*) Select from the above passage what you think the most truly poetic verses, and give reasons for your selection.

2. Welcome, my son, who are the violets now
That strew the green lap of the new-come spring?

(*a*) By whom and under what circumstances are these words spoken? Explain fully their meaning.
(*b*) Name the figure employed and quote other examples of the same figure.

3. Continue the following quotations:

(*a*) My life thou shalt command but not my shame.
(*b*) The purest treasure mortal times afford.
(*c*) A dearer merit, not so deep a maim.
(*d*) Each substance of a grief hath twenty shadows.
(*e*) O loyal father of a treacherous son.
(*f*) They love not poison that do poison need.

4. The apprehension of the good
Gives but the greater feeling to the worse.

(*a*) By whom spoken.
(*b*) Comment briefly upon the sentiment.

5. Give a short analysis of Richard's character, as represented by Shakespeare.

II.

1. "Not that I loved Cæsar less, but that I loved Rome more."

Explain the full meaning of this and show how it summarizes the whole of Brutus speech in the Forum after the assassination.

2. Sketch briefly the argument of Antony's speech in the Forum.

3. Quote some of what you consider the most powerful passages in Antony's speech, and say wherein you think their power consists.

4. Compare the speches of Antony and Brutus with respect to the classes of feelings to which they appeal.

SECOND YEAR.

MECHANICS.

Examiner: E. L. HUNT.

1. Define *acceleration*, *mass*, *momentum*. A body weighing 20 lbs. is projected vertically upwards, and reaches the ground again in $5\frac{1}{2}$ seconds. Find—

(*a*) The velocity when it reaches the ground.
(*b*) The distance through which it passed during the 3rd second.
(*c*) Its momentum at the end of the 1st second.

EASTER EXAMINATIONS, 1885—Continued.

2. In the system of pulleys where the same string passes round each pulley, there are two pulleys in the lower block. what power is required to raise a weight of 400 lbs.?

3. what is ment by *mechanical advantage* being lost or gained by the intervention of the lever? If a pitchfork be 6 feet long, and prongs 10 inches, and the weight of hay on prongs 30 lbs., with centre of gravity over the centre of prongs, find the force exerted by the right and left hands, if the left be at the end of handle and the right 18 inches from end—the fork being horizontal.

4. State and prove the principle of the Parallelogram of Forces. Two forces of 50 lbs. and 75 lbs. act upon an article at an angle of 60°. Find their resultant.

5. Show that the *Screw* is a modification of the *Inclined Plane.* If the distance between the threads of the screw be $\frac{1}{5}$ inch, and a power of 100 lbs. be applied at the end of a lever $3\frac{1}{2}$ feet long, the arms on either side of the screw being of equal length, what pressure will be produced?

6. Find the resultant pressure of a fluid on a body wholly immersed in a fluid.

(*a*) Why will a body lighter than water rise in water?

(*b*) A piece of wood, whose specific gravity is 0.75, is in the form of a cube. Find to what depth it will sink in water, if the edge of the cube be 3 feet long.

7. Draw a diagram of the Hydrostatic Press, and state the property of fluids of which practical advantage is thus taken.

8. Name any useful instruments the action of which depends upon the atmospheric pressure. Draw a diagram of one, and fully explain its working.

SECOND YEAR.

DRAINING.

Examiner: E. L. HUNT.

1. "The process of underdraining is a process of absorption and filtration, as distinguished from surface-flow and evaporation." Explain—

Enumerate the benefits arising therefrom.

2. What is a sill-basin? Where are they used?

3. In cases where slopes occur, what should be the direction of the laterals? Give the arguments for your position.

4. Describe the different kinds of tile used for underdraining and which you would prefer.

5. "If I had to borrow money at 10 per cent. I think it would pay me to drain my wet lands":—*Agricultural Commission Report.*

Fully discuss this statement, taking an average field of 10 acres, giving the details of cost, the increase of the various crops, etc.

SECOND YEAR.

BOOK-KEEPING.

Examiner: M. MACCORMICK,

Principal Guelph Business College.

1. Give definition of Ledger.

2. What is balance sheet?

3. State the use of the Loss and Gain account, and what is shown by the Dr. and Cr. sides respectively?

EASTER EXAMINATIONS, 1885—Continued.

4. What amounts are shown on the Dr. and Cr. sides respectively of the balance sheet.

5. You own, in the County of Wellington, a farm of 200 acres, worth $60 per acre, together with necessary stock and implements for working it; you have cash $500, notes in your favour $300, and no liabilities. Estimate the value of stock and implements, and give your opening debits and credits.

6. Make out and close an account with a turnip field of six acres.

7. What accounts would be affected and how by the following transactions:—

(*a*) Bought 10 acres of bush land at the rear of my farm, at $50 per acre, giving $250 cash and my note at 12 months, with interest at 6 per cent. for balance.

(*b*) Paid E. White's bill for blacksmithing with cash $9 and contra account for one ton of hay, $10, and teaming coal and iron, $6.

(*c*) Effected insurance on barn and stables to the amount of $2,000, paying premium at $\frac{3}{4}$ per cent., and $1.25 for policy, with cash.

(*d*) Sowed a 10 acre field with fall wheat, for which I paid $1.50 per bushel, cash.

SPECIAL CLASS.

LIVE STOCK.

Examiner: WM. BROWN.

1. The Shorthorn and Jersey breeds of cattle, as extremes, have yet points or characteristics in common. Name these, and place another breed between them that would tie most of the dissimilar points.

2. What facts would stand in favour, and against, the practice in Ontario of finishing yearling beef for the British market?

3. Compare the Cheviot and Leicester breeds of sheep.

4. Describe and compare fully the two accompanying samples of wool.

5. Note, in order of occurrence, with dates, ten of the principal events in tihe life of a fattened Shearling Wether.

6. Milk, as a farm product, varies in value according to its application. Specify these, and indicate in what other respects it varies in value.

7. What is the proper position of green fodder crops in Ontario?

8. Give a concise idea of the importance to Canada of better pasture, and name the principal grasses at present reliable for permanent use.

SPECIAL CLASS.

LIVE STOCK.

Examiner: P. J. WOODS.

1. Describe the best kind of a store steer for feeding purposes, and also one that would be unprofitable as a feeder. Give a full statement and reasons for your answer.

2. What is understood by the word finished when applied to fat cattle, and how would you judge the weight of dressed beef as to live weight of an animal fit for the shambles.

3. Give the general principles of breeding, and also the excellent points in a flock of sheep.

EASTER EXAMINATIONS, 1885—Continued.

4. Write fully on the following question:—Give the signs of lambing in the ewe. Should it be apparent that the lamb is presented wrong what is necessary to be done? Sometimes the ewe has not strength to expel the lamb, in such cases what would you do?

5. Name three breeds of pigs best adapted for our Canadian markets. Give reasons for your selection. What is meant by fertility in sows? Give treatment of a sow about to pig, and until the pigs are six weeks old.

6. Give the essential points in a good milch cow without reference to breed.

SPECIAL CLASS.

JUDGING CATTLE (ORAL).

Examiner: W. BROWN.

1. Judge the Short Horn cows, giving first, second, and third places, with reasons.

2. Which is the most typical of the cows? Give reasons.

3. Which of the cows, irrespective of breeds, gives the best milking indications as regards (1) skin, (2) veins, (3) escutcheon, (4) udder.

SPECIAL CLASS.

JUDGING CATTLE (ORAL).

Examiner: P. J. WOODS.

1. Judge the cows for the dairy and compare their build from a milking standpoint.

2 Judge the steers; give first, second and third places; giving reasons for your selections.

3. Would you consider the steers you have just judged good representatives of what beefing steers should be. Give reasons for your answers.

4. Which of the steers indicates the best handling quality.

SPECIAL CLASS.

JUDGING SHEEP (ORAL).

Examiner: W. BROWN.

1. Judge the fleece of the Oxford Down grade wether.

2. Criticise the two shorn grade wethers from a Leicester standpoint.

3. Which is the most typical of the long-wooled rams? Explain fully.

SPECIAL CLASS.

VETERINARY OBSTETRICS.

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

1. In which of our patients is difficult parturition most frequently seen, and what is the relative difficulty in affording relief, in mare and cow, and causes, of the same.

2. Give directions for attention to offspring immediately after birth.

3. Give the modes of restraint, state what assistance the obstetrician requires, and describe how traction should be applied.

EASTER EXAMINATIONS, 1885—Continued.

4. Describe how to perform cephalatomy, and mention the condition that calls for this operation.

5. What is the normal presentation, and in what other position is delivery sometimes effected.

6. Under what circumstances is it advisable to resort to Cæsarean section.

7. Give directions for delivering when the head is deviated downwards, between the fore-legs.

8. Give directions for delivering in reverse anterior presentation.

9. Give the symptoms of retention of Placenta.

10. Give the treatment of inversion of the Uterus.

SPECIAL CLASS.

LAW'S VETERINARY ADVISERS.

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

1. What is an Aneurism? and what are the symptoms of the condition?

2. What are the differences between the symptoms of hæmorrhage from arteries and veins?

3. Mention the causes of Phlebitis.

4. What are the causes of local Lymphangitis, and symptoms of the same?

5. Give the symptoms of the presence of Trichinæ Spirales in animals.

6. Give the symptoms of Gangrenous Ergotism, and means of prevention.

7. Give the causes of Acute Anasarca.

8. What is Anæmia, and what are its causes?

SPECIAL CLASS.

STOCK BREEDING (MILES).

Examiner: JOHN HOBSON.

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

2. Give some illustrations of that form of heredity known as the heredity of acquired and abnormal characters.

3. In what way have many of the most valuable characteristics of the various improved breeds of animals been produced?

4. What course must be followed to make the improved characters in animals permanent?

5. Define the form of heredity termed "Atavism," and give some illustrations.

6. For what purpose has in-and-in breeding been practised by most of the great breeders; and what is the most obvious objection to close-breeding?

7. When cross-breeding has been successfully practised, what has been the object in view?

8. How may the constitutional tendencies and general characteristics of animals be ascertained with great certainty? And how must additional information in regard to the details of the organization which determine the qualities that are of value in the economy of the farm, be gained?

EASTER EXAMINATIONS, 1885—Continued.

9. How have all the best qualities of the improved breeds been obtained?

10. In what way has the high development of special qualities in our improved breeds which have been obtained by artificial treatment, affected them in other respects?

SPECIAL CLASS.

FEEDING OF ANIMALS (Stewart).

Examiner: JAMES P. PHIN.

1. Why should we study the nature of the animal we feed?

2. Define the terms—Protein, Cellulose, and Respiratory Food.

3. Why should foods rich in Albuminoids not be fed alone?

4. The digestible nutrients of wheat-bran are—say Albuminoids 12, Carbo-hydrates 42.2, Fat 2.5. What will be the nutritive ratio?

5. Explain "The System of Ensilage," and state the benefits likely to result from that discovery.

6. Describe how to feed the young calf until it is six months old.

7. At what age should beef cattle be ready for market? And how has the economy of young beef been demonstrated?

8. Describe the principal characteristics to be considered in selecting a dairy cow, and give the composition of an average winter ration for such cow.

9. How many lbs. of milk should a good cow well fed yield in a season? And what portion of the food goes to keep the animal alive?

10. Give your opinion as to the best method of managing a flock of sheep so as to produce the best results in wool and mutton.

III. PAPERS SET AT THE SESSIONAL EXAMINATIONS, MIDSUMMER, 1885.

FIRST YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. What quantities of wheat, oats, and barley, would you sow per acre, and what circumstances would guide you in varying these quantities?

2. Describe the preparation and management of a root crop, and explain what position it holds in the rotation.

3. What is the general character of the soil of this farm, the rotation of cropping in use, and the special conditions of No. 17 field?

4. Give a list of our principal green fodders, their feeding value, quantity per season, and order of earliness.

5. Answer the following points in drainage:—
   (1) what regulates depth and distance apart of drains?
   (2) The cost of cutting, laying, and filling drains, per rod.
   (3) Sketch field 12, show how it is being drained, and give names to drains therein.

MIDSUMMER EXAMINATIONS, 1885—Continued.

FIRST YEAR.

GEOLOGY.

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

1. From what rock formations have the principal ingredients in Ontario soil been derived, and by what means has their disintegration been chiefly effected.

2. What is the composition of dolomite, quartzite, selemite, apatite, feldspar, calcite, talc, and gneiss? In what rocks are they usually found?

3. Describe the occurrence of fossils in two forms, and state what inferences can be made from the presence of a coral in limestone.

4. Name the *Systems* found in the second and fourth Ages of the geological records.

5. Write notes on the "Age of Reptiles," "Age of Fishes," and the "Age of Flowerless Plants."

6. Contrast the coal of the North-West with that of Nova Scotia with reference to its age and its source.

7. In what geological deposits are the following economic products found:—Iron, copper, petroleum, salt, peat, gypsum, lead, coal, chalk, silver, and graphite?

8. Describe the Third Prairie Steppe of the North-West.

9. Identify the specimens before you.

10. Arrange the accompanying slips representing the layers of the earth's crust in their relative position, and name some of the most characteristic fossils found in No. 8.

FIRST YEAR.

STRUCTURAL AND PHYSIOLOGICAL BOTANY.

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

1. Describe the different methods by which plants climb, and give examples of each.

2. Name the form of inflorescence observed in the Clover, the Indian Turnip, the Lily of the valley, the Blue Weed, the Apple, the Timothy, and the Lilac.

3. Explain fully the process of fertilization. By what means is it effected, and to what extent can it be practically taken advantage of by horticulturists?

4. Describe a leaf fully, and draw diagrams illustrating ten of the most common forms.

5. Classify roots according to their shape, and give an example of each. How are biennial forms usually distinguished from annual?

6. Contrast the characters Endogens with those of Exogens, and give three examples of each?

7. Write notes on the circulation of sap in plants, with special reference to where and what changes it undergoes before assimilation.

8. What is meant by an irregular flower? Give the terms sometimes applied to such, and an example in each case.

9. What peculiarity exists in the essential organs of reproduction in the following plants, and what terms are applied to such forms:—Begonia, Willow, Maple, Geranium, Snowball, and Pine?

10. Analyze the plants before you according to the accompanying Schedule.

MIDSUMMER EXAMINATIONS, 1885—Continued.

FIRST YEAR.

MATERIA MEDICA.

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

1. Give the theories with regard to the Allopathic, Antipathic and Homœpathic modes of cure.

2. Define the following terms, viz:—Diuretic, Tonic, Anæsthetic, Disinfectant and Alterative.

3. Give the actions of Aconite, and the indications for its use.

4. Write all you know about Aloes.

5. Describe the process to pursue in purging a horse.

6. Give the actions and uses of Belladonna, and mention its active principle.

7. How is lime-water made, and what are its uses?

8. Describe how to prepare and apply a Cantharidine blister.

9. What is Carbolic Acid obtained from, and what are its uses?

10. Describe the medical treatment of foot-rot in sheep.

FIRST YEAR.

ENGLISH LITERATURE.

Examiner: E. L. HUNT.

1. (*i*) "Oh, Sir! the good die first,
And they whose hearts are dry as summer *dust*
Burn to the socket. Many a passenger
Hath blessed poor Margaret for her gentle looks,
When she upheld the cool refreshment drawn
From that forsaken spring: * * *
* * * * * She is dead,
The light *extinguished* of her lonely hut,
The hut itself abandoned to decay,
And she forgotten in the quiet grave."

(*ii*) "*It* were a wantonness, and would demand
Severe reproof, if we were men whose hearts
Could hold vain dalliance with the misery
Even of the dead; contented thence to draw
A momentary pleasure, never marked
By reason, *barren* of all future good.
But we have known that there is often found
In mournful thoughts, and always might be found
A power of virtue *friendly*."

(*a*) Parse the words in italics.

(*b*) Point out the figures of speech in (*i*).

(*c*) "The good die first." Quote any proverb which expresses the same thought.

(*d*) "Burn to the socket." Quote a passage from any other poem where the same figure is used.

(*e*) Express clearly the meaning (*ii.*)

MIDSUMMER EXAMINATIONS, 1885—Continued.

2. What is pathetic Fallacy?" Give two or three examples from the "Excursion."

(*a*) Quote eight lines beginning :—

"Ere long the sun declining shot
A slant———.

Or quote any other passage you remember not exceeding twelve lines.

3. (*a*) Narrate briefly the story of Margaret, introducing quotations from the poem.

(*b*) Is Wordsworth justified in representing the leading character, from which the story derives its pathos, as being so neglectful of herself and her infant?

4. "The one obvious word of counsel in her (Margaret's) particular distress, which dotage could not have overlooked, he (the Wanderer) suppresses * * * To have overlooked a point of policy so broadly apparent as this, vitiates and nullifies the very basis of the story. * No such case of distress could hav. existed for one fortnight." Explain and criticise.

5. Locate the following passages and explain the meaning of each.

(*i*) "And still that length of road,
And this rude bench, one torturing hope endeared,
Fast rooted at her heart."

(*ii*) "Far and wide the clouds were touched,
And in their silent faces could be read
Unutterable love."

(*iii*) "And with a brighter eye she looked around
As if she had been shedding tears of joy."

(*iv*) "From his intellect
And from the stillness of abstracted thought
He asked repose."

(*v*) "He whistled many a snatch of merry tunes
That had no mirth in them."

(*vi*) "Whate'er, in docile childhood or in youth,
He had imbibed of fear or darker thought
Was melted all away."

(*vii*) "Beside yon spring I stood,
And eyed its waters till we seemed to feel
One sadness, they and I."

(*viii*) "Therefore with her hues,
Her forms, and with the spirit of her forms,
He clothed the nakedness of austere truth."

(*ix*) "I rose; and, having left the breezy shade,
Stood drinking comfort from the warmer sun."

FIRST YEAR.

COMPOSITION.

Examiner: JAMES MILLS, M. A.

1. Name and define the most important properties of a good style.

2. Distinguish the following words, and give an example of the correct use of each: *Truth* and *veracity*, *inaugurate* and *begin*, *balance* and *remainder*, *ambiguity* and *obscurity*, *redundancy* and *tautology*.

MIDSUMMER EXAMINATIONS, 1885—Continued.

3. Criticise the following sentences, and point out the properties of style which are violated in any of them: (1) "Sincerity is as valuable, and even more so than knowledge," (2) "May is *par excellence* the month of flowers," (3) "He not only owns a house, but also a farm," (4) "They were persons of moderate intellects, even before they were impaired by their passions," (5) "I have since learned to like nothing but what you do," (6) "He was a man of fine abilities, and who lost no opportunity of improving them by study," (7) "We came to our journey's end at last, with no small difficulty, after much fatigue, through deep roads and bad weather."

4. Explain the difference between a simile and a metaphor.

5. Point out and explain the figures in the following:—

(1) At length Eramus
Stemm'd the wild torrent of a barbarous age
And drove those holy vandals off the stage.

(2) Up rose the sun, and up rose Emilie.

(3) My heart is turned to stone.

(4) The marble speaks; the canvas glows.

(5) He was useful in his day.

(6) Athens the eye of Greece,
mother of arts and eloquence.

(7) There is too much red tape in the institution.

(8) To take arms against a sea of troubles.

(9) But yonder comes the powerful king of day
Rejoicing in the East.

(10) From the cradle to the grave.

6. Write a short composition on "method in daily life," ; or "the advantages of a good education."

FIRST YEAR.

MENSURATION.

Examiner: E. L. HUNT.

1. (*a*) A rectangular plot is 550 feet long and 330 wide; a road 7 feet wide surrounds the plot. Find the area of the road.

(*b*) Find the area of the road which surrounds a circular plot of the same perimeter.

2. A sack of wheat, a pail, and a trough, are in the hall. Take the necessary measurements and find—

(*a*) The weight of the sack of wheat;

(*b*) The number of gallons the pail will contain;

(*c*) The number of gallons the trough will contain. (A gallon contains 277$\frac{1}{4}$ inches).

3. A stick of timber 50 feet long tapers regularly, the diameters of the ends being 4 feet and 2 feet respectively. Find the volumn of the largest squared stick which may be cut from it.

MIDSUMMER EXAMINATIONS, 1885—Continued.

4. If the amount of rainfall is 0.75 inches, find how many gallons fall on an acre.

5. A ditch is 6 feet wide at the top and 2 feet wide at the bottom, and 4 feet deep.
   (*a*) How many cubic yards are removed if the ditch is one mile long?
   (*b*) If the surface of a road is horizontal, and the excavation from the ditch be applied to the road to the width of 20 feet, so as to make the surface two inclined planes meeting in the centre, how much is the centre of the road raised if the edges are raised 2 inches?

6. In question 5, if the ditch be half filled with water, find the depth of the water.

SECOND YEAR.

AGRICULTURE.

Examiner: WM. BROWN.

1. The cropping of this Farm was arranged for certain objects. What were these? For what reasons are they not now altogether required, and what additional cropping or change of system should be adopted to meet the requirements of the times for Ontario?

2. Describe the place and purpose of pasture in a rotation of cropping; indicate wherein it fails to meet our provincial wants, and show in what way it can be improved.

3. Make critical notes on the kind, the method of feeding, increase to weight, and the financial results of our store cattle last winter.

4. What are the causes leading to the extension of Dairying in Ontario? Describe briefly the factory systems of butter making, and advise, with reasons, as to the most suitable breed of cattle for such a change.

5. Name the principal causes that are likely to regulate prices of cattle at our public sale this year, and apply them to a yearling Hereford bull, a yearling Guernsey heifer, and a yearling Shorthorn bull.

SECOND YEAR.

ANALYTICAL CHEMISTRY.

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

1. Explain briefly how metals in a systematic course of analysis are separated into groups.

2. How would you separate—
   (*i*) Fe from Al, in solutions of ferrous sulphate and aluminium sulphate.
   (*ii*) Ca from Mg, in solutions of chlorides.
   (*iii*) As from Cu, in solutions of chlorides.

3. Formulate the chemical action that occurs when—
   (*i*) Ferrous sulphate and sulphuric acid are added to a solution of a nitrate.
   (*ii*) Potassium ferricyanide to solutions of a ferrous and ferric compound.
   (*iii*) Acid of carbonate of ammonia is heated with potassium hydrate.
   (*iiii*) Potassium hydroxide is added to aluminium hydroxide.

MIDSUMMER EXAMINATIONS, 1885—Continued.

(*iiiii*) Manganous hydroxide is heated with potassium nitrate and sodium carbonate.

4. Give the characteristic tests for the acids: Nitric, carbonic, oxalic, acetic and phosphoric.

5. Practical: Determine—
(*i*) The metals of solution, No. I.
(*ii*) The acids of solution, No. II.

SECOND YEAR.

HORTICULTURE.

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

1. State some of the climatic conditions which influence fruit growing, and illustrate with reference to the Province of Ontario.

2. Write notes on the roots and leaves of a plant; describing the functions of each and show the interdependence existing between them.

3. What soils are best fitted for the growing of pears, peaches, apples, plums and strawberries?

4. Describe the propagation of plants by budding, and state what precautions are necessary to be observed. Name the different ways in which plants may be obtained.

5. Name some of the hardiest shrubs best suited for ornamental purposes, and give a collection of plants especially adapted for pots and hanging baskets.

6. Give the directions for the construction of a hot bed. What is its use, and what precaution is to be observed in arranging plants in it?

7. What advantages are to be obtained by hybridization? Illustrate with reference to some Canadian fruits, and name some plants in which this is readily effected.

8. Name the different kinds of grafting and describe one of them. Upon what conditions does its success depend?

9. State the benefits derived from mulching, pruning, and the cultivation of the soil in orchards.

10. What are the principal points to be observed in planting an orchard?

SECOND YEAR.

SYSTEMATIC AND ECONOMIC BOTANY.

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

1. Upon what characters does the classification of plants into sub-kingdoms, provinces, classes and cohorts depend? Arrange the following into these divisions:—Apple, Spring Beauty, Geranium, Honeysuckle, Mint, Heliotrope, Lilac, Maple, Oak and Liverleaf.

MIDSUMMER EXAMINATIONS, 1885—Continued.

2. The White Lily of the Woods, Lily of the Valley, Orange Lily and Calla Lily. Which of these are true lilies? Name the orders to which they belong and contrast the two last.

3. From what orders are the following economic products obtained:—Sugar, resin, nuts, forage, flour, lumber, fruit, cotton, hemp and vegetables.

4. Give the economic uses of the algæ.

5. Describe the life history of the *rust* on wheat (Pucinnia graminis). Name three other forms among the Fungi injurious to crops.

6. Give the characters of the orders *Labiatæ*, *Oleaceæ*, and *Coniferæ*, and give examples of plants in each.

7. Name ten of the most common weeds and the orders to which they belong.

8. Name some important genera in the pulse family.

9. Identify the specimens before you, and state what peculiarities characterize the flowers numbered 2, 4, 6, 8.

10. Fill out the accompanying schedule with the analysis of either of the plants before you marked A and B. To what order does C belong?

SECOND YEAR.

VETERINARY MATERIA MEDICA.

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

1. Define the following terms: Antiseptic, Disinfectant and Ecbolic, and give three words that express different degrees of purgation.

2. Mention the cases in which Croton Oil can be used with advantage, and those in which it is inadvisable; state why, and give the proper doses.

3. Compare Digitalis and Ergot of Rye as to their physiological actions.

4. What are the actions of Sulphuric Ether, and how can the quantity of water contained in any specimen be determined?

5. Explain the practical value of Gamboge, and how and when to use it.

6. Of the medicinal compounds of Lead, Mercury, and Magnesium, mention those that are of the most importance in veterinary medicine, and give their properties.

7. What are the indications for the use of Nux Vomica, and the dose for the horse? Name its principal Alkaloid, and give the properties of it.

8. Describe all you know about opium.

9. Write out prescriptions for purgatives for the horse, ox, sheep and dog.

10. Give a prescription for hoven.

SECOND YEAR.

VETERINARY OBSTETRICS.

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

1. Describe how an Ovum and Spermatozoon come in contact.

2. Describe the Uterus of the mare and its functions.

MIDSUMMER EXAMINATIONS, 1885—Continued.

3. Mention the four acts by which generation is accomplished.

4. What are the causes of Par[illegible]tion?

5. Give an account of the causes [illegible] Abortion.

6. What length of time does parturition occupy in the mare, cow, and ewe, and how are we to be guided in interfering.

7. Define normal and abnormal parturition; and describe the natural presentation, also the usual cause of malpresentations.

8. Describe the instruments required in parturition.

9. Give a description of how to proceed in delivering a fœtus when one foreleg is completely retained.

10. Describe the indications for delivery when all four legs and the head are presented.

SECOND YEAR.

L'ALLEGRO AND IL PENSEROSO.

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

1. Explain carefully and fully the meaning of the following extracts, pointing out anything which you consider to be specially beautiful in thought or expression:

(*a*) The frolic wind that breathes the spring.
(*b*) While the cock with lively din
Scatters the rear of darkness thin.
(*c*) Where the great sun begins his state,
Robes in flames and amber light,
The clouds in thousand liveries dight.
(*d*) Untwisting all the chains that tie
The hidden soul of harmony.
(*e*) And every shepherd tells his tale
Under the hawthorn in the dale.
(*f*) Forget thyself to marble.
(*g*) While Cynthia checks her dragon yoke
Gently o'er the accustomed oak.

2. "And if I give the honour due,
Mirth admit me of thy crew,
To live with her and live with thee,
In unreproved pleasures free."

(*a*) Analyze this passage syntactically.
(*b*) Her. Who is meant?

3. "Half-regained Eurydice." Relate the story to which the allusion is here made.

4. *Prince Memnon*, that *starr'd Ethiop queen, Musæus, Orpheus.* Write brief notes upon these.

5. "While yet there was no fear of Jove." Explain.

6. Quote any passage which indicates Milton's opinion of the superiority of the ancient over the modern drama.

7. What is alliteration? Quote examples of its use in these poems.

8. *Twilight.* What is the ordinary signification of this word? How is it used in Il Penseroso? Give its derivation.

MIDSUMMER EXAMINATIONS, 1885—Continued.

9. "Unsphere the spirit of Plato." Explain the meaning of the word "unsphere," and complete the quotation. State briefly what you know of Plato.

10. Quote the passages in which the following expressions occur:—*dappled dawn, nibbling flocks, busy hum, looks commercing with the skies, the noise of folly, dim religious light, prophetic strain.*

11. Explain the meaning of the names of these two poems.

12. Name any other poems of Milton.

13. Say what you consider to be the essential characteristics of poetry.

SECOND YEAR.

ROAD-MAKING, LEVELLING AND SURVEYING.

Examiner: E. L. HUNT.

I.—1. Write fully on earth roads; their improvement, repairs, &c.

2. What are the objects of covering the earth which forms the natural surface of the road with some other material, such as stone, &c.?

3. Ordinary pit gravel should be screened before being put on the road. What should be the size of the gravel? State the objections to large stones.

4. What *extra* force is required to draw a load of one ton up a hill which rises 1 in 20?

II.—1. Distinguish *true* and *apparent* level, and find the difference for a distance of (*a*) 220 yards, (*b*) 3 miles.

2. Complete the following field book, and determine the relative heights of A and G:

Stations.	Distances.	Back-Sights.	Fore-Sights.	Ascents.	Descents.	Total Heights.
A						
B	60	6.00	3.70			
C	185	0.85	9.40			
D	30	1.60	6.40			
E	95	3.00	5.38			
F	70	6.24	2.50			
G	85	2.80	5.17			

(*a*) Between what two stations is the grade steepest?
(*b*) Which is the highest, and which the lowest point in the line?

III.—Draw a rough sketch of the field and find its area from the measurements given in the following field book:—

LEFT OFFSETS.	CHAIN-LINES.	RIGHT-OFFSETS.
	800 to O_6	
	620	150
	425	190
	160	120
	From O_2	
Turn	to the left.	
	1320 to O^3	
to O_2 640	840	
425	180	
	Front O_1	

APPENDIX 3.

CLASS LISTS:

I.—EASTER EXAMINATIONS, 1885.
II.—MIDSUMMER EXAMINATIONS, 1885.

I.—EASTER EXAMINATIONS, 1885.

FIRST YEAR.

Classes.		Agriculture.	Live Stock.	Judging Cattle. (Oral Exam.)	Judging Sheep. (Oral Exam.)	Inorganic Chemistry.
Honours.	I.	1 Zavitz, C. A. 2 Sharpe, W.	....	....	....	1 Madge 2 Sturge 3 Zavitz 4 Owen 5 Fee 6 Calvert 7 Brown
	II.	1 Sturge, E. 2 Owen, W. H. 3 Power, R. H. 4 { Watts, W. G. Hipwell, J. R. 6 { Menzies, R. M. Fee, J. J. 8 Madge, R. W. 9 Kennedy, J. R.	1 { Sharp Zavitz 3 Kernighan 4 { Madge Sturge 6 { Hipwell Eby 8 { Mill Brown 10 { Power Calvert	1 Sharpe 2 { Magee Calvert 4 { Menzies Owen Idington Hipwell	1 Sharpe 2 Macfarlane 3 { Mill Menzies Chadsey Hipwell Kernighan	1 Jeffrey 2 Byers 3 McKay 4 Kernighan 5 Eby ....

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

The minimum for first-class honours is 75 per cent; for second-class honours, 60 per cent; for pass, 33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	LIVE STOCK.	JUDGING CATTLE. (Oral Exam.)	JUDGING SHEEP. (Oral Exam.)	INORGANIC CHEMISTRY.
PASS. III.	1 Eby, J. R. 2 Calvert, S. 3 Kernighan, J.N. 4 Notman, C. R. 4 Mill, J. S. 4 Bateman, H. 4 Brown, C. R. 8 McKay, J. G. 8 Holtby, R. M. 8 Marsh, T. J. 11 Chadsey, W. E. 11 Broome, A.H.S. 13 Beament, H. J. 13 Green, C. W. 15 Brush, G. H.R. 15 Etherington, C. B. 15 Jeffrey, J. S. 18 Baillie, W. 18 Ledyard. E. D. 20 Routh, P. G. 21 Carr, L. H. 21 Burwash, H. A. 21 Birdsall, W. G. 24 O'Doherty, E. J. 25 Wiggins, G. C. 25 Cobb, C. 27 Idington, P. S. 28 McFarlane, A D 28 Dennis, J. E. 28 Horsman, J. F. Donaldson, H W McLean, R. M. Magee, F. P. Lobb, C. W. T. McDonald, W.A	1 Kennedy 2 Owen 2 McKay 4 Watts 4 Fee 6 Broome 7 Chadsey 9 Horsman 9 Notman 10 Green 11 Marsh 12 Menzies 12 Etherington 12 Idington 12 Jones- Bateman 16 Cobb 16 Holtby 16 Birdsali 19 Baillie 19 Donaldson 19 Wiggins 22 Burwash 23 Routh 23 Beament 23 Brush 26 McLean 27 Macfarlane 28 Jeffrey 29 Magee 30 Dennis Lobb McDonald Whitehead Carr, L. H. O'Doherty Ledyard Donaldson	1 Kernighan 1 Zavitz 1 Power 1 Chadsey 5 Brown 5 Kennedy 5 Sturge 5 Watts 9 Macfarlane 9 Mill 9 Madge 12 Burwash 13 Wiggins 13 Notman 13 Holtby 13 Beament 17 McDonald 18 Birdsall 18 Green 18 Horsman 18 Fee 18 Marsh 18 Routh 24 Baillie 24 Broome 24 Carr, L. H. 24 Etherington 24 Jeffrey 24 McLean 24 McKay 31 Byers 31 Eby 31 Lobb Brush Cobb Dennis Donaldson Ledyard O'Doherty	1 Madge 1 Fee 1 Power 1 Calvert 1 Brown 1 Magee 7 Watts 7 Sturge 7 McDonald 7 Idington 7 Horsman 7 Holtby 13 Kennedy 14 McLean 14 Marsh 14 Burwash 14 Owen 14 Zavitz 14 Routh 20 Jeffrey 20 Lobb 20 McKay 20 Birdsall 20 Broome 20 Carr, L. H. 20 Eby 20 Green 28 Etherington 28 Brush 28 Beament 28 Baillie 28 Wiggins O'Doherty Notman Dennis Cobb Byers Ledyard Donaldson	1 Cobb 2 Watts 3 Sharp 4 Broome 5 Green 6 Holtby 7 Beament 8 Chadsey 9 Baillie 10 Ledyard 10 Power 10 Dennis 10 Idington 10 Notman Birdsall Mill Kennedy Wiggins Marsh Brush Lobb Etherington Jones-Bateman Carr, L. H. Burwash Horsman O'Doherty Macfarlane Hipwell McDonald McLean Whitehead Magee Routh Menzies Donaldson ....

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

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

FIRST YEAR.

HONOURS.

Classes.	Organic Chemistry.	Natural History.	Veterinary Anatomy.	English Literature.	English Composition.
I.	1 Madge. 2 Sturge. 3 Owen. 4 Zavitz. 5 Eby. 6 Fee. 7 Calvert.	1 Madge. 2 Sturge. 3 Eby. 4 Fee 5 Owen. 6 Cobb. 7 Calvert. 8 Broome. 9 McKay.	1 Owen. 2 Madge. 3 Sturge. 4 Fee. 5 Eby. 6 Zavitz.	1 Owen. 2 Sturge. 3 Calvert. 4 Madge. 5 Zavitz. 6 Jeffrey.	1 Sturge 2 Madge. 3 Holtby. 4 Owen. 5 Kernighan. 6 Zavitz. ....
II.	1 McKay. 2 Green. 3 Brown. 4 Jeffrey.	1 Zavitz. 2 Etherington. 3 Mill. 4 Kernighan. 5 Green.	1 Calvert. 2 Hall (Sp.) 3 Kernighan. 4 Chadsey. 5 Power.	1 Kennedy. 2 Eby. 3 McKay. Kernighan. 5 Fee. 6 Brown. 7 Green. 8 Watts. 9 Holtby. 10 Dennis. 11 Broome. 12 Wiggins. 13 Cobb. 14 Donaldson.	1 Cobb. 2 Broome. 3 Kennedy. 4 Fee. 5 Calvert. 6 Mill. 7 Dennis. 8 Eby. ....

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

FIRST YEAR.

CLASSES.	ORGANIC CHEMISTRY.	NATURAL HISTORY.	VETERINARY ANATOMY.	ENGLISH LITERATURE.	ENGLISH COMPOSITION.
PASS. III.	1 Cobb.	1 Watts.	1 Walter (Sp.)	1 Mill.	1 Green.
	2 Dennis.	2 Power.	2 Holtby.	2 Burwash.	2 Brown.
	3 Kernighan.	3 Idington.	4 McKay.	3 Marsh.	3 Watts.
	4 Chadsey.	4 Notman.	5 Green.	4 Etherington.	4 Sharpe.
	5 Holtby.	5 Chadsey.	6 Beament.	5 Menzies.	5 Menzies.
	Carr.	6 Baillie.	7 Hayman (Sp.), Sharpe.	6 Idington.	6 Jeffrey.
	Sharpe.	7 Brown.	9 Magee, Jeffrey.	7 Baillie.	7 McKay.
	Mill.	8 Beament.	11 Cobb.	8 Power.	8 Beament.
	Lobb.	9 Holtby.	12 O'Doherty.	9 Chadsey.	9 Chadsey, Bateman.
	Horsman.	10 Marsh.	13 Kennedy.	10 Beament.	11 Wiggins.
	Hipwell.	11 Jeffrey.	14 Notman, Idington.	11 Notman.	12 Baillie.
	Idington.	12 Kennedy.	16 Watts.	12 Sharpe.	13 Lobb.
	Baillie.	13 Dennis.	17 Whitehead, Fortune (Sp.)	13 Magee.	14 Etherington.
	Birdsall.	14 Brush.	19 Lobb, Byers.	14 Macdonald.	15 O'Doherty.
	Burwash.	15 Ledyard.	21 Mill, Broome.	15 O'Doherty.	16 Idington, Marsh.
	Wiggins.	16 Routh.	23 Hipwell, Burwash.	16 Routh.	18 Burwash, McFarlane.
	Etherington.	17 Donaldson.	25 Menzies.	17 Brush.	20 Horsman.
	Watts.	18 Birdsall.	26 McLean, Baillie.	18 Ledyard.	21 Notman.
	Beament.	Burwash.	28 Wiggins.	19 Hipwell.	22 Power.
	Routh.	Magee, O'Doherty.	Birdsall.	20 Horsman.	23 Hipwell.
	O'Doherty.	Horsman.	Dennis.	Birdsall.	Donaldson.
	Macfarlane.	Wiggins.	Macfarlane.	McLean.	Brush.
	Jones-Bateman.	McLean.	Ledyard.	Macfarlane.	Birdsall.
	Power.	Carr, L. H.	Routh.	Carr, L. H.	McLean.
	McDonald.	Hipwell.	Etherington.	Lobb.	Carr, L. H.
	McLean.	Menzies.	Horsman.	Jones-Bateman.	Routh.
	Menzies.	McDonald.	Chipman (Sp.)	Byers.	Ledyard.
	Kennedy.	Jones-Bateman.	Macdonald.	.....	Magee.
	Ledyard.	Sharpe.	Bateman.	.....	McDonald.
	Donaldson.	Lobb.	Brush.	.....	Byers.
	Magee.	Macfarlane.	Thompson.	.....	.....
	Brush.	.....	Donaldson.	.....	.....
	Marsh.	.....	Marsh.	.....	.....
	Notman.	.....	Carr, L. H.	.....	.....
	Byers.	.....	.....	.....	.....
	Broome.	.....	.....	.....	.....
	Whitehead.	.....	.....	.....	.....
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	.....	.....	.....	.....	.....

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

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

FIRST YEAR.

CLASSES.		ARITHMETIC.	BOOK-KEEPING.	GENERAL PROFICIENCY.	DEPARTMENTS.		FIRST-CLASS MEN IN THE DEPARTMENTS.
HONOURS.	I.	1 Jeffrey. 2 Eby. 3 McKay. 4 Madge. 5 Zavitz.	1 Madge. 2 Sturge. 3 McKay. 4 Owen. 5 Burwash.	1 Madge. 2 Sturge. 3 Owen. 4 Zavitz.	I.	AGRICULTURE AND LIVE STOCK.	....
	II.	1 Brown. 2 Sharpe 3 Burwash. 4 Holtby. 5 Marsh.	1 Menzies. Eby. 3 Kernighan. 4 Broome. Zavitz. 6 Calvert. 7 Jeffrey. 8 Fee.	1 Fee. 2 Calvert. 3 Eby. 4 McKay. 5 Kernighan. 6 Brown.	II.	NATURAL SCIENCE.	1 Madge. 2 Sturge. 3 Owen. 4 Zavitz. 5 Fee. 6 Calvert.
PASS.	III.	1 Cobb. 2 Idington. 3 Owen. 4 Ledyard. 5 Fee. 6 Sturge. 7 Green. 8 Kernighan. 9 Chadsey. 10 Dennis. 11 Broome. 12 Calvert. 13 Beament. 14 Horsman. 15 McFarlane. 16 Byers. 17 Menzies. 18 Mill. Notman. 20 Baillie. 21 Watts. Wiggins. Whitehead. Carr. McDonald. Magee. Birdsall. Hipwell. Etherington. Jones-Bateman. Lobb. Power. O'Doherty. Routh. McLean. Donaldson. Brush. Kennedy.	1 Holtby. 2 Sharpe. 3 Brown. 4 Magee. 5 McFarlane. 6 Watts. 7 Cobb. 8 Birdsall. 9 Mill. 10 Baillie. Ledyard. 12 Notman. 13 Power. 14 Green. 15 Kennedy. 16 Marsh. Etherington. 18 Chadsey. 19 Beament. 20 Idington. 21 Hipwell. Horsman. Dennis. Routh. Jones-Bateman. O'Doherty. Wiggins. Lobb. Byers. McLean. Donaldson. Carr, L. H. McDonald. Brush.	1 Jeffrey. 2 Holtby. 3 Green. 4 Chadsey.	III.	VETERINARY SCIENCE.	1 Owen. 2 Madge. 3 Sturge. 4 Fee. 5 Eby. 6 Zavitz.
					IV.	ENGLISH LITERATURE AND COMPOSITION.	1 Sturge. 2 Owen. 3 Madge. 4 Calvert. 5 Zavitz.
					V.	MATHEMATICS AND BOOK-KEEPING.	1 Madge. 2 McKay. 3 Eby. 4 Jeffrey. 5 Zavitz.

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

First-class men in general proficiency must obtained at least 75 per cent. of the total number of marks; second-class men, at least 60 per cent. of the total number of marks. First-class men in any department must obtain at least 75 per cent. of the marks allotted to the subjects in that department.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURE.	ARBORICULTURE.	LIVE STOCK.	JUDGING CATTLE. (Oral Exam.)	JUDGING SHEEP. (Oral Exam.)
HONOURS. I.	1 Muir, J. B. 2 Raynor, T. 3 McKay, J. B. 3 Butler, G.C. 5 McIntyre, D. N.	1 Muir. 2 Raynor. 3 McKay. 3 McPherson. 5 Butler.	1 Raynor. 2 McKay. 3 Muir. 3 McIntyre.	1 Raynor.	1 Raynor. 2 McIntyre.
HONOURS. II.	1 McPherson, A. 2 Reid, A. 3 Thompson, W.D. 3 Smith, E. P.	1 McIntyre. 2 Reid.	1 Butler. 1 McPherson. 3 Reid.	1 Butler. 1 Muir. 3 Thompson. 3 McKay. 3 McIntyre. 6 McPherson. 7 Reid. 8 Smith.	1 Muir. 2 McKay. 3 Butler. 4 Thompson.
PASS. III.		1 Smith.	1 Smith. 2 Thompson.		1 McPherson. 2 Smith.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	AGRICULTURAL CHEMISTRY.	ENTOMOLOGY.	METEOROLOGY.	VETERINARY PATHOLOGY.	JUDGING HORSES.
HONOURS. I.	1 Muir. 2 Raynor. 3 Butler. 4 McKay. 5 McPherson.	1 Raynor. 2 McKay. 3 Muir. 4 McPherson. 5 Butler. 6 Reid. 7 McIntyre.	1 Raynor. 2 Butler. 3 Muir. 4 McPherson.	1 Muir. 2 McKay. 3 Raynor. 4 Butler.	1 Muir. 2 McKay. 3 Raynor. 4 McPherson. 5 McIntyre. ....
HONOURS. II.	1 McIntyre. 2 Reid.	1 Thompson.	1 McIntyre. 2 McKay.	1 McPherson.	1 Butler. .....
PASS. III.	1 Thompson. 2 Smith.	1 Smith.	1 Reid. 2 Thompson. 3 Smith.	1 McIntyre. 2 Reid. 3 Thompson. 4 Smith.	1 Reid. 2 Thompson. 3 Smith. .....

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASSES.	ENGLISH LITERATURE.	POLITICAL ECONOMY.	MECHANICS.	DRAINING.	BOOK-KEEPING.
HONOURS. I.	1 Raynor. 2 Butler. 3 McKay.	....	1 Raynor.	1 Muir. 2 McKay. 3 McIntyre. Raynor. 5 McPherson.	1 Raynor. ....
HONOURS. II.	1 Muir.	1 Muir. 2 Butler. 3 McPherson. 4 McKay. 5 Reid. 6 Raynor.	1 Butler. 2 McKay. 3 McIntyre. 4 Muir.	1 Butler.	1 Butler. Muir. 3 McKay. ....
PASS. III.	1 Reid. 2 McPherson. 3 Smith. 4 McIntyre. 5 Thompson.	1 McIntyre. 2 Smith. 3 Thompson.	1 McPherson. 2 Reid. 3 Thompson. 4 Smith.	1 Reid. 2 Smith. 3 Thompson.	1 Thompson. Smith. 3 Reid. 4 McPherson. 5 McIntyre.

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

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

SECOND YEAR.

GENERAL PROFICIENCY.	DEPARTMENTS.		FIRST-CLASS MEN IN THE DEPARTMENTS.
1 Raynor. 2 Muir. 3 McKay. 4 Butler. 5 McPherson. 6 McIntyre. 7 Reid. 8 Thompson. 9 Smith.	I.	AGRICULTURE AND LIVE STOCK.	1 Raynor. 2 Muir.
	II.	NATURAL SCIENCE.	1 Raynor. 2 Muir. 3 Butler. 4 McKay. 5 McPherson. 6 McIntyre.
	III.	VETERINARY SCIENCE.	1 Muir. 2 McKay. 3 Raynor. 4 Butler. 5 McPherson. Rowat (Sp.)
	IV.	ENGLISH LITERATURE AND POLITICAL ECONOMY.	1 Butler.
	V.	MATHEMATICS AND BOOK-KEEPING.	1 Raynor.

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

First-class men in general proficiency must obtain at least 75 per cent. of the total number of marks; second-class men at least 60 per cent. of the total number or marks.

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

SPECIAL CLASS.

Classes.		Live Stock.	Judging Sheep.	Judging Cattle. Paper I.	Judging Cattle. Paper II.	Veterinary Anatomy.	Veterinary Pathology.
HONOURS.	I.	1 Caswell, A. B. 2 Hall, H. B.			1 Caswell. 2 Ridings. 3 Hannah.		
	II.	1 Ridings, H. L. 2 Hannah, J.	1 Caswell.	1 { Ridings. { Hannah. 3 Caswell.	1 Hall.	1 Hall.	1 Rowat. 2 Richings.
PASS.	III.	1 Walter, J. R. 2 Rowat, J. P. 3 Fortune, G. R. 4 Hayman, J. M. 5 Thompson, H. S.	1 { Ridings. { Hayman. 2 { Hannah. { Hall. 4 Rowat. 5 Walter. 6 Fortune. Chipman. Thompson.	1 { Fortune. { Rowat. 3 { Hall. { Hayman. 5 Walter. Thompson. Chipman.	1 { Walter. { Hayman. 3 Rowat. 4 Fortune. 5 Thompson.	1 Walter. 2 Hayman. 3 Fortune. Chipman. Thompson.	1 Hannah. 2 Caswell.

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SPECIAL CLASS.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SPECIAL CLASS.

Classes.	Judging Horses. (Oral Examination).	Veterinary Obstetrics.	Law's Veterinary Adviser.	Stock Breeding, (Miles).	Feeding of Animals. (Stewart).	General Proficiency.
HONOURS. I.	1. Rowat, J. P.	1 Hayman. 2 Ridings. 3 Caswell. 4 Hannah.	1 Hayman. 2 Rowat. 3 Ridings.	1 Hall. 2 Walter.	1 Ridings. 2 Walter.	*First Year.* 1 Hall 2 Walter. 3 Hayman.
HONOURS. II.	1 Hannah, J.	1 Rowat. 2 Hall. 3 Walter.	1 Hannah. 2 Caswell.	1 Rowat. 2 Hayman. 3 Caswell. 4 Ridings.	1 Caswell. 2 Hall.	
PASS. III.	1 Caswell, A. B. 2 Ridings, H. L.	1 Fortune. 2 Thompson.	1 Walter. 2 Thompson. 3 Hall. 4 Chipman. 5 Fortune.	1 Hannah. 2 Fortune. 3 Thompson.	1 Hannah. 2 Fortune. Thompson. 3 Rowat. 5 Hayman.	*Second Year.* 1 Ridings. 2 Rowat. 3 Caswell. 4 Hannah.

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Class Lists.

II.—MIDSUMMER EXAMINATIONS, 1885.

FIRST YEAR.

Classes.	Agriculture.	Geology.	Botany.	Materia Medica.	English Literature.
HONOURS. I.	1 Zavitz, C. A. 2 Madge, R. W. 3 { Brown, C. R. { Sturge, E.	1 Madge. 2 Sturge. 3 Brown. 4 Zavitz. 5 Holtby.	1 Madge. 2 Brown. 3 Zavitz. 4 Sturge. 5 Holtby. 6 Kernighan. 7 Fee.	1 Sturge. 2 Madge. 3 Zavitz.	1 { Brown. { Madge. 3 Zavitz. 4 Sturge.
HONOURS. II.	1 Kernighan, J. N. 2 Calvert, S. 3 { Denton, E. { Fee, J. J. 5 { Holtby, R. M. { Chadsey, W. E.	1 Power. 2 Fee. 3 Calvert. 4 Mill. 5 Cobb. 6 Kernighan. 7 Chadsey. 8 Ross. 9 Notman. 10 Denton.	1 Cobb. 2 { Mill. { Power. 4 Chadsey. 5 Marsh. 6 Hirsh. 9 Beament. 10 Dennis. 11 Ross.	1 Holtby. 2 Hirsh. 3 Jeffrey.	1 Calvert. 2 Johnston. 3 Idington.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASSES.	AGRICULTURE.	GEOLOGY.	BOTANY.	MATERIA MEDICA.	ENGLISH LITERATURE.
PASS. III.	1 Kennedy, J. R. Bowie, T. M. 3 Menzies, R. M. Notman, C. R. 5 Ledyard, E. D. 6 Cobb, C. 7 Mill, J. S. 8 Acres, A. G. Ross, J. H. 10 Jeffrey, J. S. Carr, G. P. Power, R. H. Robertson, D. 14 Beament, H. J. 15 Etherington, C. B. 16 Horsman, J. V. Brush, G. H. B. 18 Johnston, J. F. Birdsall, W. G. 20 Iddington, P. S. Marsh, G. T. Carman, H. D. 23 McFarlane, A. D. 24 Wiggins, G. C. 25 Baillie, W. 26 White, S. A. Ritchie, H. Hirsch, J. March, H. Marcon, F. McLean, R. M. Dennis, J. E. Davidson. Carr, L. H. O'Doherty E. J. Magee, F. P. Macvicar, A. F. Brown, W.	1 Johnston. 2 Ledyard. 3 Dennis. 4 Bowie. 5 Beament. 6 Baillie. 7 Acres. 8 Birdsall. 9 Robertson. Brush. 11 Jeffrey. 12 Marsh. 13 Etherington. 14 Idington. 15 McFarlane. 16 Ritchie. March. 18 Hirsch. 19 Menzies. 20 Carr G. P. White. O'Doherty. Davidson. Wiggins. Horsman. McLean. Carr, L. H. Carman. Marcon. Macvicar. Brown, W. Magee. Kennedy. McNiven.	1 Calvert. 2 Bowie. 3 Baillie. 4 March. 5 Menzies. Acres. 7 Denton. 8 Birdsall. 9 Carman. 10 Jeffrey. Notman. 12 Johnston. 13 Etherington. 14 Kennedy. Ritchie. 16 Ledyard. 17 Brush. 18 Robertson. Idington. 20 Carr, G. P. 21 McFarlane. O'Doherty. Horsman. McNiven. McLean. White. Magee. Davidson. McVicar. Marcon. Wiggins. Brown. W. Carr, L. H.	1 Fee. 2 Cobb. 3 Calvert. 4 Davidson. 5 Kernighan. 6 Dennis. Ross. 8 Carr, G. P. 9 Carr, L. H. Brown, C. R. 11 Idington. Menzies. 13 Kennedy. 14 Power. Carman. 16 Chadsey. Wiggins. Marsh, G. F. Beament. March, H. Ledyard. Ritchie. O'Dohorty. McFarlane. Birdsall. Mill. Denton. Notman. Bowie. Etherington. Acres. Brown, W. White. Brush. Robertson. Johnston. Magee. Baillie. Macvicar. McLean. Horsman.	1 Holtby. 2 Kennedy. 3 Baillie. 4 Hirsch. 5 Kernighan. 6 March. 7 Etherington. 8 Davidson. 9 Chadsey. 10 McFarlane. 11 Cobb. 12 Fee. 13 Marsh, G. F. 14 Carman. 15 Power. 16 Jeffrey. 17 Dennis. 18 Mill. 19 Magee. Notman. Carr, G. P. Wiggins. Ritchie. Carr, L. H. Acres. Birdsall. Bowie. Beament. Menzies. Robertson. Ledyard. McLean. Brush. McNiven. White. Denton. O'Doherty. Macvicar. Brown, W. Marcon. Horsman. Ross.

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

FIRST YEAR.

CLASSES.		COMPOSITION.	MENSURATION.	GENERAL PROFICIENCY.	DEPARTMENTS.		FIRST-CLASS MEN IN THE DEPARTMENTS.
HONOURS.	I.	1 Madge. 2 Calvert. 3 Sturge.	1 Madge. / Zavitz. 3 March, G. F. 4 Brown, C. R. 5 Holtby.	1 Madge. 2 Zavitz. 3 Sturge. 4 Brown.	I.	AGRICULTURE AND LIVE STOCK.	1 Zavitz. 2 Madge. 3 Brown. / Sturge.
	II.	1 Kennedy. 2 Kernighan. 3 Johnston. 4 Brown. / Zavitz. 6 Holtby. 7 Cobb.	1 Kernighan. 2 Ledyard. 3 Ross. 4 Beament. 5 Sturge.	1 Holtby. 2 Kernighan. 3 Calvert.	II.	NATURAL SCIENCE.	1 Madge. 2 Brown. 3 Sturge. / Lavitz. 5 Holtby.
PASS.	III.	1 Dennis. 2 Mill. 3 Fee. 4 March. 5 Hirsch. / Menzies. 7 Marsh. 8 Robertson. 9 Jeffrey. 10 Davidson. 11 Beament. 12 Etherington. 13 Carman. 14 Bowie. / Chadsey. 16 O'Doherty. 17 Idington. 18 Magee. 19 Notman. 20 Carr, G. P. 21 Macvicar. 22 Birdsall. / McFarlane. / Ledyard. / Wiggins. / Ritchie. / Brush. Carr, L. H. Baillie. Horsman. Acres. Power. Marcon. Denton. Ross. White. Brown, W. McLean.	1 Menzies. 2 Jeffrey. 3 Chadsey. 4 Fee. 5 Baillie. 6 Johnston. 7 Hirsch. 8 Mill. 9 March. 10 Power. 11 Birdsall. / Calvert. 13 Bowie 14 Carr. / Magee. 16 Cobb. / Notman. / Dennis. / Idington. Ritchie. Kennedy. Horsman. McFarlane. Etherington. Robertson. Wiggins. Acres. O'Doherty. Brown, W. Davidson. Carr, L. H. White. McLean. Macvicar. Denton. Brush. Marcon.	1 Fee. 2 Cobb. 3 Marsh, G. F. / Chadsey. 5 Jeffrey. 6 Hirsch. 7 Beament. 8 Menzies 9 Idington. 10 Carr, G. P.	III.	VETERINARY SCIENCE.	1 Sturge. 2 Madge. 3 Zavitz.
					IV.	ENGISH LITERATURE AND COMPOSITION.	1 Madge. 2 Brown. 3 Sturge. / Zavitz.
					V.	MATHEMATICS.	1 Madge. / Zavitz. 2 Marsh. 3 Brown. 4 Holtby.

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CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASS.		AGRICULTURE.	SYSTEMATIC AND ECONOMIC BOTANY.	HORTICULTURE.	ANALYTICAL CHEMISTRY.	MATERIA MEDICA.
HONOURS.	I.	1 Muir, J. B. 2 Raynor, T. 3 Butler, G. C. 4 Macpherson, A. 5 McIntyre, D. N.	1 Raynor. 2 Muir. Macpherson. 4 Butler. 5 Reid. 6 Owen.	1 Muir. 2 Raynor. 3 Butler. 4 Reid. 5 Broome. Macpherson. 7 Thompson. 8 McIntyre.	1 Raynor. 2 Muir. 3 Macpherson. 4 Watts. Butler.	1 Raynor. 2 Muir. 3 Owen. 4 McIntyre. ....
	II.	1 Watts, W. G. Reid, T. 3 Smith, E. P. 4 McKay, J. G. Thompson, W. D. Owen, W. H. 7 Patterson, J. W. Broome, A. H.	1 McIntyre. 2 Thompson. 3 Watts.	1 Owen. 2 Watts. 3 Smith. 4 Patterson.	1 Owen. 2 Reid. 3 Broome. 4 McIntyre.	1 Macpherson. 2 Butler. 3 Reid. ....
PASS.	III.	1 Poe, J. P.	1 Broome. 2 Patterson. 3 Watts. 4 McKay. 5 Poe.	1 Poe. 2 McKay.	1 Thompson. 2 McKay. 3 Smith.	1 Broome. 2 Smith. 3 Thompson. 4 Watts. 5 McKay.

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASS.	VETERINARY OBSTETRICS.	ENGLISH LITERATURE.	LEVELLING, ROAD-MAKING AND SURVEYING.	GENERAL PROFICIENCY.	DEPARTMENT.		FIRST-CLASS MEN IN THE DEPARTMENTS.
HONOURS. I.	1 Muir. 2 Raynor. 3 Owen. 4 McIntyre.	1 Butler. 2 Macpherson. 3 Rayner. 4 Owen.	1 Raynor. 2 Muir. 3 Broome. 4 Butler. 5 Reid. 6 Macpherson. 7 McIntyre. 8 Poe.	1 Raynor. 2 Muir. 3 Macpherson. 4 Butler.	I.	AGRICULTURE.	1 Muir. 2 Raynor. 3 Butler. 4 Macpherson. 5 McIntyre.
					II.	NATURAL SCIENCE.	1 Raynor. 2 Muir. 3 Owen. 4 Butler.
HONOURS. II.	1 Macpherson.	1 { Muir. Reid. 2 Broome. 3 McIntyre.	1 McKay. 2 Owen 3 Watts. 4 Thompson.	1 Owen. 2 McIntyre. 3 Reid. 4 Broome. 5 Watts.	III.	VET'Y. SCIENCE.	1 Raynor. 2 Muir. 3 Owen. 4 McIntyre.
					IV.	ENGLISH LITERATURE.	1 Butler. 2 Muir. 3 Raynor. 4 Owen.
PASS. III.	1 Broome. 2 Reid. 3 Thompson. 4 Butler. 5 Smith. 6 Watts. 7 Poe. 8 McKay.	1 Watts. 2 Thompson. 3 Smith. 4 Poe. 5 McKay.	1 Patterson.	1 Thompson. 2 Smith.	V.	MATHEMATICS.	1 Raynor. 2 Muir. 3 Broome. 4 Butler. 5 Reid. 6 McPherson. 7 McIntyre. 8 Poe.

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

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

First-class men in general proficiency must obtain at least 75 per cent. of the total number of marks; second-class men, at least 60 per cent. of the total number of marks. First-class men in any department must obtain at least 75 per cent. of marks allotted to the subjects in that department.

APPENDIX 4.

COLLEGE IN ACCOUNT WITH FARM AND GARDEN.

(*a*) With Farm.	*Dr.*
To 215 bags potatoes, at 45c	$141 75
" 3,870 gallons milk, at 12c	464 40
" 34½ bags flour, at $2.00	69 00
" Cartage for College	25 00
" Feed of College horse (without attendance)	75 00
" Feed of Matron's horse (without attendance)	75 00
" Carpenter work for College	15 00
	$790 15

(*b*) With Garden.	
To fruit and vegetables (for items see Mr. Forsyth's report in Part V.)	622 10
	$1,412 25
By amount paid for Students' labour on farm and garden	3,696 29
By balance	$2,284 04

PART II.

REPORT

OF THE

PROFESSOR OF NATURAL HISTORY

AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December 31st, 1885.

To the President of the Ontario Agricultural College:

SIR,—In submitting to you a report of the Department which is allotted to my charge, it will be convenient to consider it under the following topics :—

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

COLLEGE MUSEUM.

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

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

I hope you will be able to impress those who have means at their disposal to do somethng to improve the accommodation and equipment of the room. The introduction of more modern cases, the raising of the roof and construction of a gallery around the sides would effect most satisfactory results in the appearance and utility of this valuable adjunct to college work. I am quite confident, if we could secure these necessary improvements we would soon possess a museum unique in its character as an important factor in the progress of agricultural education, instructive to students and interesting to the ordinary visitor.

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

1. Sir J. W. Dawson. A collection of Carboniferous and Post-Pliocene fossils.
2. Geological Survey, Ottawa. A collection of Cambrian, Carboniferous and Post-Pliocene fossils, and upwards of 150 species of plants, illutrating the flora of the North-West.
3. Prof. J. Hoyes Panton. Collection of Silurian, Devonian and Cretaceous fossils.
4. George Murton, Esq., Guelph. Fossil plants from the coal measures of Nova Scotia.
5. C. Zavitz, student. Specimens of roots of several agricultural plants.
6. C. B. Etherington, student. Collection of Canadian bird's eggs.
7. Prof. W. Brown. An ammonite from the Cretaceous deposits of the North-West.
8. E. A. Shuttleworth, ex-student. Collection of grasses from the Experimental Field on the College Farm.
9. J. W. Brown, B.A. Indian relics of the North-West rebellion.
10. B. E. Paterson, student. An excellent fossil from the Guelph Formation.
11. J. Townsend, Esq. Fossils from the Guelph Formation near Elora.

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

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

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

The collection of birds is also classified and labelled so as to be of practical use to students.

We intend to employ duplicates in making another form of classification, consisting of two groups, embracing the beneficial and injurious forms of bird life. As soon as time will permit, the same arrangement will be adopted with the collection of insects. Our entomological collection is capable of great improvement, to assist the students in economic entomology. At present it is made up of mature insects, while the larval condition, often the most important, is unrepresented. It will be our object to have in the collection, specimens showing the egg, larva, pupa and imago, together with illustrations of how they affect farm crops, etc.

During autumn, a collection of fruits was made; it was but the commencement of securing typical forms to exemplify the Canadian fruits found in Ontario. These will be preserved in a condition, which will enable the students to compare with little difficulty the fruits discussed in lectures on Horticulture.

At present there are upwards of three thousand specimens in the diffierent departments represented in the museum. This number will rapidly increase as our students become interested in the work and send donations from year to year.

This very important department of instruction should be a credit to our College and to the wealthy Province in which it is located, but if the improvements already suggested cannot be carried out, we can scarcely expect to hold the position we should.

Library.

Here, too, the work of systematizing has received much attention during the year. The books are conveniently arranged, and every facility afforded to encourage reading. The following summary shows the number of books taken out during the respective terms and the departments to which they belong :—

	Winter Term.	Spring Term.	Summer Term.	Fall Term.	Total.
Agriculture	188	71	33	216	508
Chemistry	10	4	4	31	49
Natural History	64	62	7	64	197
Literature	80	32	11	108	231
Veterinary	31	24	7	68	130
Mathematics	5	3	..	22	30
History	25	7	10	58	110
Travel	25	12	4	40	81
Miscellaneous	48	20	20	60	148
Biography	35	11	7	40	93
	521	246	103	707	1,577

You will notice a marked improvement in the last term. This is, no doubt, the result of the improved arrangement for study in the afternoon of each day. There is also now a list of the best books in each department of study placed in a conspicuous place, so as to aid the students in selecting proper books to study, in connection with the lectures ; this list is prepared by the Professor of each department. During the year there has also been made a synopsis of all the reports in the Library, many of which contain very able essays on subjects connected with Agriculture. This enables a student to find with but little trouble papers on important topics in connection with agricultural science, which in almost every case were unknown to the students, and only in a few cases known to the Professors themselves.

The Library contains at present 5,000 volumes, of which four hundred and eight have been added this year. These latter may be grouped as follows :—

Reports, chiefly agricultural	290
Natural History, including Botany	15
Veterinary	3
Agriculture	25
Chemistry	7
Literature	9
Encyclopædias	7
Bound Journals	14
Directory	1
Atlas	1
Dairying	4
Geology	3
History	20
Pamphlets	8

Although the number of agricultural reports appears large in comparison with that of other books added during the year, it must be remembered that in many of these some most valuable papers are found, and these are now so indexed that our students can readily find them. On this account these reports may be considered valuable acquisitions to our library, and in many respects almost equivalent to text-books upon agricultural subjects. The library is, no doubt, a very important factor in our work, and, if properly used by the students, will from year to year influence their minds in the line of study and thought. As instructors of the young men under our charge, we cannot do too much in striving to impress upon their minds the benefits to be derived from reading, not only in connection with their lectures, but even beyond them. It is usually found that the best thinkers are those who read most.

Reading-room.

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

The students avail themselves of these excellent facilities afforded for reading, and can be seen at all times consulting the papers and journals on file. It is a pleasing feature to notice there is becoming a much less tendency to cut or destroy the papers than when this room was first opened.

Rules regarding the proper use of the reading-room are posted in conspicuous places.

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

The following is the list of papers, journals and magazines which come to the College, and are for the use of the students in attendance:

Papers and Magazines.

(a) *Sent free by the Publishers.*

Name.	Where Published.
1. Journal of Commerce	Montreal.
2. Journal of Agriculture	"
3. Weekly Witness	"
4. Christian Guardian	Toronto.
5. Canada Presbyterian	"
6. Mechanical and Milling News	"
7. Monthly Weather Review	"
8. Dominion Churchman	"
9. Canadian Lumberman	Peterboro'
10. Manitoba Weekly Free Press	Winnipeg.
11. Canadian Horticulturist	St. Catharines.
12. Canadian Entomologist	London, Ont.
13. St. John Telegraph	St. John, N.B.
14. Weekly Herald	Stratford.
15. Bee Journal	Beeton.

(b) *Furnished by the College.*

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

Practical Work.

So much of my time has been employed in connection with the Museum and Library and during the last term, in discharging the duties belonging to the department of Chemistry, owing to the death of the late Dr. Hare, that I have had little or no time to devote in the line of iuvestigation. However, under the improved system of study, more time will be afforded for such work, and I hope at an early date to arrange a series of experiments for the purpose of elucidating some points connected with agricultural science. During the year I have observed a marked advance in outsiders seeking information, especially in regard to the identification of plants. This has entailed considerable correspondence ; but on all occasions it has been a pleasure to give the desired information.

Under this head may properly be given the result of meteorological observations taken at the College during the past year.

I have departed somewhat from the method of arrangement in the report of this work, but it will be found to contain a summary of all the observations taken, expressed in a way which will prove convenient at any time for reference.

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1885.

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 follow :—

Anemometer—Recording the direction of the wind and indicating the number of miles travelled.

Barometer—Showing the atmospheric pressure at the time of observation.

Maximum thermometer—Indicating the highest temperature between times of observation.

Minimum thermometer—Indicating the lowest temperature between times of observation.

Hygrometer—With *dry* and *wet* bulb thermometers, for the purpose of showing the condition of the atmosphere with reference to moisture.

Pluviameter—Used in measuring the rainfall.

Thermometer—For observing ordinary temperature.

Besides taking observations from these instruments, the cloudiness of the sky is observed, and general remarks on the weather for the day are recorded in the daily register. At the close of each month a summary of the month's observations is given to the Guelph papers for publication. From these monthly summaries the condensed statement of the year's meteorology is made out.

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

At examinations some of the instruments are brought into the class-room and the candidates asked to read them.

Form of Monthly Summary.

Meteorology.

A summary of the meteorological observations taken at Ontario Agricultural College during the month of.....

Normal height of barometer at Guelph (1,100 feet above sea level and 740 above Lake Ontario), 28.86 inches.

Barometer—
- Highest barometer.
- Lowest "
- Highest mean barometer.
- Lowest " "
- Monthly " "
- Monthly range.

Thermometer—
- Highest thermometer.
- Lowest "
- Highest mean thermometer.
- Lowest " "
- Monthly " "
- Monthly range.

Pluviameter.

Days rain fell.
Greatest rainfall.
Days snow fell.
Greatest snowfall.
Total precipitation.

Anemometer—

Direction of wind.
Greatest number of miles travelled in twenty-four hours.
Greatest velocity per hour.
Mean velocity per month.

Clouds—

Cloudy days.
Clear days.
Mean cloudiness for the month.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Barometer—	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches
Highest barometer	29.384	29.262	29.190	29.236	29.032	29.088	29.600	29.068	29.058	29.140	29.216	29.564
Lowest "	28.054	29.050	28.324	28.340	28.400	28.500	28.378	28.358	28.359	28.252	28.332	28.020
Highest mean barom'er.	29.314	29.238	29.051	29.163	28.998	29.068	29.216	29.057	29.042	29.090	29.151	29.434
Lowest " "	28.110	28.160	28.458	28.404	28.350	28.528	28.619	28.419	28.428	28.433	28.444	28.143
Monthly " "	28.752	28.962	28.870	28.873	28.741	28.859	28.835	28.822	28.813	28.822	28.366	28.778
Monthly range.....	1.330	1.202	.886	.896	.632	.588	1.222	.710	.699	.888	.884	1.544
Thermometer—	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.	deg's.
Highest temperature ..	45	36	42.9	79.8	81.6	84.7	90.3	86.8	85.1	69	63.8	59.2
Lowest " ..	-13	-20	-16.5	12.5	26	41.3	45.7	38.9	36.5	17.3	23	-3
Highest mean " ..	39	29.8	38.2	67.3	67.1	72.5	76.0	72	71.6	51.2	56.7	40
Lowest " " ..	-5.6	-13	-6.3	23.1	26	44.9	57.1	50.4	49.5	26.6	25.8	4.6
Monthly " " ..	31.1	-12	14	33.8	41.7	60.5	68.8	58.2	55.8	42.8	36.4	25.9
Monthly range	58	56	59.4	92.3	55.6	43.4	44.6	47.9	48.6	57.7	40.8	62.2
Pluviameter—												
Number days rain fell..	2	.....	.....	7	8	11	9	11	6	11	10	3
" snow fell..	9	5	9	3	1	.....	.....	.....	.....	1	5	12
Greatest rainfall, inches	.08	.....	.....	.44	.48	1.04	.49	1.19	1.58	.89	.7	.2
Rainfall for month, in.	1.4	.....	.....	.97	1.44	3.20	2.24	2.03	3.40	2 17	1.07	.38
Greatest snowfall, in. ...	2.5	2	2.2	.....	1	.....	.....	.....	.....	.2	3	3.0
Snowfall for month, in.	6.5	4	6.2	8.30	1	.....	.....	.....	.....	.2	4.8	13.1
Total precipitation	2.05	.4	.62	1.80	1.54	3.20	2.24	2.03	3.40	2.19	1.55	1.64
Anemometer—												
Predominating wind...	S.W.	N.W.	N.W.	N.W.	E.	S.W.	N.W.	N.W.	N.W.	S.W.	S.W.	S.W.
Greatest No. of miles in 24 hours.....	783	822	901	705	583	529	462	539	512	556	569	719
Mean velocity for the month	18.5	19.1	20.4	15.6	14.9	13.4	9.2	9.92	9.56	10.6	11.6	15.45
Clouds—												
Cloudy days	20	15	17	11	16	14	13	14	16	17	20	21
Clear days	4	9	11	14	14	12	10	10	9	6	4	5
Mean cloudiness for the month	7.6	5.4	5.6	4.7	5.6	5.1	5.2	5.8	5.3	6.3	8.1	7.8

Mean Meteorlogical Results for the Year 1885.

	1885. Guelph.	Average of 40 Years. Toronto.
Barometer.		
Mean pressure for the year	28.791	29.616
Month of highest mean pressure	December.	September.
Highest mean monthly	29.434	29.664
Lowest " "	28.110	29.572
Month of the lowest mean	January.	June.
Highest pressure	29.600	30.358
Lowest pressure	28.020	28.692
Range of the year	1.580	1.668
Thermometer.		
Mean temperature of the year	38.3	44.17°
Warmest month	July.	July.
Mean temperature of the warmest month	76.0	67.64°
Coldest month	February.	February.
Mean temperature of the coldest month	-12	22.73°
Mean temperature of the warmest day	72.8	77.85°
Mean temperature of the coldest day	-13	-1.50°
Date of the highest temperature	July 23rd.	.....
Highest temperature	90.3	91°
Date of the lowest temperature	February 11th.	.....
Lowest temperature	-20	11.9°
Range of the year	110.3	102°
Pluviameter.		
Total depth of *rain* in inches	18.27	28.30
Number of days on which *rain* fell	78	110
Month in which the greatest depth of *rain* fell	September.	September.
Greatest depth of *rain* in one month	3.40	3.55
Month with most *rainy* days	August.	October.
Greatest number of *rainy* days in one month	11	13
Total depth of *snow* in inches	44	.....
Number of days on which *snow* fell	45	.....
Month in which the greatest depth of *snow* fell	December.	.....
Greatest depth of *snow* in one month	13.1	.....
Month with most *snowy* days	December	.....
Greatest number of *snowy* days in one month	12	.....
Total precipitation in inches	22.65	.....

Diagram Illustrating the Mean Meteorological Results for 1885.

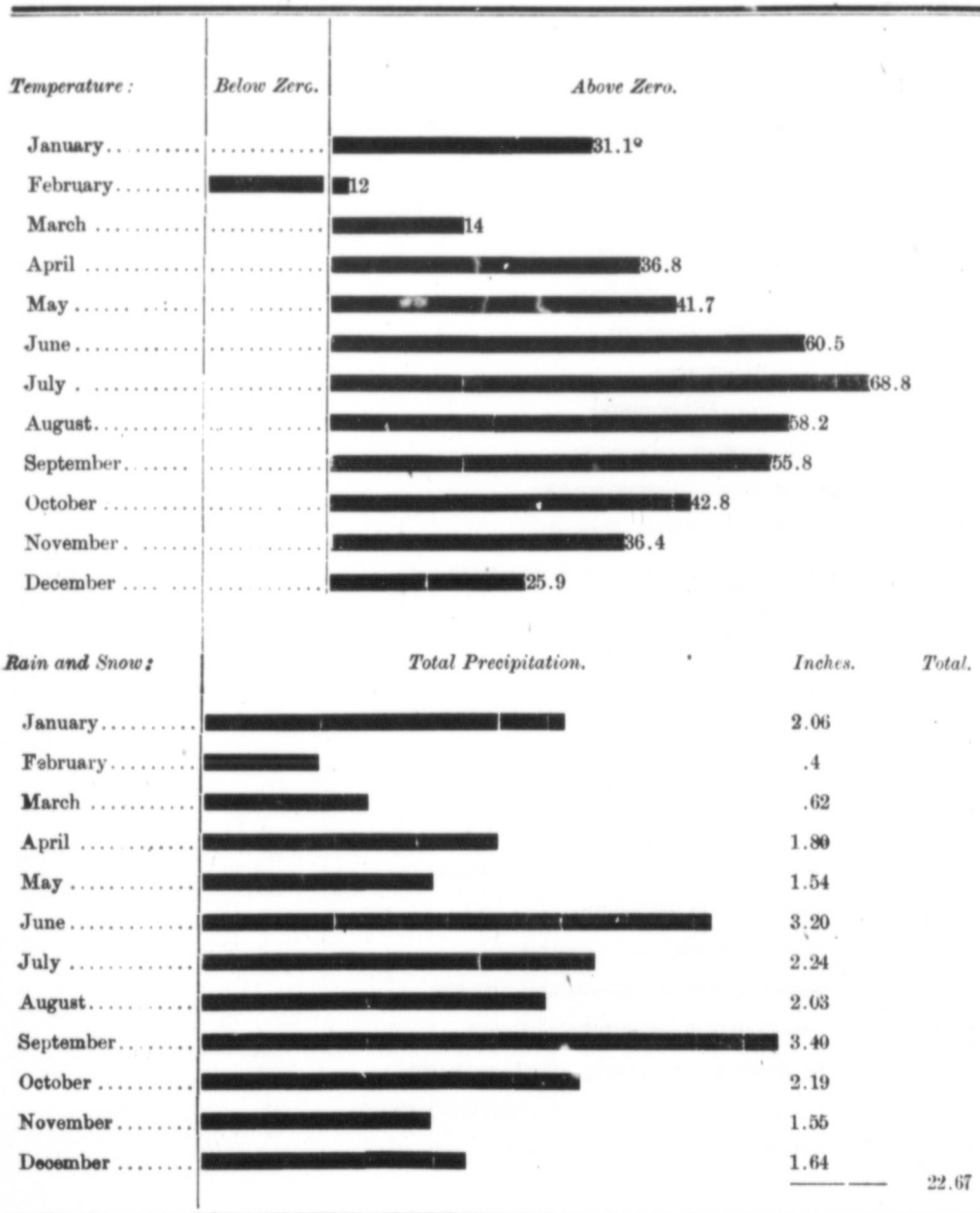
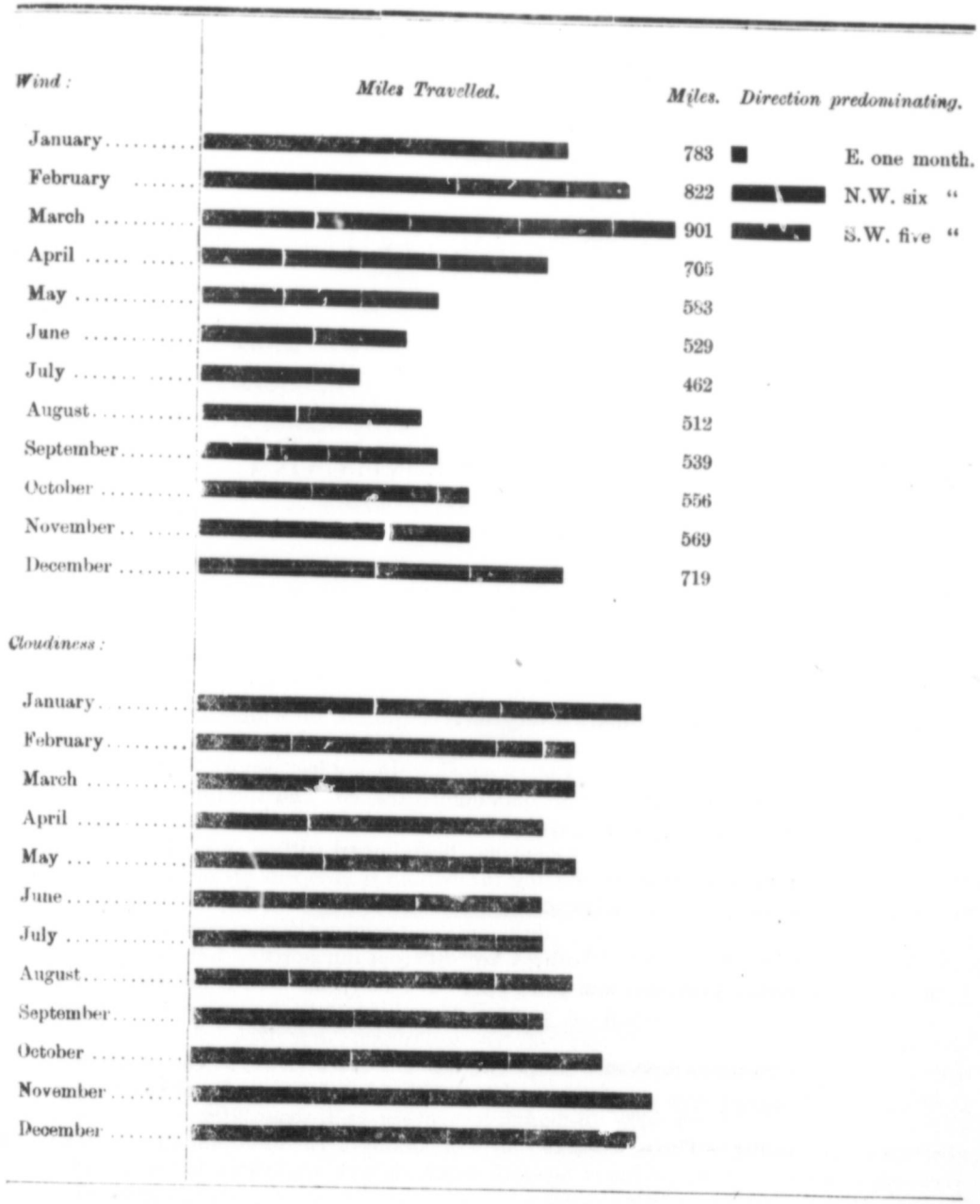


DIAGRAM ILLUSTRATING THE MEAN METEOROLOGICAL RESULTS.—*Continued.*



I remain, Sir, yours respectfully,

J. HOYES PANTON,
Professor Natural History and Geology.

PART III.

REPORT

OF THE

PROFESSOR OF VETERINARY SCIENCE.

GUELPH, December 31st, 1885.

To the President of Ontario Agricultural College :—

SIR,—Outside of the ordinary every day casualties to which a comparatively large stock is subject, the past year has been a pretty favourable one and few losses have occurred from death amongst the College stock. In my last report I gave an account of a somewhat serious outbreak of abortion amongst the cows on the farm ; and at the time of writing that account expressed the hope that it was over, and that no more losses from this cause would be sustained, as some time had elapsed without a mishap ; but unfortunately two more lost their calves during the winter. This winter, so far, we have had no loss from this cause, and the influence, whatever it is, seems to have worn itself out.

Last year I dilated at some length on the various theories regarding the causes of this trouble, which have been advanced by different authorities, and which seem to be based on reasonable evidence, and as no new light has since been thrown on the subject, we must allow it to remain as it is until something more than mere hypothesis can be given.

It is interesting to note that this scourge committed serious ravages in Great Britain, and particularly in Scotland last winter, and that a gentleman from whom one of our recently imported cows was purchased, lost every calf, some fifty cows in all having slipped their young. The cow spoken of was amongst the first to abort with us. Of course it is merely speculation to try and establish any connection between the outbreak amongst the recently imported cattle and the existence to a marked degree of the same trouble in the herds from whence they came, but it is a coincidence, which with many others that have been observed, tend towards confirming the impression that it is of contagious origin, and that it is a poison of an animate character, that is the essential element in bringing about the accident.

I am authoritatively informed that several breeders of some prominence in this Province have suffered somewhat severely from abortions during the last couple of years.

Two imported ewes died about the end of January, out of five that were seriously sick.

The symptoms of illness presented were of a very acute character, and in those cases which terminated fatally, indisposition was only noticed for three days. The first signs of derangement were dulness, inappetence and hurried breathing, soon followed by straining, evident pain, and the voidance of a considerable quantity of semi-fluid dark coloured fæces. The patients were placed in a dry room and some artificial heat provided, as it was very cold weather at the time. Opium was administered to relieve the pain and straining. In the three that recovered the pain soon subsided and the bowels became inactive, when Epsom salts in small and repeated doses, dissolved in linseed tea, was given, resulting in speedy and complete restoration to health.

A *post mortem* on the two that died revealed very evident, "Inflammation of the Liver," that organ presenting a yellow colour, and being much softened and infiltrated with puriform like fluid. It was also somewhat enlarged. In assigning a cause for this diseased condition, the continuous severity of the weather of last winter should not be overlooked, especially the influence it would be likely to have upon sheep unacclimatised. Cold is a very frequent exciting cause of inflammation in internal organs, although the liver is not often the seat of it. The subjects of the attack described were in very high condition, and had doubtless been fed on a stimulating diet throughout their lives, which had been short, as they were only shearlings and two shears. High feeding in taxing the liver to its utmost will, no doubt, predispose this organ to disease, and in the absence of more ostensible causes the above explanation seems reasonable, and founded on physiological facts.

A gentleman in this neighbourhood who imported a flock at the time the College sheep were brought out, lost several in exactly the same way and about the same time, which is evidence that climatic influence was a factor in bringing about the disease. About the end of November a Guernsey cow was reported to me as sick, and on examination she was found to be in a very serious condition. The cattleman gave her history as being an animal that had never been very thrifty since her arrival with the new importation; her appetite being capricious, and she showed a general want of life.

When my attention was drawn to her I found her very weak—so much so that a moderate push would almost knock her over, and there was a complete loss of appetite. The pulse was very weak and beating about one hundred times a minute. The respirations were increased to about forty to the minute, but were not laboured. The ears and legs were colder than natural, and the bowels somewhat confined. On listening to the sounds emitted by the chest, over the lower end of the windpipe and bronchial tubes, a harsh and weazing sound was audible. On the right side of the chest the respiratory murmur was unnaturally pronounced, while on the left there was an almost entire absence of sound either from the lungs or heart. These symptoms simulated so nearly what I had before observed in connection with "Tuberculosis," when the tubercular deposits have formed a thick lining on various parts of the chest, that I was inclined to the opinion, that it was a case of "Tuberculosis" we had to deal with, although it was seldom any coughing was heard. In discussing the case with the students at a clinical lecture, I mentioned the resemblance that the case bore to a condition not infrequently met with in cattle in connection with the pericardium or sac that envelopes the heart, and termed pericarditis or inflammation of the heart's covering. From the history of the case and its symptoms, however, I was inclined to the opinion that it was of a tubercular character; but a *post mortem* examination, which we soon had an opportunity of making, revealed that no tubercles were present, but that the sac containing the heart was extensively diseased, being much thickened and having a hardened coating of lung tissue adherent to it. It was much distended and contained more than a gallon of dirty-coloured fluid. Many such cases have been recorded by veterinary writers, but some foreign body, as a piece of wire, a darning needle or sharp pointed nail has generally been found to account for the condition. Such articles on being swallowed pierce their way through the coats of the stomach and through the diaphragm, finally reaching the heart or remaining in its covering. The channel by which such bodies travel from the stomach to the heart can generally be easily detected by the diseased traces they leave behind them. It seems that the contractions of the coats of the stomach impel such bodies outwards, and that the pumping action of the heart draws them towards it. In this instance, however, a

careful search failed to reveal any foreign body. This condition has been described by some writers as resulting from inflammation caused by damp, cold and variable temperature. When recovery is made from a mild attack of this character, more or less organic change usually remains, rendering such a subject liable to a return of the trouble from time to time. Thus the inflammatory products accumulate and finally bring about a fatal termination. If it is determined to build new stabling accommodation, it is to be hoped that some provision will be made for furnishing an apartment for use as a veterinary hospital. Hitherto we have had no facilities for affording isolation, quietude, or for regulating the temperature, all of which are important auxiliaries in the treatment of disease.

Respectfully submitted,

F. C. GRENSIDE, V.S.

REPORT OF THE PHYSICIAN.

DEC. 31, 1885.

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

SIR,—I have the honour to present to you my Annual Report.

We had a good deal of sickness, especially during the earlier months of the year, but I am glad to be able to state that nothing of a fatal character occurred.

Scarlet Fever and Diphtheria visited our city and neighbourhood during the past summer and autumn, but we did not have a single case at the college.

By instruction from the President early in the present session, I vaccinated all the young men who had not been successfully vaccinated within seven years.

The building is in a good sanitary condition. Dry earth closets have been in use for the past four months, and, I have no doubt, with proper care will be a great improvement on the former ones if the ventilating pipes are run up above the main buildings.

I have the honour to be, Sir,

Your most obedient Servant,

E. W. McGUIRE,, M.D.
Physician Ontario School of Agriculture.

PART IV.

REPORT

OF THE

PROFESSOR OF AGRICULTURE,

FARM MANAGER AND EXPERIMENTAL SUPERINTENDENT.

The Honourable A. M. Ross,
Commissioner of Agriculture.

31st December, 1885.

SIR,—I beg to submit the eleventh Annual Report of the Outside Departments of this Institution, and as introductory, have pleasure in bringing under your notice what, during the year, has been the warmest part of our work.

The most interesting feature of the Agriculture of Ontario to day is unquestionably Dairying—the production of milk, butter and cheese. This is acknowledged in various ways. Your Government still contributes to the maintenance of two Dairymen's Associations, that annually hold conventions, publish reports, and give instruction in cheese manufacture, by travelling experts amongst factories, and it has been through their influence, and the special advice of Mr. Ballantyne, M.P.P., that Canada has during the last two years gained such renown in teaching Scotland how to improve her cheese. Then also, as a mark in your own management, our station has been supplied with two important additions to its appliances ; the establishment of a Butter Factory, and a special Professor of Dairying. Professor Barré will no doubt tell us well and fully as to the practical outcome, and attendant bearings of this factory for the year just closed, and President Mills will submit the plan of lectures thereon, and the instruction being otherwise given on such an important division of our profession. Having had the honour of explaining the cream gathering system to patrons last spring, and opening the factory previous to Mr. Barré's appointment, I may be permitted to express the hope that the fullest details in every way affecting the question of butter-making be given to the Province. The question is not necessarily one of profits, but, under judicious management, to obtain light of every sort upon what is at present a sore point by the world's estimate of our average Provincial product. In doing this the position of the Centrifugal Separator should be argued, so that our people may have the best and latest,—the practical, the scientific, and the truth.

As if to endorse these Government efforts, the two largest Agricultural Exhibitions of Canada gave very special encouragement to Dairying this year. I have given elsewhere a short notice of the work undertaken by Professor Barré and myself at London and Toronto,—and certainly no small measure of thanks is due to the management of these Exhibitions for liberality and progressiveness. The universal commendatory Press notice in Europe and America of this specialty is encouragement for the future.

And I think it is clearly my duty to mention that the "Midsummer Advance Report," treating mainly of Experimental Dairy subjects, has been received in high favour in all civilized countries. Brief as the various subjects had to be treated, they have nevertheless rung a note of the times that has been taken up and responded to in a very gratifying manner,—indeed in such a manner as makes us think seriously of our future work. I could send you a large book of letters received from the United States and Britain complimenting the College on this branch of its labours.

On the farm we are adhering to rotation in cropping as strictly as is consistent with seasons, bare fallowing, and the particular circumstances of fields, especially in regard to good or poor condition—natural, or that has been made so by cultivation. I have told in previous reports very much of all the practical and scientific bearings of what we aim at in good farming—what each field has come through, and year by year their conduct in the production of each class of crops, but I have delayed until now to say anything in regard to what we have realized other than by the ordinary methods in getting rid of the Canada Thistle; and, as the subject is a very big one all over the country, I give it the important position of this introduction.

This weed can be thoroughly exterminated without the loss of a crop as in fallowing, or by the almost equally expensive cutting in most crops, or by the cultivation of roots, either of which is not permanent. The agent we have found for this purpose is—the best establishment and maintenance of permanent pasture. This may not be new to some, for many observers say nothing; at any rate it has never to my knowledge been brought under the particular notice of our farmers. Some farmers can tell us of natural meadows, orchards and lawns, without thistles, except it may be in odd spots, but what do our roadsides say, and nearly all the pasture that accompanies the rotation called hay in our system of cultivation? Many know of smothering out thistles by a very heavy crop of corn, or other green fodder, but this is temporary. When land is laid down to permanent pasture with the proper variety of grasses and clovers, under good average conditions, there is such a rush of growth during the first year, and such a close matting of everything in all subsequent years—such an *early* and *continuous* cropping of pasture, that nothing else has a chance of establishment. We have had this clearly demonstrated in all our experimental permanent pasture plots during the last ten years, where in other plots immediately adjoining, with any other crop—grain, roots and some fodder plants, singly—thistles were continually bothering, but, four feet distant on the pasture none existed. There is not only a smothering of the thistle, but a rotting of its stem deep down, and apparently the permanent extermination of the weed. It shall be my duty to tell in what way such pasture can be rotated with other crops so as to overtake what has long baffled the Province, and, at the same time, give greater returns than can possibly be got by any other method.

A feature of our Live Stock interest particularly gratifying this year is the patronage of the newly imported bulls. The service revenue for the year amounts to $608, which, if taken as interest upon capital at six per cent., represents a capital of $10,000. The eight bulls cost $9,500. This alone, from such a source, outside of surplus stock revenue, is certainly very satisfactory. Had all the bulls been in request equal to the Short Horn, the revenue would have been $2,070! But the surplus cattle realized the sum of $2,865, after a loss of $1,170 from abortions. So that altogether throughout several unfavourable circumstances, the cattle alone have returned a gross revenue of $3,473 per annum. The ordinary keep of the bulls is about $450, which in ordinary cases would be deducted from revenue, but to us their educational value is more than twice their keep. Were actual cash returns the only consideration I could not advise the possession of more than *three bulls*.

II.---THE FARM.

1.—FARM BUILDINGS.

Our farm buildings and other property were almost totally destroyed by fire on the 30th Sept., cause unknown. The following is an abstract of detailed list of loss therefrom :—

Buildings	$22,215
Live Stock	905
Crops	2,567
Manures	1,380
Feed and Fodder	64
Medicine	30
Implements, Machinery and Tools	3,126
Total	$30,287

We have provided temporary accommodation for the Live Stock by covering some of the old walls, and taking possession of the large implement shed that was saved, with bull shed and small experimental barn.

It will be your privilege to arrange for a new suite of buildings on another site ; it is my duty to make out a list of requirements that I consider necessary in correspondence with the size, the aims and the character of the farm, as regards Cropping, Live Stock. Experimental Work and Mechanics. On the 10th December last I sent you a plan showing these in detail, from which I trust you will be able to provide us with such accommodation as shall be creditable to the Province, and in keeping with our other appliances.

FARM FOREMAN'S REPORT.

To Prof. Wm. Brown :

Sir,—I have the honor to herewith submit my annual report of the Farm and Live Stock Department. These departments are, I am pleased to be able to say, in a satisfactory condition. I must confess that in the busy season, when an hour's delay probably meant damage to the crops and consequent loss to the institution, I could not possibly superintend the work done by all the students. To show them how, and start them at it in each field is about as much as one man can do, especially when the peculiar nature of the operations in one particular place may render his presence there continually necessary. When in connection with this it is considered that nearly all the students who have had any experience at farm work leave for home when harvest commences, it will be readily seen that the position of farm foreman is no sinecure. As to the present condition of the farm, I may say that there is much to commend and little or nothing to condemn. There has been a gradual diminution of thistles and noxious weeds during the past year, and very shortly it is hoped the farm will be entirely free of such pests. I might also state that last summer we drained the north-west half of field No. 12, and removed many of the stumps and second growth bush. If the means are forthcoming for drainage purposes it is hoped that next year this entire field will be made arable. It will then be one of the best plots on the farm.

FIELD CROPPING.

Owing to the fire destroying a large quantity of grain, etc., it is impossible to give the yield in a great many of the fields. Hence, in the following table there are several omissions of the quantity harvested, and on that account the statement is not as complete as usual :

FIELDS.

No. 1. Nineteen acres. Nine were sown with mensury barley yielding 40 bushels per acre, and ten with black barley.*

No. 2. Seventeen acres under hay, yielding 1 ton per acre.

No. 3. Seventeen acres. Four sown with spring wheat,* four with corn for green fodder yielding 40 tons per acre, six with Egyptian oats,*, one-half racehorse oats,* one-half early blossom oats.*

No. 4. Twenty acres pasture.
No. 5. " " "
No. 6. " " "
No. 7. " " summer fallow.
No. 8. " " Twelve sown with Egyptian oats*, seven with New Zealand oats,* one with racehorse oats.*

No. 9. Twenty acres, sown with golden vine peas, giving a net yield of 446 bushels.

No. 10. Eight acres, Egyptian oats.*

No. 11. Twenty-three acres, under fall wheat, Bonnell and Rodger varieties, giving a net yield of 700 bushels.

No. 12. Fifteen acres, uncultivated, used as pasture.

No. 13. Nineteen and three-quarter acres, seven of which were under turnips, yielding 900 bushels per acre. Eight acres of this field were under mangold, yielding 1,020 bushels per acre; one acre was sown with carrots, white Belgian, yielding 750 bushels per acre; two and three-quarter acres of potatoes, yielding 174 bushels; remaining acre under vetches and oats used as green fodder.

No. 14. Twenty-five acres, experimental field.

No. 15. Twenty acres, pasture.

No. 16. Thirty acres, twenty-six acres hay,* yielding two tons per acre; four acres under white Russian wheat.*

No. 17. Thirteen acres hay, yielding 2 tons per acre.*
No. 18. Thirteen acres " " $1\frac{3}{4}$ " " "
No. 19. Thirty acres " " $1\frac{1}{2}$ " " "

No. 20. Twenty acres uncultivated.

No. 21. Twelve acres, five acres under potatoes, yielding 750 bushels, and seven acres of turnips. As this plot was sold, and as yet a portion of them remain in pits, I am unable to give the result per acre.

The above marked thus * were burned.

LIVE STOCK.

There have been two extensive sales during the past year. The first, the annual live stock sale, was well attended, buyers being present from all parts of the Dominion. The result was, on the whole, satisfactory, but in some cases the animals did not bring the expected figures. The Shorthorn, Hereford, and Polled Angus breeds were most in demand, and sold readily. The surplus grade stock, accommodation for which could not be found after the fire, was sold at the special sale at somewhat of a sacrifice.

THE FIRE.

Destroying as it did all the stabling accommodation, except the bull shed and the building for fattening cattle, the fire was a visitation greatly to be deplored, as it disarranged the departments very much. The implement shed has been fitted up as stabling for the cattle held over. It suits the purpose well, and the animals are now comfortably housed there.

THE WINDMILL.

If my memory serves me, in my last report I drew your attention to the satisfactory manner in which the windmill erected in the south-west portion of the farm for the purpose of supplying water to the stock, was performing its operations, and also laying before you the desirability of having another erected in the north-east part. What I said then I would, did space permit, repeat now. This suggestion I hope will be given your consideration, as I feel incalculable advantages would accrue from its being carried into effect.

P. I. WOODS,
Farm Foreman.

III. LIVE STOCK.

PUBLIC SALE OF LIVE STOCK.

We had two public sales of Live Stock this year—the first, the regular surplus sale on the 4th September,—and the second, on the 16th October, was necessitated by the fire that destroyed most of our farm buildings—a culling out of several animals that did not affect the standing of our herds and flocks, but considered desirable in view to ease expense in erecting temporary buildings for winter. Following is detail of these sales :—

PUBLIC SALE OF LIVE STOCK, SEPTEMBER 4TH, 1885.

LOT.	CLASS.	PURCHASER, ETC.	Amount.	Total.
	CATTLE.			
	Short Horns :		$ c.	$ c.
1	Bull	P. Bathgate, Eramosa	140 00	
2	Bull Calf	J. Lamont, Caledon	125 00	
3	Cow	Alex. Taylor, Dromore	190 00	
4	Heifer	Amos Cutler, Coldstream	280 00	
5	Heifer	J. McHugh	280 00	
				1015 00
	Herefords :			
6	Bull Calf	C. J. Alloway, Montreal	250 00	
7	Bull Calf	F. W. Stone, Guelph	225 00	
8	Cow	H. Sorby, Guelph	350 00	
9	Heifer	H. Sorby, Guelph	230 00	
				1055 00
	Aberdeen Polls :			
10	Bull Calf	C. Cumming, Troy	200 00	
11	Bull Calf	Geary Bros., London	100 00	
12	Bull Calf	H. Stairs, Nova Scotia	340 00	
13	Bull Calf	Thomas McRae, Guelph	180 00	
14	Bull Calf	Mossom, Boyd & Co., Bobcaygeon	60 00	
15	Heifer	Geary Bros., London	125 00	
16	Cow	Geary Bros., London	300 00	
17	Cow	Mossom, Boyd & Co., Bobcaygeon	325 00	
				1630 00
	Holsteins :			
18	Bull Calf	J. Jackson, Malton	100 00	
19	Bull Calf	W. Leeds, Toronto	65 00	
20	Heifer	Withdrawn	.....	
				165 00
	Ayrshires :			
21	Bull Calf	H. G. Clarke, Brampton	30 00	
22	Bull Calf	F. Kean, Orillia	35 00	
23	Heifer	A. Cairns, Flesherton	80 00	
24	Cow	A. Cairns, Flesherton	90 00	
25	Cow	A. Kains, Byron	100 00	
				335 00
	Jerseys :			
26	Bull Calf	J. Jackson, Malton	90 00	
27	Heifer	W. Leeds, Toronto	65 00	
28	Heifer	W. Leeds, Toronto	70 00	
				225 00
	Guernseys :			
29	Heifer	F. W. Stone, Guelph	45 00	
30	Heifer	J. Langton, Stratford	63 00	
31	Heifer	Geary Bros., Bothwell	30 00	
				138 00
	Fat Cattle :			
32	Hereford Grade Steer	C. J. Alloway, Montreal	150 00	
33	Aberdeen Grade Steer	C. J. Alloway, Montreal	230 00	
34	Short Horn Grade Steer	W. West, Guelph	220 00	
35	Short Horn Grade Steer	T. Simpson, Guelph	150 00	
36	Short Horn Grade Steer	L. O. Barber, Guelph	135 00	
				885 00

Public sale of Live Stock—*Continued.*

LOT.	CLASS.	PURCHASER, ETC.	Amount.	Total.
	CATTLE—*Continued.*			
	Grades:		$ c.	$
37	Cow	Thomas Kershaw, Holstein	70 00	
38	Cow	J. Lamont, Caledon	65 00	
39	Cow	A. Taylor, Dromore	90 00	
40	Cow	D. Reed, Glanford	50 00	
				275 00
	Total for Cattle			$5723 00
	SHEEP.			
1	Cotswold Ram Lamb	J. Taylor, Rockwood	11 00	
2	Pair Cotswold Ewe Lambs	A. J. Brown, Jeddo	8 00	
3	Leicester Ram Lamb	Robert Coulter, Wingham	9 00	
4	Pair Leicester Ewe Lambs	A. Cairns, Flesherton	7 00	
5	Shropshire Ram Lambs	A. Taylor, Dromore	21 00	
6	Pair Shropshire Ewe Lambs	A. Taylor, Dromore	22 00	
7	Highland Ram Lamb	H. Y. Attrill, Goderich	3 00	
8	Cotswold Ram	J. Gilchrist, Puslinch	8 00	
9	Cotswold Ram	A. J. Brown, Jeddo, N.Y	17 00	
10	Shropshire Ram	T. C. Patteson, Toronto	47 00	
11	Leicester Cheviot Cross	Walter West, Guelph	12 00	
12	Leicester Cheviot Cross	James Glennie, Guelph	21 00	
13	Hampshire Grade	James Glennie, Guelph	42 00	
14	Cotswold Grade	W. West, Guelph	7 00	
15	Cotswold Grade	W. West, Guelph	7 00	
16	Southdown Grade	W. West, Guelph	12 00	
17	Shropshire Grade	W. West, Guelph	30 00	
18	Shropshire Grade	J. Glennie, Guelph	20 00	
19	Leicester Grade	W. West, Guelph	15 00	
20	Leicester Grade	W. West, Guelph		
21	Oxford Grade	J. Millar, Guelph	16 00	
22	Oxford Grade	J. Millar, Guelph		
23	Merino Grade			
	Total for Sheep			335 00
	SWINE.			
1	Berkshire Boar	J. Hewer, Guelph	21 00	
2	Berkshire Sow	J. Hewer, Guelph	28 00	
3	Berkshire Sow	J. H. Wilcox, Guelph	22 00	
4	Essex Boar	A. Kerr, Guelph	11 00	
5	Essex Sow	John Anderson, Guelph	9 00	
6	Essex Sow	A. McDougall, Guelph	10 00	
7	Essex Sow	E. Coghlin	10 00	
	Total for Swine			111 00
	HORSES.			
	Clyde Cross Mare	H. Sorby, Guelph	110 00	
	Clyde Cross Mare	A. J. Brown, Jeddo	155 00	
	Total for Horses			265 00
	SCOTCH COOLIE DOGS.			
1	Dog	G. Moore, Waterloo	4 00	
2	Dog	G. Moore, Waterloo	4 00	
3	Bitch	P. Burnet	1 00	
4	Bitch	A. Broome, O.A.C	2 00	
5	Bitch	R. Menzies, O.A.C	2 00	
6	Bitch	H. A. Paget, O.A.C	2 00	
7	Bitch	A. Macdonald, O.A.C	2 00	
8	Bitch	James Pinkely	2 00	
9	Bitch	J. R. Kennedy, O.A.C	9 00	
	Total for Dogs			28 00
	Grand Total			6462 00

Public Sale of Live Stock, October 16th, 1885.

LOT.	Class.	Purchaser, Etc.	Amount.	Total.
	Cattle.		$ c.	$ c.
1	Grade Cow	J. & R. Millar, Guelph	28 00	
2	Grade Cow	J. Sandilands, Guelph	28 00	
3	Grade Cow	J. & R. Millar, Guelph	45 00	
4	Grade Cow	J. & R. Millar, Guelph	35 00	
5	Grade Cow	R. White, Rockwood	29 00	
6	Grade Cow	— Macdonald, Guelph	45 00	
7	Hereford Grade Heifer	J. Thomson, Guelph	11 00	
8	Hereford Grade Heifer	F. McQuillan, Guelph	10 00	
9	Hereford Grade Steer	J. Thomson, Guelph	16 00	
10	Hereford Grade Steer	J. Thomson, Guelph	10 00	
10½	Hereford Heifer	J. Thomson, Guelph	18 00	
				275 00
	Horses.			
11	Clyde Cross Mare	Charles Austin	81 00	
12	Aged Horse	D. O'Connor	51 00	
13	Clyde Cross Horse	W. Dawson	150 00	
				282 00
	Sheep.			
	Grade Ewes (in pairs):			
14	Nos. 639,853	J. & R. Millar	7 00	
15	" 247,848	John Henderson	8 50	
16	" 679,850	F. Simmons	7 50	
17	" 248,288	J. Sanderson	9 00	
18	" 295,867	J. Sanderson	8 50	
19	" 268,831	J. Shirton	9 50	
20	" 680,895	N. Moore	8 00	
21	" 269,675	A. Heleher	10 50	
22	" 270,638	Robert Shortreed	8 00	
23	" 265,890	A. Heleher	7 50	
24	" 686,825	W. Simmons	5 00	
25	" 858,899	J. & R. Millar	7 00	
26	" 206,859	R. Shortreed	9 00	
27		A. White	9 00	
28	One Cotswold	J. Simmons	2 00	
				116 00
	Pure bred Ewe Lambs:			
29	Hampshire (pair)	M. P. Doyle	5 00	
30	Cotswold (pair)	W. Elliott	7 00	
31	Grade Lambs (pair)	J. Tyson	5 00	
32	Grade Lambs (pair)	J. Roberts	5 00	
33	Grade Lambs (pair)	J. & R. Millar	10 00	
34	Grade Lambs (pair)	W. Scott	7 00	
35	Grade Lambs (pair)	J. Tyson	6 50	
36	Grade Lambs (pair)	J. Tyson	6 00	
37	Grade Lambs (pair)	J. & R. Millar	5 00	
38	Grade Lambs (pair)	W. Elliott	4 50	
				61 00
	Grade Ewe Lambs:			
39	Pair Ewes	J. Tyson	3 00	
40	Pair Ewes	J. & R. Millar	7 00	
41	Pair Ewes	J. & R. Millar	7 50	
42	Pair Ewes	J. Tyson	6 50	
43	Pair Ewes	J. Tyson	8 00	
44	Pair Ewes	J. Tyson	6 00	
				38 00
	Grand Total			$772 00

IV.—EXPERIMENTS.

It cannot be said that the Province is full of facts with reference to any branch of farming, and certainly not so as regards dairying. When such an authority as Professor Arnold says, "There are many things about cow's milk and its production, with which we are all in some respects so familiar, which the most careful students have not been able to explain or comprehend. There are so many things in regard to it which are still unknown, that I could not, if I would, make a complete account of it."—The use of cow's milk among civilized nations has been of more importance than even flesh, and no article of the farm has ever stood the vicissitudes of time, of markets, of climate, and of fashion so well as this has. It has never been superseded in food value by anything else in nature or art, and yet it is the most easily spoiled and destroyed among animal products, —not only so, but man himself is less certain about its physiological source, knows less about its variety of source, is less able to regulate its quality, and thinks less about its actual value, or even what it costs to produce it—all the while that most men use it daily. Do we yet know how skilfully and easily to detect adulterated milk, how to choose a cow *exactly* by any real or supposed indications, what is meant by *character* of a cow as regards dairy products?—do we know even what *heavy* milk implies, and why milk is not valued and paid for according to its kind; or why cheese and butter are not systematically manufactured in winter as well as summer? It stands as a remarkable fact in the agricultural history of nations that whatever be their position—in age or civilization—whatever their wealth and resources of any other kind—if troubles arise in the growing of crops from causes within or without themselves—climatic, disease, or competition causes—then recourse is had to the dairy. One of the oldest and one of the newest civilized countries are to-day examples of this striking fact. Britain and Canada are dipping deep into butter and cheese. It is possibly a phase in the agricultural battle that will culminate in some scientific and practical revolutions.

In view then of the increasing importance of this interest in our country, I have deemed it advisable to attempt the production of more light. The appliances of this station are now such as authorize our farmers in asking for this. It has not been difficult to arrange a plan, and it should not be difficult to carry it out systematically and accurately. The food, and the agents (cows) as well as the chemical, microscopic, centrifugal, and other helps, have been liberally supplied. The work involved may be gathered from the fact that on dairy subjects alone as many as 2,700 separate tests have been made during six months. Similar testing in other lands cannot be taken as guides for us because of the very marked difference of conditions.

I have also thought it well to submit some more information about mutton, wool, grasses and even the fattening of cattle, in these times of doubt to many. These advanced notes would be justified were it only to report the position of permanent pasture, to which I beg your particular attention.

The public will understand that it is not desirable to elaborate in the early stages of an inquiry, but when we are more full of experience, at the end of the season, a greater latitude will be given in commenting on the various subjects; and it should be distinctly understood that such experiments are but the beginning of a series, and results cannot necessarily meantime be taken as characteristic of particular sources.

NOTE.—This portion of the report is the Midsummer Advanced Report, referred to on page 5, and is to be understood as written under date of July 1.

2. THE ANIMALS USED IN THESE TESTS.

Breed.	Names of Cows.	Age in Years.	Weight in lbs. May 1.	Had last Calf on	In Calf Again.	Applicable to Chapters.
Aberdeen Poll.....	Advie.....	5	1300	September, '84*...	January, '85..	7, 8, 9, 11, 12, 13, 16, 17, 21.
	Mavis.....	6	1390	April, '85	no.	
Ayrshire.....	Stately.....	6	1130	June, '84	September, '84	5, 7, 8, 12.
	Sensation. ...	4	1155	January, '85*.....	April, '85.....	13, 14, 16, 17, 20, 21.
Devon	Esmeralda ...	7	1450	October, '84*.....	no.	7, 8, 9, 11, 12, 14.
	Ruddie.....	5	1100	April, '85	no.	16, 17, 20, 21.
Galloway	Berta	3	1260	December, '84*....	March, '85....	7, 8, 9, 12.
	Gem	3	1410	October, '84	January, '85.	13, 17, 21.
Guernsey	Ruth.....	3	880	June, '84	August, '84...	7, 8, 12, 14, 17.
	Goldleaf.....	4	910	June, '84	November, '84	
Hereford	Sunflower	3	1220	June, '84	November, '84	12.
Holstein	Verapina.....	3	895	January, '85.....	March, '85....	5, 7, 8, 9, 11, 12, 13, 14, 16, 17, 20, 23.
Jersey	Beauty o' the Mill.....	3	835	February, '85.....	April, '85.....	5, 7, 8, 9, 11, 12, 13, 14, 16, 17, 23.
Ontario Grade.....	Grannie	old.	950	March, '86*.....	no.	12, 17, 21.
Quebec Grade.....	Mack	5	800	April, '85.....	no.	8, 9, 12, 20.
	Flower	5	880	May, '85.....	no.	
Short Horn	Madamoiselle.	7	1530	November, '84*...	April, '85.....	7, 8, 9, 12, 13, 14, 16, 17, 21.
Short Horn Grade.	Little Taylor .	9	1100	November, '84	February, '85 .	6, 7, 8, 9, 12, 13, 14, 17.

Brief Description of the Cows used in the Experiments.

"Advie" is a five year old, whole red Aberdeen Poll—true to her origin, a persistent milker in moderate quantity—a kindly cow, with a touch of the beefy disposition so characteristic of the breed.

"Mavis" is another Aberdeen Poll, six years old, of a more delicate looking type than some of her kind—a sweet cow, without any appearance of individual character.

"Stately."—I had difficulty in securing this Ayrshire from the Duke of Buccleuch's agent, and no wonder. Every time we have to milk her daily two weeks before calving, and, even though nursing twins, have had to milk by hand twice a day for three weeks after calving. Her head and horns, staggy, are not liked by some, but the great quarters, the double udder, and the whole make up of the cow, speak of milk.

"Sensation" is another Ayrshire, four years old. This is the unsettled cow referred to in permanent pasture records—kindly, but nervous. For the class her colour is

* These cows aborted their calves—see Chapter 21.

unusually yellow all over ; is at present too fleshy ; a very neat animal, clean boned, with silky hair—a remarkably rich milker, but largely under average in qnantity.

"Esmeralda" is a seven year old Devon, and heavy as an average Short Horn. This cow cannot be kept in moderate flesh, and at the same time save our reputation for kindness. Of the light Devon shade and Short Horn in form, she is a very moderate milker in quantity.

"Ruddie," another Devon, five years old, is a very different cast from the other—having neither the flesh nor form, but more leggy, more irregular, and without much appearance of milk.

"Bertie" and "Jem" are three year old Galloways, averaging 1,350 lbs. Good judges place them well up, and for milking appearance they compare favourably with the average of other kinds.

"Ruth" and "Goldleaf" are Guernseys, three and four years old ; their stamp reminds one of a cross between Ayrshire and Jersey—both in size, colour and form. Goldleaf is actually yellow from hoof to horn, with all the surface mirroring and irregular outline that delights the dairyman.

"Verapina."—This is a medium sized Holstein, three years old, and, as with her kind at the age, is lanky and leggy. She possesses a beautiful skin, a well balanced udder and good barrel, nevertheless. Weight, 900 lbs.

"Beauty o' the Mill" may be described as a Jersey that pokes her nose into everybody's pocket—an uneducated pet. With such a disposition we have had much pleasure in handling this cow. Cream-coloured, even, roomy, a fine skin, but with little milk mirror and medium udder.

"Grannie" is an old 950 lb. grade that evidently has had nothing to do with any blood other than the roadside chance ; and yet her handling quality is short of nothing in our experience.

"Mack" and "Flower" are five year old Quebec grades averaging 840 lbs. These cattle are not without character, in appearance as well as milk. The unusual dwarfing of the quarters of Mack, and the beautifully developed udder and veins of Flower, are well-known features in our herd.

"Madamoiselle" is the seven year Short Horn that we could hardly purchase in Scotland last year. A light roan, deep, round, broad, full, and almost faultless ; she holds the delicate head, neck, and forequarters of a milker, and yet all over, the character and frame to make and hold beef.

"Little Taylor" is an undersized nine year old Short Horn grade, compact and neat.

3. WHAT REGULATES MILK.

I take the risk of placing in systematic order, and under valuation, those agencies that, to the intelligent farmer, seem to regulate or influence cows in producing milk. That our opinion will not agree with others is certain, but that it will help us to understand some of the experiments to be submitted in this report, is the principal object.

AGENCIES THAT GOVERN THE PRODUCTION OF MILK.

	Quantity. Per cent	Quality. Per cent.	Quantity and Quality Combined.
1. Breed	20	45	32·5
2. Food	30	20	25
3. Individual Merit	15	10	12·5
4. Management	15	8	12
5. Time after calving	12·5	12	12·5
6. Age of Animal	7·5	5	7·5
	100	100	100

The sources of milk—what is called *particular breeds*—among cattle may be taken as the first general idea; it is unquestionably the prime regulator of quality, if not also of quantity, and together they give breed a valuation of thirty-two per cent. It cannot be said, however, that breed regulates quantity more than food, for though it does so in some individuals that are typically strong or weak, as the case may be, the fact of food influencing quantity more than breed is now acknowledged. We say, then, that breed demands fully one-third of all that goes to produce milk.

In the second place, I am of opinion that food claims fully one-fifth of this position—taking its greatest direction in quantity, and a somewhat less one in quality; of course appropriate food is implied in this valuation as against what is known to be poor for such a purpose.

What is called "Individual Merit," or the average goodness of a cow in her class, takes third-class as a point in estimating milk value, amounting to one-eighth of the whole. The world has been so much treated, of late, to one cow records, that some people will object to the middle place I give this, but reflection as to the average individual of any breed cannot ask for more, and no doubt individual merit has more to do with the quantity than the quality of the product.

The fourth place is given to time after calving. This agent is naturally a strong one, and as yet, in our knowledge of variety of sources, it is uncertain whether quantity or quality has the stronger hold upon it; meantime quantity is given the higher value. It is possible that no influence is so unerring in its regularity as this, and yet, by reason of associations, cannot be allowed more value than individual merit.

Among the agencies are two, that, so to speak, are in our hands for better or for worse, namely, food and management; not overlooking the fact of breeding as partly ours also. Management, as the fifth in order of importance, may be safely placed at an average of ten per cent., and telling much more on quantity than quality; management means —system, favourable surroundings, along with kindness and half a dozen other things.

Then, in the sixth place, the valuation is closed by the very indefinite agent—age, which at seven and one-half per cent. is probably more proportionately than experience has indicated. It is one of the things of the future as to whether age affects quantity or quality most, but in waiting for light I have made it stronger on the former.

In checking, or hearing any criticisms on this subject, the public will remember to allow for :—Individual herd experience, partiality to a breed, physical influences, and high or low pressure management.

This chapter is written without reference to any facts exhibited by the following tests.

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4. THE MAINTENANCE OF CHARACTER IN DAIRY PRODUCTS.

A feature in the manufacture of butter and cheese, either not known or undervalued, is the maintenance of its *character*. We prosecute the business with every respect to profits by securing the quantity and also the quality as generally understood ; but quality is more usually looked upon as the result of manipulation, and though it is known that the particular condition of the cow is an element of some value, this value is neither properly appreciated nor systematically arranged for.

The *character* of butter and cheese is that full natural rich flavour, odour, colour, and texture always obtained from milk, whatever its source, when nature is prepared to support herself best. All the constituents of milk being thus at their maximum during early calf growth, we have the *character*.

The best butter and cheese must have this character, and hence must have new milk ; no other arrangement can possibly secure it. Take the case of butter—remembering that good cream makes good butter at any season ; whether home make or factory make, it ought to be part of the system to breed cows to calve every month, and as one gallon of new milk gives character to twelve gallons that do not possess it, the number of incoming cows at any time need not exceed that proportion.

Let dairymen understand that this question is no unimportant one, but one of the prime regulators of market value.

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5. THE TESTING OF NEWLY-CALVED COWS OF THE FOUR PROMINENT DAIRY BREEDS.

It has often been said by some of our writers and dairymen that this farm should be put in possession of the best possible couple, or trio, of cows of the principal milking breeds, for the purpose of making a two or three year test of their respective merits—all so well balanced according to their kind, and so exactly managed alike as should command the confidence of the country. I consider the suggestion a good one—and am prepared to help at any time. Subject to some such systematic and thorough experiment, I have, at the same time, every confidence in placing, as the next best thing in our hands, the record of any breed against another, that, by age, and calving particularly, give us opportunity for reliable work. Among the animals imported last year are several young cows of all our breeds, and I am glad to say that the equality of conditions were, last fall, so favourable as to induce a systematic testing of their milk, cream, butter and cheese. The cows were set aside on 1st February, and every day since, each milking has been weighed, the percentage of cream ascertained by various methods, and butter and cheese made at intervals. It is proposed to continue this throughout the summer, and indeed part of the summer results form part of this report.

The age, weight, and time of last calving are given in the tables hereto, but their general type as milkers can be ascertained only by inspection. The public will understand that there has been no desire to choose, necessarily, an "extraordinary" cow of any of the breeds, nor would we have anything to do, in any case, with a poor specimen of them. The three cows of this chapter are good of their kind, and being all from their first calf, the contest may be taken as a very fair one indeed.

First, then, as to the winter competition :—

CONTEST IN WINTER MILKING OF THREE COWS OF PROMINENT DAIRY BREEDS.

BREED.	Name.	Age.	Calved.	Weight.	Feb. Milk.	March Milk.	April Milk.	Mean Daily.
				lbs.	lbs.	lbs.	lbs.	lbs.
Ayrshire	Sensation	4	January, 1885.	1150	21	22	17	20
Holstein	Verapina	3	January, 1885.	900	22	22½	21	22
Jersey	Beauty o' the Mill	3	February, 1885	830	15½	21	18	18

The first glance at this table tells of an uniform milk produce that would not be expected by even those not well up in characteristic of breeds. Twenty pounds, or a little over two gallons of milk per head per day, is certainly not poor for winter, and is over the average of Ontario factory records for summer, but the quantity is not unusual considering the sources—particularly if Ayrshire and Holstein records be all true. Indeed the reflection is decidedly in favour of the Jersey, with its 18 lbs., as against the others with 20 and 22,—Ayrshire and Holstein respectively. Of course we are not forgetting that they were all heifers last year, and that summer may tell another story. What at present about the character of the milk in winter?

BREED.	Cream per cent.	Butter, from 100 lbs. Cream.	Cheese Curd, from 100 lbs. Milk, less 10 per cent.
	Deep Setting at 40°.	lbs.	lbs.
Ayrshire	12.81	37½	13½
Holstein	11.68	30¾	10½
Jersey	18.52	43⅛	14

These represent as many as 134 separate tests in cream, 12 in butter, and 12 in cheese, distributed over the period from January to May. There is a distinct correspondence in the per cent. of cream with the amount of butter obtained, and while it may be said that none of the cream is high according to sources, the per cent. of butter is decidedly above the average, and may indicate a higher specific gravity of cream, because of winter conditions, than is usually got from pasture. The highest individual churning was 50 lbs. per 100 lbs. of cream from Jersey, and the lowest 17½ lbs. from the Ayrshire. The cheese curd was thoroughly dried, and I may observe here that, in all our tests for cheese during the last nine years at this station, the proportion is always considerably more than the usual factory returns throughout the Province. Even allowing for any waste, and general rough management at cheese factories, as against our more accurate work, there would still be a large margin. Do we get more milk solids in winter than in summer? The cream is more than, and of course helps the cheese record, but there are other solids that go to make cheese.

It will be interesting to examine the summer character of these milks, in comparison with winter, and then our notes will also be more full.

SUMMER MILKING OF THREE COWS OF PROMINENT DAIRY BREEDS.

May and June, 1885.

BREED.	Age.	Calved.	In Calf again.	Milk Average per day.	Per cent. of Cream.	Butter from 100 lbs. Cream.	Cheese Curd per 100 lbs. Milk, less 10 p.c.
		1885.		lbs.			
Ayrshire	4	January	April	15	14.7	49.3	15.7
Holstein	3	January	March	21	8.8	31.0	12.3
Jersey	3	February	April	22	14.2	61.0	17.3
				20	12.6	47.	15.

It is not true, then, that winter milk is richer than summer, even though showing nearly two per cent. more cream by bulk. This summer table is from the same cows, and hence makes a valuable comparison as to effects of seasons and food. The milk quantity remains unchanged from winter to summer—a feature in this testing that must be accounted for partly by time from calving, the effect of change perhaps, and the being again in calf. As regards cream quantity, there is all over nearly two per cent. less in summer, but there was obtained in May and June no less than 10 lbs. more butter from the same weight of cream than in winter—from 37 to 47 lbs. on an average. In cheese the difference is equally striking, from 12.2 in winter to 15 lbs. per 100 lbs. of milk in summer.

The conduct of cows individually is worth noting. The Ayrshire increased very prominently in cream, butter and cheese proportions from winter to summer, the only one to increase her cream percentage indeed, though the milk quantity was reduced, as explained elsewhere. That the Holstein decreased in cream from 11.68 to 8.8, and yet held almost exactly to butter yield, may appear a contradiction. Why did not the summer milk give an equal proportion of cream? But, the Jersey not only gave four per cent. less cream proportion in summer, she actually gave 18 lbs. more butter in summer from the 100 lbs. of cream, and 30 lbs. more from her cream than the Holstein did!—facts all through that point to the necessity of further inquiry as to animals, food and seasons.

6. DAIRY PRODUCTS FROM ENSILAGE AND TURNIP-FED COWS.

PER HEAD PER DAY.

	ENSILAGE.			TURNIPS.		
	Milk.	Cream.	Butter.	Milk.	Cream.	Butter.
	lbs.	per cent.	lbs. per 100 lbs. Cream.	lbs.	per cent.	lbs. per 100 lbs. Cream.
November	25	11	....	23½	7½	....
December	24⅛	8	38½	39	7⅛	39
January	33	8	44	26	8½	40
February	29	12½	....	27	12½	....
Means	28	9½	41	29	9	39½

Dairy Products from Ensilage and Turnip-Fed Cows.

For the third time we have placed ensilaged corn against turnips in the production of milk in quantity and quality. The plan from 1884-85 was similar to others by setting aside four cows as equally matched as possible in regard to kind, size, time after calving, and apparent milking properties—two on ensilage and two on turnips,—alternating each pair every month, so that any condition, for or against, was met by alternating. At time of exchange, seven days were allowed for the new food to over-influence the old before testing reopened. The experiment began on the 19th November, and was closed on 2nd March last.

The average daily consumption of food per head in each case was :—
Ensilage—30 lbs.; hay, 9 lbs.; and bran, 13 lbs.
Turnips—30 lbs.; hay, 9 lbs.; and bran, 13 lbs.

The case was therefore equal weights of ensilage and turnips, and equal weights of hay and bran. It is then only necessary now to submit the results.

Weight of Cows under this Experiment.

	Average weight on Entry.	Average weight at Finish.	Difference.
Ensilage	1187	1207	20
Turnips	1185	1192	7

This statement has one very prominent feature—uniformity of averages in all the three products, and there was not even any large difference any month.

Then also, the weight of the cows on entry and closing of each of the terms shews no practical difference, so that all over we are to gather up some points of real value.

That this preserved, short cut, green corn fodder has, weight for weight, been equal to turnips in the production of dairy products, demands some thought, for prejudice is still strong against this new form of winter green fodder. A fleshy bulb like turnips is, of course, a very different fodder to the stalk and leaves of one of the cereals, as corn, and hence it can be said of such an ensilaged plant that it is more likely to meet the wants of animal sustenance and produce, than a bulb having about 90 per cent. of water in its composition. Much, however, of the object of a green fodder in winter is to keep animals in a natural condition, not necessarily for much feeding value, but if feeding value can be combined with the green condition, then two objects are attained. Now, while I am an unflinching advocate of a root division in the rotation of every farm, for objects absolutely indispensable to first-class agriculture, I am prepared to accept ensilage if, as a crop, it can do the same thing. We require a change of crop, a cultivated crop, a deep-rooting crop, a crop that lives upon the subsoil and atmosphere, and a crop at all times sweet and good for food. Corn, and I speak of it now only because it is the standard of this country, cannot possibly take the place of roots in a division of cropping, for its whole character and requirements differ so essentially that neither fallowing nor soil relief could be brought about by its substitution for roots. I am not prepared at present to allow for both crops on a farm, as may be advanced by those who argue for variety, as a safer investment, until it is shown that both—place as a crop and crop value—are as good with corn fodder as with roots. With reference to food value, it cannot be shown that ensilaged corn fodder is either so natural, so palatable, or really of more value for any class of animals, as turnips and mangolds ; animals will not eat so much of the one as of the other, nor can

corn stalks and leaves be possibly kept sweet; there is no such thing as sweet ensilage, and the writer has examined within the last three years silos in the States, in Canada, and in England. Then also, ensilage cannot be fed alone as roots can, nor even as hay,—it must be treated with some form of grain, or mixed with dry fodder such as hay.

I therefore respectfully submit to the farmers of Ontario that unless a majority of them desire to prosecute the enquiry in a different line to what we have done here, or should the Government desire to keep it up as a matter of interest, we do not propose continuing "Ensilage Experimentation."

7. CREAM AS OBTAINED BY DEEP SETTING UNDER TWO TEMPERATURES.

During Winter.

It is not my purpose meantime to discuss all the conditions that go to make the best cream that makes the best butter—whether they be breed, food management, and the particular management of the milk to give the desired cream, as I wish in this chapter to obtain the greatest amount of cream from a given quantity of milk.

Sources.	Deep Setting at 40°.	Deep Setting at 60°.	Difference.
Jersey	19.2	11.2	8.0
Ayrshire	18.7	9.5	9.2
Short Horn	17.8	11.4	6.4
Short Horn Grade	15.6	12.8	2.8
Aberdeen Poll	12.7	8.4	4.3
Galloway	11.8	6.2	5.6
Holstein	10.0	1.9	8.1
Means	15.1	8.8	6.3

We did not think it necessary to wander over all the fields of depths of milk, but sufficient to confine the enquiry to what is most likely to benefit the factory system. The cans for this purpose are twenty inches deep and eight and one-half in diameter—the standard, at present, in which two inches of cream, on an average, give one pound of butter. Confining ourselves to this, and the corresponding test tubes, our winter work began on 26th November, and closed for that term on 1st May last. Our Experimental Dairy is heated by an underground stove, sending hot water to radiators, which are easily regulated. The temperature of the room was held at 60°, day and night. Here, then, we have taken, for the purpose of this chapter alone, no fewer than 750 separate tests. All milk was allowed to stand twenty-four hours before creaming.

It will be observed, first of all, that for a temperature of 60°, we had simply to use the room as it stood on an average—which was rarely below 55°, and never over 65°. In that case, the milk, coming from the stables at about 85°, was at once strained into the large glass test tubes and allowed to remain the prescribed time. There was then a falling temperature of 20° to 25°, and the milk usually came to 60° on an average of three hours. On the other hand, for a temperature of 40° we had to use water and ice. When

the milk was brought in, the tubes were immediately filled, allowed to stand in the room temperature for two hours ; during the second two hours they were placed in water at a temperature of 50°, and afterwards were set in iced water that was held at an average temperature of 40°. These gradual steps were adopted upon the well-known fact that cream rises best *during* a falling temperature, so that it is of primary importance to give time, instead of plunging at once into the lower temperature. During the four hours thus arranged before getting to 40°, very much of the cream settled, and usually the reading of percentage of cream could be made before the end of six hours, and nearly all came up in eight hours. I think it well to be precise in describing the two methods, for, while some know what 60° and 40° mean, very many do not, and, besides, the results are so wide apart as to demand attention. The point accordingly is the really extraordinary difference of volume or bulk of cream in favor of 40° ; that, on an average of seven sources of milk, varying in condition, influenced by breed, and the other conditions, there should be such a range from 1·9 to 19·2 seemed almost beyond belief. Why is it so? Not food nor difference of management, nor temperature, but difference of source and the individual circumstances of the source. In the case of 60°, we have the range of 1·9 per cent. in that of the Holstein, up to 12·8 in that of the Short Horn grade. A mean of 8·8 from 60°, is not more than two and one-half per cent. more than the difference between the mean of the 60° and the 40°, which, as shown by the table, amounts to 6·3. It will be observed that deep setting at 60° has told best with the Short Horn Grade, for when submitted to 40° it only gave 2·8 per cent. more cream, and the other extreme is the Ayrshire, which debits 60° with actually as much as 9·2, or within three decimals of double ; these figures are more than interesting—they should be of much practical value, for although generally known among experts, the experts themselves have never had the appliances we have for variety of proof. It may seem to some as either abnormal or otherwise doubtful, that the Holstein, by giving only 1·9 per cent. at 60°, should actually send up ten per cent. at 40°, but the table says that in the example of Jersey and Ayrshire there is as much *difference*, though starting from very different percentages. We know the general meaning of dead or heavy milk, and that milk that is "stiff" at parting with its cream is invariably fairly rich, but few know that as much as *double* can be got from it by the very same method with a lower temperature.

I ask the attention of the Province, at this early stage of our inquiries, to this subject, in order that, when making our next tour at Farmers' Institutes, suggestions may be submitted, and possibly a fuller line of work acted upon.

CREAM AS OBTAINED BY DEEP SETTING IN TWO TEMPERATURES DURING SUMMER.

SOURCES.	Deep Setting at 40°.	Deep Setting at 60°.	Difference.
Jersey	20.0	16.1	3.9
Ayrshire	18.8	15.5	3.3
Short Horn Grade	18.0	13.8	4.2
Short Horn	16.8	12.9	3.9
Guernsey	16.2	11.1	5.1
Quebec Grade	14.0	11.5	2.5
Holstein	13.8	8.5	5.3
Devon	11.7	7.5	4.2
Mean	16.2	12.1	4.1

During summer we had three more breeds to handle in this line of enquiry than for winter, and dropping out the Aberdeen Poll and Galloway as of less importance to the dairy interest. The Jersey, Ayrshire, and the two Short Horn sources, and Holstein, have kept their relative positions, the Short Horns only exchanging. Taking these to compare with winter results, there is only an increase of 6 per cent. more cream in summer by setting at 40°, but the large difference of 3·5 per cent. more during summer at 60° than the same in winter—a fact attributable, no doubt, to better rising conditions according to season.

The new sources called Guernsey, and Quebec Grade, have stepped in between the Holstein and Short Horn with an average of 15 per cent. at 40°, and 11·3 at 60°, so that Holland with us is still low, and that it is above the Devon—a fresh, newly calved five-year old—is even surprising under the other facts of both breeds. The Holstein still holds back more cream at 60° than any other, the Guernsey being about equal, with 5·1 per cent. We must congratulate Quebec on possessing a liberal and free character of milk through her common cattle, which are said to be not a little touched with Jersey. The three cows now in full milk here have given 14 per cent. of cream at 40°, and as much as 11·5 at 60°—the least of all in difference.

8.—THE CENTRIFUGAL SEPARATION OF CREAM FROM MILK OF TEN DIFFERENT BREEDS, IN COMPARISON WITH DEEP SETTING.

It is usually—not always—desirable to obtain *all* the cream from milk, whether for immediate sale, or to be changed into butter. In no case can cream be removed, as a pure oil, unaccompanied by any other material, and in any case about one-eighth of the volume of the globules remain in the milk. I do not know that it is possible to name all the influences that regulate the rising, or removal otherwise, of cream from milk, but generally they may be given as

Breed.
Season of the year.
Time after calving.
Mode of removal.
Temperature.

There may be—or come to be—an arrangement by which the butter globules are passed through some medium, liquid possibly, which would free them of all milk proper. I am not advising this necessarily for economy, or even for the production of a better article ; because, as is well-known, a certain proportion of milk with the cream is liked for the sake of easy and better churning, but I note the point now as one of interest in connection with the removal of cream by machinery.

We possess a Fjord Centrifugal Tester with which twelve kinds of varieties of milk can be handled at the same time. It is driven by a side belt from the portable engine at a revolution of 1,200 per minute, and, as by the instructions, 40,000 revolutions are required to complete the separation, we have allowed from 32 to 35 minutes, according to circumstances. The size of the machine, its peculiar construction with the graduated bottles, mixing the milk with water at a certain temperature, etc., are matters of much interest, but unnecessary in these advance sheets, and those desirous of making its acquaintance should call at the Butter Factory during summer, and at the Experimental Dairy in winter. We have used it all winter and the past summer regularly, and systematically in connection with breeds and other methods of obtaining cream. The detail management of deep setting is explained in another chapter, and is applicable to this section of the work. I propose now to submit its work, and make some very interesting comparisons.

DURING WINTER.

From Short Horn Source.

Take the milk of the Short Horn first. By deep setting in a steady temperature of 60° we obtained 11·4 per cent. of cream from this source, and by deep setting and cooling down to 40°, 17·8 per cent. was got from the same milkings. We thus got a mean of 14·6 per cent. of cream by two methods of setting, or rather from two temperatures by the same method.

Now, the centrifugal took 15 per cent. from the whole series of Short Horn's milk; this, all over, is nearly an increase of one-half per cent., and three and one-half per cent. more than by deep setting at 60°; but, in comparison with deep setting or cooling with ice to 40°, is not so good by nearly three per cent. (2·8.)

It is not my present purpose to comment upon the extraordinary difference in per cent. of cream obtained by the two temperatures, as it forms subject for another chapter, and what we have to say on the whole aspect of centrifugal separation under these conditions will best follow the account of sources.

CREAM FROM DIFFERENT SOURCES BY DEEP SETTING IN COMPARISON WITH CENTRIFUGAL SEPARATION DURING WINTER.

SOURCE.	Deep Setting at 60°.	Deep Setting at 40°.	Centrifugal.
	per cent.	per cent.	per cent.
Aberdeen Poll	8.4	12.7	11.6
Ayrshire	9.5	18.7	15.0
Devon	8.0	....	14.5
Galloway	6.2	11.8	14.6
Guernsey	5.0	....	7.1
Jersey	11.2	19.2	13.0
Holstein	1.9	10.0	11.9
Quebec Grade	8.5	....	13.7
Short Horn	11.4	17.8	15.0
Short Horn Grade	12.8	15.6	14.7
Mean	8.5	15.1	13.1

From Short Horn Grade Source.

This has been a very uniform record comparatively. By deep setting at 60° we got 12·8 per cent. in cream, and 15·6 per cent. on cooling with ice to 40°—all the examples having stood for twenty-four hours. The milk from the same cows, at same time, gave 14·7 per cent. of cream on being subjected to centrifugal, so that the centrifugal drove two per cent. more cream from this source than by deep setting at 60°, but one per cent. less than when the temperature was lowered to 40°, while all over the centrifugal had the advantage to the extent of one-half per cent.

From Aberdeen Poll Source.

Here, from another beefing tribe, we have 8·4 per cent. of cream by deep setting at 60°, and 12·7 per cent. by cooling the same depth to 40° in the same time ; the centrifugal machine gathered 11·6 per cent. of cream. Accordingly, the machine gave fully three per cent. more than the 60° temperature, but one per cent. less than cooling to 40° ; yet, all over, the centrifugal made fully one per cent. more cream.

From Galloway Source.

Another of the breeds strong in beef has made an unusual record under these cream tests. With 6·2 per cent. from deep setting at 60°, and 11·8 per cent. at 40°, it afforded no less than 14·6 per cent. of cream when submitted to the centrifugal machine. This is eight and one-half per cent. more than from the 60°, and nearly three per cent. over the 40°. We have therefore obtained five and one-half more of cream by centrifugal separation from the Galloway than from an average of the deep setting at two temperatures.

From Ayrshire Source.

The Ayrshire by deep setting at 60° gave 9·5 per cent. of cream, and actually 18·7 per cent. when lowered to a temperature of 40°—a mean of 14·1 from the two. The centrifugal tester separated 15 per cent. of cream from the same source, which is therefore one per cent. more than the setting at 60°, but 3·7 per cent. less than that at 40°. All over the centrifugal made one per cent. more cream than the mean of the two settings.

From Holstein Source.

Even in these notes of simple facts it is difficult to hold comment from the comparatively unusual conduct of Holstein milk. Only 1·9 per cent.—say 2 per cent. of cream, as marked at least by the naked eye, from deep setting at a temperature of 60°—as much as 10·0 per cent. at 40°, and 11·9 per cent. under the centrifugal machine. Meantime, take the memoranda that at 40° we got eight per cent. more cream than at 60°, that the centrifugal drove ten per cent. more cream from the milk than deep setting at 60°, and two per cent. more than setting at 40°, and thus six per cent. more than the average of both settings.

From Devon Source.

This gave 8·0 per cent. of cream by deep setting at 60°, and 14·5 when submitted to the machine, and thus, meantime, six and one-half per cent. in favour of the centrifugal.

From Guernsey Source.

At the time we had two Guernseys in milk arrangements for cooling to 40° with ice were not completed, and hence, for winter, we have no comparisons to make in this respect, nor also with the Devon and Quebec grade. The Guernsey gave 5 per cent. cream from deep setting at 60°, and 7·1 per cent. by centrifugal, so that the machine gave fully two per cent. more than the other.

From Quebec Grade Source.

This possibly high graded Jersey or Guernsey, recorded 8·5 per cent. of cream by deep setting in a temperature of 60°, and 13·7 per cent. by the centrifugal tester ; the difference is five per cent. in favour of the machine.

From Jersey Source.

In winter—a condition in many respects favourable to milk quality—the Jersey threw up 11·2 per cent. of its cream when set deep and held at a temperature of 60°, but when subjected to 40° it gave 19·2 per cent. or eight per cent. more. The centrifugal made 13·0 per cent. which is fully two per cent. more than setting at 60°, but six per cent. less than setting at 40°, and more than two per cent. less than a mean of the two settings.

Recapitulation and Criticism.

As many of our readers will naturally think of the more common or summer conditions of obtaining milk, I beg first of all to remind them that the facts handled in the first part of this chapter were all obtained from 16th Dec. to 1st May, and consequently under the more unnatural milk conditions. The point here is not so much the particular conditions that made the milk, as the power of the centrifugal machine in separating its cream, in comparison with other methods. Then, also, I must guard the patrons of any special breeds of cattle from necessarily drawing conclusions one way or the other without a very exact knowledge of the particular individual cow or cows, and the other regulators of milk ; these are given elsewhere. And, also, it is a point of paramount importance to remember that we have yet to ascertain the exact *value* or butter produce from each of the methods, and to what extent the one, more or less than the other, takes milk with the cream, for undoubtedly the quality and keeping proportions of butter are affected by the purity of the cream. Under the proper head I shall ask attention to these as well as the quantity of butter proportionately to cream bulk. (See Chapter 23.)

Through ten distinct sources, or breeds of cattle, from December to May—entailing some 135 separate experiments, we obtained milk that was subjected to three conditions for the removal of its cream—the object being to test the power of the centrifugal machine in doing so in comparison with the best known method, or deep setting at two different temperatures. First, we naturally look at the abstract results, and note that deep setting in an uniform temperature of 60° for twenty-four hours gave 8·5 per cent. of cream—the extremes being 1·9 and 12·8. This is not a high average, being about the same as a large number of results from twelve sources at our station from 1881 to 1883, yet it may be a fair one under the particular conditions ; dry fodder with roots and grain are no doubt producers of fat, but when asked to do so in a mean outside temperature of 16° and an inside one of 40° , the very best machinery—that is cow constitution—may refuse to do the work completely ; fattening cattle did so very satisfactorily under precisely similar circumstances (see Chapter 33). Yet nature, if true to herself here, would rather hold the fat than give it away, as in the form of milk or cream.

Perhaps this criticism may appear unnecessary with the fact that we obtained from the same milk, as shewn by the table, as much as 15·1 per cent. of cream when its temperature was lowered to 40° with ice. That a high percentage of cream was the result of low cooling is clear, but that it was a corresponding butter product, even in quantity, is not at all certain. However, suffice it is to say, meantime, the 20° of lower temperature did raise nearly seven per cent. more cream, which of itself is a very important practical fact, and which is discussed elsewhere in these notes. The mean of the two temperature results is 11·8 per cent. of cream, and as the centrifugal drove 13·1 per cent. off we have to submit meantime that, over all the field, the machine is entitled to one and one-tenth per cent. credit, and this is, of course, ten per cent. more than the other.

It is a matter of very considerable interest to note the conduct of the milk from some sources. The most uniform under all the testing was Short Horn Grade—giving liberally everywhere, a condition evidencing possibly large size, and evenness of size, of butter globules, as well as a more watery milk, which alone can be told by chemical analysis—see chapters 9-10. The extreme to the Short Horn Grade in this milk conduct is that of the Holstein. I may remove much misconstruction of our winter facts in this particular source by saying that we submitted the skimmed milk of the Holstein, from which 1·9 per cent. of cream had been removed, to the centrifugal machine, and obtained actually

6 per cent. more cream from it,—strong evidence of two things: the dead or heavy, yet fairly rich milk of the Holstein in this case, and the reliability of centrifugal separation, for it even took two per cent. more away, after deep setting at 40° had removed ten per cent. Jersey skimmed milk that had given 14·7 per cent. of cream would only yield two per cent. more under the centrifugal, so that there is clearly "milk and milk."

Another example from these tests is with reference to Galloway milk. Years ago we advanced some facts in regard to Galloway milk being heavy, and even now the facts are gathering, for in comparison with others—the Holstein excepted—it has given a greater result between the deep setting at 60° on the one hand and a mean of the other two methods. The mean of these two is double that of the other.

But even the Jersey requires a little pressing to submit all its richness; on this and other characteristics of milk we have checks from summer conditions.

NOTE.—All the foregoing percentages of cream for *centrifugal* separation are subject to an explanation as indicated in chapter 23 herewith, entitled "The Possibilities of the Centrifugal Separator."

DURING SUMMER.

CREAM FROM DIFFERENT SOURCES BY DEEP SETTING IN COMPARISON WITH CENTRIFUGAL SEPARATION DURING SUMMER.

SOURCE.	Deep Setting at 60°.	Deep Setting at 40°.	Centrifugal.
Ayrshire	15.5	18.8	13.1
Devon	7.5	11.7	9.0
Guernsey	11.1	16.2	9.4
Jersey	16.1	20.0	13.3
Holstein	8.5	13.8	10.0
Quebec Grade	11.5	14.0	9.1
Short Horn	12.9	16.8	11.5
Short Horn Grade	13.8	18.0	11.6
	12.1	16.2	11.0

The first glance at the summer table, in comparison with the winter one, shows—allowing for the absence of the Aberdeen Poll and Galloway—a large difference in the per cent. of cream by deep setting at 60° in favour of summer, as well as a little at 40°,—by both temperatures as much as a mean of 2·5 per cent.; that, on the other hand, there is fully 2 per cent. less under the centrifugal in summer, so that all over the total average of cream is just 2·5 per cent. in favour of summer. The fact of the centrifugal not getting more than 11 per cent. in summer, a quantity less even than from deep setting at 60°, is evidence of a thinner condition of milk from pasture, no heavy milk, comparatively, and therefore less work for machinery to do; we may thus indicate that the use of the centrifugal separator may be more important in winter than in summer.

Whatever may be the cause, we now get the Holstein to yield 5 per cent. more cream in summer than in winter evidently more free, being, of which we have also evidence in the butter produce. The Jersey again leads in every example, with close quarters from the Ayrshire and Short Horn Grade. If there were such a thing desirable as a poor man's milk in the sense of giving least trouble to secure the most cream at 60°, the Jersey and Ayrshire have led at 16 per cent.

9. THE CHEMICAL ANALYSIS OF WINTER MILK.

We often hear the remark that no test is equal to the churn ; this is true within the appliances of the practical dairyman. When it takes but eight hours to make the most thorough chemical analysis of milk as regards its proportion of water, fat and other solids, and as the operation is within the means and the skill of average men I see no reason why, in the future of dairying, the testing laboratory should not form a corner in every advanced factory. The system and beautiful accuracy of chemical analysis are being abundantly evidenced every week at our station by Dr. Hare, assisted by Mr. Shuttleworth. These gentlemen have so thoroughly and cordially co-operated with me in this work, that I ask these few lines of thanks to them ; and I know that Dr. Hare joins me in a special notice of Mr. Shuttleworth, whose devotion night and day to his duties calls for unqualified praise.*

Well, then, our milks are now in the hands of an unerring judge—the chemist—what has he said ? Study first the abstract results.

CHEMICAL ANALYSIS OF WINTER MILK.

(*Mean of several tests.*)

SOURCE OF MILK IN ORDER OF FATNESS.	Water.	Fat.	Solids other than Fat.	Total Solids.
	per cent.	per cent.	per cent.	per cent.
Jersey	84.55	7.35	8.10	15.45
Short Horn	85.17	5.63	9.20	14.83
Ontario Grade	86.75	4.65	8.60	13.25
Ayrshire	88.20	4.60	7.20	11.80
Devon	86.70	4.45	8.85	13.30
Short Horn Grade	87.40	4.40	8.20	12.60
Galloway	85.72	4.38	9.90	14.28
Quebec Grade	87.20	4.00	8.80	12.80
Holstein	87.45	3.55	9.00	12.55
Aberdeen Poll	88.43	2.87	8.70	10.80
Mean	86.77	4.58	8.65	13.16
Extremely rich milk, Britain	83.90	7.62	8.48	16.10
Extremely poor milk, Britain	90.20	1.90	7.90	10.80
British mean	87.25	3.50	9.25	12.75

That milk upon an average is made up of fully $86\frac{3}{4}$ per cent. of water most people know, though our best testers have great difficulty in recognizing when milk is adulterated with one gallon of water to ten of pure milk ; the extremes of percentage of water

* Since this was written for the Midsummer Report, Dr. Hare has gone to his long home. A more enthusiastic, careful, unselfish and gentlemanly chemist may not be found. We miss him very much indeed.

in winter with us have been 88·43 in the case of the Aberdeen Poll, and 84·55 in that of the Jersey; four per cent. thus, more or less water, means clearly a very different proportion of the other things in milk, and on an average amount to 8⅔ per cent.—the extremes being 9.90 in the case of the Galloway and 8.10 per cent. in that of the Jersey; the extreme individual analysis occurred also with Galloway milk, and amounted to 10.9—the very lowest being 5.9 from an Ayrshire.

Solids, other than fat, are the sugar and salts, which are given together in the fourth column of the table. Water should be less in winter than in summer, because of the character of the food; the greatest extreme in any individual analysis was from an Ayrshire, which gave actually 90. per cent of water—a quantity looked upon as belonging to succulent herbage early in summer In this individual example the fat was as much as 4.10, but other solids only 5.90 per cent. The least proportion of water was obtained from one of the samples of Short Horn, being 83.70, and as it had fat as high as 6.40 the result was, of course, also a large percentage of other solids—9.90. Fat, or cream largely, is the principal item we are in search of, and I have given the table of sources in the order from greatest to least fat; these are very interesting and, as we take them to be the base of all the other constituents of milk, some special criticism will not be out of place.

The least fat, or 2·4 per cent., got during winter was from the Aberdeen Poll—two cows, one three weeks after calving and the other six months, so that the conditions were, all over, favourable enough, and the greatest proportion of fat obtained from any source was 7·5 in a Jersey. Between these extremes the field is a curious one. I desire to place on record, to the credit of our chemists, that the uniformity of the analyses by breeds or sources came out very prettily. In nearly all the work from the ten sources, sent to the Laboratory by *numbers*, reports came back so defined by percentages that they looked like the production of an artist who had made the likeness of each of the cows; the exception to this rule was in the case of the Short Horn—from 4·8 to 6·4 of fat,—two days intervening between the analysis of milk from the same animal, but all other influencing conditions, so far as we knew, being equal; in no other case did we receive even one per cent. difference in the fat, so that in addition to the chemical accuracy the facts point to uniform conditions throughout—even to the machine called the cow.

That one breed should give only 2·87 per cent. of fat and another as high as 7·35 seems almost wonderful. The whole position is unmistakably one of breeds—not food, nor individual cow merit, nor time after calving, nor age, nor management. The first natural inclination is to classifying the sources, and endeavour to fix the production of fat according to what we think by long use is the characteristic of the source—that is, whether a beef-maker, a milk-maker, or a combination of both; or possibly some may be inclined to examine with the eye of a butter-maker or a cheese-maker.

As a matter of interest, then, bring the well-known beefers and milkers together.

MILK FROM BEEFING BREEDS OF CATTLE IN WINTER.

SOURCE.	Water per cent.	Fat per cent.	Solids other than Fat.	Total Solids.
Short Horn	85.17	5.63	9.20	14.83
Galloway	85.72	4.38	9.90	14.28
Aberdeen Poll	88.43	2.87	8.70	10.80
Mean	86.44	4.29	9.27	13.30

MILK FROM DAIRY BREEDS OF CATTLE IN WINTER.

SOURCE.	Water per cent.	Fat per cent.	Solids other than Fat.	Total Solids.
Jersey	84.55	7.35	8.10	15.45
Ayrshire	88.20	4.60	7.20	11.80
Devon	86.70	4.45	8.85	13.30
Holstein	87.45	3.35	9.00	12.55
Mean	86.77	4.94	8.29	13.27

It is to be regretted, of course, that the Hereford is not with these tests, but though possessing several good specimens they were not in milk for the purpose. Summer may help us in this particular. We are now only criticising pure breeds—not any crosses or grades.

Here are three of the well known breeds, famous for "laying on" fat. Their average production of fat through milk is 4·29 per cent., somewhat less than the average of all the sources, 4·58 per cent., and decidedly less than the mean of the dairy breeds (4·94). The Short Horn has made such a high record that possibly an individual cow had much to say, and while I claim that breed is the greater regulator, it is fair to refer to this here (See chap. on animals). Not only so, but the world is always telling us of the strong lines still tying some Short Horns with their great milking ancestors. We are, no doubt, not satisfied with the Aberdeen Poll winter record of fat, good as the sources and conditions were, for as beefers they should show a good average of cream, as evidenced in our own previous records, and still evidenced in other parts of this report.

The Galloway takes a prominent position in milk quality, and by reference to centrifugal separation and other parts of our tests these chemical analyses support the fact of its richness, though difficult to obtain the cream or fat by ordinary methods.

But, in sort of opposition to the beefing breeds, look at the combination of milk analysis from dairy breeds. Could we get rid of that mysterious living churn, the Jersey, comparison would be much more easy and natural, but on every occasion it comes up as the unchallenged of milk quality; now, though the Jersey with its 7·35 per cent. of fat—a quantity approached only—and that even at a respectful distance—by the Short Horn, it is also well up in solids, (8·10) and holds altogether as much as 15·45 of what thickens milk and makes butter and cheese. But for this breed, the dairy list herewith would make a less record of fat than the beefers. The Devon—with the Ontario Grade which we do not at present include in these comparisons—has taken that exact middle place among breeds which its conduct at home and abroad has invariably indicated. Among dairy cows it averages their chemical analyses, and is still more so when the figures of all the *pure breeds* are tabled.

Perhaps no dairy breed, and no other breed, the Galloway excepted, has so much right to walk up to the chemist and ask for fair play as the Ayrshire. The facts elsewhere in our testing say so, and here also her "watery" milk wants not for average fat, and an apparent enigma is the small per cent. of solids other than fat (7·20), which, if having much to do with the production of cheese, does not agree with the facts in this specialty.

After the Aberdeen Poll, the Holstein is lowest in butter fats of all the breeds, yet good in other solids, and hence only one per cent. more in water than the average of all.

10. THE CHEMICAL ANALYSIS OF SUMMER MILK.

MEAN OF SEVERAL TESTS.

SOURCE OF MILK IN ORDER OF FATNESS.	Water per cent.	Fat per cent.	Solids other than Fat.	Total Solids.
Ayrshire	84.75	6.85	8.40	15.25
Jersey	86.15	5.89	7.96	13.85
Short Horn	86.85	4.35	8.80	13.15
Quebec Grade	87.10	4.15	8.75	12.90
Holstein	88.80	3.90	7.30	11.00
Devon	89.00	3.80	7.20	11.00
Short Horn Grade	87.45	3.65	8.90	12.55
Mean	87.10	4.66	8.24	12.90

An examination of the chemical analysis of summer milk is, at present, more important than the same thing in winter, and though general criticism has been given to the latter by reason of precedence in time, some is due to the other as well. We did not keep up the testing of Aberdeen Poll, Galloway and the Ontario Grade during summer ; these withdrawn from the winter table, so as to compare the general average with summer, make no practical difference in water, but increase the fat from 4·58 to 4·84.

Summer conditions have therefore added only about one per cent. more water, slightly reduced the fat, and added one-half per cent. to the other solids, so that all over variety of food and physical conditions appear to have little effect in changing the constituents of milk throughout a number of sources.

The greatest change occurred with the Ayrshire, and in a manner quite unexpected in milk from any source. From winter to summer it has *reduced* its proportion of water from 88·20 to 84·75, and *increased* the fat from 4·60 to 6·85, so that in solids it has changed from 11·80 to 15·25. This unusual feature is without example, except slightly in the case of Quebec Grade and the Holstein, which have also increased their fat from winter to summer, but so little in comparison with the Ayrshire as to pass without comment. Much of the Ayrshire grazing was upon our best permanent pasture (see chapter 20), and if fretting (so as to reduce quantity of milk) and the best of summer conditions are conducive to richness of milk, the apparent irregularity may be accounted for.

11.—CREAM FROM DIFFERENT BREEDS, AND DIFFERENT CONDITIONS OF THE SAME BREED IN RELATION TO PRICES PAID TO PATRONS OF CREAMERIES.

It must be obvious to even the very tyro in dairy matters that just as there are different causes influencimg the character of milk there must be corresponding results in the outcome, and therefore in the value of any of its products. In the case of cream and its purchase for butter manufacture on a large scale at factories, it becomes a matter of serious practical importance whether carried out upon the co-operative plan or managed by a private individual, that we know what cream is. At the present time cream is paid

for by the inch in a given size of can that is said to give on an average one pound of butter, or it is paid for equally co-operatively by the total result, all over the patrons, in butter manufactured ; for while the churning tests are made now and again at factories from a particular route, or even an individual herd for that matter, there is not any system by which each patron is paid for his cream according to its individual butter properties The result is an unequal and unfair value paid for cream.

To impress the facts in these cases is the object of these notes.

Beginning with an extreme example under conditions almost precisely similar as to age of cow, time after calving, and food, as well as dairy breeds, we have had 45 lbs. of butter from the Devon and 31 lbs. from the Holstein. Here is a difference of 14 lbs. of butter from 100 lbs. of cream, where the possessor of the Holstein would gain an unfair advantage, on an average, granting the equality of cream produce, to the extent of $21 per cow per milking season from May to October—and where the creamery would also have lost or gained—the balance depending upon the one class of cows over the other. Keeping to dairy breeds—look again at the position of the Jersey and Ayrshire, which have given us respectively 44 and 37 lbs. of butter from the like weight of cream ; this difference of 7 lbs. would affect financially per cow to the extent of $10 per season.

The value of cream is then a very uncertain thing, and from the four breeds named the butter maker would be justified in paying as follows for 100 lbs. of cream :—

Devon	$7 65
Jersey	7 48
Ayrshire	6 29
Holstein	5 27

Or, for the two inches on the common shot gun can, would be—Ayrshire being the standard :

Devon	23 cts.
Jersey	22 "
Ayrshire	17 "
Holstein	13 "

This is calculated upon the basis of cream being worth 17 cents for every pound of butter it makes.

NOTE.—The Standard of WEIGHT of Milk in the United States and Europe is now 8½ lbs. per gallon

12.—THE SIZE OF BUTTER GLOBULES IN MILK FROM TWELVE DISTINCT SOURCES.

I have been for the last two years in search of information from works on dairying as to the size of butter globules in milk of cows. In every publication of any pretensions the subject is referred to in a general way, and in a few there is an illustration. What I desired to know was if those globules differed much in size in particular breeds, and to what extent, if any, the size had to do with the whole *character* of milk. Not finding what was wanted, and willing to help others if possible, I took up the study personally during the last winter, and find I have just made an opening into an extensive and beautiful field—old as it is, may be.

It will be obvious to those acquainted with our appliances here that we are favourably circumstanced for such an enquiry, because, with all the breeds and equal conditions, some light should be gathered. From what follows it will be seen that several bearings have already developed into matters of business, which may be anticipated by saying that the size of butter globules has a direct relation to :

1. The particular breed of cattle.
2. The time after calving.
3. The food given.
4. Individual character of animal.
5. Healthy conditions.

And commercially to:

1. Proportion of butter obtained.
2. Richness and poorness of skim milk.
3. Prices paid for milk and cream.
4. Quality of buttermilk, and generally have to do with the whole stamp and character of milk whether for cheese or butter, from any source.

In examination I have used a "Zeiss" microscope, magnifying up to 670, taking sizes and proportion of small globules with specially constructed scale. Of course it is plain that a few observations would go for little in such work, but having taken as many as 221 during the past winter there is, if not a complete set, at least sufficient data to draw the inferences I have now to submit.

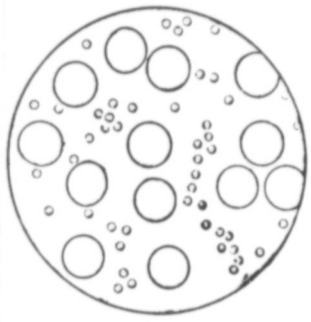
The following table of results and illustrations will help explanation.

SIZE OF BUTTER GLOBULES IN MILK OF TWELVE BREEDS OF CATTLE.

RESULT OF 221 OBSERVATIONS FROM DECEMBER, 1884, TO MAY, 1885.

BREEDS.	Average Time after Calving.	Size of Large Globules.	Proportiou of Small Globules.
	Months.		per cent.
1. Aberdeen Poll	1	1.40	.33
2. Jersey	6	1.39	.33
3. Ontario Grade	2	1.37	.33
4. Holstein	2	1.27	.50
5. Short Horn	3	1.25	.60
6. Galloway	3	1.14	.66
7. Devon	4	1.06	.33
8. *Ayrshire*	7	1.00	.50
9. Short Horn Grade	6	.95	.40
10. Guernsey	8	.93	.64
11. Quebec Grade	6	.78	.50
12. Hereford	8	.50	.68
Means	5	1.08	**.48**

HOLSTEIN



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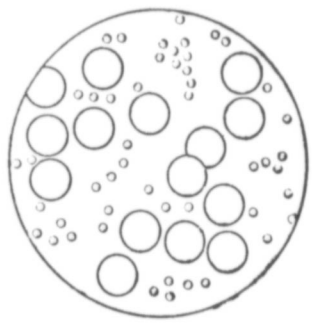
AYRSHIRE



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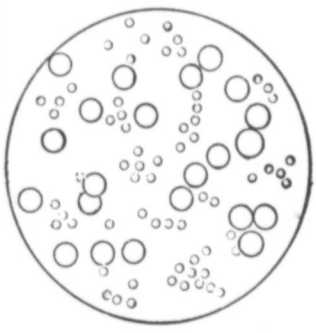
HEREFORD



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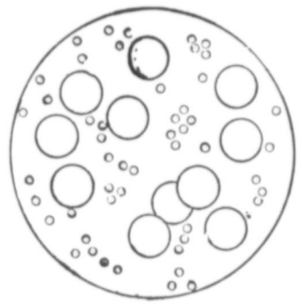
SIZE OF BUTTER GLOBULES IN MILK

OF TWELVE BREEDS OF CATTLE:

ABD'N POLL



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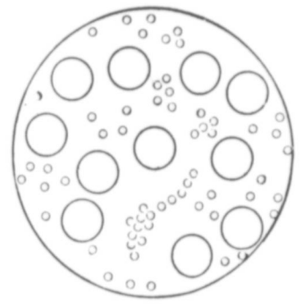
JERSEY



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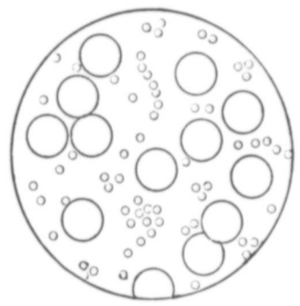
ONT. GRADE



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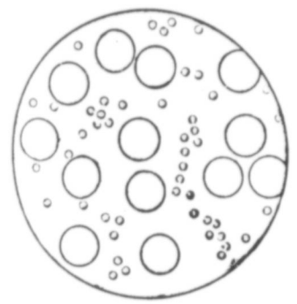
HOLSTEIN



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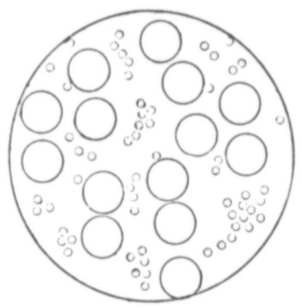
SHORT HORN



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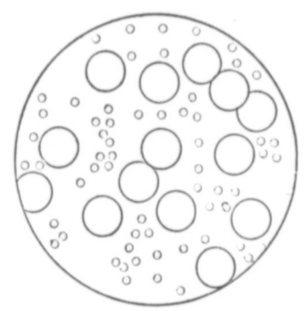
GALLOWAY



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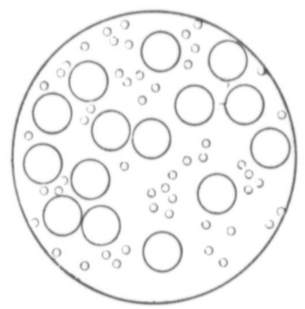

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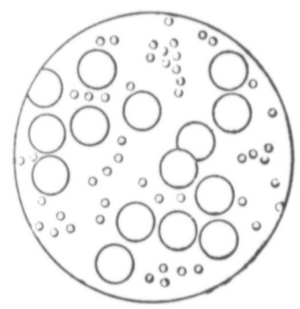

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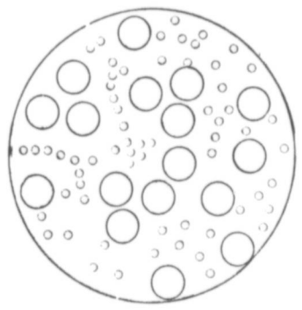
S. H. GRADE



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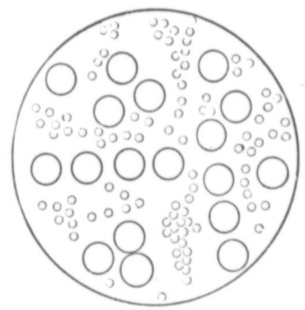
GUERNSEY



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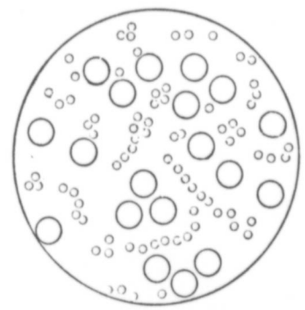
Q. GRADE



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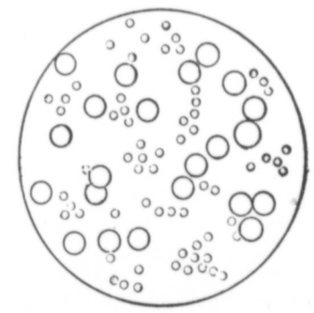
HEREFORD



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RESULT OF 221 MICROSCOPIC OBSERVATIONS, FROM DECEMBER, 1884, TO MAY, 1885.

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There being no standard to compare size with, and as the proportion of an inch when into the thousands is impossible of conception to any mind—common though the quotation be—I propose to call the size of butter globules in milk simply, 1.00 and so on, as applicable to their diameter. Now, as the milk of the Ayrshire breed is well known and has been more handled in this respect and oftener referred to in books than any other, and its size of butter globules well-known, I also propose to use it as the standard or unit (1.00), so that whatever microscope may be used the size of others relatively to it can at once be measured even by the eye without a scale or micrometer. Of course it is obvious by this method that in order to know whether the globules of any milk is more or less than the Ayrshire it would be necessary to possess the standard or 1.00. With reference to this I beg to say that after overtaking as many summer observations as the winter ones just completed, it may be well to prepare a microscopic specimen to be sold at a small price. Meantime, those who desire them can apply.

The cows from which specimens of milk were obtained are specified in chapter 2, and, as the average time since last calving forms the first column of figures in the table herewith, we have a good idea of the respective sources. In examining the table, take the standard Ayrshire with its valuation of butter globules at 1·00 and its proportion of small globules equal to one-half; above and below this, observe the variety of both sizes of globules.

The table indicates generally that size of butter globules has nothing to do with a dairy breed as against a beefing one; that nevertheless, the Short Horn and Aberdeen Poll hold a high place over the standard; that the proverbially rich Jersey and poor Holstein are equally high; yet all differing very much in proportion of small globules. We also gather that size of butter globules appears to have some connection with time after calving, as shown from Nos. 3 to 6 inclusive, and yet the two highest are just an average of the whole. It is evident, too, that the larger proportions of small globules have no connection with the largest globules—the Devon possibly being an exception in the sense of being a medium of both globules.

The illustrations are made not exactly as seen under the microscope, because there would be more variety of size, but giving one size as the *mean of the larger globules* of each, so that the eye can more readily make comparisons; the small globules are merely introduced to make the general appearance more natural, and therefore have no connection with the results tabulated.

That two beefing breeds should head and end the list may be noted as singular—the rather that the Hereford is lowest, for invariably a good beef maker is a rich milk maker. I think it is not so surprising that the Aberdeen Poll leads. Some will expect a higher place for the Devon and Quebec grades and Guernsey, and possibly extended observations may do so; the highest jump is from Hereford to Quebec grade, the least from Ontario grade to Jersey, and from Guernsey to Short Horn grade.

Why are the butter globules of some milk on an average nearly three times greater in diameter than those from another source?

I have observed what I do not find stated in works on dairying, that the butter globule is a very elastic thing; when compressed together as in the case of thick cream they give way to each other and assume a very distinct hexagon, the sides being perfectly straight, not curved, and on being relieved from pressure immediately resume their circular form. It must therefore be very harsh treatment, the worst of churning for example, that breaks the globules; and, as I have said in chapter 16, the butter globules are not broken under the best management.

13.—THE SIZE OF BUTTER GLOBULES IN RELATION TO CREAM OBTAINED BY SETTING.

This need be but a simple statement with little comment; and, first, the statement.

Breed.	Globule Size.	Cream, Mean of Deep Setting at 60° and 40°.	Fat by Chemical Analysis.
Aberdeen Poll	1.40	10.5	2.87
Jersey	1.38	15.2	7.35
Holstein	1.27	6.0	3.55
Short Horn	1.25	14.6	5.63
Galloway	1.14	9.0	4.38
Ayrshire	1.00	14.1	4.60
Short Horn Grade	.95	14.2	4.40

It would be natural reasoning to say that the larger the globules the more cream in the shortest time, because of their size floating easier and coming to the surface more rapidly. This is upon the supposition that globules are numerous, or, in other words, that the milk is rich in fat. In addition therefore to the cream obtained by a mean of deep setting in low temperatures, take also the chemical analysis of the milk. The only agreement of the three things is in the case of Jersey and Short Horn, so that the inference is that large globules do exist in "thin milk,"—example Holstein,—and that "thin milk," so called because it does not give off its cream readily—as example, the Galloway—does possess over an average proportion of fat, as well as an over-average size of butter globules.

14.—CHURNING IN RELATION TO SIZE OF BUTTER GLOBULES.

In the chapter on Judging Butter we have submitted an opinion as to the proper results of churning, and here I have pleasure in giving what must be new to most dairymen, and not often treated of anywhere,—the old idea of temperature and ripeness of cream being the chief regulators, of free or fast time in butter-making must be most respectfully acknowledged still, but the size of globules is also no inconsiderable element inthe act. During the past winter and spring we have kept an exact record of the time occupied in the churning of butter from all our sources; the churn is a common stone dash—a form we consider to be the truest in science and practice—and all conditions inside man's ken were carefully attended to at a temperature of 62°. The question now is, to what extent has size of butter globules to do with the time occupied in churning? The accompanying table is the mean of all the work referred to. As the winter is not separated from summer in this abstract, it is well to observe that the average time was twenty-five minutes in winter and thirty in summer, a fact of itself worthy of notice and not easily accounted for, unless it be that of nearness to time after calving.

Breed.	Time Churning.	Globule Size.	S = Summer. W = Winter.
	minutes.	diameter.	
Guernsey	10	2.00	S.
Jersey	17	1.64	S. W.
Ayrshire	22	1.45	S. W.
Devon	24	1.33	S. W.
Holstein	40	1.51	S. W.
Short Horn	40	1.33	S. W.
Short Horn Grade	40	1.22	S. W.
	28	1.50	

The table requires little explanation. In every case but one, time and size of globules agree in a very marked manner, the short time and the large globule being inseparable Step by step we are led up from 10 minutes with 2·00 as the globule size, to 40 minutes and a butter globule of 1·22. The exception named is that of Holstein, which, though possessing an average globule of 1·51 (the exact average being 1·50), has taken as much as 40 minutes to bring butter—the extremes being 20 and 53 minutes. Now, while the Holstein has always given a good average globule of the larger kind, it has also had much heavy cream, as clearly shown in other parts of this report, so that when any abnormal cream conditions occur it cannot be expected to act in uniformity with others.

The prosecution of this study is not only scientifically interesting but of direct practical value to our dairymen, for unquestionably it has also something to do with the ripening and keeping properties of cheese.

15.—THE QUESTION OF BUTTER-MAKING IN WINTER WITH SPECIAL REFERENCE TO CREAMERIES.

As a Province we have done nothing in the extensive manufacture of butter during winter. In the Northern States it is being introduced steadily, even with an amount of caution not usual with our neighbours in most other things. We therefore naturally look for any objections to the system; extreme frost is one as against milk particularly, though cream would be less affected; the want of the best of green fodder and cheap production may be called objections, but, on the other hand, there is the convenience and more systematic feeding and management otherwise, the richer milk, if in less quantity, the unquestionably more favourable temperature for manufacture, and particularly, farmers being able at that season to pay more attention to breeding and the care of calves.

The position of the business, commercially, in winter, is one I am not prepared to state with any certainty, though it is safe to infer that the production of a good article will no doubt command a market. My concern at present is with the farmer's side of the question: What does it mean financially to him, from November to May?

The breeding of a certain number of cows to come in October and November is already a point in management with many who have no view to its dairy value, but who desire to make better calves in connection with pure breeds and the fattening of stock. To catch the dairy with this system ought then to be their aim.

We have shown elsewhere in this report that ordinary cows calving in the fall will under moderately liberal treatment, give 25 lbs. of milk per head per day up to May, which milk threw off 10 per cent. of cream, which cream made 40 lbs. of butter from the hundred. The six months then from 1st Nov. to 1st May, being 180 days, would produce 4,500 lbs. of milk and 180 lbs. of butter. To a butter factory this would be worth $30 at least, and therefore the farmer would receive that sum for the cream, at the same time having the sweet skim milk on hand. The food cost to produce these dairy products is given in chapter 19 herewith.

Value of 450 lbs. cream for factory	$27 00
Value of 400 gallons skim milk	12 00
	$39 00
Less cost of food	15 00
Net value of dairy products per cow during winter	$24 00

16.—JUDGING BUTTER FROM DIFFERENT SOURCES.

We have not had an opportunity of comparing systems of judging butter either by points or with practical experts who are able to give reasons for all their opinions, and though the students and I have studied and handled a large variety for some years, our experience has necessarily been confined to small quantities and unchecked by any one. Our scale is this :

Texture (Grain)	50 per cent.
Globules	10 " "
Flavour	20 " "
Smell	10 " "
Colour	5 " "
General appearance	5 " "
	100 per cent.

It is rare to find good texture with greasiness, and greasiness invariably accompanies poor keeping properties. Texture speaks of a particular source as well as proper churning and handling; flavour is rarely good without texture, and so in relation to greasiness,—flavour, as affected by food, is different from the natural aroma of butter, and may be classed with smell, and yet there is a smell that belongs to the aroma in question. Colour and general appearance are points that cannot be neglected though valued in judging at so little comparatively. Their actual value in the public market is nevertheless no inconsiderable thing; the best textures, flavour and smell will not sell butter without a taking colour and general appearance. But colour can be made, and general appearance is invariably right when texture is right.

JUDGING WINTER BUTTER FROM EIGHT SOURCES, IN ORDER OF GENERAL MERIT.

SOURCE.	Texture Grain. 50	Globules. 10	Flavour 20	Smell 10	Colour 5	Gen. App. 5	Total. value 100.
Jersey	50	7	17	8	4	4	88
Ontario Grade on Ensilage	40	9	17	9	5	4	80
Devon	45	8	15	7	3	3	78
Holstein	35	8	15	9	4	4	76
Ontario Grade on Turnips	38	8	10	8	4	3	68
Short Horn	30	4	14	6	2	3	60
Ayrshire	28	7	12	8	3	3	59
Aberdeen Poll	25	6	12	6	2	3	53

Allowance necessarily must be made for influences over which as yet we have no really *exact systematic control*—such as equal condition of milk, acidity of cream, temperature during and speed of churning, and working the butter, but as respects general good management all the samples were alike.

Properly made butter—from the receipt of the cream unto the packing—should have the greater number of its globules intact; the act of churning properly is one by which the globules are impacted and not broken—by which "like draws to like,"—a cohesion of similar particles without destruction, and which can be made to take place without agitation necessarily.

Now, while experience gives one a judgment of butter that is, or is not, in an unbroken globular state, as evidenced by its grain or texture, it is not always safe to decide as between a crisp, hard condition—as brought about by the nature of the source (breed) and good management in making,—and the real grain of full globules. The use of the microscope is best, and in the foregoing table of judging from different breeds I have given a column for "Globules," as seen in the butter. In my opinion this should form part of all correct judgment in close competitions at exhibitions.

I had samples of all the kinds of butter named in the table exposed under equal conditions for *twelve months*, so as to note any marked differences in keeping properties. The result has been a lesson as regards pinning one's faith to what, by such judging, would take prizes over others. The spoiling by bad colour—actual decay indeed—and smell, has overriden all notions of sequence as the following order from best to worst shows:

1. Devon.
2. Ontario Grade.
3. Holstein.
4. Aberdeen Poll.
5. Ayreshire.
6. Jersey.
7. Short Horn.

17.—CHEESE FROM DIFFERENT BREEDS DURING WINTER AND SUMMER.

While as yet Canada has done nothing in the manufacture of cheese from November to April, and while possibly it could be shown that butter would be a more suitable dairy product in our special conditions then, as against cheese, it is a matter of considerable interest to know the condition of winter milk for such a purpose. We have for some years regularly tested varieties of milk for cheese, and the following are the results for 1884-5.

CHEESE FROM TEN BREEDS DURING WINTER, IN ORDER OF QUANTITY.

BREED.	Cheese from 100 lbs. Milk.		Total Solids by Chemical Analysis.
	Dried Curd.	Less 10 per cent. for Cheese.	
Guernsey	16	14½	.....
Devon	14¾	13⅛	13.30
Short Horn Grade	14½	12 15/16	12.60
Jersey	14¼	12 7/16	15.45
Ontario Grade	14	12⅜	13.25
Galloway	13	11⅝	14.28
Short Horn	12½	11¼	14.83
Ayrshire	12	10⅞	11.80
Aberdeen Poll	11	10 1/16	10.80
Holstein	10½	9½	12.55
Mean	13	11¾	13.20

We are taught that cheese consists of,

Water	$\frac{1}{3}$
Fat	$\frac{1}{3}$
Protein and Ash	$\frac{1}{3}$

and not much, if any, sugar, which is another of the solids of milk. Meantime I submit the winter cheese from the Guernsey breed with caution, because for a considerable time the milk was obtained from two cows that were suckling calves, and consequently, by reason of *frequent draining*, would be richer in most things. Putting it aside and looking to the summer testing for its comparison, the first point to be noticed in the foregoing table is the very large average of *dried cheese curd* from a variety of sources. As I have elsewhere remarked, the mode of testing was alike to all kinds, and the curd was thoroughly dried before weighing; so that assuming that curd is not a ripened cheese, it remains a fact that all the kinds were treated alike, and can be fairly compared. What the difference is, if any, between cheese ready for the market and the dried curd I do not know, and meantime it will not affect our position, nor possibly would it be fair with dried curd, to deduct the usual ten per cent. for ripening a cheese, which is also given in the table.

The seemingly unusual amount—and the past year tallies with all our previous work—of 13 lbs. per hundred of milk will, no doubt, startle some factory patrons and raise the question of why summer gives only, in their experience, the old standard of 10 lbs.

It is a fact then that winter in Ontario, with the rich feeding of good clover hay, turnips, mangolds, bran and grain, in addition to quiet and non-ranging, gives a richer milk in every respect, and particularly adds to those solids that rennet converts into cheese? We need not necessarily ask for the special conditions of the cows in this generalizing, because the average condition may be taken as a safe ground to compare with summer results. On this footing, then, I ask the critic to accept of chemical evidence in justification of what rennet has said. On an average from nine breeds by several tests, Dr. Hare has shown that winter milk with us has given thirteen and one-fifth per cent. of solids—all the solids that could be obtained by the most correct chemical analysis, remember—the lowest being 10·80, and the highest 15·45. Is it not, to say the least, a somewhat remarkable fact that the proportion of cheese curd is almost exactly the same, thirteen per cent.? I am not able to point to the cause, and while I do not claim that our station has made a discovery in this respect I submit that we are the first to have the necessary variety of breeds under precisely similar conditions and management that alone can safely lead to such comparisons—and no station, private or public, has paid the like attention to these details that we have; at the same time we are aware that these tests are but a touch of what is required to a long series of them for reliable standards.

With reference to breeds, there is roughly an agreement with the chemist, and the Ontario Grade is again nearest the mean of all. The Jersey seems to bow to nothing—not even in cheese and solids in winter, for, taking an average of the rennet and chemical testing, its mean of 14·85 is considerably over all others. The Devon has rarely been second in cheese in our experience, and now again takes a lead, subject only to a fuller Guernsey record. The nearest agreement of rennet and chemist is in the case of the Ayrshire and Aberdeen Poll. The Ontario farmer will note with satisfaction the position taken by the Short Horn Grade, nor will he be displeased at that of the ordinary cow, whatever that may be. The Galloway and Short Horn are close competitors, the former leading.

Cheese from Different Breeds during Summer.

It is not true, however, that winter milk gives more cheese than summer as the following table shows. Under deduction of the ten per cent. formerly referred to, it is seen that summer has given 14·6 lbs. of cheese from the 100 of milk, and from no source has it been so low as in winter—the lowest of summer being 11 lbs. as against winter 9½ lbs.

CHEESE FROM EIGHT BREEDS DURING SUMMER, IN ORDER OF QUANTITY.

BREED.	Cheese from 100 lbs. Milk.		Total Solids by Chemical Analysis.
	Dried Curd.	Less 10 per cent. for Cheese.	
	lbs.		
Short Horn	19.6	17.6	13.15
Jersey	19.4	17.5	13.85
Short Horn Grade	18.9	17.0	12.55
Ayrshire	16.9	15.2	15.25
Quebec Grade	16.9	15.2	12.90
Devon	13.2	11.8	11.00
Holstein	13.1	11.8	11.00
Guernsey	12.3	11.0	.....
Mean	16.7	14.6	12.81

The breeds have changed positions considerably from winter to summer; the Guernsey that stood highest, is actually at the foot of the summer list; and the Devon, that was second, is below summer average. On the other hand the Short Horn, Jersey and Short Horn Grade have stept from average and under average up to first, second and third respectively. It would therefore be very difficult, if not almost impossible, to give as yet, in these early stages of such an extensive enquiry, anything like correct reasons for any of this going and coming in cheese among different breeds of cattle, food, and physical conditions. The chemical analysis of summer milk does not agree so closely with its corresponding cheese as winter did, and on the whole question of differences there is material for careful study in the table herewith.

18.—THE FEEDING OF CALVES ON SKIM MILK, IN CONNECTION WITH SELLING CREAM TO BUTTER FACTORIES.

This experiment was undertaken at the special suggestion of several of our stockmen. It suited our plans best to begin in winter, and hence the introduction will be more expensive than summer conditions. The period ran from November to April, when the calves were weaned; they are Short Horn Grades, one bull and one heifer, and were allowed three days with the mother before beginning skim milk. The average daily treatment consisted of two meals of skim milk; linseed boiled to a jelly and molasses and oatmeal mixed in the warmed skim milk; daily rate of milk 18 lbs., of oatmeal one teacup, of linseed meal $1\frac{1}{2}$ table spoon, of molasses $1\frac{3}{4}$ table spoon, and given quantities of clover hay. Beginning on the 12th week the calves got bran and roots with the hay.

One of the calves came nearly two months before time; was necessarily small—45 lbs. only—and did not increase in growth so much—a point, with the winter conditions, that held against the experiment. The whole position is summarised as follows:

Average results, per head, of feeding calves on skim milk, with substitutes for cream; during 150 days:—

Date of birth, 2nd November, 1884.
Weight, when calved, 72 lbs.
Skim milk consumed, 2,700 lbs.

Other food:

Oatmeal	41 lbs.
Linseed meal	14 "
Molasses	16 "
Hay	250 "
Bran	35 "
Roots	40 "

Weight of average calf at weaning = 376 lbs.

Cost of food:

Milk, skimmed	$6 00
Other food, as above	2 82
Total cost of food	$8 82

It appears, therefore, that an average calf of 72 lbs. at birth, getting two gallons of skim milk per day—the average of an Ontario cow by factory records—with varieties of other food as named, and kept on such for five months, will consume in value $8.82. This is charging half the price of full milk for the skim, as shown by chapter 19 herewith, and other things at market rates. At the end of that period the average calf weighed 376 lbs.,—a daily rate of fully 2 lbs., not including birth weight, a rate therefore not large and yet fair under the circumstances. The animals were in good bloom all through, though not full fleshed, and could not be called "grand."

The main object of the experiment was, if possible, to make a good calf at less cost—even in winter—than by giving it full rations of milk direct from the cow—selling the cream to a butter factory at 17 cents for the amount of cream that made one pound of butter. The cream thus fetched $27.20.

Several arguments can be made from these facts. One is to ascertain the value of skim milk in calf-feeding, and is made thus:

A calf gained 304 lbs., with skim milk and other food; the food other than the milk cost $2.82. The calf, as veal, is worth $15, so that we received $12.18 for the milk consumed. This is the lowest possible use of the milk. Were the calf retained for breeding, or for a store steer, its value is invariably placed at one-third more than veal price, so that in this case we find the value of the milk to be $17.18. Then again, supposing the calf had got the whole of the full milk with the roots, bran and hay only, its production would have cost $18.32, but by taking the cream from the milk and selling to a butter factory, and by adding concentrated foods to the milk, the calf was produced for $8.82.

The practical value to be drawn from this experiment is, that under the more expensive and somewhat unnatural conditions of winter, good calves can be made at less than half the cost of allowing full milk, and at the same time realizing fully $33 per cow during five months, by supplying cream to the butter factory.

19.—THE FOOD COST OF PRODUCING DAIRY PRODUCTS.

This subject has two divisions—summer and winter. Few know much about either, and winter is now as important as summer. This station has been credited with placing the cost of dairy products at about the same as beef, but our extended experience enables me to submit more full and reliable figures.

Milk in Summer.

Going out in May, and coming in about 1st November, the six months of the present class of pasture in Ontario, gives, with the average cow that, however, is being gradually improved—just 3,500 lbs. of milk—no more. To do this she requires a range of three acres, cultivated hay pasture—timothy and clover—including a touch of the bush, natural meadow and roadside. I avoid the temptation thus given to use strong language on such waste of land and opportunities. The ar ual value of this cow's keep cannot be charged, as some contend, by first allowing so much to maintain life steadily and then debit the milk only with the balance. I cannot follow the argument that it is different here in comparison with beef; do we set aside the oil and tear and wear of a steam engine, as having nothing to do with the cutting of ensilage fodder, or can we separate from the cost of producing beef, that proportion of the food used in maintaining the animal heat and life?

To the farmer—not the milkman or cow-keeper near towns and cities necessarily—the grass of these three acres, with the additions named, is worth $10 per season, and consequently the food cost of producing milk is about 3 mills per lb., or 3 cents per gallon, upon the present Ontario pasture.

But elsewhere in this report I have shown that the same cow, on permanent pasture of the right sort, not only gives more milk, but can be kept on one and one-half acres in place of three, which, subject to the extra cost of establishing and maintaining such pasture, reduces the cost of producing milk to 2 mills per lb., or 2 cents per gallon.

Milk in Winter.

The food of the cow from November to April inclusive, in Canada, is purely all preserved, and her management entirely in the house. For the best results there should be but one item of difference practically between her all-over-care, and that of a good steer—less grain only, and hence we do not introduce as a point in these notes the starvation system of cow management in winter. I ask that she receive 10 lbs. hay, 30 lbs. turnips or mangolds, 3 lbs. bran, and 2 lbs. crushed oats per day. (See chapter, entitled, "Guide to Winter Feeding," herewith.) The market value of these is 12½ cents, but this is selling at a distinct profit, and as the producer of the milk is the grower of the food it is not regular, in order to ascertain actual cost of production, to charge the cow with more than the cost of producing her food: on an average, therefore, the difference is fully one-half, and 6 cents is thus the daily cost of the cow's keep. Granting the same class of cows in winter as in summer, the yield of milk is not so large, but, in our experience, is not so different as is usually understood. During the past winter several of our cows gave 30 lbs. per head per day, from December to May, and as we are treating of the results obtained from the common Ontario cow, and the Short Horn Grade, their daily winter milking is safely set down at 25 lbs. At the market value for food, we can then produce milk in winter at an actual food cost of ½ cent per lb., or 4½ cents per gallon.

Cream in Winter.

We have had extensive experience in this. Winter, with its quiet, its system, and liberal feeding, has always given a large proportion of cream—rarely under 10, and as

much as 15 lbs, from the 100 of milk, averaging 13 lbs. Two things require valuation here: the cream and the skim milk. As we have already seen, the 100 lbs. of sweet milk cost 50 cents; from this we have taken 13 lbs. cream, and as sweet skim milk is well worth one-half the cost of the full sweet milk, we obtain 22 cents for the 87 lbs. of skim, which leaves 28 cents for the cost of the cream, or say, 2 cents per lb. for cream, or 18 cents per gallon.

Butter in Winter.

The milk and the cream thus handled, under the conditions and from the sources named, will give 3½ lbs. of butter from the milk, and 27½ from the 100 lbs. of cream. The cream having cost $2.00, and buttermilk being worth 3 cents per gallon, the two gallons of buttermilk, or 6 cents, have to be deducted. The result is fully 7½ cents as the actual food cost of producing one pound of butter in winter.

Cheese in Winter.

There is winter cheese, and, though not yet on a large scale, will eventually become an important product. Taking, again, the milk formerly obtained at a cost of 50 cents, and deducting the value of the whey at 8 cents for every 11 lbs. of cheese, the actual food cost of producing every pound of cheese amounts to nearly 4 cents.

Cream in Summer.

The summer average of cream being 16 per cent., and the milk in greater quantity than winter, it follows that the food cost of producing it is considerably less; on an average it is 1½ cent per lb., or 12½ cents per gallon, 5½ less than winter.

Butter in Summer.

Proportionately to the quantities in winter, as already explained, the food cost of producing one pound of butter in summer will range about 5 cents per lb. from ordinary pasture, and will come to 2 cents when we have the best of permanent pasture.

Cheese in Summer.

The greater proportion of cheese curd in summer as against winter, the greater quantity of milk produced per acre, and the nature of the maintenance, brings the food cost of producing cheese down to 2 cents per pound.

20.—MILK FROM PERMANENT PASTURE.

Until this season we have not had the best of facilities to ascertain the character of milk obtained by feeding cows solely on the best of pasture—such pasture as we have been recommending to the Province, and which is again specified in chapters 37 and 20 herewith, as well as in special letters to Ontario farmers in this report. The questions involved under the present inquiry are:

1. The quantity and character of milk per acre.
2. Effect of such pasture on milk from particular breeds.

ANALYSIS OF MILK FROM COWS ON PERMANENT PASTURE.

(*Mean of Several Tests.*)

BREED.	Water.	Fat.	Solids other than Fat.	Total Solids.
Ayrshire	84.8	6.8	8.4	15.2
Devon	89.0	3.7	7.3	11.0
Holstein	88.8	3.9	7.3	11.2
Jersey	86.1	5.9	8.0	13.9
Mean	87.2	5.1	7.7	12.8

ANALYSIS OF MILK FROM THE SAME COWS DURING WINTER.

(*Mean of Several Tests.*)

BREEDS.	Water.	Fat.	Solids other than Fat.	Total Solids.
Ayrshire	88.20	4.60	7.20	11.80
Devon	86.70	4.45	8.85	13.30
Holstein	87.45	3.55	9.00	12.55
Jersey	84.55	7.35	8.10	15.45
Mean	86.72	4.99	8.29	13.28

We seeded down in May, 1884, one acre of the plots in the Experimental Field (plots 61–70, Range 4), and hence the present season is the first that grazing could be safely adopted, though the catch was so good and strong last year as to require cutting with the mower. The pasture is already all that the most exacting could desire.

We set aside four cows for continuous depasturing all season on this acre—in couples alternating every two weeks—the Ayrshire and Holstein, and the Devon and Jersey, being together, named respectively, "Sensation," "Verapina," "Ruddie," and "Beauty o' the Mill"—See chapter 2. Water and shelter are supplied; the cows are left out day and night; milking is done in the field twice a day, and is weighed there also. The cows are weighed at each change, the manure regularly spread over the pasture; the milk daily tested for cream by different methods of setting, by centrifugal twice a week, chemically analysed every week and sent twice a week to myself for microscopic examination. We are aware of the extra "waste" by confining two animals to one acre—tramping, lying

upon, and manure dropping—than there is under ordinary circumstances of a farm, and so, partly to check this as well as to offer a fresh bite, the area is devided into two fields, and a change made every seven days. As I have said, it is proposed to carry this experiment through the season, because much of the value of such pasture should be in holding good during drought and late into the fall. It is possibly not too much to anticipate from present indications that one acre will actually maintain two cows; if not, we have other similar pasture adjoining that can be weighed and fed upon the original run, so that in any event the cows will be kept to the one influence as much as possible. The Ayrshire during the first week was very unsettled, and, communicating this to her Holstein mate, they both reduced in weight very heavily, consequently affecting the quantity, at least of their milk. The season being a late one, we did not put to grass until 24th May.

We consider the subject of permanent pasture and dairy products so important at the present moment to Ontario that we do not hesitate in giving her farmers this early touch of what is being done at their Experimental station:

1.—*The Quantity and Character of Milk per Acre from Permanent Pasture.*

The unsettled condition of all the cows when removed from the large herd on our ordinary pasture, and placed in the somewhat unusual circumstances in the experimental plots, have for the first month materially affected the daily yield of milk; it is therefore but fair to wait the results of the whole season as regards this item, but yet, 48 lbs. of milk per day from young cows three months after calving, and a mixture of breeds, is not unusually low. Assuming this very moderate quantity as an average, it is an indication that we will receive over 8,000 lbs. of milk per acre per season of five and one-half months—not six months because of the late spring growth. This would be a very high return per acre, the usual Ontario pasture giving 1,300 lbs. on an average per acre. It is perfectly evident that our choice permanent pasture will yield at *least* 5,000 lbs. of milk per acre, or four times that of timothy and clover as now prevails. I have been teaching to look for double the ordinary quantity, and those really interested may therefore guess how anxiously our Station is anticipating the full facts for the season by this very practical test through permanent pasture.

[For subsequent facts see Chapter entitled, "Some New Features of the Dairy Interest."]

MAY AND JUNE DAIRY RECORDS OF FIVE BREEDS ON PERMANENT PASTURE, AT THE ONTARIO EXPERIMENTAL FARM, 1885.

Breeds.	Age in Years.	Weight of Cow.	Had last Calf in	In Calf again in	Milk, average per day.	Per cent. of Cream.	Butter.		Cheese—Curd from 100 lbs. Milk, less 10 per cent.
							From 100 lbs. Milk.	From 100 lbs. Cream.	
			1885.	1885.	lbs.	At 40°.			
Ayrshire	4	1155	January.	April.	15	14.7	4.6	49.3	15.7
Devon	5	1100	April.	June.	28	8.5	.....	53.3	11.8
Jersey	3	840	February.	April.	22	14.2	3.3	61.0	17.3
Holstein	3	900	January.	March.	21	8.8	1.5	31.0	12.2
Quebec Grade	5	910	April.	June.	31	13.8	2.8	50.0	13.3

NOTE.—See Chapter V. for conduct of Ayrshire cow. Compare Chemical Analysis—Summer—Chapter X.

The general character of the milk is shown in various ways: Under the microscope it has changed from winter influences in a very striking manner; with the well known fact that the butter globules are always larger for some time after calving and lessen towards the end of the milking term, it is interesting and practically valuable to record that in their fourth month after calving the same cows put to permanent pasture have given butter globules fully one-half larger, and this relatively over the four cows, with the exception of the Ayrshire which has developed its globules to an extraordinary extent—from 1·00 (see chapter 12) to 1·90 in diameter. In the first place, that pasture increases the size of the butter globules of milk against what may be called the natural order of diminution is an important dairy item, and may help to explain some things in the physiology of the cow as affected by the extremes of weather and the extremes of kinds of food. The general character of the milk otherwise is evidenced under chemical analyses. The great change of food does not appear to affect the average amount of fat materially; 5·1 in winter and 4·99 in summer, but there is a little more water, not much, though, and a decided decrease in solids, from 13·28 to 12·8 per cent.

2.—*Effect of such Pasture on Milk from Particular Breeds.*

Space will not allow of more than a short notice of this point, meantime. The unusual circumstance to us is, as already hinted, the conduct of the Ayrshire: under all her fretting and diminution of quantity, she has given us in *every respect* richer milk than she did during winter. The increase of butter globules from 1·00 to 1·90, said so before even the cream rose or the chemist pronounced judgment. There is evidently a very intimate relation between the *size* of globules and butter results. We are not forgetting individual cow merits in these notes, but now it is not these, but conditions of food and seasons on the same animal. The Devon has yielded most to the watery influence of pasture, has lowered her record of fat very seriously, frem 4·45 to 3·7 per cent., and consequently a corresponding reduction of total solids; the Holstein has stood the test more steadily, that is, in regularity of materials, than any of the others, and this circumstance we have observed elsewhere; a slight increase of fat on pasture is a feature of some importance in her case. The wonderful Jersey gave way in her characteristics from winter to summer conditions. Why so? In milk, water, fat and solids she has bowed to permanent pasture, and yet observe how high are all her averages above the averages of others.

Cream from permanent pasture: 15 per cent., by deep setting at 40°

Butter from permanent pasture: 3·2 lbs., from 100 of milk, 47 lbs., from 100 of cream.

Cheese curd from permanent pasture: 13⅓ lbs., from 100 of milk, dried and under deduction of ten per cent.

Dairy Produce per Acre.

All quotations of farm produce should be "per acre"—whether grain, fodder, flesh, wool or milk,—if not so, no correct estimate can be made of what an individual or a nation is doing in comparison with others. With reference to dairy products, the Province of Ontario cannot tell at the present time what she has done in the past as regards amount and value of milk, butter and cheese, per acre per annum. With all our high standing as cheese makers, how can we tell that our farmers are up to time, or are actually making any profits in dairy products in correspondence with grain and beef? I have no doubt our statistical department will overtake this line of enquiry ere long, and meantime I have pleasure in opening the gate with the dairy cow.

The average cow giving under 4,000 lbs. of milk from the required three acres of ordinary timothy and clover rotation pasture produces necessarily only $10 an acre when the milk is sold to the cheese factory; if the cream is sold to the butter factory, and the sweet milk fed to calves, the revenue per acre will be about $12. The same pasture with a better selected type of the same class of cows will produce 5,000 lbs. of milk, which would be equal to $14 per acre on an average of cheese and butter.

But the same cow last referred to, on the best of permanent pasture, will average $25 per acre per milking season, and were a very strong culling made with reference to

class and individual merit, it is not high to estimate the gross annual revenue per acre per annum up to $30. These figures are no more than in correspondence with other farm crops: Grain profit per acre stands above $16; hay, $11; and roots $25—say $17 on an average. So that if we allow as much as ten per cent. for management, risks, etc., of a dairy herd, the profits of dairying will show at least $15 per acre per annum, and should be $25 when pasture and cow selection are what they can easily be made.

MILK PER SEASON: ESTIMATE OF AVERAGE OF DIFFERENT BREEDS.

BREEDS.	Milk—lbs.	Value of Milk alone.	Mean Value of Milk, Butter and Cheese.
Holstein	7,000	$52	$39
Ayrshire	6,000	45	48
Ontario Grade	5,000	37	33
Short Horn Grade	4,500	34	43
Guernsey	4,000	30	33
Quebec Grade	3,600	27	39
Jersey	3,500	26	46
Shorthorn	3,000	22	40
Devon	2,800	21	35
Galloway	2,500	19	28
Aberdeen Poll	2,300	17	26
Hereford	2,000	15	25
	3,850	29	33

I believe no one could do more than estimate this subject, for nowhere can we find enough material for definite figures. But, from European and American testing, from public and private dairies, exhibition tests, factories and experimental stations, an approximate estimate can be made of the average quantity of milk given by different breeds during a season—which ranges from 200 to 300 days, according to peculiarities of breeds and their management. In criticising the above estimate, therefore, remember the variety of the source of information, the more extensive use of some of the breeds in dairies, in comparison with others—such as Ayrshire vs. Hereford; consider, also, the duration of the milking season, as characteristic of breeds, the physical conditions appropriate or otherwise, for such production and continuance, and particularly, we must cautiously handle the record of individual cows that have of late been so much offered as public property.

21.—ABORTION AMONG COWS IN RELATION TO MILK PRODUCTION.

Happily the Ontario Experimental Farm herds are now free from this contagion, or whatever it should be called, for I think it has no definite obstetric name. In past year's report Professor Grenside accounted for some of it, and my purpose now is to show the immediate sympathy existing between cows and unnatural calving, which though known, is not often made subject for public information. Among our cases were the following:—

1. Aberdeen Poll aborted at 6 months in September, 1884.
2. Devon " 6 " October, 1884.
3. Shorthorn " 7 " November, 1884.
4. Ayrshire " 7 " January, 1885.

In every instance but that of the Devon, the calving and cleaning were natural enough, as regards ease, and free of any after trouble to the cow. All the calves were dead, and, as we desired to encourage the production of milk gradually, feeding was arranged accordingly. The Devon was set aside to help nurse an Aberdeen Poll bull calf, and in thus dismissing her case it is fair to say that this calf, which is valued at $500 (the previous bull calf from the same cow fetched $550 at our public sale), is due three-fourths of his condition to the Devon.

The Aberdeen Poll, a five-year old, aborted on grass, and had to be milked immediately after. In the course of ten days she milked freely, and up to the 9th December, about the time of her natural calving, was giving 14 lbs. per day, cream equal to ten per cent., butter 30 lbs. from 100 cream, and 10½ lbs. cheese from 100 of milk.

The Shorthorn is a high-priced seven-year old from Scotland, in good flesh, a very roomy, even animal, and yet one of the most feminine of cows, possessing that beautiful handling and delicate fore-quarter so much liked everywhere. Even before her abortion milk gathered, and an immediate flow came on parturition. She has kept her condition and health all through, and is still in fair quantity of milk. Throughout March and April, previous to what would have been her natural gestation, this cow gave 15 lbs. of milk per day under ordinary feeding, with thirteen per cent. cream from December to May, and 44 lbs. of butter from 100 of cream, with 13 lbs. of the dried cheese curd to 100 of milk.

The Ayrshire gave no trouble in any respect, and has now indeed too much flesh for her class. Her winter record has been 20 lbs. milk daily, 14 per cent of cream, 41 lbs. of butter per 100 of cream, and 12 lbs. dried cheese curd per 100 of milk.

Now, though these are but ordinary records, particularly in milk quantity, they yet indicate a condition of animal constitution, under what is unnatural, so little differing from what is natural that it is not only physiologically interesting, but of some value to practical dairymen. I am not speaking of the rarity of the facts, for unfortunately they are too plentiful in Ontario, but asking for the exact scientific reasons that give a cow, when she drops a calf three months previous to the regular time, immediate provision for the sustenance of that calf—which is generally, if not always, born dead. I am not prepared to take the common-place reason that "nature provides," and while it is true that milk can be induced by manipulation without reference to reproduction, it is doubtful if its character is similar to that otherwise secreted. The natural conduct of the milk, as regards cream, butter and cheese, is of itself evidence of natural provision, and if further evidence be needed to supplement these, chemical analysis can be added.

CHEMICAL ANALYSIS OF MILK FROM COWS THAT ABORTED AT SIX MONTHS.

Water, per cent.	Fat, per cent.	Solids, other than Fat, per cent.	Total Solids.
87.34	4.33	8.33	12.66

Thus equal to a good average of breeds in full natural milking. The conclusion is plain as regards the unrestricted resources of the cow under whatever circumstances.

22.—BUTTE FROM MILK AND CREAM OF DIFFERENT BREEDS—WINTER AND SUMMER.

This subject needs little explanation; the condition of the respective cows as given in Chapter II. should be studied in considering differences of quantity of butter, and the percentage of cream being also given here, interesting comparisons can be made.

During Winter.

Breeds in order of Merit for Butter quantity from Milk.	Butter from 100 lbs. Milk.	Butter from 100 lbs. Cream.	Per cent. of Cream from Milk.
	lbs.	lbs.	at 40°.
Jersey	6.1	43½	19
Short Horn	5.2	44	16½
Ayrshire	4.9	37	15
Devon	4.7	45½	15
Ontario Grade	4.4	43	14
Short Horn Grade	4.1	42½	14
Aberdeen Poll	3.5	28	11½
Holstein	2.4	31	7½
Galloway	2.3	34	8¾
Mean	4.2	38½	13⅓

The extremes were 45½ lbs. of butter from Devon, and 17½ from Ayrshire.

When we are told from Europe that the average yield of butter from milk is 3 lbs., and compare it with our winter quantity of 4.2 on an average from breeds, the practical importance of studying the character of milk is very evident. Milk that gives during winter 13⅓ per cent. of cream, and 38½ lbs. of butter from 100 lbs. of that cream, is manifestly obtained from good cows, well fed. Had we now the mean quantity of milk per season from the various sources named, most important conclusions could be discussed as applicable to Canadian dairying, but, as it is, we are not without facts. The sources are divisible into three classes, as regards merits: the Jersey, Devon, Ayrshire and Short Horn rank first with a mean of 5 lbs. of butter from the 100 of milk, which is 20 per cent. more than the second class of Ontario Grade, and Short Horn Grade with their mean of 4.3, and nearly 50 per cent. more than the third class of Aberdeen Poll, Galloway and Holstein, which have a mean of 2.7.

If we take the prominent heavy milkers—Holstein and Ayrshire—that profess milk without beef, we have the mean of 3.6—where, but for the Ayrshire, the winter record would be a very low one indeed. Then, take the Jersey and Devon that speak of an under-average of milk, and slow and small in beef, and we obtain the very high average of 5.4 lbs. of butter from the 100 of milk. Cattle, such as the Short Horn, Aberdeen

Poll and Galloway—the three corners of the beefing world as regards quality, hardiness, and maturing—and their union of butter nearly touches the average of all kinds. If we be correct in naming the Short Horn Grade and the Ontario Grade as representatives of both *milk and beef*, their butter of 4.3 lbs. is probably the better record of anything thus submitted.* Take next the *summer period*.

BUTTER DURING SUMMER.

BREEDS IN ORDER OF MERIT FOR BUTTER QUANTITY FROM MILK.	Butter from 100 lbs. Milk.	Butter from 100 lbs. Cream.	Per cent. of Cream from Milk.
	lbs.	lbs.	at 40°.
Jersey	4.2	60.1	21.0
Ayrshire	4.0	49.6	18.5
Quebec Grade	3.4	55.9	15.0
Short Horn Grade	3.3	50.0	16.0
Short Horn	3.3	47.6	14.0
Devon	2.7	51.0	12.0
Guernsey	2.5	44.5	12.5
Holstein	2.3	36.5	12.5
Mean	3.2	49.4	15.2

The extremes were 61 lbs. from Jersey, and 31 lbs. from Holstein.

We are now nearer the European proportion of butter from milk, if not that from cream, and in this connection I think it is important to note again that if it be true that food has little effect in regulating the proportion of butter fat, other conditions, such as temperature, and possibly the small relative production of milk proper in the animal system during cold weather, accounts for one per cent. more butter in winter than in summer. I trust the Province will not neglect winter dairying in future years.

But, with all that can be said for winter in some respects, it is the flush of nature, after all, that gives the wealth of butter. We may have the fat milk, and even the quantity in winter, but it takes pasture to give "character," as evidence the 49.4 lbs. of butter in summer from the same cream sources, as against the 38.5 lbs. of winter.

The Jersey is again distinctly ahead, with a very close neighbourhood from the Ayrshire. We have pleasure in introducing the Quebec Grade as second in butter from cream. The Holstein has more than any other kept up its butter from milk record.

23—THE POSSIBILITIES OF THE CENTRIFUGAL SEPARATOR.

In Chapter 8 I have submitted the work of mechanical separation of cream from different kinds of milk, winter and summer, in comparison with the best known other methods, and now, I presume, some thoughts on its possibilities, based partly upon these results and partly upon the history of the machine in Europe, the United States and Canada; Prof. Baré, now the dairy expert at this institution, was, I believe, the first to introduce the Centrifugal Separator into our country, and as he will be at Farmers'

Institutes next winter, opportunity will be had of getting full information from the best source.

As I write, the public are told for the first time that electricity may very soon have a great deal to do with the separation of cream from milk. If this new agent acts in this relation as actively and efficiently as it does in some other things, then the centrifugal machine may soon be found in our museums as a relic of the genius of the middle of the nineteenth century; at present we are without facts in electro-creamology.

I am of opinion, if the centrifugal machine can be reduced in price to about $100, and a one-horse power sufficient, that there is a very near place for it in the future, at any farm that has not less than twelve or fifteen cows contributing to a butter factory, or even making on the farm. The minimum of 280 lbs. of milk thus got could be separated from its cream in one hour—no waiting for cream gatherer, no setting at a certain depth and temperature, less risks from bad management, no possible sour milk for calves, no necessity whatever for ice or water, nor a specially constructed dairy, and no "heavy" milk losses.

Not being able to find any facts with reference to the butter-making properties of the cream centrifugally separated, in comparison with that from other methods, and being impressed with the belief that the *tester* of the centrifugal we are using has given a very different character of cream from anything else, or even from the centrifugal machine itself, we made the following tests: Chemical analysis of weight and volume; cream from centrifugal tester, in comparison with cream by deep setting at 40° for 24 hours.

CHEMICAL ANALYSIS OF CREAM FROM SHORT HORN GRADE.

——	Centrifugal.	Deep Setting at 40°.
Water	58.4	73.9
Fat	39.4	22.9
Solids (other than Fat)	2.2	3.2

In the first place, it is almost unnecessary to say that we used the same milk, the same kind of testing glasses, and that all conditions of cow and chemical management were alike.

The centrifugal recorded a mean of 10.7 per cent. of cream, and that by deep setting at 40° gave 18 per cent. From each of those the chemist removed 8 per cent. of cream, leaving sufficient space of cream below so as not to interfere with the milk. This 8 per cent. from centrifugal weighed 2.77, and that from deep setting, 3.02; these figures may for convenience be called ordinary pounds. Now, before looking at the chemical analysis, observe that whatever may be the character of the cream by deep setting—if much or little casein intermixed with the butter globules—there was to the naked eye fully seven per cent. more cream than the centrifugal indicated, and, when accurately weighed, the cream from deep setting was eight per cent. heavier—one of the evidences of the presence of more casein among the butter globules. To those acquainted with the characteristics of milk these tests would be sufficient to denote considerable difference in the butter-producing properties of the two samples of cream, but of course, without the churn, could not be accurately stated. Thus the chemist was called into requisition.

The above analysis is most suggestive indeed. Remembering the circumstances just narrated, there is surely food for thought in the very extraordinary difference in the

NOTE TO CHAPTER ON "THE POSSIBILITIES OF THE CENTRIFUGAL SEPARATOR."—Since writing the above, *Bell's Weekly Messenger and Farmers' Journal*, of England, has come to hand, in which appears an excellent article by James Long, entitled, "Is the Centrifugal Separator adapted to the requirements of the British dairy farmer?" It is full of facts in favour of the machine. In addition to the points given by me as above, he says the separator can be economically used on any farm having from ten to twenty cows, that it costs £28, is driven by one horse, will separate twenty gallons per hour at a speed of 3,000, and as small a quantity as five gallons can be handled.

proportionate composition of the two samples of cream from the same milk, of the same milking, of the same cow—repeated twice, by the most accurate chemical work. The body of cream from the deep setting at 40° contained 73.9 per cent. of water, while that from the centrifugal was 58.4 per cent.—an actual difference of 15.5 per cent. less in the latter, so that we now gather why the deep setting weighed eight per cent. more than the other—water being of greater specific gravity than an oil called cream. It is obvious, therefore, than the one contained more butter fat than the other. The chemical analysis shows actually 16.5 per cent. more fat in the same volume of cream by centrifugal separation as against deep setting at 40°. We have now arrived at *the point* of this enquiry—the relative proportions of butter fat from the two systems of obtaining cream from milk. What does it mean? It means, if the larger centrifugal machine acts similarly to its tester, that, bulk for bulk of cream, the centrifugal will give 6 lbs. more butter from the 100 lbs. than the deep setting material would. I am not prepared meantime to show that the centrifugal machines named are alike or not, but certainly even supposing they are not, and that we have given some new light on this subject, it is plain that further invention would complete the separation equal to the tester. From what we have seen of the large centrifugal separator it is a point after all whether the cream is as completely separated from the milk, or compacted as much as in the glass bottles that accompany each for the purpose of testing the milk of each patron.

24.—SYNOPSIS OF DAIRY VALUE OF BREEDS OF CATTLE, PER 100 LBS. MILK, AS GATHERED FROM O. E. FARM EXPERIMENTS.

Breed.	Cream.		Butter.		Cheese.		Mean, per Season of 210 Days.	
	Winter.	Summer.	Winter.	Summer.	Winter.	Summer.	Winter.	Summer.
Jersey	$0 77	$0 80	$1 03	$0 71	$1 42	$1 90	$54 00	$57 00
Short Horn	0 71	0 67	0 88	0 56	1 25	1 76	47 00	50 00
Ayrshire	0 75	0 75	0 83	0 68	1 20	1 52	46 00	50 00
Short Horn Grade	0 62	0 72	0 70	0 56	1 45	1 70	46 00	50 00
Quebec Grade	0 52	0 56	0 75	0 58	1 40	1 52	44 00	45 00
Devon	0 60	0 47	0 80	0 46	1 47	1 18	48 00	35 00
Holstein	0 40	0 55	0 40	0 39	1 00	1 18	30 00	36 00
Guernsey	.....	0 65	.....	0 42	.....	1 10	.....	36 00
Galloway	0 47	.....	0 39	.....	1 30	.....	36 00	.....
Aberdeen Poll	0 50	.....	0 59	.....	1 10	.....	36 00	.....
Mean	0 60	0 65	0 71	0 55	1 29	1 48	43 00	45 00

Subject to the actual quantities of milk and the duration of the milking season, as may characterize each breed, we obtain from this table a good idea of their value by every hundred pounds of milk for any special line of dairying; cream is charged at 4 cents, butter at 17 cents, and cheese at 10 cents per pound.

It is not at all likely that Ontario will agree for many years to come, as to the average quantity of milk per season from different breeds and grades; Europe is still quarrelling over this subject after one hundred years' experience; it is necessarily much more difficult than quality in all its forms, so that all we can do at present is to talk "*per 100 lbs. milk.*" A very superficial glance at this table gives rise to some very serious dairy thought.

If cream be the particular subject desired in value per 100 lbs. milk, the Jersey, Ayrshire and Short Horn with its grade make a very close competition and are away beyond comparison with others; a middle range is taken by all the others.

But if butter is wanted it would not be sound argument, necessarily, to follow the bulk of cream; were this the case, some that are high would stand second only to the Jersey, but they do not; the Ayrshire now ranks with the Jersey and Short Horn in first-class value of butter from the 100 lbs. milk.

Still further, if cheese be the principal object of the dairyman, the choice becomes more difficult, because it appears that the properties required for it are much more evenly balanced amongst breeds than either cream or butter. The Jersey and Short Horn grade are about equal in value of cheese per 100 lbs. milk; the Galloway, Ayrshire and Quebec grade are average, and the others under average.

Another view of the respective merits of breeds for dairy purposes is through a "mean of things." As the table is arranged in that order, it is unnecessary to repeat the list. Observe, however, the extraordinary range between the extremes of $57 and $33 per season of 210 making days. If the Ayrshire is taken as a standard—a position we have already given it on another subject in this report—its annual mean value of $48 is just the mean of all the ten breeds, and we shall allow 5000 lbs. of milk for this standard annually from this standpoint. The following would be the *amount of milk required from each breed* in order to make each equal in value per season, for a mean of cream, butter and cheese, during winter and summer.

Breeds in Order of Milk Quantity Required.	Quantity of Milk required per season of 210 days.
Holstein	7,270 lbs.
Devon	5,714 "
Quebec Grade	5,393 "
Ayrshire	5,000 "
Short Horn Grade	5,000 "
Jersey	4,324 "

Now, will any of the breeds produce in 210 days the milk placed opposite its name? We say, decidedly not for the Devon and Quebec grade, but on an average the position of all the others is possibly not wide of what is actually the case—not high for the Holstein, high for the Jersey, but otherwise a very good average.

Having gone this length with indications of value per season, it is but fair to add that, *granting the quantities of milk* as given, it could well be argued that some of the breeds would return more money by making a specialty of a line of dairying—whether milk for direct consumption, cream for butter, or for cheese.

25.—WHICH CATTLE FOR ONTARIO?

I think it is time the farmers of Ontario came to a decision as to breeds of cattle and sheep. We are not old, truly, but neither are we young in experience, nor in enterprise Naturally during the past ten years the fever of breeds has occupied much of our atten

tion along with other nations, and while admitting the liability of the outside market to change, there can be but little in the future to affect our local wants. Our Provincial conditions are not of a kind to be twisted about by every wind of farm speculation, for we are solidly *crop growers* and must always remain so. We need not touch at present upon the legitimate fields of live stock open so favourably to us in breeding for neighbouring Provinces and the United States—in classes of cattle and sheep that are not so desirable for Ontario.

As crop growers, therefore, we must always remain prominent producers of cattle and sheep—even assuming we had no outside market, the very mention of grain growing implies live stock—now in our old arable conditions. Let us give up the much-talk about breeds suitable for Ontario; it is not necessary to keep in good terms—because of the peace at any price principle—with every admirer or patron of the ten or twelve classes each of cattle and sheep, and as it is easier for me to stand criticism by reason of thickened use, I shall now open what I trust may be the closing controversy.

We require cattle directly and indirectly for beef production and cattle for the dairy; I know of no other local cattle want. In each of these we wish to obtain the greatest amount of the best through the most permanent source, and at the least cost. We are perfectly satisfied that Aberdeen Poll, Hereford and Galloways are not the best for the first purpose, although they are certainly good, and to place them as competitors for the second would be an admission of great ignorance indeed. To meet any thickheadedness, allow the repetition that we are speaking for the average farmer of Ontario, and not for every farmer of the Province. It is not so easy, however, to dismiss the Jersey, Guernsey, Ayrshire and Holstein, but it has to be done. The three first are well enough known in Canada, and require no description now. Neither the Jersey, Guernsey, Ayrshire, nor Devon can possibly take the place of direct or indirect beef-makers; for the dairy they have strong claims, and hence the difficulty of many in choosing. Were the dairy to become one-half of all our agricultural interest, and one-half of our arable area became permanent pasture, we would hesitate in saying good bye to all these breeds; but, will Ontario ever change from her six months' dry fodder and her top beef? We are also still of opinion that Ontario judgment will always admire the milk, and butter, and cheese, as seen through the greatest consistent allowance of flesh—aye, even to the disadvantage of the former things, so that could we possibly get all the desired value from an Ayrshire, Jersey, Guernsey, or Devon—their size and form are against them. To say that this is foolish, would be right commercially, but what is bred in the bone is said to be invaluable so long as it is believed.

It is natural to pause on meeting the Holstein, because experience of them is short, and in some respects we see our typical mixture of butcher and dairyman—in the male especially. Holland does not care for the beef that England, and even Canada, loves to produce. Are we right then in expecting this breed to fill the account for Ontario, when in its own country it has not been managed for such an end? The possibilities are, therefore, against that union of beef and milk—unreasonable as such a general-purpose idea may be—and, in any case we have to wait for evidences.

The special dairy wants of Ontario can be fully maintained by selection from her common cows—the acclimated, hardy, ranging, non-beefy, and liberal milking grade.

The special beef and the conjoint beef and dairy wants of Ontario can be best upheld by the use of that stamp of Short Horn—so easy to select and so often met with. Why, then, the need of more discussion?

26.—THE SILO, 1884-5.

Like many others, we are still working for light on this subject. Light is a mild term here, when, on the one hand, the steady faith of the Walsingham trials in Norfolk, England, is considered, and the unmeasured disgust of some Americans on the other hand. All are looking to Rothamstead where Sir J. B. Lawes, for the first time, is putting preserved green fodder to thorough test.

Our third year's method of preserving was thus chronicled :

1884. No. 1 Silo—Uncut Fodder.

Aug. 29th.—In morning, team with reaper, cut one acre of broadcast corn fodder in No. 3 field. Team, with two men, began hauling-in at 1.30 p.m. for No. 1 Silo.

No. 1 Silo is constructed to hold 15 tons, having stone and brick walls, cemented, like floor; doorway to cattle on level with floor, and with appliances made air-tight. This Silo was filled with *uncut* fodder, carefully laid.

Aug. 30th.—Finished filling No. 1 Silo at noon, when 14,370 lbs. of fodder were laid in. Placed two-inch plank covering upon fodder, weighted with three tons of stone.

Sept. 2nd.—At noon removed weights and plank cover from No. 1 Silo, and added 6,680 lbs. of green fodder. Less weight than formerly was returned, and left untouched until the 6th inst.

Sept. 6th.—Removed cover from No. 1 Silo, and added 5,360 lbs. more fodder, which completed the filling of the pit. Returned plank, and just weight enough placed to press cover close to fodder as it settled. Left No. 1 Silo in this condition for two weeks.

Sept. 20th.—Put earth all over plank in No. 1 Silo, to a depth of 6 inches, or about 500 lbs. per square yard.

Silo No. 1, therefore, contained 13½ tons of green corn fodder.

Sept. 24.—Placed a seven-feet "ground" thermometer horizontally through the door into the heart of the pit. It then registered 95° and gradually rose to 101° on the 3rd October. Pressure broke thermometer on 4th October.

Oct. 7th.—No. 1 Silo was uncovered, and 1,586 lbs. of rape, with 1,522 lbs. of prickly comfrey added. Covering finally replaced.

Nov. 19th.—Opened Silos to day ; found the uncut fodder much damaged, but the short cut was green, fresh, moist, with a brown tinge and slightly acid smell and taste ; concluded to use the latter only.

No. 2 Silo—Short Cut Fodder.

No. 2 Silo is of the same size and construction and under the same conditions as No. 1 Silo.

Sept. 1st.—Commenced at 1.30 p.m. to draw and fill No. 2 Silo with green corn fodder, cut into *half-inch lengths*. Two teams, two men loading in field, one man with boy spreading and tramping in pit, two men feeding cutter, and one man at engine.

Sept. 2nd.—At noon, had put 17,828 lbs. of cut fodder into No. 2 Silo, plank weighted with 3 tons of stone, and left until 6th September.

Sept. 6th.—Removed cover and added finally 17,060 lbs. more of cut fodder to No. 2 Silo. Closed similar to No. 1 Silo. Total fodder pitted in No. 2 Silo—17½ tons.

The temperature of No. 2 was also noted similarly to No. 1 Silo. On 24th September it stood at 92° ; on 3rd October it was 94°. After this it gradually fell to 64° ; on November 15th, when the Silo was opened ; 64° appeared to be a normal temperature.

27.—BUYING AND FEEDING STORE CATTLE, AND SELLING AT SAME PRICE PER POUND AS WAS PAID FOR THEM.

Probably for the first time in the history of shipping live stock to Britain, and certainly for the first time in the experience of this farm, have store cattle been bought and, after fattening, sold at the same price per pound. If we do not hear of similar results from very many parts of the province, it is not for want of facts, but for want of willingness to submit them ; we are not only not ashamed of the position, but feel it a duty to submit the whole as a national lesson in these times.

During the first and second weeks of November, 1884, we purchased eighteen two-year-old Short Horn grade steers that weighed 1,000 lbs. and cost $46 per head on an average, or just 4⅔ cts. per pound. They were allowed one week to settle down before actual weighing and noting of food. This was a very miscellaneous lot of cattle indeed—such as any Canadian would not care to say much about, and certainly would not introduce to any one whose judgment he wished to propitiate, or that they represented the Province of Ontario, as well as in preparation for the British market. Not that they wanted quality and health, but form and condition were things unnumbered in their belongings—some six head excepted.

The batch was therefore entered for serious work on 14th November in a specially built half-lean-to shed, having head and hind passages and tied with chain, two in each stall.

The food consisted of cut hay mixed with pulped turnips and bran from the large pile made thrice a week for the breeding stock, along with a mixture of grain and a forty days' topping-off with oil-cake—giving as much as the animals would consume—yet keeping free of surfeiting. We sold four culls to a local butcher on 1st April for four cents per pound; eleven tops for exportation to Britain, on 18th April, for five cents, and three second culls to the butcher on 21st April, at 4½ cents per pound. The average time of feeding was thus 150 days, and other particulars are given in following list:

Particulars of *average animal* for 150 days:—

Weight on entry	1010 lbs.
Price paid	$46

Food consumed daily:—

Hay	11 lbs.
Turnips	22 "
Bran	3 "
Oats	2 "
Wheat	3 "
Barley (white)	2 "
Barley (black)	2 "
Oil Cake (for 40 days.)	2 "

Market value of food	$30 50
Weight at finish	1,369 lbs.
Price at finish	$63 00
Difference in value	$17 00

Naturally, the first consideration is cost of feed and increase of weight of the average animal. Entering at 1,010 lbs. in November, and carried on for 150 days, of a very severe Canadian winter—with hardly a touch of thaw for one hundred days—ordinary store steers were yet able easily, comfortably, and very healthily to come out in April with 350 lbs. added to their weight—or a daily rate of no less than 2¼ lbs. This is unquestionably unusually good under the circumstances—a fact in Ontario wintering that should always be held up to the world by our agricultural economists,—proof of a very busy farm time, though sealed up from the fields, and that rich crops can be produced twelve months a year. We could have held these animals over until May, when probably one-half cent per pound more would have been got for the tops, but grain was scarce, and the half cent did not tempt, and the experiment had reached the weight for exportation, part cargo of an early ship from Boston to Liverpool.

The food given was not only good, each of its kind, but good as giving variety for animal sustenance and increase; the grain proper was ground, mixed, and fed without any other preparation. Its value on the market amounted to $30.50 per head for the period of 150 days.

As the *point* of this experiment was getting no more per pound live weight for the animals than what was paid for them as stores—a circumstance not uncommon in

England—it becomes our duty to shew cause for or against such a condition of beef in Ontario. Take first an abstract balance sheet thus:

Cost of store 1,019 lbs. at $4\frac{1}{2}$ (roughly)	$45 00
Market value of food consumed	30 50
	$75 50
Sold 1,369 lbs. at $4\frac{3}{4}$	63 50
Difference, being debit	$12 00

So that to the rough calculator, there is a loss of $12 per head. But the country is now over such a system of farm book-keeping.

Take another view of the case:

Cost of store	$45 00
Cost to farmer of food consumed	14 00
Actual cost of animal	$59 00
Sold for	63 50
Difference, being credit	$4 50

Yet, in fair figuring, it is evident that as the feeder here is the producer of the food he should in the first place charge the animal only with what it cost him to produce that food, and thus arrive at the actual cash cost to him of finishing the piece of beef in question; the result is a little profit—a little only, but a profit.

The farmer, however, must have more than this. He could have got $16.50 more on the market for the food that was consumed by the average steer, and unless there be something else as the result of this making of beef, we are arguing a hard case indeed.

I have often said that the fattening of cattle with Ontario conditions is, *primarily*, to manufacture crops into manure, and *secondarily* to produce food; that it must be so is perfectly clear, until we arrive at—if we ever do—a period in our profession when plant life will not be so dependent on animal life as animal life is upon plant life. Meantime, nothing as yet has taken the place of farm yard manure; and while men of science and practical farmers in old nations are differing as to the real value of such a fertilizer under a variety of conditions, it is no matter of doubt that they agree as to its absolute necessity—whatever be its value. In such feeding as we are discussing, the value of the manure made by the animal, irrespective of chemical valuation, is usually placed as worth $15—allowance being made for bedding and attendance. Our actual cash debit having been $12, there is a safe credit balance of $3 per head under the conditions we have enumerated, and under a better market it would be easy to show that, in combination with manure, a good steer always gives a profit of $33 during its finishing period.

Now, while it would be foolish, under most circumstances, to advocate the prosecution of a branch of farming that, subject only to its cost of production, does not give an actual cash profit, which this grain feeding of cattle has not done, it is yet a matter of real vital importance to maintenance of proper soil fertility that so much of first-class stall-feeding be done every year—whatever the market.

28.—THE POSSIBILITY OF MAKING YEARLING BEEF FIT FOR EXPORTATION.

As was expected, we are having opponents to the early maturing management of live stock. Their criticism is doing much good—is simply making more prominent the advantages of the system. It is sound, nationally, because it means greater progress, more enterprise, more rapid circulation of money and a general well-doing; and it is sound in farm practice, because it implies a better system, more scientific knowledge, greater

returns, and the investment of more capital in the business. Unquestionably it has some objectionable features, but they are of immeasurably minor importance; some people think only of present prominent contrasts with the old style, and overlook the widening field of a world's new work.

I wish to draw attention to the possibility of making yearling beef in Ontario fit for exportation, and submit a sample. The sample is a first cross with Hereford bull and Shorthorn grade cow, that was calved on 28th November, 1883. The calf weighed 103 lbs. at birth, suckled its mother for six months, got hay, bran, oats, and a smell of oil cake—all in moderate quantity, from three months old until now, was grazed last year, and is again on pasture. To-day (1st June) it weighs 1280 lbs. As it will not be two years old until next November, and its progress depending on the season, we may safely estimate that it will scale 1430 lbs., for late shipping on September 1st, when one year and nine months old. First of all, this is no extraordinary case and no unusual feeding; no doubt the breeding has a good deal to do with the stamp of the animal, which is what we call strong-built, and will never make a show steer as regards form. The weight at shipping time will be over the average now being exported, and all that is required for the best results, I believe. Such being the case the reasonable question may be asked,—why are we not making for more of this kind of work? It is also obvious from a consideration of the subjects treated of in chapters 15 and 18, that yearling beef would be more seasonably and economically handled. We are coming to it.

NOTE.—This animal weighed 1460 lbs. when exactly twenty-four months old.

29.—THE CLOSING BEEF CONTEST AT THE ONTARIO EXPERIMENTAL FARM.

Two of the top steers that have been held over from the nine head reported upon in our 1883 and 1884 annals, are to be put up to public sale on September 1st; these are the Hereford and Aberdeen Poll—the Short Horn was sold at Christmas last, having been taken out of the contest because of not being bred here, nor secured by us until nearly two years old. This is to be regretted, and yet I can say with every confidence that it would have had no chance of the first, and possibly not even of the second place in the competition. In closing the present contest, therefore, our remarks are confined to the Hereford and Aberdeen Poll steers.

Weight.—Though 104 days older, the Aberdeen Poll is only 75 lbs. more in weight than the Hereford; and so in this, the first consideration generally of a piece of beef, the Hereford is winner, according to age:

Aberdeen Poll,	1101	days old,	2028	lbs.,	1.85 daily rate.
Hereford,	997	"	1953	"	1.86 "

Form.—Irrespective of standard according to kind, there is in the case of the Hereford a more compact frame, a greater general evenness, and less irregularity of surface.

Fleshing.—For even covering all over—the loin especially—depth and thickness of flank, and filling of shoulder and breast, the Hereford is decidedly ahead.

Quality.—Again, there is no difficulty in awarding the Hereford first place in respect to bone, pelt, and general appearance.

Waste.—It is the opinion of butchers that the Hereford will give the largest per cent. of block meat, and indeed the previous points indicate this.

30.—SOME WOOL CLIPS, 1885.

I have pleasure in appending the average weight of fleeces from some of our rams and ewes this spring—all unwashed. They are from newly imported stock, and a few of both

classes were shorn of half their wool on arrival in quarantine last June; the others had been before importation:

Breed.	Rams.	Ewes.
	lbs.	lbs.
Lincoln	18	18½
Cotswold	20	18
Leicester	15	14
Highland	10	.....
Cheviot	10	10
Oxford	18½	.....
Shrops	13½	17
Hamps	12½	19½
South Down	10½	9
Merino	.....	12

31.—FATTENED SHEARLING WETHERS.

Grade Wether Lambs in Competition—Results per Head.

Class.	Weight on Entry.	Food consumed during 119 days.						Weight at Finish.	Increase for Period.	Food cost of Increase.
		Hay.	Roots.	Cake.	Oats.	Peas.	Bran.			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	$
Cotswold	106¼	202	37[illegible]	80	56	112	34	147¼	41	4.54
Leicester	109½	144	384	78	56	111	34	140½	31	4.15
Oxford	95	140	384	77	55	110	33	136	41	4.08
Shrops	122	166	433	86	56	113	35	165	43	4.56
South Down	120	138	427	88	59	118	35	157½	37½	4.52
Average	110½	160	401	82	56	113	34	150	39	4.37

Began 21st November, 1884; closed 20th March, 1885.

Clip of Wether Lambs, 5th January, 1885.

Cotswold	10¾	lbs.	per fleece,	unwashed.
Leicester	9½	"	"	"
Oxford	7⅓	"	"	"
Shrops	10	"	"	"
South Down	7	"	"	"

32.—LAMBS FROM NINE DISTINCT BREEDS; THEIR WEIGHT AND VALUE.

Breed.	Weight when lambed.	Present average market value.
	lbs.	per head.
Lincoln	9	$ 12
Leicester	9¼	15
Cotswold	7	13
Highland	7½	7
Cheviot	12	10
Oxford	11	17
Shrops	9⅓	27
Hamps	9	25
South Downs	7½	20

Lambing began on 1st March, and ended 15th April this year. The weight of the Cheviot must be unusual, for the kind is not more than the Highland in that respect. Our South Downs have always been much more than this year's record. The valuation is simply an estimate.

33.—CROSS-BRED LAMBS FROM TWELVE SOURCES.

Average of Thirty Head.

Breeding with Canadian Grade Ewe.	Weight when lambed.
	lbs.
Lincoln	8⅛
Leicester	9½
Highland	9
Cheviot	9
Cotswold	8
Oxford Down	10½
Shrops	9½
Hamps	10
South Down	10½
Merino	8

Here also lambs came between 1st March and 15th April. Much could be said about this practically valuable business.

34.—THREE CROPS OF WOOL IN 15 MONTHS.

We find no practically sound reason why, in most countries, sheep are shorn but once a year; that nature says but once by shedding is only partially true, and in any case the question is now one of cultivated conditions. We do not now wait for the natural maturing of beef and mutton, and in the farm and garden we force most plants—taking three and four crops a year. Were cows permitted to give milk just as nature advised there would be less quantity and a shorter season—and so on with reference to other things that have been educated into the high pressure.

Since I submitted this question in our report of 1883, a few Ontario farmers have followed the practice. We are only continuing experimentally with fattening sheep, not with those for breeding, as in such a prominent departure caution is advisable.

Lambs are shorn in July, when, from a number of kinds we obtain an average of 3 lbs. of wool; feeding and management on to June the following year is of such a kind as to secure 165 lbs. for the British market, so that the growth of wool is no small feature: the second clip takes place in March, when we get a mean wool average per head from fattened grade wethers of fully 9 lbs. per head, and in June, one month before shipping, they are again shorn which clip on an average gives fully 5 lbs.

THREE CLIPS IN FIFTEEN MONTHS.

CLASS.	Clip, Lamb, July, 1884.	Clip, March, 1885.	Clip, June, 1885.	Total clip in 15 months.
	lbs.	lbs.	lbs.	lbs.
Cotswold	3½	11	6	20½
Leicester	3¼	10	5	18¼
Oxford Downs	3	8	5	16
Shrops	3	10½	5	18½
South Downs	2¼	7½	6½	16¼
Mean	3	9⅓	5½	17⅚

There is no space meantime to make comment on this system of growing wool and mutton—twice the usual amount of wool, and fifty per cent. more mutton in the same time as ordinary management. It can be done to the comfort of the animals, to the advantage of manufacturers, and clearly to greater profits.

35.—SOME NEW VARIETIES OF CULTIVATED GRASSES, AND MEMORANDA OF THE OLD ONES.

We are determined to leave nothing undone in securing all the best and reliable grasses for the Province. The public is aware of what we have already done, in showing the importance of variety for pastures, and now, more than ever, it is desirable in connection with our advancing agriculture to further prove and hold fast.

Timothy, Orchard, Meadow Fescue, Red Top, Yellow Oat, Tall Oat, Kentucky Blue, and the Common Bent are on the old list, with a doubtful look at Perennial Rye, Italian Rye and others.

I find some seedsmen still giving in their catalogues names of some grasses that we are certain are perfectly unreliable in our country—unwittingly, no doubt—for it is a common thing to repeat lists applicable to Europe. Let us first cull out the decidedly useles grasses for Ontario.

Sweet Vernal—Under any circumstances.
Crested Dog's Tail— " "
Italian Rye—Good in association with others only.

In giving orders therefore to your seedsman name the above as not wanted, and at the same time, if you are a believer in a small variety as against a very large number of kinds, tell him to keep out the following, which, though generally safe in our climate, are not always so, and those marked * are of second-rate importance for either cattle or sheep.

Small Fescue.
*Rough Stalked Meadow.
Wood Meadow.
Tall Oat.
*Creeping Bent.

So that the most reliable and most valuable for pasture are, in order of merit :

Meadow Fescue.
Meadow Fox Tail.
Perrenial Rye.
Red Top.
Orchard.
Kentucky or Canadian Blue.
Yellow Oat.
Timothy.

Of the newer varieties, we find the Meadow Fox Tail the earliest of all grasses, in full bloom during May ; as a pasture plant it is somewhat short and bare in leaves, but rich and strong.

The Wood Meadow and Rough Stalked Meadow make a regular matting of close, fine short leaves and stems. The Tall Fescue wants body, is too open, bunches somewhat, but covers the ground irregularly well. The Small Fescue is a strong, bunchy, wiry, non-leafing grass, and Sheep Fescue as well as Red Fescue are somewhat similar, but more vigorous. The large-leafed Fescue has strong, broad leaves of a rich dark colour—a good grass, tending to bunch.

Our favorite mixture to date for permanent pasture is therefore the following :

Grasses.		*Clovers.*	
Meadow Fescue	6 lbs.	Lucerne	4 lbs.
Meadow Fox Tail	3 "	White	2 "
Red Top	2 "	Alsike	2 "
Orchard	3 "	Red	1 "
Kentucky Blue	4 "	Yellow	1 "
Timothy	3 "		10 lbs.
Perennial or English Rye	2 "		25 "
Yellow Oat	2 "		
	25 lbs.	Per acre	35 lbs.

36.—OUR WALNUT AND LARCH CLUMPS.

We have established two very important facts for the forestry of the Province, namely, that on an exposed situation 880 feet above Lake Ontario (therefore 1,130 above the sea), black walnut can be successfully grown, sixty miles north of its natural habitat, and that the European larch in the same situation is also a success.

Our walnut clump has had three years' growth; the plants were one years seedings averaging one foot above ground, many are now eight feet high and 2½ inches in diameter at bottom; they show great vigour, and though planted seven feet apart are already touching each other. They form one acre between fields seventeen and eighteen, described in former reports and specially designed, by its form, to shelter animals in either field from any possible storm. In this respect it is matter of national gratulation that one of our most valuable timber trees will actually make such a shelter in less that ten years from time of planting. Thirty-five years ago, when a lad of fifteen, I assisted in establishing a larch plantation in Scotland, which I visited last year and found thinnings being removed for railway sleepers and ship-building. Three years ago the students and I planted a European larch clump round an old gravel pit in field two—seedlings from the States, per post—some of which are now eight feet in height and 2½ inches in diameter.

What use of saying that man cannot realize matured timber during his life-time—if sure in Britain, how much surer here?

Our larch clump has not done so well as the walnut one, especially on a rich low-lying spot, where frost and snow have broken and dwarfed many, but among the débris of the old pit, where soil is fully half pure gravel and where no cultivation could be given, the plants are in full vigour and as handsome as any Scotch production.

37.—GUIDE TO WINTER FEEDING LIVE STOCK AT THE ONTARIO EXPERIMENTAL FARM.

DAILY RATION PER HEAD. QUANTITIES IN LBS.

	Average	Turnips								Cost	
											Total

37.—GUIDE TO WINTER FEEDING LIVE STOCK AT THE ONTARIO EXPERIMENTAL FARM.

DAILY RATION PER HEAD. QUANTITIES IN LBS.

CLASS.	Average Weight of Animal.	Hay.	Turnips and Mangolds.	Carrots.	Bran.	Oats.	Barley.	Peas.	Corn.	Linseed Cake.	Cotton Seed Meal.	Condiment.	Total Quantity.	Cost per day, Market Prices.
CATTLE.														cts.
Calves on milk	300	1½	1	.....	1	1½	1	.....	.....	½	.....	.....	6½	4
Calves off milk	550	6	6	.....	2	4	.....	.....	.....	1½	.....	.....	19½	10
Cows off milk	1100	10	25	.....	2	1½	.....	.....	.....	.....	.....	.....	.....	11
Yearling Steers	900	6	20	.....	3	4	.....	4	2	1	1	.....	41	20
Yearling Bulls and Heifers	900	8	20	.....	4	4	3	2	.....	3	.....	.....	44	23
Stock Bulls	1700	10	20	.....	5	3	1½	2	.....	4	.....	1/6	45½	24
Cows in milk	1050	12	30	.....	3	2	.....	.....	.....	.....	.....	1/6	47	15
Priming Steers	1700	12	20	.....	3	2	2	3	.....	3	.....	⅛	48	23
Fattening Store Steers	1000	10	25	.....	3	2	2	2	.....	2	2	⅛	50	23
SHEEP.														
Breeding Ewes	180	5	2	.....	⅓	⅓	.....	⅓	.....	.....	.....	.....	8	3
Stock Rams	210	4	3	.....	¼	⅓	.....	½	.....	2	.....	.....	8½	4
Fattening Wethers	95	5	4	.....	⅓	½	.....	1	.....	1	.....	.....	12	5
HORSES.														
Not at work	1350	10	.....	1	.....	6	.....	.....	.....	.....	.....	.....	17	11
Working half time	1350	14	.....	2	.....	10	.....	.....	.....	.....	.....	.....	26	17
Roadsters	1050	10	.....	1	.....	12	.....	.....	.....	.....	.....	.....	23	17

Physiological abstract reasoning for these rations :—

Cattle.—Calves on milk—confirming the jelley state. Calves off milk—beginning bone and muscle. Cows off milk—breeding a steady condition. Yearling steers—frame-preparing period. Yearling bulls and heifers—frame period for breeding. Stock bulls—nearing maturity, vigorous life, maintenance of heat. Cows in milk—production of milk, quantity and quality wanted. Priming steers—waiting for Christmas, a losing time, if no market. Stores—high pressure period.

Sheep.—Breeding to shear ewes—A steady condition with some growth.

Stock Rams—A make-up-cooling-down period.

Fattening Wethers.—Pressure for two crops.

Horses.—Not at work—Steady, no going back. Work half time—some waste,—steady. Roadsters—hard work, the best care.

MARKET PRICES OF FEED IN ONTARIO FROM 1874 TO 1884.

Corn	$0 62 for 56 lbs.
Peas	0 72 " 60 "
Oats	0 40 " 34 "
Barley	0 66 " 48 "
Rice Meal	35 00 per ton.
Bran	11 00 "
Hay	10 00 "
Turnips	0 08 for 60 lbs.
Mangolds	0 10 " 60 "
Sugar Beet	0 12 " 60 "
Linseed Cake	30 00 per ton.
Cotton Seed Meal	35 00 "
Thorley Condiment	0 05 per lb.

38.—CONCLUDING REMARKS.

In closing these notes of experiments for season 1884-85, some general remarks are naturally looked for.

I am of opinion that no time should be lost by this station as regards the elucidation of any facts not yet developed with reference to the dairy interest of Ontario. It would be a proud day for the Province were it to lead in the production of butter, as now in cheese ; there seems to be no reason why this should not result within a few years. With the Dairymen's Associations, a special Professor of the Art now established at the Ontario Experimental Farm, with all the possible appliances in live stock, pastures, machinery, and opportunities for lecturing throughout the country, the industry should be so developed during the next ten years as to place us at least on a par with the best anywhere. Dairying requires more detail education than the growing of crops, as is abundantly evidenced by its condition in Britain and in the United States, where even after years of experience very many are still enquiring for the "reason" of this and that. At the present moment the small state of Denmark is expending annually $30,000 on experimental dairying, so that if our Legislature is awake to the importance of this branch of agriculture it should at least double the $5,000 now appropriated. It needs but a glance at the subjects treated of in this report to show how much is yet dark. The Presidents of each of the Dairymen's Associations should be members of an advisory committee, with the authorities of the College, for the purpose of furthering the interest they represent ; and special prominent dairy exhibits at all our leading agricultural

exhibitions should be encouraged. With the exception of the Holstein breed, with which we have yet to make a thorough acquaintance, I think the Province need not trouble about "the best breed for the dairy," so long as we attend to proper selection by Short Horn grading, upon which subject this report contains some information.

The production of the best and cheapest can only be consummated, in addition to the education of the farmer, and the particular breed of cattle, by the establishment of permanent pasture, which our experiments have again and again shown can be so well done in Ontario: no more money, no more area, but a little more interest and a little more care; the result being fully double that of the rotation pasture.

V.—REPORT OF MECHANICAL FOREMAN.

MR. BROWN:

DEAR SIR,—I beg to submit to you the following statement in reference to the Mechanical Department of the Agricultural College. The records show that the term opened on the 3rd Oct., 1884, and the first work done by students was some repairing in class-rooms, among desks, seats, etc., likewise arrangement in lumber yard. A quantity of hurdle-fencing was built for separating the newly imported stock, which had lately arrived. There were also some improvements done on the cattle feeding stable which had recently been erected. The experimental dairy was also completed for winter work. Towards the end of November the outside windows of college building were repaired and put on.

I have stated in former reports the inconvenience I labour under in regard to not having a proper place to store those windows, which should be near the college and guarded against intruders.

For the month of December the repairs were in a general way, and to give the details of one class would be a repetition of the other. Take the third of twelfth month.

Owen, Moberley—General repairs of farm tools.

Madge, McLean—Repairing windows, putting glass in college.

Sharp, Creig—Repairing doors in college.

Notman, Marsh—Repairing tables in reading room.

Mills—Messages.

Those students were employed three and a half hours, at an average rate of seven cents per hour, amounting to $7.15, and this is about the daily routine of the department?

On the 13th December, education closed for the holidays, resumed again on the 22nd January, 1885. The principal operation was erecting a house for portable engine at one end of implement shed, and putting in shafting and rollers for driving farm implements; this was purely as a means of education for the purpose of instructing with the machines in motion. Later on there was erected a small out-house at one of the cattlemen's cottages, and about this time we made calculations for a quantity of fencing to be erected during the coming summer, we advertised for tenders and purchased 1,000 cedar posts at $9\frac{1}{4}$ cents a piece and 60,000 of board fencing at $13 per thousand. Of this we have on hand about 12,000 feet. As soon as weather permitted we erected about 300 rods of post and board fence at a labour cost (student's labour) of $100. There were also made two neat gates for garden and four farm gates placed in lanes.

In these remarks you will find embodied the general operations which engaged the attention of the mechanical department from October, 1884, until October, 1885, being the eleventh year of the institution.

I am, Sir,

Your obedient servant,

JAMES McINTOSH.

Guelph, Dec. 18, 1885.

VI.—MISCELLANEOUS.

(*a*) THE WORKING DAIRY AT THE PROVINCIAL AND TORONTO EXHIBITIONS, 1885.

(From the Public Press.)

"The Working Dairy at the Provincial and Toronto Industrial Exhibitions this year deserves special notice. The idea originated in a letter to Mr. Rennie, from Professor Brown, of the Agricultural College, and, as mentioned in the *Globe* at the time, the Executive Committee of the Industrial at once very heartily arranged for such an exhibit. Enlisting the services of Professor Barré, now the dairy expert at Guelph, a large and medium-sized centrifugal separator was obtained from Montreal, and in order still further to complete the appliances of this character, a one-horse centrifuge was ordered from Denmark, which latter has become the property of the Toronto Exhibition, and is the first of the kind ever brought into the country. Not only so, but Mr. Walton, of Hamilton, added a medium-sized machine, and thus altogether the dairy was equipped with four of these modern creamers. Milk was supplied by Mr. Walton, and half a ton used daily. This was but a mouthful, so to speak, for each as, had they worked even six hours together, they would have manipulated ten tons of milk: the large separator 1,200 lbs., the medium 700, and the small 300 lbs. per hour. It is not necessary to describe the mechanism, or detail working of the centrifuge, other than that used by the professors to the farmers, by saying that when you stand with a handful of grain and wheel rapidly round, at the same time allowing the grain to escape gradually, the heavy berries will be found farthest from, and the lightest ones nearest the operator—in the case of the milk enclosed in a drum of iron, the cream being the lightest remains near the centre and the milk proper thrown upon the side. With the exception of Mr. Walton's De Laval, all of the machines were of the Burmonster and Wain make. The respective merits of the two have been lately under trial in England, and a pretty even balancing reported; at the same time we think the Ontario Experimental Farm should possess one of each for thorough testing, and thus secure unprejudiced conclusions for our own farmers. The cream obtained daily at London and Toronto was at once churned, and, had the management desired, the novel feature of separating cream from its milk and making butter within one hour could have been shown. The butter was pronounced excellent, wanting a little of that flavour which time for the ripening of cream gives to suit some palates. There is possibly no arrangement without its trouble, and this was no exception. Party or parties unknown tampered with the one horse centrifuge, before unpacking, an essential piece being removed, which rendered its working impossible. This annoying circumstance was specially to be regretted, because it was the desire of the indefatigable Industrial Association to show farmers the possibility of an early date for any one who has, say fifteen or twenty cows in milk, and who with a one horse put on at 6 a.m. would remove the cream—more or less as found desirable—from all the milk in one hour, and serve the sweet warm skim milk to calves at 7.30 a.m., making his own butter or selling the cream to a factory as found most suitable. This one-horse centrifuge will be sent to Guelph for repairs and testing,

Another department of this working dairy was the testing of all the milch cows in competition for prizes offered by the Association. This proved so interesting and instructive that we gladly take space for some details. Several visitors acknowledged that such a systematic, reliable, and fair testing for quantity and quality has possibly never been made either in Europe or on this continent. In saying so we do not forget that chemical analysis is always the unfailing judge, but, while Professor Brown was prepared to have this done, it was considered better, meantime, to test in such a way that farmers could

copy, and certainly would appreciate more fully. Taking hints from the present year's competitions at the Royal, of England, and Highland, of Scotland, the College secured the approval of our corresponding societies to use the following in judging milch cows:—

	lbs.	Points.
1. Quantity of milk in 24 hours	24.12	
Allow 1 point for every pound		24.12
2. Butter per 100 lbs. milk	3.81	
3.5 being standard, add or deduct 10 for every 1 above or below		53.10
3. Wet cheese curd per 100 lbs. milk	20.60	
Allow 1 point for every pound		20.60
4. Time since calving	114 days.	
Allow 1 point for every 10 days		11.40
Total value		109.22

In this they increased the per cent. of butter per hundred pounds of milk from 3 to 3½, as the Ontario Experimental Farm tests have shown that Canadian milk, on an average from various sources, is richer in fat than European averages. Then, also, in view to partly meet the solids that chemistry would best submit, the wet cheese curd is given as a point. Altogether the system is similar to British. Of course in a brief contest of this kind, where many meet for only a week's work, the element of feeding and such like cannot be considered. The figures in the example we have given are those of the Jersey cow "Rose of Eden," the property of V. A. Fuller, of Hamilton, that took first in her class at London. At London the contest was by breeds separately, at Toronto open to all comers. The following were the prize winners respectively:—

London.	Points.
Jerseys—1st, V. E. Fuller	109.22
" 2nd, "	78.10
Short Horn grade—1st, W. Patrick	81.52
" 2nd, "	55.57
Ayrshires—1st, G. Hill	83.85
" 2nd, T. Gray	68.27
Holstein—1st, H. M. Williams	64.29
" 2nd, M. Cook & Sons	59.07

Toronto.	
Jersey—1st, W. A. Reburn	89.55
" 2nd, V. E. Fuller	86.82
" 3rd, A. Jeffrey	83.66

Along with these the percentages of cream from each of the cows, and any others—for all were invited—were shown in test tubes in a neatly constructed case holding iced water so as to make the temperature 40°. The great range from 9 to 35 per cent.,

according to breed, individual character, and time after calving, was a source of unfailing interest and discussion amongst the farmers and their wives. The cheese curd was obtained by careful weighings and manipulation.

Altogether, Professors Brown and Barré have to be congratulated on the success of the first really working Exhibition Dairy in Canada, and both gave large praise to their assistants, Messrs. Shuttleworth, Caswell, Zavitz, and Denton, all students from the college, and no small measure of the good work of the centrifuge was due to Mr. A. Garth, of Montreal, who, with all the others, gave gratuitous service both at London and Toronto. The arrangement to lecture daily did not succeed. It was found simply impossible to hold an audience with any advantage that would keep move, moving; people go to such exhibitions to see everything in one day, and cannot be held perforce at any one spot unless where variety and excitement is presented, such as in the ring. Some fifteen large maps were arranged round the building, showing dairy statistics of all kinds, from the breeds, by milk, cream, butter, cheese, chemical analysis, cost of production, revenue per acre, and the many items of interest and value in connection with results through various methods of obtaining the products.

On visiting the Exhibition Sir Charles Tupper at once realized the importance of the whole dairy display, and is arranging for a similar Canadian one next year at the Indian and Colonial Exposition in England."

(*b*) SOME NEW FEATURES OF THE DAIRY INTEREST.

I have said elsewhere that the country is not full of facts with reference to any branch of farming, and is certainly not so as regards dairying. The use of cow's milk has been, and is perhaps even now, of more importance than flesh, and no product of the soil has stood the vicissitudes of time, of markets, of climate and of fashion, so well as this has done. It has never been superseded in food value by anything else in nature or art, and yet it is the most easily spoiled of animal products; not only so, but man himself is less certain about its physiological source, knows less about its variety of source, is less able to regulate its quality, and thinks less about its actual value, or even what it costs to produce it—all the while that most men use it daily.

This is simply the result of milk having been so long looked upon as a "thing of course," and the general ignorance that milk is milk, from whatever source. It stands as a remarkable fact, however, in the agricultural history of nations, that whatever be their position—in age or civilization—whatever their wealth and resources of any other kind, if troubles arise in the growing of crops from causes within or without themselves—climatic, diseases, or competition causes, then recourse is had to the dairy. One of the oldest and one of the newest civilized countries are to-day examples of this striking fact. Britain and the North American continent are dipping deep into dairy products, and hence is a phase in the agricultural battle that will likely draw out some scientific and practical revolutions.

One of the first newest things must be the production of crops—whether milk, butter or cheese—during twelve, in place of six months a year. The activity of this nation especially, will not long rest satisfied with half measures, and the very difficulties now towards the prosecution of the business in winter will the sooner send us to victory. If dairying is to become a wide and established branch of our rural economy, as seems to be almost ensured, it is as evident that the field of production will extend into winter, and indeed, it is not unlikely that the winter products will be the better for several purposes. The want of the best of green fodder, and the greater cost of production, may be called objections, but these may be met partly by the growing of different crops, as to which I shall say something further on—and partly by the systematic incoming of cows. On the other hand there would be the advantages of more systematic feeding and management, perhaps richer products, the unquestionably more favourable temperature, and its easier regulation, and particularly, farmers at that season being able to pay more personal attention to the care of calves and the dairy work itself.

Financially, as we shall see, it would mean such an increase to revenue as to draw men where even now men are looked upon as either old school, stiff-necked, or blind.

I desire still further to impress the immense importance under our physical conditions, of obtaining crops twelve months a year. Practically, we are one half our life dead. Why should this be so? What is the difference between "soiling" in summer and our winter management? None really—for both are the best maintenance of live stock to produce the most and the best, cheapest. Of course you can see that I am aiming at butter and cheese, and not so much the milk as a retail product, which, nevertheless, is a mismanaged branch of the interest, both in quantity and quality, cheaply, during winter.

Yes, why not go on growing crops all the year round, other than wheat and corn, for half the time? The national energy should be roused up. Though not old, we are not young in experience nor in enterprise. Our rural conditions are undoubtedly not of a kind to be twisted by every wind of farm speculation, for we are solidly summer crop growers, and must always remain such, but it is this very fact that backs up the necessity of better and more extensive winter work. Winter cropping cannot long remain the dead letter it has hitherto been. There should even be a greater produce per acre than from summer results, when we look at the five crops of flesh, wool, breeding, manure and dairy products against those of summer, in which comparison we wouid likely find the over-balancing regulated by the value of the crop called *manure*.

And now naturally we are concerned to know something either not already known, or that remains obscure, on this subject.

I think one of the weak things in our agriculture is the "*per acre per annum*" knowledge. All quotations of farm produce should be "per acre," whether grain, fodder, flesh, wool or milk. If not so, no correct estimate can be made of what an individual or a nation is doing in comparison with others. With reference to dairy products, can we tell at the present moment what we have done in the past as regards amount and value of milk, butter and cheese per acre per annum? With all the high standing of the States and Canada in cheese, how can we judge that our farmers are up to the time, or are actually making any profit in dairying in correspondence with grain and beef?

Take an average farm of 150 acres, and we know from long experience, that the average annual profits, not allowing for household maintenance other than the direct farm food consumed, is about $500.00 or $3.50 per acre. I think this position will not be disputed, at least as regards being too high.

Now, individually and nationally, we have been looking to this as representative of the "per acre per annum," and throwing anything that has or may result from *winter*, either "into the bargain," or more possibly have taken the position of calling the summer crops as the necessary preparation for winter maintenance only, without reference to any profits being realized during winter. I think this is a false position or wrong to the country, and the profession at least, if not to the individual who, of course, realizes whether he knows it or not. No part of the world is so much concerned in this as we are, for nowhere else is there such a distinct necessity of housing of live stock. I contend most unhesitatingly that all our past agricultural comparisons—nation with nation, and acre per acre—have been clearly against the Northern States and Canada. When we harvest summer crops north of latitude 40° we close the book, shut the door, and virtually move upon new land, taking up farming in another physical world. But the change of scene has still reference to the 150 acres, and I venture to make a close under-estimate of the winter "per acre per annum" thus, from—

Flesh	$1 50
Manure	1 50
Dairy	1 00
Breeding	0 80
Wool	0 20
	$5 00

These figures necessarily are more Ontario than elsewhere, but I think that both

the general idea and principle are applicable, and there is no time at present to explain every item; so then winter crops are so prominent with us as to demand separate national recognition.

This leads me to another branch as a new feature in dairying—the comparison of cost of producing dairy products with their actual price in the market, and it will save complication that we confine our figures, first of all, to the *food cost* of producing them.

There are the divisions of summer and winter. In summer, upon the average pasture of our cultivated timothy and clover, pasture that is really not up to the times, as I shall ask you to consider—and with cows of the average type, milk costs 2 cents per gallon, cream 12½ cents per gallon, butter 5 cents per lb., and cheese 2 cents per lb. We could take advantage of these summer rates to make, possibly, a somewhat unfavourable comparison with their market prices, but looking even to part of our present practice in winter, and particularly to the future—the *new* feature of the work—it is better to make one average for the two divisions. During winter, by present average practice, milk costs 4½ cents per gallon, cream 18 cents per gallon, and butter 7½ cents per lb.—by the food consumed that enabled the cow to produce them.

So then, *all the year over*, milk cannot be produced at less than 3 cents per gallon of 9 lbs.; cream 15 cents per gallon, butter 6 cents per lb., and cheese 3 cents per lb. —allowance having to be made for manufacturing in each case, which should not be more than 1 cent per gallon for milk, 8 cents for cream, 4 cents per lb. for butter, and 2 cents for cheese. The interesting point now is: how do these prices correspond with what we have to pay *on the market?*

If milk be retailed at 25 cents per gallon, summer and winter, there appears to be the enormous figure of 21 cents per gallon as going to the retailer, who may, of course, be also the producer. Pay him for cost of distribution, at rate of 9 cents per gallon, however, and there is left 12 cents as the real or apparent profit on a gallon of milk retailed in cities—a sum four times more than the food cost of producing it. When cream is retailed at 80 cents per gallon, or when we get 50 from butter factories, the profit is three times more than its cost of production in the one case, and even sufficient in th other to draw the worry and labour from our wives and daughters.

FINANCIAL POSITION OF DAIRY PRODUCTS.

	Milk per gallon.	Butter per lb.	Cheese per lb.
	c.	c.	c.
Food cost	3	6	3
Manufacturing	1	4	2
Marketing	9	2	1
	13	12	6
Market price	25	15	10½
Profit	12	3	4½

Cream is such an uncertain thing, pure or otherwise, that little can be said about its position in the retail market. Its production costing, as we have said, about 6 cents per

quart, and its delivery to customers 2 cents per quart, it is evident that to obtain a corresponding profit, it is worth 20 cents a quart. Remembering that this has been a low season in butter factories (the cream for them has been worth 12 cents a quart, delivered), there is a good margin at 20 to retail cream.

Butter is a more definite article, if not always a more reliable one as to purity, in our agricultural debit and credit. We have placed its production cost at 10 cents per lb. in ordinary farm practice—not in butter factories necessarily. When, therefore, the farmer gets 15 cents, he is well paid, for the delivery is practically nil. When, however, butter factories, as they do, give the farmer on his own floor, as much for the cream that makes the pound of butter, as the farmer gets for his butter on the market, the place of the farm, now, in the butter industry, is a very clear one indeed. Five cents will produce one pound of cheese, and as cheese has averaged 10½ cents wholesale during the last ten years, this dairy article stands as a well-balanced agricultural crop.

We shall now examine some new things in the sources of dairy products, and first as regards food.

The world does not agree as to the exact effect of different kinds of food on milk. Most men agree that the strongest effect, more or less, of food, is to produce quantity, the least effect being quality. Therefore, before closing, I think I shall have no difficulty in showing that it is the animal agency more than the food that regulates what is called the quality of milk; meantime look at the great and cheap source of dairy products,—*pasture.*

I wish we had time to tell all about that combination of grasses and clovers properly established and maintained—that we term Permanent Pasture. I desire to place on record to-day, what a Scotch Canadian thinks is the biggest weakness of the agriculture of this Province, in correspondence with all the aims and actual work in progress. I do so now for the first time, and it is, that we have *no pasture in our cultivation.* There is nothing in all agricultural practice anywhere so neglected as pasture. The average rotation after-math of timothy and clover is not pasture, but hay, and hay is not pasture, nor never will be. Hay is not made subservient to its pasture. Were it so, the results would be much better; but even allowing this, there is nothing in these two plants at all able to meet the wants of even reasonable animal life. But pasture made permanent with its reliable ten or twelve grasses and four clovers for our agricultural conditions, there is an incomparable annual offering, reliability and value. Such pasture gives several crops per annum; offers an earlier and later bite; animals are more healthy and less liable to disease upon it; it cannot possibly be destroyed by either drought or frost, it gives more daily produce than any other kind of fodder, it gives three times more of any animal produce per acre, it can be used as a soiling crop every year, it is less expensive to produce and maintain than any other crop, it is a continual source of reliance and wealth, and it is *permanent.* What more need be said than to shew what it can do in dairy products, as realized at our Experimental Station for several years, and particularly during 1884-5.

We set aside six cows and one acre for continuous depasturing, in couples alternating every two weeks, so as to secure an average of sources—using the Ayrshire, Holstein, Devon, Jersey, and what we call a Quebec grade. Water and shelter were good, cows left out day and night, milking in the field twice a day, and weighed there also. The cows were weighed at each change, the manure regularly spread over the pasture, the milk daily tested for cream by different methods of setting, by centrifugal twice a week, chemically analysed every week, and sent twice a week to myself for microscopic examination. We were aware of the extra "waste" by confining two animals to one acre—tramping, lying upon, and manure-dropping—than there is under the ordinary circumstances of a farm, and so, partly to check this as well as to offer a *fresh* bite, the area was divided into two fields, and a change made every seven days. We had plenty more acres of the same, but decided to make a very severe test.

The Ayrshire during the first week was very unsettled, and communicating this to her Holstein mate, they both reduced in weight very heavily, consequently affecting at least the quantity of their milk—in other respects nothing marred the test. The average daily yield of milk per cow from May to October, was 23⅔ lbs., which for four year old

cows three months after calving, and a mixture of breeds, is neither low nor high. One acre maintained the two cows *all the season through* for five and a half months, say 165 days, so that we got 7,800 lbs. of milk from that acre. Or we got per acre, 1,090 lbs. cream, or 270 lbs. butter, or 800 lbs. cheese. It requires three acres to maintain one cow per pasture season in Ontario, which gives on an average 3,900 lbs. milk, therefore 1,300 lbs. of milk per acre; and recent returns from some of the Northern States give fully four acres as needed for one cow, so that granting the like cows, the milk per acre is only 950 lbs. Such is our national position of dairy produce per acre—a humiliating position in all truth, an extraordinary admission of something worse than indifference.

In the States and Canada we are harvesting 1,200 lbs. of milk per acre, while it should be at least 5,000. In place of 200 lbs. cream, it should be 1,000 lbs. per acre. Butter per acre with us is only 40 lbs. in place of 200 lbs., and cheese should be 600 lbs. and not 150 only, per acre. We are coming to it, though.

(c) LETTER TO ONTARIO FARMERS ON PERMANENT PASTURE.

During my recent run at Farmers' Institutes throughout the Province, every one without exception chose the subject of Permanent Pastures as part of the programme, and such was the keen interest manifested that even after much discussion and the apparent exhaustion of explanations, I was asked and promised to give a full statement in the *Globe* and *Mail*, in order that others should copy, and every part of the country be thus placed in possession of the facts in good time for spring work.

Permit me introductorily to say what is implied by our farmers taking the interest they do in this seemingly simple crop.

It needs no great wisdom to tell that our agriculture must advance with the times as regulated by the great markets of the world, and that, if it does not do so, we must take a second or third place and learn to be content, for it is only the progressive that have any legitimate claim to grumbling. Fifteen years ago it was easy enough for Ontario to calmly hold fast and look on, but now that the agricultural world is strung upon the sharpest lines of science and practice—crossing each other as they do at even many uncivilized corners of this big earth—nations are bound to go ahead or suffer. The very fact of Ontario being in advance of other countries as regards several branches of rural economy, makes her position more dangerous as a competitor—dangerous not only to her reputation, but seriously so financially. No nation of our age, experience, and wealth, is to-day doing so much in the best introduction, maintenance, and production of farm live stock, nor of dairy products, nor even of grain, and certainly there is no climate and soil so suitable and reliable as ours for variety of products. Yet we lack. Our reliability can be greatly increased by associating scientific and practical arboriculture with our everyday farming; we are not recognizing the undeveloped resources of districts within our own bounds, and particularly seem afraid to do anything that does not immediately return a large profit. The undrained lands and natural pastures of the Province are yet unknown in their area and value. Our wool and mutton produce, of the right sorts, have actually no place in our statistics—the while our own people are calling for them—and the land rich with all the virtues that make them. After all our education, specially designed, very many of us are still in doubt as to the propriety of growing finished beef, whatever the condition of the market—unable yet to see that the flesh in question is the secondary object in connection with our cultivation of crops, and maintenance of fertility. Then, also, unless it be at once clearly apprehended by the country that it is absolutely necessary to produce more crops systematically during winter as well as in summer, we shall certainly fall terribly short. We are bound to produce cheaper and in greater quantity. It is not so much the area that is troubling, but the "per acre per annum,"—than which there is no truer gauge of national or individual well-doing. Once our national pride is thoroughly aroused the world will soon hear from us with a great big sound that shall

shake old farming tracks and constitutions. The admirable address of our Lieutenant-Governor the other day is enough to band the farmers of Ontario in an impolitical union stronger and broader than from ocean to ocean.

Towards these ends I respectfully submit that permanent pasture will have a great deal to say. As a stimulus to healthy appreciation of the importance of permanent pasture, and as one of the best possible ways to impress our people, I may ask why it is that Britain, with all her age, experience, and wealth of other things, has already placed half her arable under this crop? It is not altogether because of outside competition in other crops, nor of climatic trouble, but because she knows of no better way to conserve, to wait, and to make money by doing little at the least risk and outlay. Britain has never hesitated how to "hedge" in her agriculture when troubles arose, and to-day her farmers make more revenue per acre per annum on the best pasture than from any other source. One cow per acre being her average, there is a gross return of three times more money than Ontario now shows, and thousands of prime bullocks are annually produced from the same source.

Another stimulus to the extension of such pasture is the examples already existing in the Province, and that have been established since the prominence given the subject by this Experimental Farm some five years ago. As nothing goes home so strongly as neighbouring examples—stronger even than that of an experimental station—I beg indulgence for a few of them:—

Near Belleville twenty acres were seeded down four years ago, and so profuse was the first years' growth that pasturing and haying had to be adopted in order to prevent smothering. The second year was pastured, when fully two head of cattle were kept per acre; during the third year twenty cows were grazed up to 11th July, when ten tons of first-class hay was harvested from one-half of the field, and, after the hay was removed, seventeen cattle were grazed for the remainder of the season, leaving the pasture with a much better bottom. The enterprising farmer in this example gave particular attention to the effect of the variety of grasses and clovers upon dairy products. He says:—"The milk produced was richer and of a peculiar flavour, having, directly after milking, a greasy appearance like oil on the top of water; the butter had also a peculiar flavour and a richer yellow colour;" the same effect was produced on the butter when cows were fed on the hay.

Not far from the same place a prominent public man seeded some forty acres, and he expressed his satisfaction to the writer in this way:—"If the farmers take advantage of what the Experimental Farm has shown can be done with permanent pasture alone, it has more than paid all its cost to the country for many years to come." I am not aware exactly how the calculation was made, but probably somewhat in this manner:—The present cultivated pasture of Ontario maintains one cow on every three acres (it is really three and a quarter acres), and as the average cow gives 3,800 lbs of milk per grass season, the produce is 1,270 lbs. per acre per annum. As the permanent pasture in question can hold more than one cow per acre, and enables the same cow to give one-fourth more milk, the acre produces 4,750 lbs. of milk every season. There being about 15,000,000 acres of arable land in Ontario it results that if ten acres of permanent pasture were established to every one hundred acres, the 1,500,000 acres thus changed from the present stamp of pasture would actually give a cash difference of $25,000,000, or $250 a year to every farmer of the Province. The cash cost to the Province of the Ontario Agricultural College and Experimental Farm is about $20,000 a year. If this rough estimate is wide of the position taken by the gentleman referred to, I shall be glad to have it corrected, as his congratulations were hurriedly made in a railway car two years ago.

Another example is near Stratford that laid down twenty-five acres two years ago. For the first year the farmer was obliged to graze as well as make hay. Twenty store cattle, yearlings and two year olds, were kept on these acres, and they would have held more, he said. The land was newly cleared and had never been cropped. Here was a case of a cash receipt of $15 of beef per acre per annum, as against the average of $5.25 from timothy and clover pasture.

At Meaford, a hilly piece of naturally poor and light land, has been put to permanent pasture, and is giving unexpected results under the conditions. In the county of Simcoe a three hundred acre farm, largely devoted to raising thoroughbred cattle, has placed no less than eighty acres under this class of pasture—being satisfied that its character will, better than anything else, meet all the wants of such an establishment. I could cite other cases, but these are enough. In order, however, to keep the principal facts to date, in a bunch, I shall now abstract the results of this Experimental Station. When I took charge of the farm in 1876, and opened a small separate experimental department, we never hesitated in giving a prominent place to grasses and green fodders. Ever since we have systematically obtained a large number of varieties, both from England and our own seedsmen, in order to thoroughly test their character and reliability for Ontario conditions. Our annual reports give the details, and as the situation at Guelph is comparatively high lying and exposed, what succeeds there is almost certain to do so in any other part of the Province, if not all Canada. Until last year we had no opportunity and appliances to undertake the "per acre per annum," when, however, a very full and fair test of such produce was carried out, as detailed in the Midsummer Advance Report, 1885, and which is repeated in this one. I may also note here that we have planned to test this summer the ability of this pasture to produce finished beef by the ordinary store steers of the country—a feature of our work that cannot fail to be very valuable—and of course we should continue testing dairy products from the same plots of last year. The dairy testing last year was a product of 7,800 pounds of milk per acre, where one acre maintained two cows, all the year through—a result so apparently remarkable in comparison with the present Provincial average of 1,300 pounds, that comment stands still.

The conduct of this class of pasture is very uniform and characteristic. On all hands the complaint has been that it comes so strong and profuse the first year, necessitating a kind of management contrary to the best practice in Europe. As an example of this, take the case of the four acres we seeded in May last in preparation for the store steers of 1886. A late spring made a late seed-bed of good clay loam, in good trim, however, in May. Growth became so rank that for the sake of giving air and a better chance to roots, we ran the mower over in May, and left the cutting as a mulsh. In June another cutting was considered necessary for the like objects. as well as to check some soft milk-thistles that had come with the grass seeds. Again the mower was used for the third time, and finally in September, fearing that the continued profuse growth might smother out some plants when winter came, we took off a crop of hay—the fourth cutting—that averaged $1\frac{1}{4}$ tons per acre. Thus, the same season the seeding was done we had to cut four times, and could have pastured afterwards had it been consistent with good management.

What we have realized with others are the following facts: That permanent pasture, after the first year, is the earliest of most green things, some of the grasses and the lucerne clover growing under the snow—if deep and late in going. The meadow fox tail leads in earliness, and with the English rye, orchard, and lucerne, offers a full bite even for cattle early in May; these are followed by meadow fescue, blue grass, red top, yellow oat, and timothy, in regular order, so that with the five clovers the animals are presented with a succession of different crops throughout summer and right into the snows of November—never bare and always fresh. The meadow fescue may be termed the "general purpose" plant of the mixture, no other is equal in an average of good things; never coarse, always in leaf, a good spreader, and a good neighbour; other grasses could be dispensed with—the meadow fescue never. Animal health is better where a variety of plants exist, though England has found, in some instances, that heifers grazed alone upon such pasture are more difficult to get in calf by reason of too many good things giving over-much fat.

Another feature of this crop will be the use of part of it all season as green fodder for housed animals, and part to be made hay for milch cows in winter. The Experimental Station has had the experience that the feeding of timothy hay without much clover

tends to dry up the flow of milk in winter, and as winter must become a largely extended dairy field, if Ontario means to cope with other countries in these competitive times, she must secure the kind of meadow hay that has always helped to give Britain her winter milk.

The soils best adapted for permanent pasture are those with a decided clayey tendency. Whatever the soil be, secure a firm, friable, rich seed bed, naturally or artificially dry. The best preparatory crop is roots that have been liberally dealt with as to manures and cultivation, so as to obtain a rich and clear surface. We agree with the Belleville farmer that it is better not to turn under this surface but till only, in the fall as well as spring, if you desire to run no risks, but conserve everything for the future crop, seed in the spring and seed without a crop of grain of any kind. Sow immediately the land is mellow enough, never deeper than half an inch, and therefore, after, and rarely before the harrows, the roller is usually sufficient to cover. The grasses and clovers, with quantities that are best and most reliable to date, are as follows:—

GRASSES.

	Lbs.
Meadow Fescue	6
Meadow Fox Tail	3
English Rye	2
Timothy	3
Canadian Blue	4
Orchard	3
Red Top	2
Yellow Oat	2
	25

CLOVERS.

Lucerne	4
White	2
Alsike	2
Red	1
Yellow	1
	10
	25
Per acre	35

The quantity can be varied according to circumstances; never less than 25 pounds under the best conditions, and not more than 35 upon the poorest conditions.

Avoid grazing any class of animals the first year, and if blessed with much rankness mow and mulsh as previously explained. If weeds should trouble they cannot remain long were liberal treatment is carried out in after years, because the cultivated plants thus encouraged soon kill out the poorer. Believe and practise rolling every year, and top dressing with compost, or farm yard manure every third year. For my extended views of the best management of permanent pasture I beg to refer to the "Canadian Farm Cyclopedia" as published by Hunter Rose & Co., Toronto. Do not be afraid of heavy depasturing early in the season and use the mower to keep under what the animals won't touch. Lime and salt sweeten and stimulate pastures, when never more than 5,000 lbs. every eighth year per acre, and 300 lbs., respectively, every fourth year per acre. If any difficulty arises in securing a good crop by the use of ordinary appliances, try 300 lbs. of bone dust; if this fails break up. Manuring is usually best after haying

or in early fall, as, if in spring with a succeeding dry season, the effect is not good. Take advantage of any natural irrigation from streams or barnyard liquid, which are best in winter, or spring rains, so that the position of the plot of permanent pasture is an important one indeed.

A few of the Farmers' Institutes have petitioned the Commissioner of Agriculture to this effect:—That in view of the importance of permanent pasture, and the desirability of securing reliable seeds, the officers of the Ontario Experimental Farm be authorized to advise with the principal seedsmen of the Province for this purpose; and it was also at the earnest solicitation of several thousand farmers that I promised to publish this letter, in order that others would unite in assuring these seedsmen, that, provided some guarantee be obtained as to purity of kind, good germination and freedom from foreign seeds, the demand for the grasses and clovers this spring would be very large. The demand may, indeed, be now assured, and I therefore beg hereby to notify all interested seedsmen to prepare and place the price as shall hold reasonable profit only, so as to beget encouragement for a very fine future business.

But I must now close. If the 100,000 farmers of Ontario do not within ten years make up one million acres of permanent pasture, we shall not only suffer for lack of progress but have to change our belief in the cupidity of average humanity.

INVENTORY AND VALUATION OF LIVE STOCK AND IMPLEMENTS ON HAND DECEMBER 31st, 1885.

Horses:		
8 working horses	$1,550 00	
1 cart horse	80 00	
1 express horse	50 00	
		$1,680 00
Cattle:		
1 Shorthorn bull	$2,500 00	
2 Shorthorn cows	1,975 00	
		4,475 00
1 Hereford bull	$2,600 00	
2 Hereford cows	1,060 00	
1 Hereford bull calf	250 00	
		3,910 00
1 Polled Angus bull	$2,600 00	
3 Polled Angus cows	2,300 00	
1 Polled Angus bull calf	100 00	
		5,000 00
1 Galloway bull	$600 00	
2 Galloway cows	700 00	
1 Galloway bull calf	80 00	
		1,380 00
1 Jersey bull	$325 00	
2 Jersey cows	550 00	
		875 00
1 Guernsey bull	$350 00	
1 Guernsey cow	275 00	
1 Guernsey heifer calf	50 00	
		675 00
1 Devon bull	$325 00	
1 Devon cow	300 00	
		625 00
1 Holstein bull	$1,100 00	
2 Holstein cows	800 00	
1 Holstein heifer calf	50 00	
		1,950 00
1 Ayrshire bull	$300 00	
2 Ayrshire cows	500 00	
		800 00
1 West Highland bull	$200 00	
		200 00
8 Grade cows	$481 00	
3 Grade calves	80 00	
5 feeding cattle	200 00	
		761 00

Sheep:		
3 Cotswold rams	$310 00	
10 Cotswold ewes	250 00	
		560 00
1 Leicester ram	$260 00	
6 Leicester ewes	310 00	
		570 00
1 Lincoln ram	$160 00	
3 Lincoln ewes	180 00	
		340 00
3 Oxford rams	$250 00	
9 Oxford ewes	480 00	
		730 00
3 Shropshire rams	$580 00	
10 Shropshire ewes	350 00	
		930 00
1 Hampshire ram	$200 00	
5 Hampshire ewes	200 00	
		400 00
1 Southdown ram	$270 00	
6 Southdown ewes	370 00	
		640 00
1 Cheviot ram	$60 00	
2 Cheviot ewes	45 00	
		105 00
1 Highland ram	$60 00	
4 Highland ewes	50 00	
		110 00
2 Merino ewes		25 00
Pigs:		
1 Berkshire boar	$50 00	
1 Middle York sow	50 00	
1 Essex boar	40 00	
1 Essex sow	30 00	
		170 00
Total Live Stock		$26,911 00
Implements:		
Value of farm implements, per inventory	$4,020 00	
Value of mechanical stock and implements	1,128 25	
Value of experimental implements	1,247 50	
		6,395 75
Total		$33,306 75

I have the honour to be, Sir, your obedient servant,

W. BROWN.

PART V.

REPORT OF THE FOREMAN

OF THE

HORTICULTURAL DEPARTMENT.

GUELPH, December 31st, 1885.

Honourable A. M. ROSS,

Commissioner of Agriculture:

SIR,—In very briefly reporting on the practical horticultural work of this Institution for the closing year, I would say that, notwithstanding some failures, chiefly from causes beyond our control, on the whole satisfactory progress has been made. Although not much new work has been accomplished or attempted this season, the labor of the past few years on the grounds in front of and surrounding the College buildings, we think, will prove equal to the anticipation of its originators and fully justify the expenditure caused by the grading, road-making, levelling and planting done on the lawn, the grass on which, although only two years from seed, has formed a tolerably close matted turf, that to the casual observer would pass as an established lawn of many years' standing.

The planting in front of the College buildings is composed of the smaller-sized trees and shrubs, embracing a variety of about three hundred, arranged in groups according to the families or natural orders to which they belong. Thirty-two distinct families are represented, which were named in last year's report, and a complete list of the varieties was given in the report of 1882; since then some of the tenderer species have been lost, and have not as yet been replaced. Arranged and planted in their present position in the spring of 1884, they continued to grow later in the summer months, and consequently the young wood was not so well matured and conditioned to withstand the coming frosts; to provide against which we were specially careful to protect all transplanted that season by mulching well with stable manure, and further protecting all those deemed the least tender by surrounding them with evergreen brush, and fortunately so, as we believe the winter proved to be the most trying of a succession of severe winters, which have left their traces in most parts of the Province, and we think specially so in this section. A like precaution has been taken this fall by giving all possible protection for the winter, and we await the result, but fear that we will yet lose a further portion of our large collection. The flower beds immediately in front of the College buildings (more minutely described last year) were as usual filled with all the ordinary bedding and other ornamental plants, which kept up a succession of bloom from the first of June to the middle of October, and throughout the summer months were noted by several visitors, whose opinions we respect, as at least equal to any other flower garden in the Province. The older flower beds and borders near the greenhouses were equally attractive and satisfactory during the season; the whole being furnished with over nine thousand plants of all sorts, either propagated by cuttings, or raised from seed in the early spring months, under glass, including outside hotbeds.

The Kitchen Garden.

I have pleasure in saying that the vegetable crops—due to a specially favourable season for growth— were all that could be desired, good and plentiful in their season. Asparagus, beans, peas, spinach, beets, carrots, corn, cabbage, celery, cucumbers, squash and tomatoes, were all good in quality and abundant in quantity, considerably in excess of an average crop; yet we had some partial failures. Potatoes were very promising until about the middle of August, when disease made its appearance, probably caused by the unusual amount of moisture and a week or two of very cool nights which occurred at that time, succeeding a season of strong growth, and thus checking them previous to maturity. Be this as it may, when dug the last week in September, fully a third of the crop was found to be useless. Onions, at an early stage of their growth, were attacked by the well-known root maggot, whose ravages thinned them out to about half a crop. Fall cauliflower, although planted the first of July, proved somewhat late,—the variety being Autumn Giant, perhaps not so suitable for general crop in this section as some others. Still, sufficient came in to meet the demand for a time, and, as a whole, the vegetable supply has met all requirements throughout the season, and what can be preserved are stored in sufficient quantity for winter use.

Orchard.

I regret to say that fruit trees, from a succession of severe winters, have suffered much in this locality. After the first severe winter of 1880-81, it was said by many of the hopeful that we may not have such a winter again for twenty years, but the fact is that three out of the four succeeding winters have proved equally as severe, and the last worse than the first. Such experience, we think, is sufficient to shake the faith and discourage the efforts of any one short of a confirmed enthusiast.

The young trees planted in the borders of the kitchen garden here ten or eleven years ago, about 280 in number, in the summer of 1880 looked as healthy and promising as any one could desire; but since then each successive year has had its victims, killing some and injuring the vitality of others, until nearly half the original number are gone. Composed of apple, pear, plum and cherry, all have alike shared in the devastation. The young orchard established in field known as No. 10, as an experimental ground for testing what varieties of fruits may be profitably produced in the Province, as well as showing to students and others the comparative merits of as many varieties as possible, from a small beginning in 1880, it was enlarged the three following years, until we had reached 130 varieties of apples, 55 of pears, 29 of plum and 21 of cherry, including in all nearly 1,400 trees. An attempt was made to keep up all the varieties by replacing all failures and adding to the collection from year to year as new varieties were commended, until last spring, when the number of deaths were found to be so great, and entirely from winter killing, that it was deemed inadvisable to continue the course hitherto pursued. On referring the matter to yourself and after consultation, it was decided to give up about a third of the field on the south side, which is low, flat and only partially drained in such a position that, on the occasion of a winter thaw or spring freshet, it has to take the surface water of over fifty acres. On this portion of the ground, containing from four to five hundred trees, we found but few with vitality enough left to be worth transplanting. The north half of the field which is more rolling, with a somewhat gravelly subsoil, the trees have stood better, although there are many vacancies throughout which I should recommend filling with the best hardy variety obtainable, and fortunately we have many good apples, chiefly of Russian origin, said to withstand the severest tests, and favoured by some fertile mind with the name of ironclads, such as Yellow Transparent, Tetofsky, Duchess of Oldenburgh, Haas, Alexander, Stump, Red Brietigheimer, New Brunswick, Pewauka, Ben Davis, Wealthy, Wallbridge, Mann, Rubicon, and others highly recommended as perfectly hardy varieties of good quality.

Small fruits, viz., Goosberries, Currants, Raspberries and Strawberries, planted in a portion of the orchard between the rows of the larger trees, fruited fairly well for the season. Goosberries and Currants were somewhat punished by the usual attacks of the

caterpillers which caused both attention and labour to keep them under, but sufficient fruit was produced for college use. Strawberries being planted between the lines of grape vines in rather an exposed situation, suffered considerably by winter killing, and consequently but a sparse crop was secured. Crescent Seedling kept the ground the best, and in early spring was quite promising, but the fruiting season was short. Cumberland Triumph and Monarch of the West were our next best, and produced an ordinary crop of fair sample. The remaining varieties were so much injured that but little could be said of their respective merits, and being for three years in the same ground materially interfering with efficient cultivation and fertilizing of the grape vines, we decided to make a new plantation in a portion of the apple orchard, which we did in September, planting from the varieties on hand in the following proportion: 1,500 Crescent Seedling, 1,200 Cumberland Triumph, 600 Wilson's Albany, 600 Monarch of the West, 500 Nicinor, 500 Maggie, 150 Alpha, and 150 Sharpless, in all about 5,000.

Raspberries, notwithstanding the severity of the winter, turned out better than expected; the Philadelphia was but little injured and bore an abundant crop; Cuthbert was our next favorite, having a fair crop of fine, large, firm and showy fruit; Herstine was perhaps the next in order, a hardy, vigorous grower, and fairly prolific, but the fruit is soft and watery, and does not stand handling so well as most of the other varieties; Turner, Thwack, Brandywine, Niagara, Clark, and Caroline, were all more or less killed back, although a limited quantity of fruit was procured from all; Black Caps, Davison's Thornless, Dorchester, Gregg, and Mammoth Cluster, whether from being on the lower part of the field or other cause, were the most injured, and but very little fruit was got from them, but on the whole, abundance of fruit was produced to meet all demands from the college and quite a few cases were marketed, which is a new departure for us.

Vineyard.

The grapevines, as stated in previous reports, are planted in field No. 17, north of the College buildings, and occupy a space of about two and a half acres. The planting was commenced in 1881, and the two following years enlarged to its present dimensions, containing about 750 vines in all, and embracing some 90 varieties, each having claims to some special property of merit according to the taste or prejudice of its originator or patron. Many of the newer and untried sorts were represented only by a single plant, and through failure or other mishap incidental to cultivation some of them were lost, and have not as yet been replaced, but the collection still contains from 70 to 75 distinct varieties, which with ordinary success could not fail to be interesting as well as instructive to the students or others interested in grape culture. Unfortunately, thus far our success has been very limited. Last two years, either by late season or early fall frosts, scarcely a bunch of good ripe fruit was matured. Still, the vines continue to grow healthy and some of them vigorous, but to keep them in this condition it is necessary to lay them down every fall and cover for winter protection. To make this practicable it is necessary to train and prune on the renewal system, that is, to grow the bearing canes on two horizontal limbs from each vine, the limbs being tied to the lower wire of the trellis, right and left, so that they may be loosened and lowered every fall for covering, an operation simple enough to perform, but causing a tax on time and labour in this section of the Province which is unnecessary in a more favoured locality. Having had almost a complete failure of the grape crop for two years in succession, we hoped for better success this season, and appearances during the spring and early summer months warranted this prospect. The healthy growth and weight of fruit on the vines were all that could be desired, but the season was late throughout, and from a continuance of cool weather and unusual amount of moisture during the month of August and first weeks of September the fruit of only a very few varieties were sufficiently ripe to be cut before getting injured by the early fall frosts. In looking over some notes of observation taken during the fall months, I find under date of September 1st the varieties Champion and Janesville just showing colour, evidently the earliest in the collection. Again, on the 7th, the above fairly coloured and as near equal as possible, but not by any means ripe, Moor's early and Massasiot colouring distinctly, and Early Dawn, Masatawney, Brant, Clinton, and

Othello just on the change. Sept 14th, after a week of very unpropitious weather for maturing grapes, we intended cutting a few of the earliest, but found that we had been anticipated by some smarter and less particular party, who in a very unceremonious way had helped themselves to the best they could find. On the 21st we cut about 100lbs of Moor's early, Massasiot, and Delaware. The 23rd showing a great indication of frost we cut all that was useful of the above named, as well as Brant, Early Dawn, Masatawny, Othello, Brighton, Lindley, Wilder, Clinton, and a very few Concords. The frost not proving so severe as we expected, we cut a few from day to day up to October the 6th, when the final cutting was made for the season, and included more or less of each of the following sorts,—Cottage Dempsey, No. 4, Ives Seedling, Black Hawk, Emmeline, Herbert, Gartner, Amber, Salem, Duchess, Alvery, Rogers No. 30, Lady, Barry, Merrimack, Hartford prolific, Wilden, Amber Queen and Worden, the majority of which, so far as the season would permit of judging, came in about equal with Concord, of which we secured only about one-third of the crop, proving as clear as may be from our experience of the past five years in this locality, that only the very earliest varieties of grape-vines can be relied on.

Forest Tree Clumps.

In 1880 and two following years, a number of tree clumps were planted on various parts of the farm, the objects being two-fold, first for landscape effect, in breaking views, and secondly for the purpose of showing what progress may be made by forest trees under cultivation; a question that of late years has caused considerable discussion among those who not only believe it to be our duty to do what we can to prevent the depletion of our forests, but who see that the time is not far distant, when it will become a necessity to replant in order to keep up a supply to meet the ever increasing demands for timbers; to such, our small experiment, however limited, may be of some interest. The first of these, a clump of five hundred black walnut planted between fields 17 and 18 four years ago, the plants were seedlings from six inches to a foot in height, and planted in rows seven feet apart, thus occupying about an acre of ground. The planting was a good average success, only a slight growth was made the first season, but for the last three years the growth has been healthy and vigorous, so that many of them now stand from six to eight feet high, with strong spreading, but very irregular, tops. Believeing that trees of this class having large top-roots would grow cleaner, taller and straighter specimens if not transplanted, an operation causing the cutting of tap roots, and thus checking the leading shoot, I havo this fall procured a small quantity of nuts of each of the following trees, viz: black walnt, butternut, hickory and sweet chesnut, planting the seed in a spare piece of ground where they may remain as permanent trees; in the course of a few years the effect of this experiment may be noted, as compared with those transplanted. Another clump planted the same year as the above, and consisting of nearly an equal number of European Larch, situated in field number two, intended to screen an old and somewhat unsightly gravel pit, lying almost in front of the College buildings; from being planted rather late in the season and many of the plants in poor condition, this group was a partial failure the first year, but renewed the following spring by filling up all vacancies and thoroughly cultivating the soil, they have since done remarkably well, and may be called an established success; some of the best trees have attained a height of from six to eight feet—although the soil is almost a pure gravel; showing evidently that the larch is suitable for land of this description. A clump of young butternuts was also planted in a similar soil and position as the above, in field number four, on the face of a gravel ridge adjoining a pit still in use; the ground was in sod at the time of planting, and from the extra amount of work on hand we were unable to give it due cultivation for the first two years, which undoubtfully had a deteriorating effect, but whether from this cause or unsuitable composition of soil it is difficult to determine. The plants, however, have never come up to our expectation, showing that free and healthy growth, characteristic of this tree under favourable conditions, but we have now in stock a fine healthy lot of young plants with which we intend to fill up all vacancies and give this group a further trial.

The two following years three additional clumps were planted, one of white ash, one of hard maple, and the third a mixed group, composed of black walnut, ash, birch, American larch, linden and elms; the white ash being planted in field No. 14 which was selected the following year for permanent experimental purposes, in consequence of which, this clump had to be removed; the plants were therefore carefully transplanted into close lines in our small nursery ground, where they still remain until a new situation is decided on.

The hard maple, from the roots getting somewhat dry in transhipment, and planted rather late in the season, did not succeed so well as we could wish. Although there were but few failures from planting, they started into growth very weakly, and the tops of many afterwards died off, but they are now pushing from the roots and lower portion of the stems, and we have no doubt, with a little training and pruning, most of them will ultimately become good trees.

The mixed group which was planted in a low lying and rather moist portion of No. 2 field has quite exceeded our expectations, especially last two years, by a luxurious, healthy and vigorous growth, so much so that in cultivating the past summer it was difficult for a horse to pass between the lines.

Nursery.—The nursery ground above referred to, is situated in, and laid out in accordance with the general plan of the experimental field; and was established three years ago for the purpose of keeping a stock of young trees and shrubs, for the renewal or extension of the arboretum and forest tree clump as may be required; the ground is only half an acre in extent, consisting of five plots, each one-tenth of an acre; the plots are bounded on the north and south sides by hedges of different shrubs, intended as permanent specimen hedges of a useful or ornamental character. With the exception of due and necessary cultivation, very little change has been made in the nursery this year, but the whole stock, consisting of walnut, butternut, hickory, white oak, ash, birch, elm, linden, maple, Norway and native spruce, etc., as well as barberry and other shrubs, over three thousand in all, having been three years in their present position, ought, and with justice to the trees, be transplanted the coming spring.

Greenhouses.—With the exception of some necessary and indispensable repairs to furnaces and flues, which have always been in a very defective condition, no material change has been made in the structure of the buildings, which consist of a greenhouse, an intermediate house and a propagating house. The two latter are required principally for the propagation and raising of bedding and other ornamental plants necessary to furnish the flower beds and borders, which of late years has been increased so that all our available room for plant raising is fully occupied, especially in the spring months, when we, in addition to the houses, require a good many hotbeds to furnish, as we did last spring, fully nine thousand bedding plants. In the larger building, we have a fair collection of ordinary greenhouse plants, a complete list of which was given in the report of 1883. They are chiefly of the soft wooded class, and, consequently, not the most expensive or difficult to grow. But, as I have stated on former occasions, I believe they are about all, both in variety and value, that can be grown with satisfaction in the present building, which is heated by flues of very defective construction. This season we have got some alterations and improvements made to the tool-house and work-shop connected with the greenhouses, which will make it more commodious and comfortable for the students during the winter months, when a portion of their time is devoted to practical instruction in this department, which consists of practice in grafting, budding, potting and the various modes of propagating and keeping up a stock of greenhouse, half-hardy and bedding plants—with general instruction as to temperature and moisture—including the use and general management of hot-beds, etc., etc.

For several years past, the senior division or second year students took a more complete course. by becoming acquainted with the technical and common names of all the plants we have in stock, as well as the family or natural order to which each belongs; but last winter, on account of experimental feeding of cattle, dairy work, etc., the senior students were not in this department during the winter months; consequently, the subject was deferred until after the Easter holidays, when Professor Panton took it up, and, no

doubt, did good service in thus practically illustrating his more systematic lectures on botany.

The following are the vegetables, fruits, etc., supplied to the College during the year.

JAS. FORSYTH,
Superintendent, Practical Horticulture.

January.

Onions, 3¾ bush. at 90c	$3 37	
Cabbage, 3½ doz. at 70c	2 45	
Carrots, 3¼ bush. at 25c	81	
Vegetable Marrow, 1¼ doz. at 60c	75	
Salsify, 2 bush. at 75c	1 50	
Parsnips, 4¼ bush. at 40c	1 70	
Turnips, 4 bush. at 20c	80	
Squash, 22 bush. at 5c	1 10	
Beet, ½ bush. at 30	15	
		$12 63

February.

Carrots, 5¼ bush. at 25c	$1 31	
Onions, 6¼ bush. at 90c	5 62	
Cabbage, 3½ doz. at 70c	2 45	
Turnips, 4½ bush. at 20c	90	
Parsnips, 5 bush. 40c	2 00	
Squash, 16 at 5c	80	
Vegetable Marrow, 10 at 5c	50	
Herbs, 4 bunches at 5c	20	
Beet, ½ bush. at 30c	15	
		$14 56

March.

Carrots, 8½ bush. at 25c	$2 12	
Beets, 1½ bush. at 30c	45	
Onions, 1½ bush. at 90c	1 35	
Squash, 33 bush. at 5c	1 65	
Cabbage, 2½ doz. at 60c	1 50	
Parsnips, 7½ bush. at 45c	3 37	
Turnips, 7½ bush. at 20c	1 50	
Herbs, 1 bunch at 10	10	
		$12 04

April.

Carrots, 8½ bush. at 25c	$2 12	
Squash, 24 bush. at 5c	1 20	
Parsnips, 7½ bush. at 45c	3 27	
Beets, 2½ bush at 30c	75	
Cabbage, 5¼ doz. at 75c	3 93	
Lettuce, ¾ bush. at 60c	45	
		$11 82

May.

Carrots, 4½ bush. at 25c.	$ 1 12
Salsify, 4½ bush. at 60c.	2 70
Parsnips, 3½ bush. at 45c.	1 57
Cabbage, 1½ doz. at 75c.	1 12
Turnips, 1 bush. at 20c.	20
Beets, 1½ bush. at 30c.	45
Asparagus, 435 bunches at 4c.	17 40
Rhubarb, 7 bush. at 75c.	5 25
Lettuce, 2 bush. at 70c.	1 40
Spinach, 1 bush. at 50c.	50
	$31 71

June.

Lettuce, 9 bush. at 50c.	$ 4 50
Rhubarb, 25½ bush. at 65c.	16 57
Carrots, 1 bush. at 25c.	25
Asparagus, 614 bunches at 4c.	24 56
Parsnips, 5 bush. at 45c.	2 25
Onions, 1 bush. at 90c.	90
Beets, ½ bush. at 30c.	15
Spinach, 13½ bush. at 50c.	6 75
Strawberries, 216 boxes at 7c.	15 12
Herbs, 2 bunches at 5c.	10
	$71 15

July.

Spinach, 8 bush. at 50c.	$ 4 00
Gooseberries, 112 qrts. at 8c.	8 96
Rhubarb, 5 bush. at 70c.	3 50
Lettuce, 6 bush. at 50c.	3 00
Asparagus, 131 bunches at 4c.	5 24
Strawberries, 508 boxes at 6c.	30 48
Herbs, 2 bunches at 5c.	10
Onions, 36 bunches at 5c.	1 80
Raspberries, 658 boxes at 6c.	39 30
Peas, 12½ bush. at 90c.	11 25
Beets, 3 bush. at 80c.	2 40
Currants, 88 qrts. at 10c.	8 80
Beans, 3½ bush. at $1	3 50
Potatoes, 7½ bush. at $1.25	9 37
Currants, white, 20 quarts at 10c.	2 00
Cauliflower, 22, each at 7c.	1 54
Carrots, 6 bunches at 5c.	30
Radish, 7 bunches at 5c.	35
Cabbage, 10 at 5c.	50
Cucumbers, 1½ pk. 2 doz, pickle and table.	1 00
	$137 39

August.

Potatoes, 29 bush. at 50c.	$14 50
Beans, 5 bush at $1.	5 00
Radish, 64 bunches at 5c.	3 20
Raspberries, 418 boxes at 6c	24 08
Cucumbers, 9½ bush. at $1.50	14 25

Rhubarb, ½ bush. at 60c.	30	
Cabbage, 7 doz. at 60c.	4 20	
Peas, 6 bush at 90c.	5 40	
Onions, ½ bush. at 80c.	40	
Currants, black, 3 quarts at 12c.	36	
Apples, 8 bush. at $1.20	9 60	
Carrots, 1 bush. at 35c.	35	
Tomatoes, 4 bush. at $1.25	5 00	
Corn, 43 doz. at 8c.	3 44	
Cauliflower, 6 at 5c.	30	
Beets, ½ bush. at 20c.	10	
Plums, 13 quarts at 10c	1 30	
		$91 78

September.

Pears, 1½ pks. at 50c.	$ 0 75	
Plums, 80 quarts at 8c	6 40	
Apples, 2 bush. at 50c	1 00	
Potatoes, 8½ bush. at 50c.	4 25	
Corn, 74 doz. at 8c.	5 92	
Cucumbers, 5 bush. at 75c.	3 75	
Tomatoes, 19½ bush. at 80c	15 90	
Celery, 10½ doz. at 60c.	6 30	
Onions, 1¼ bush. at 90c	1 12	
Cabbage, 14 at 5c	70	
Salsify, ½ bush. at 75c	37	
Citron, 50 at 5c.	2 50	
Vegetable Marrow, 12 at 5c	60	
Carrots, 1 bush. at 30c	30	
Radish, 6 bunchs at 5c.	30	
Grapes, 150 lbs. at 4c	6 00	
Potatoes, 110 bush. at 40c	44 00	
		$100 16

October.

Grapes, 137 lbs. at 4c.	$ 5 48	
Onions, 6½ bush. at 90c.	5 85	
Tomatoes, 14½ bush. at 60c	8 70	
Celery, 24½ doz. at 60c.	14 70	
Cabbage, 8½ doz. at 60c.	5 10	
Carrots, 5¼ bush. at 25c.	1 37	
Beets, 1½ bush. at 30c	45	
Radish, 6 bunches at 5c.	30	
Vegetable Marrow, 8 doz. at 60c.	4 80	
Turnips, 1 bush. at 10c.	10	
Cauliflower, 2⅓ bush. at $1	2 50	
Artichokes, 13½ bush. at 75c	9 92	
Herbs, 4 bunches at 5c.	20	
Parsnips, 1 bush. at 40c.	40	
Salsify, 8 bush. at 75c	6 00	
		$65 87

November.

Carrots, 6⅓ bush. at 25c	$ 1 63	
Celery, 24½ doz. at 70c.	17 15	
Onions, 2¾ bush. at 90c.	2 47	

Turnips, 6 bush. at 12c.	72	
Parsnips, 6 bush. at 40c.	2 40	
Beets, 2 bush. at 30c.	60	
Horse Radish, 1 doz. at 20c.	20	
Vegetable Marrow, 4½ doz. at 60c	2 70	
Cabbage, 4 doz. at 70c.	4 80	
Cauliflower, 8½ doz at $1.	8 50	
Red Cabbage, 9½ doz. at 65c.	5 85	
Herbs, 5 bunches at 5c.	25	
Radish, ½ peck at 20c.	10	
		$45 37

December.

Celery, 18½ doz. at 70c.	$12 95	
Onions, 5½ bush. at 90c	4 95	
Turnips, 8 bush. at 15c.	1 20	
Vegetable Marrow, 3 doz. at 60c.	1 80	
Cabbage, 4 doz. at 70c	2 80	
Carrots, 5½ bush. at 25c	1 37	
Beets, 1 bush. at 30c.	30	
Parsnips, 1½ bush. at 40c.	60	
Herbs, 2 bunches at 5c.	10	
Artichokes, ¾ bush. at 75c.	55	
		$26 62
		$621 10
Supplied to Prof. Brown at above rates		121 21
Sold and cash paid to Bursar.		74 37
Total		$816 68

Inventory—Stock and implements on hand, as per list in office ..... $1,813 25.

PART VI.

REPORT

OF THE

PROFESSOR OF DAIRYING.

The Honourable A. M. Ross,
Commissioner of Agriculture.

SIR,—In submitting this report I beg to state that the duties of my position are both numerous and varied. In fact they are now so numerous and varied as not to permit of complete justice being done to all departments. The work to be done comprises :—

1. *A course of lectures to students in the College.* These lectures, to be of value, must be practical and progressive. For lectures of the stamp indicated, the lecturer must think, improve, and, above all, study with attention in the works and periodicals devoted to the subject elsewhere. All of which, it is needless to say, requires much time.

2. *The management of the creamery.* This requires the undivided attention of one man. The sub-manager should be a person of some age and experience. Students are not competent.

3. *A series of experiments.* Dairy experiments require to be closely foliowed, and cannot be trusted to inexperienced hands. My time has been so much taken up with other departments of the work that very little attention could be paid to experimenting. Besides, the quantity of milk at our disposal for experimental purposes is far too small. During a portion of the year we have none at all. Some of the modern dairy appliances, such as centrifugal separators, are also required.

4. *Lecturing throughout the Province.* Never in the history of Ontario agriculture was there so much interest taken in dairy matters. The farming community is in great need of information, and eagerly asks for it.

5. *Answering numerous questions* on dairy subjects from all parts of the Province. Although we are not obliged to answer these questions, we are naturally forced by circumstances to do so.

This creamery was organized and already in operation when I took charge of it. I regret to state that a worse creamery section than Guelph I never met. The dairy herds are small and scattered, the routes are long and hilly, and in consequence the cost of drawing the cream is proportionately high. However, in spite of all these disadvantages, it is very gratifying to know that the creamery is a success, financially and otherwise.

FINANCIAL STATEMENT OF THE CREAMERY.

RECEIPTS FROM SALE OF PRODUCTS.

Butter sold	$12,253 00	
Butter sold to patrons	20 79	
Cream sold	12 00	
Buttermilk sold and collected	331 43	
Buttermilk sold to the farm	42 90	
		$12,660 12

EXPENDITURE.

Amount of Expenditure	$13,524 30	
Less Capital Account	1,041 54	
		$12,482 76
Balance		$177 36

Notes on Creamery Operations for the Season.

The quantity of cream received was 126,076 inches, and the quantity of butter made was 63,337 lbs., or 1.99½ inches of cream to a pound of butter.

The creamery was worked from the 18th of May to the 15th of October, or 129 days.

There were 225 patrons, who gave the cream from the milk of about 800 cows.

The milk was set twelve and twenty-four hours in common shot gun cans, 8½x17 inches for milk space, two inches of cream on which are supposed to make one pound of butter.

The average temperature at which the milk was cooled by patrons on the different farms was, for June, July and August, 52° Fahr.

The skimming was done by the teamsters, and the cream was brought every day to the factory.

The drivers or cream collectors received $2.00 to $2.25 for single horses, and $3.00 for teams, per day.

On arrival at the factory the cream was emptied into vats, and generally kept twelve hours before being churned.

The temperature at which the cream arrived at the creamery was: For July, 65°; for August, 64°; for September, 58°; and for October 56°; being an average of 60¾° Fahr.

In hot weather the cream was cooled to below churning temperature, and in cold weather it was heated to facilitate ripening.

It was churned at a temperature of 58° in plain box churns. Towards the end of the churning operation a quantity of cold water was added to the contents of the churn, in order to reduce the temperature and help the separation of the butter from the milk.

The butter was washed in the churn with cold water (ranging from 52° to 58°) after the removal of the buttermilk. It was then taken out of the churn, and from seven-eighths to one ounce of salt to the pound of butter was added to it. It was worked just enough to incorporate the salt throughout the mass, and allowed to stand in a cool place until the following morning.

The butter was then re-worked and closely packed in 56 to 70lb. white-ash or oak tubs; these tubs had previously been thoroughly soaked in brine. The average daily make was 491lbs.

Suggestions on Creamery and Dairy Management.

1. The cost of drawing the cream should be reduced. This could be done by drawing every second day, one driver going over two routes. If this suggestion be adopted the farmers will skim the milk, and keep the cream in a can set in cold water. The drivers will measure the cream in a tin pail with a steel rule.

2. The proceeds should be divided amongst the patrons according to the churn test or butter value of the cream furnished by different patrons.

3. The ice-house and butter storage of the creamery are both too small. The ice-house should be made into a butter storage and a new building constructed for storing ice.

4. The inside walls and the floors should be painted.

5. The best way to provide practical dairy work for the students would be to turn the farm, as much as possible, into a dairy farm, with cows well selected from the best of the common stock. The calving time could be so regulated as to obtain an even

supply of milk during the whole year. Then there would be at least from 400 to 500lbs. of milk per day to work upon. In this way experiments could be made and practical education given. At present the students work in the creamery while it is in operation, but the dairy season barely allows all the students to work a day or two each. This is evidently insufficient.

6. That experiments of practical utility may be performed, an ample supply of milk is needed; for some experiments have to be carried on through a whole season. Experiments on the following subjects would be of great value:—(1) Reducing the cost of milk production. (2) Milk *vs.* feed, bad milking period, temperature and methods of cream separation. (3) Effects of heat and cold upon milk and its products. (4) The development of keeping quality in butter. (5) Milk and cream testing instruments. (6) Dairy utensils and machinery.

THE CREAMERIES OF ONTARIO.

The demand for information in connection with the establishment and working of creameries is now very great, and I shall devote most of the present report to the treatment of this important subject.

According to your instructions, I visited most of the creameries of Ontario and gave to proprietors and patrons whatever advice and information was thought necessary. Unfortunately, at the season when visited, there was but a part of them in operation. I have gathered information on this subject which I hope will prove of value.

As far as I have been able to ascertain there are, in Ontario, twenty-eight creameries, exclusive of the College one, of which sixteen are conducted on the cream gathering plan; seven on the flat pan plan; three on the centrifugal plan; one on the deep setting plan; and one on the deep setting and centrifugal plan. Twenty-five are making butter only, and three are making butter and skim milk cheese.

During the last season four creameries were worked as cheese factories, but, on the other hand, eight new creameries were started.

No. of Creamery. Stock Companies. Private Concerns.	How many years in operation
Stock Company.	
1	
2	
3	
4	
5	
Private concerns	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
Total..16	4
Averages.....	

No. of Creamery. Stock Companies. Private Concerns.	How many years in operation.	Quantity of Butter made last season.	Number of patrons.	Number of patrons using Ice for milk setting.	Average number of Cows in herds.	Number of Cream gatherers Employed.	Daily wages of gatherers using their own teams.	Daily wages of gatherers using the creamery teams.	Kind of cans used for milk setting.	Number of times the cream is drawn.	Patrons allowed to skim cream into a special gauge can.	Patrons allowed to skim into any can. Cream measured in a pail with a rule by drivers.	Cream measured on the setting can.
Stock Company.							$ c.	$ c.					
1	5	.....	120	50	5	2	.....	.....	Cherry.	Ev'ry 2d day	....	Yes	....
2	4	53274	120	30	5	3	2 00	.....	Cooly.	"	Yes	.....	....
3	3	35839	142	95	5	3	2 00 / 3 00	.....	"	"	....	Yes	....
4	1	29550	80	30	5	2	1 50 / 1 75	.....	Sturgeon	"	....	Yes	....
5	2	20503	90	60	4	2	2 00	.....	Cooly.	"	Yes	.....	....
Private concerns													
6	8	68840	170	45	6	3	.....	1 15	Cooly.	"	Yes	.....	....
7	2	53100	....	.....	....	....	.....	.....	"	"	Yes	.....	....
8	3	36283	110	None	....	2	.....	.....	"	Every day.	....	.....	Yes
9	2	30000	80	40	5	2	2 00	.....	"	Ev'ry 2d day	Yes	.....	....
10	1	27180	....	.....	....	....	.....	.....	"	"	Yes	.....	....
11	2	26000	75	4	5	2	.....	0 80	Cherry.	"	....	.....	Yes
12	3	18210	57	14	6	1	of butter 1½c. ₰ lb.	.....	Cooly.	"	Yes	.....	....
13	2	15000	25	4	7	....	.....	.....	Cherry.	"	Yes	.....	....
14	1	15000	30	6	4	1	.....	1 00	"	"	.....	Yes	....
15	1	12000	42	6	6	2	.....	1 00	Cooly.	"	Yes	.....	....
16	1	10068	35	3	6	1	.....	.....	"	"	Yes	.....	....
Total..16	41	450847	1174	387	69	26	14 25	.....	.....	.....	....	.....	....
Averages.....	2½	30056	84	27	5	2	2 00	.....	.....	.....	....	.....	....

Returns distributed to patrons according to butter value of cream.	Cream tested how often?	Cost of drawing per lb. of butter.	Price paid per butter inch of cream.	Combined cost of making butter and drawing cream per lb.	Kind of vat used to hold cream.	Kind of churn used.	Kind of butter worker used.	Engine and Boiler. Number of horse-power.	Cost of building and plant.	Remarks.
Yes	3 times a m'nth	2 cts.	.....	.....	Cheese vat	Blanchard	Lever	4 x 6	$2000	Build'g 30x36 ft
....	.....	.....	15 cts.	4½c.	.....	Cylindrical Box churn.	"	"	.....	
Yes	Every week.	1½ cts.	16 cts.	.....	Cream vat	"	"	"	.....	
Yes	3 times a m'nth	.....	.....	4c.	Cheese vat	Blanchard	"	"	1500	
....	.....	.....	13 cts.	4½c.	"	.....	"	"	.....	
....	.....	.....	14 cts.	.....	"	Blanchard	"	3 x 10	.....	
....	.....	1⅓ cts.	15 cts.	.....	Cream vat	Blanchard and barrel.	"	Water power	.....	
....	3 times a m'nth	.....	14 cts.	.....	Cheese vat	Dash churn	"	4 x 6	.....	
....	.....	.....	14 cts.	.....	"	Blanchard	"	6 x 10	.....	
....	.....	.....	14½ cts.	.....	"	.....	"	.....	.....	
Yes	3 times a m'nth	.....	.....	4c.	"	Blanchard	"	4 x 6	.....	
....	.....	1¾ cts.	14½ cts.	.....	"	.....	"	8 x 10	.....	
Yes	3 times a m'nth	.....	15 cts.	.....	"	Box churn	"	Horse power	.....	
Yes	.....	.....	.....	4½c.	Cream vat	"	"	6 x 8	.....	
....	.....	1⅛ cts.	14 cts.	.....	"	"	"	6 x 10	.....	
....	.....	.....	.....	4c.	Cheese vat	"	"	Water power	.....	
....	.....	7 11-12 cts.	1.59	25½c.	.....	.....	.....	.....	.....	
....	.....	1.6	14 1-11 cts.	4⅛c.	.....	.....	.....	.....	.....	

Cost of building and plant.	Remarks.
$2000	Build'g 30x36 ft
1500	

Creameries Managed on the Cream Gathering Plan.

The foregoing table shows the following facts of creameries of this description, the average age is two and a-half years. The youngest is one year old, and the oldest eight years. The average number of patrons is 84. The average product of butter is 30,056 pounds. The average number of patrons using ice for milk setting is 27, or nearly one-third of the whole. The average number of cows in herds is five. The average number of drivers employed at a creamery is two, or one driver for every 45 patrons. Most of the creameries draw the cream every second day. Ten creameries allow the farmers to skim the milk into a specially constructed cream gauge can, in which it is measured by the drivers. Five creameries allow the farmers to strain into any can. The cream is measured in a special pail, with a steel rule, by the driver. In two creameries the cream was measured by the drivers in the setter can. Six creameries applied the churn test, and distributed the proceeds to the patrons, according to the butter value of the cream. The cost of drawing the cream is about 1.6 cents per pound of butter, and the combined cost of drawing the cream and making the butter averages $4\frac{1}{6}$ cents per pound of butter. The average price paid to drivers is $2.00 per day.

Remarks on the Stock Creameries.

No. 1.—The building is two stories high, the lower of brick and the upper of wood. Everything was nice and tidy about the factory. This is one of the first cream-gathering factories of Ontario. It was managed for a number of years by Mr. George Browning, one of the pioneers of the Ontario Creameries.

No. 2—The building is a good one. It was constructed for the flat pan system. This factory was conducted for five years under the flat pan method, but was changed into a cream-gathering creamery four years ago. I believe the centrifugal could be used here with advantage.

No. 3.—The building was only temporary, and a new one is being put up. This paid the largest dividends of any factory in Ontario. The cream was drawn most of the time twice a week, a practice not to be recommended, especially during hot weather. Nearly all the patrons used ice in connection with milk setting.

No. 4.—The building is two stories high, half stone and half wood. It is badly divided; dark, damp, too small and low, and the machinery is not well placed. The building and plant cost $1,500.

No. 5.—The building is two stories high, of stone and wood. It is badly divided. The plant is inconveniently situated. The churn used is antiquated.

Remarks on the Private Creameries.

No. 6.—An old cheese factory building transformed into a creamery. There are too many buildings, which are rather dark and gloomy.

No. 7.—A good stone building, formerly used for making butter and skim cheese. It is doing a good business, but requires a better place for storing butter.

No. 8.—The building is a good one, but dark and damp. It is to be improved for next season. The butter was cheesy during the hot weather. This defect would disappear if ice were used by the patrons and the creamery.

Nor 9.—Fine brick building, formerly used as a cheese factory. The creamery own the horses and waggons for hauling the cream, and the drivers are hired by the day. One horse travels from twenty to thirty miles a day, and brings from 1700 to 2200 pounds of cream.

No. 10.—The building is small and the churn is antiquated.

No. 11.—The building was formerly used for a cheese factory, and is in a rather dilapidated condition. It will be renovated for next season. The owner uses his own horses for drawing the cream.

No. 12.—The building is too small, low and damp, and the churn is out of date. The plant is inconveniently placed. I found the cellar flooded by a spring. When a current of water is used for cooling a cellar it should pass through it in a tin pipe or spout.

No. 13.—The building is to be enlarged and improved for next season. A submerged and ventilated can is used.

No. 14.—The plant is conveniently placed, but the building is rather light.

No. 15.—This being a new creamery, a temporary building was used. A new building is being put up.

No. 16.—The plant is inconveniently placed.

Defects and Difficulties of Cream-gathering Factories.

The defects of these creameries may be classified under three heads:—(1) In the buildings; (2) in the requisites; and (3) in handling, setting of the milk, and transporting of the cream. A few buildings are very good, but there has been a tendency to erecting buildings with but little regard to the purpose for which required, and without any regard to conditions necessary to save labor and protect the product against deleterious influences. As a rule, the buildings are too small, too low, too dark and damp. They lack ventilation and drainage. The floors are constructed of poor material—the general placing of the plant is inconvenient, thus throwing unnecessary labor on the operator. The vessels generally used for holding the cream in the factories are simlar in construction to cheese vats. Such vats do not cool the cream with sufficient rapidity, neither do they cool it low enough. Many of Blanchard's cylindrical churns are used. The objections to this churn are the following:—(1) A portion of the cream adheres to the inside of the cover and remains unchurned; (2) it requires a great deal of attention at the end of the operation to prevent overchurning. The quality of the creamery butter is yet much impaired by the want of care of the milk and cream on the farm. Cleanliness and temperature, two of the most important elements in milk setting, are in a great many places ignored. The milk is kept near the stables or barn yard. It is sometimes set in unclean vessels. and, as a rule, at a too high temperature. In consequence, the cream is sour or tainted, and the butter is cheesy and off flavor. Hardly one-third of the patrons use ice in connection with milk setting. They generally use well or spring water, and the temperature of such water soon rises in the tanks above 50° Fahrenheit. The water in the tanks is changed occasionally, but in many cases not often enough. In the summer months such a mode of cream separation leaves nearly one-third of the butter fat in the skim milk. This is proved by the result of a chemical analysis of skim milk obtained from patrons of the O. A. C. Creamery in the mouth of August. The milk was set at the ordinary temperature of well and spring water, or at about 50° Fahr.

AVERAGE RESULTS OF 12 AND 24 HOURS SETTING.

Patron's Number.	Temperature of Milk at the time of Setting.	Butter Fat Contained in the Whole Milk.	Butter Fat Contained in the Skim Milk	Percentage.
		Lbs.	Lbs.	
1	86 Fahr	3.50	0.723	21 Per Cent.
2	94 "	3.30	1.267	34 "
3	88 "	4.32	1.290	30 "
4	88 "	3.90	1.090	27 "

According to the result of these experiments, the average quantity of butter fat left in the skim milk, of 100 pounds of whole milk, is 29 per cent. of all the butter fat, or 1½ pounds.

At the end of the milking period, when the milk is "heavy," a good portion of the cream remains in the skim milk. This peculiarity of the milk does not exist in the same degree of intensity in all the farms; but I am aware that in October last, on one farm sending cream to a gathering factory, it took from 35 to 40 pounds of milk to make a pound of butter, when from the same milk it should not have required more than 20 lbs.

Taking all the facts into consideration it is not surprising to find that creameries have not given large returns to patrons.

Let the farmers use plenty of ice in connection with milk setting. Let them cool the milk below 40° Fahr. A judicious use of ice will give more butter, save the labor of pumping the water and filling the tanks three or four times a day, besides keeping the cream and skim milk in fine condition for the creamery and the farmer. The use of ice will allow the cream being drawn every second day without any trouble.

The cream drivers are, as a rule, a cause of trouble. Some factories own the horses and waggons, and hire men to drive them. It is said that this plan gives far better satisfaction than when the drivers are hired with their own teams at so much per day.. In this case they are interested in having short routes and bringing small loads. The best way is to hire the cream drivers at so much per pound of butter brought by themselves to the creamery. The price paid ranges from $1\frac{1}{4}$ to 2 cents per pound. One horse should draw cream enough to make from 150 lbs. to 200 lbs. of butter at a load. Two horses should draw cream enough to make from 200 lbs. to 400 lbs. of butter, according to the size of the herds and the length of the routes.

The proceeds should be distributed according to the butter value of each patron's cream, as determined by the test churn. The extreme limit of variation, as determined in this way, is from 3 to 12oz. ; the average is from 5 to 9oz. of butter from a quart of cream.

Milk-gathering Creameries

There are two on the deep setting method. One is owned by a Company, the other is a private concern.

In the Stock Company, four cents a pound is charged for making butter, and two for cheese. It costs 25 cents to work 100 lbs. of milk into cheese and butter.

In the private concern the quantity of butter made was 59,140 lbs. ; deep setting and centrifugal plans combined. Average quantity of milk required to make a pound of butter, $25\frac{3}{4}$ lbs.; average net value of 100 lbs. of milk, 63 cents. Some farmers bring the milk once and others twice a day. Three and a half cents is charged for making. Butter sold from 19 cents to 23 cents per pound ; average price, $20\frac{1}{3}$ cents per pound.

Flat Pan Creameries.

There are seven creameries worked on this plan. All are private concerns.

No.. 1.—Butter made, 23,000 lbs. First class building. Farmers bring the milk twice a day. Twenty-six pounds of milk required to make a pound of butter. The milk was bought, and paid 80 cents during the last season. This was too high if the price of butter be considered.

No. 2.—Butter made, 39,308 lbs. First class building. Took from 24 lbs. to 28lbs. of milk to a pound of butter. Farmers bring the milk twice a day.

No. 3.—Butter made, 16,000 lbs. Good building. Pounds of milk to a pound of butter, 26. Butter sold from 19 cents to 22 cents per pound. Charges $3\frac{1}{2}$ cents for making. Farmers pay $1.25 per cow to have the milk brought to the creamery.

No. 4.—Butter made, 10,000 lbs. Good building. Pounds of milk to a pound of butter, 26. Three cents a pound is charged for making, This price is too low. Place well kept and neat. There is a lack of interest on the part of the farmers ; lecturing would do there some good.

Nos. 5, 6 and 7.—I did not visit.

As a rule, the buildings are very good. The milk is brought twice a day by the farmers themselves. In some cases the patrons pay $1.25 per cow per season for the carrying of the milk. This is equal to $1.25 a ton. It takes from 24 lbs. to 28 lbs. of milk to make a pound of butter, or an average of 26 lbs.

Centrifugal Factories.

Of these there are three, all private concerns.

No. 1.—First year in operation. The proprietor is entitled to a great deal of credit for the pluck and energy displayed in the management of this enterprise. Number of patrons, 75. Average size of the herds, six cows. Milk drawn on some routes from as far as seven miles. Cost of drawing the milk, $2.50 a ton. Quantity of milk received, 667,331 lbs.; butter made, 25,951 lbs. Pounds of milk to a pound of butter, 25.71. The creamery was worked 138 days. Average quantity of milk received per day, 4,834 lbs. Three De Laval milk separators are used for skimming milk. Maximum quantity of milk worked per hour by one separator, 600 lbs. The milk is drawn once a day, in the morning, and the skim milk is returned to farmers in the forenoon of the same day. The building is 18 ft. by 27 ft., and with the plant it cost nearly $2,000. The building is too small, and the general placing of the machinery is inconvenient. However, the patrons are well pleased and there is a very good prospect of a reduction in the cost of drawing the milk, by an increase of patrons, etc.

No. 2.—First year's operation. Butter and cheese made; cheese during the latter part of the season only. Number of patrons, 14. Size of the herds, eight cows. Milk drawn 2½ miles. Cost of drawing the milk, $2.60 per ton. Average quantity of milk required to make a pound of butter, 25 lbs. Milk brought once a day to the factory. One De Laval separator used. Good prospect for an increase of business next year.

No. 3.—Butter and cheese made. Milk received, 633,392 lbs. Butter made, 8,331 lbs. Cheese made, 54,352 lbs. Cost of drawing the milk, from $1.00 to $2.50 a ton; average, $2.00. The building is to be enlarged for next season. The farmers are well satisfied. Two DeLaval separators used. The milk is brought once a day to the factory.

Some of these creameries have not given such good results here as elsewhere. Many centrifugal creameries established in other parts of the Dominion have repeatedly shown results of 22½ lbs. and 23 lbs. of milk to a pound of butter. It took 25lbs. and 25¾ lbs. in Ontario. This may depend to a certain extent on the milk, but I am inclined to think that the inferior yield of the Ontario centrifugal creameries is due to a want of experience in their management.

Some of the agencies tending to decrease the butter yield of the centrifugal creameries are the following:—(1) The partial skimming of the milk on the farm. (2) Feeding too much milk to the separators. (3) Insufficient cooling of the cream obtained from heated milk. Things to be remembered in using a milk separator:—(1) The quantity of butter fat left in the centrifugal skim milk should not exceed 0.25 per cent., or four ounces per 100 lbs. of whole milk. (2) Let the speed be constant. Use the best of regulators on the engine, and a belt strainer on all separators. (3) Regulate the inflow of milk according to the square of the speed, and also according to the known capacity of the separator. When the speed decreases, diminish the inflow; when the speed increases, increase the inflow. (4) Skim the milk while warm from the cow. If this be inconvenient, the milk can be warmed to 88° Fahr. before skimming. (5) For cold milk, let the inflow be one-third less than for warm milk. If a machine skims 1,500lbs. of warm milk in an hour, it will skim 1,000 lbs. of cold milk during the same time. (6) Regulate your separator, or the skimming tubes of the same, so as to allow from 15 to 18 per cent. of the liquid to come out in the shape of cream. (7) As the season advances and the quantity of fat contained in milk increases, diminish the inflow proportionately. (8) Keep the working parts very well oiled. Use for this purpose the very best of lard oil. (9) Clean immediately after using. These notes are to be applied to all milk separators, as they are all constructed on the same principle.

General Remarks.

Out of 29 creameries six are owned and managed by stock companies. Regarding creameries owned by stock companies, one reliable person should be manager. Such institutions managed by half a dozen very seldom succeed.

Good butter makers are scarce. There is now a good opening for young men willing to go into dairying. There seems to be a desire to get cheap butter makers, cheap milk or cream drivers, in fact, everything cheap. It is wise, economy, to pay fair wages to a good workman. Cheap butter makers will make cheap butter. The difference between the value of good butter and of cheap butter amounts to more than two cents per pound. If you are making 300 lbs. of butter per day, two cents a pound equals $6.00 a day, or $180 per month, lost by employing an inferior hand.

Cost of making Butter on the Cream-gathering Plan.

The table on page 188 shows the average to be $4\frac{1}{6}$ cents per pound ; but I am inclined to believe that many managers, being pressed by a close competition, do not allow enough for wear and tear and interest on the capital. At present it may be estimated as follows :

To draw the cream from $1\frac{3}{4}$ cts. to 2 cts. per pound of butter.
To make the butter " $1\frac{3}{4}$ " 2 " "
Wear and tear and interest on capital, from $\frac{1}{2}$ ct. to 1 ct. per pound of butter.

The average would probably be $4\frac{1}{2}$ cents. The cost of making may be reduced according as the cost of drawing decreases, and the quantity of butter made in one factory increases.

The cream-gathering plan is the most advantageous to start with in all sections, where the herds are small and scattered. In localities where the drawing of the milk would not cost over $1.75 per ton, the centrifugal may be used with advantage.

Requisites of the Cream-gathering Plan.

The milk-room should be away from the barnyard, and also from all odors and smells, in a dry airy position. The room should be kept scrupulously clean and well-ventilated. The proper place is near a spring or a well from which the water can be easily led to it. The milk-room should be well protected against the heat or rain. It should not be forgotton that dampness is deleterious to milk and its products.

The vessels generally used for setting the milk are deep cans holding from 40 to 50 pounds of milk. Provided the milk is cooled below 40° Fahrenheit, and kept in a place where the air is pure, the size, form, or submersion of a can, has but very little effect on the quantity and quality of cream obtained. The best can for the purpose is the one which will give ventilation, combined with rapid cooling and easy cleaning.

Whether the milk cans are to have guages or not, depends altogether upon the method of measurement adopted by the creamery.

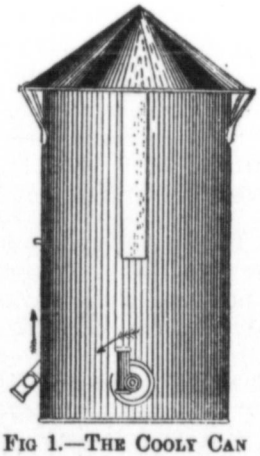


Fig 1.—The Cooly Can

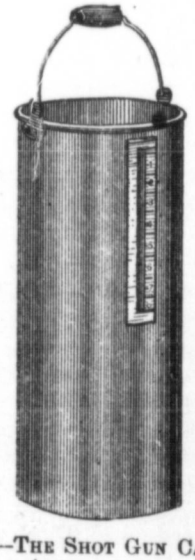


Fig. 2—The Shot Gun Can.

The skimmers generally used for taking the cream from the top of the cans are conical in form.

The size of the tank should be adapted to the number and form of the cans used. The tanks should be four inches higher than the cans. There should be a space of five inches between each can and between the last two cans and the extremities of the tank. It should be large enough to hold three milkings, and should be divided so as to hold each milking separate. These tanks are made of good dry two-inch lumber, with or without double sides. With double sides, the vacant space, (two or three inches) between the sides is filled with charcoal or saw dust. These tanks are sometimes lined with zinc or tin. If not lined with tin, a coat of varnish or paint should be given inside, as is done with brewer's vats. This precaution makes them easier to clean.

The milk should be set immediately after milking, and cooled down below 40 degrees Fahrenheit. First fill the tank two-thirds full of cold water, then strain the milk into the cans, and set them into the water. Let the warm milk stand say twenty minutes; the top of the water in the tank should then be drawn off, (as it has become warm) and replaced with fresh water, and a sufficient quantity of ice to keep the temperature below 40° during at least twelve hours.

When skimming from the top of the can care should be taken not to disturb the cream any more than can be helped. Place the skimmer so as to let cream into it slowly, remove it full of cream, and so continue taking the cream from one place. Do not run after the cream with the skimmer; such practice mixes the cream with the milk.

Three different plans have been used for measuring the cream in connection with the gathering plans.

1st.—It is measured on the setter can by the cream collector, who also skims the milk. A gauge placed in the inside of the can, at the top, indicates the number of of inches, and two inches of cream are supposed to make a pound of butter. In some cases the cream is measured in the can and skimmed alternately, one day by the cream collector, and the next by the patron.

2nd.—The farmers are allowed to skim the milk, and the cream is kept in a can bearing a gauge from the bottom upwards, in which it can be measured later by the cream collector. In this case the skimming must be done eight or ten hours before the arrival of the gatherer, in order to allow that portion of the skim milk which is necessarily mixed with the cream to separate again and settle at the bottom of the can.

3rd.—The milk is skimmed by the farmers, and the cream is kept in any can in cold water. It is measured in a special pail with a steel rule by the collector. This method does away with all gauges, either in the setting or cream cans. But it can only be used in connection with the test churn. In this case the proceeds of the factory are divided according to the butter value of the cream.

The Building.

The essentials of a good Creamery building are:—1. Ample space, ample height between floors, plenty of light, good ventilation and perfect drainage. 2. The building should be divided, and the machinery placed with an eye to convenience and saving of labor. 3. It need not be ornamental, but it ought to be tasteful and neat. 4. It should be substantial and secure against changes of temperature. 5. It should be wide so as to allow of more compactness in the placing of the plant, and also so that it could be enlarged with little trouble and expense without impairing this compactness which is so desirable. 6. It may have two stories, according as a dwelling is required for the operator.

A stone wall, 18 inches thick, is excellent for the purpose. A brick wall, with a dead air space, is also excellent.

Some wooden walls are constructed in the following manner:—Place on the sills upright, 3 or 4 by 10 or 12 inches, from 3 to 4 feet apart; over these, on both sides, nail rough boards and fill in with sawdust; next, side and ceil with pine timber. In some cases, previous to nailing the rough boards, the studding is covered on both sides with ceiling paper, and the space between the two papers remains empty.

The following description of a good wall was given to me by Prof. Roberts, of Cornell Universty :—1. On sills which are made of lumber 6 x 6 inches, place 2 x 4 inch studding, from 16 to 18 inches apart. 2. Fasten a layer of strong building paper to the face of the studs which is turned towards the inside of the building. 3. At a distance of 2 inches from the first layer of paper, between each couple of studs, insert another layer of paper. It is held on by strips of wood nailed to the studding. 4. To the outer edge of the studding nail a third layer. It must be remembered that the paper runs up and down. Each strip of paper will cover two spaces. To make this clearer, we may state that a strip laid on will cover the edges of three studs. 5. On the inside and outside, over the edges, where two strips meet, nail slats of wood an inch thick, making the joints as air tight as possible. 6. Over these slats, on the outside of the building, nail tongued and grooved boards as tightly as possible. On the inside nail narrow timber, tongued and grooved, and give it an oil finish.

This plan gives a wall about $7\frac{1}{2}$ inches thick, containing four air chambers. The two central ones are two inches, and inside and outside ones, one inch each.

The roof of such a building is made double. This effect is obtained by boarding the rafters on each side. It forms a draft chamber from the eaves to the ventilator at the peak. The draft chamber is left open under the eaves. Wooden walls should stand on stone foundations, carried below the line of frost.

Floors may be made of stone flags, well burnt bricks, cement or asphalt. When flags or bricks are used the interstices should be filled with cement, so that they may be easily cleaned. When wood is used it should be neatly and tightly matched, and well covered with a couple coats of paint. Floors of any description should be made to incline from each side to a fixed line of depression, so that all slops may be quickly removed, or drained into a gutter specially built for this purpose.

The windows, which should be large, may stand four or five feet from the ground. There should be a good number of them, especially on the north side. Outside wire screens are attached to them to keep out the flies, and also outside blinds or shutters to exclude the light when it is required to do so.

Ventilation should be sufficient to completely renew the air in the room from time to time. For this purpose a series of flues are sometimes constructed in the walls. When opened they create a draught towards the central ventilator, which should be from twenty to twenty-four inches square.

The Cream-gathering method requires a building with five or six divisions :—1. A cream room. 2. A churn room. (These may be united into one). 3. A butter store room. 4. An ice house. 5. An engine room which may also be used for a wash room. 6. A store room. The cream room containing the cream vats should be in front of the working room. The floor of the cream room should be thirty inches higher than that of the churn room so as enable the cream to run off itself from the vats into the churns.

The churn or working room is that in which all operations of butter making are carried on. It should be in the centre of the building and have easy and free access to all other parts. It generally contains the churns, the butter worker, the salt box, the scales, the hot water tank, etc. The cream and churn rooms may be in one, provided that the vats are properly constructed and kept covered when necessary. In the plans given below the cream and churn room can be made into one or two at will.

The engine room should stand near the working room. In the case of a small creamery it should be placed on the side farthest from the ice house. In the case of a large creamery it can be placed on either side of it.

Butter is no longer stored in cellars in the best creameries. Cellars, it is well known, are often damp and musty. The mould would appear in such places, which does not improve the flavor or the keeping quality of butter. The custom at the present time is to build a store room on a level with or slightly below the rest of the building. It is generally built against the ice house, and two openings are made through the walls of the latter into the store room, one close to the floor and the other close to the ceiling, in order to create a current of cold air from the ice house into the store room. These openings are provided with sliding covers, by which the current can be increased or decreased at will, thus regulating the temperature.

An ice house should have a well drained and air-tight foundation. The walls should be built to exclude the outside air. Ample ventilation should be maintained over the ice. The walls are now made from 15 to 18 inches thick, and no sawdust is allowed inside. A covering of clean straw or, better, of swamp rushes, is all that is required. Dairy ice houses are no longer a separate construction from the best creamery buildings. They form a part of the whole, and are built against the butter store room, so as to cool the latter as well as the rest of the building. The cold air may be brought from the ice house to the working room, etc., by means of pipes.

When ice houses form a part of the dairy or creamery building the entrance to the ice house should be in the garret. In front of this entrance a porch should be built, underneath which a shaft is constructed reaching almost to the floor of the working room. In the wall of the ice house at different heights are openings into this shaft. Through these the ice is thrown into the shaft, from which it falls into a box at the bottom of the shaft. The bottom of the shaft is covered with iron plates to protect it against the blows of the blocks of ice. The shaft is closed by means of a trap door.

A. Cream ro
B. Working
C. Ice house

1, Cream vat
9, engine; 10, te

PLANS OF CREAMERIES.

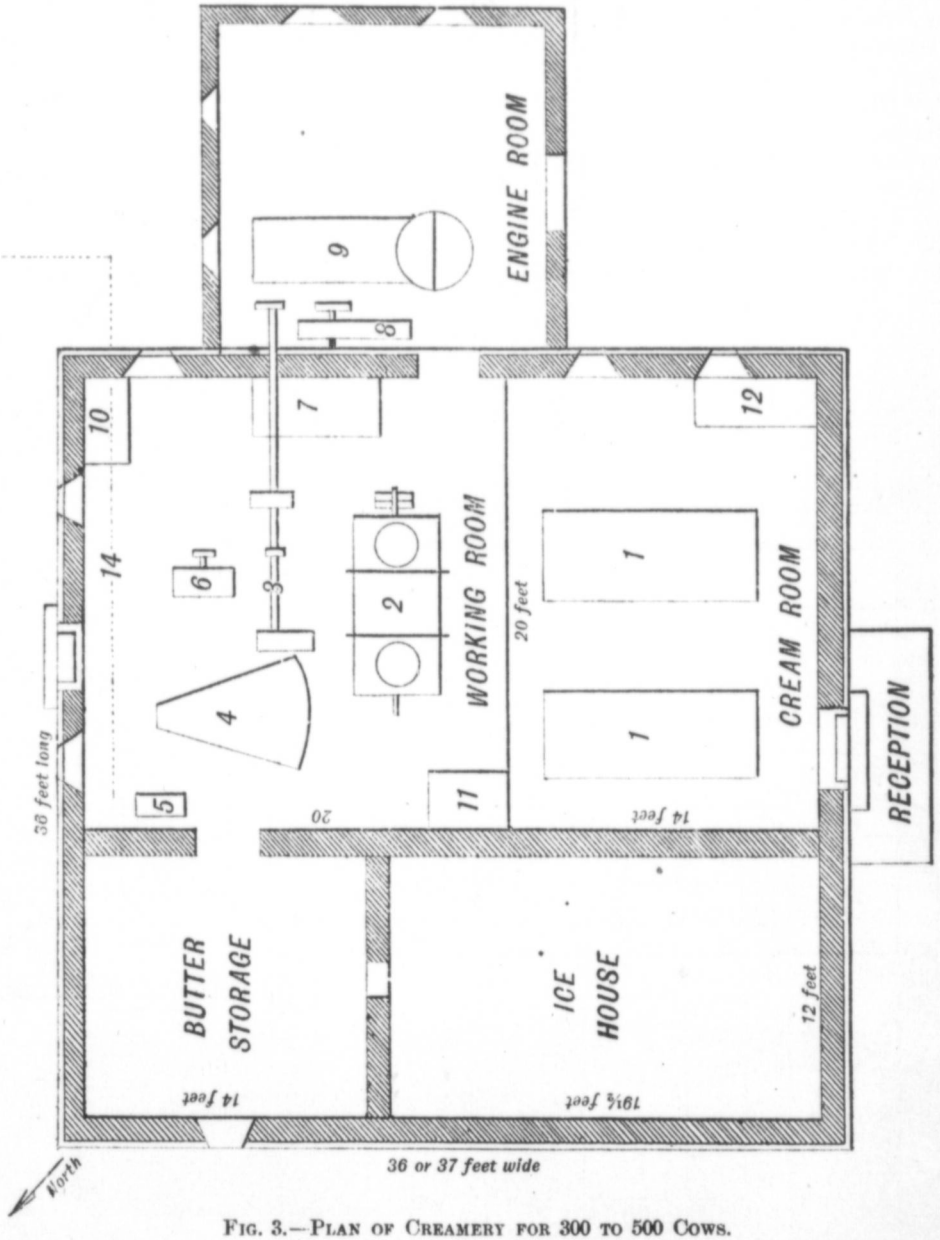


FIG. 3.—PLAN OF CREAMERY FOR 300 TO 500 COWS.

A. Cream room, 14 by 18 feet.
B. Working room, 20 by 18 feet.
C. Ice house, 12 by 20 feet.
D. Butter Storage, 12 by 14 feet.
E. Engine house, 15 by 18 feet.
F. Reception stand, 5 by 10 feet.

1, Cream vat; 2, churn; 3, shaft; 4, butter worker; 5, salt box; 6, water tank; 7, ice box; 8, boiler 9, engine; 10, test churn; 11, table: 12, desk

Ground plan No. 4 is intended for a creamery working the cream of from 800 to 1,200 cows.

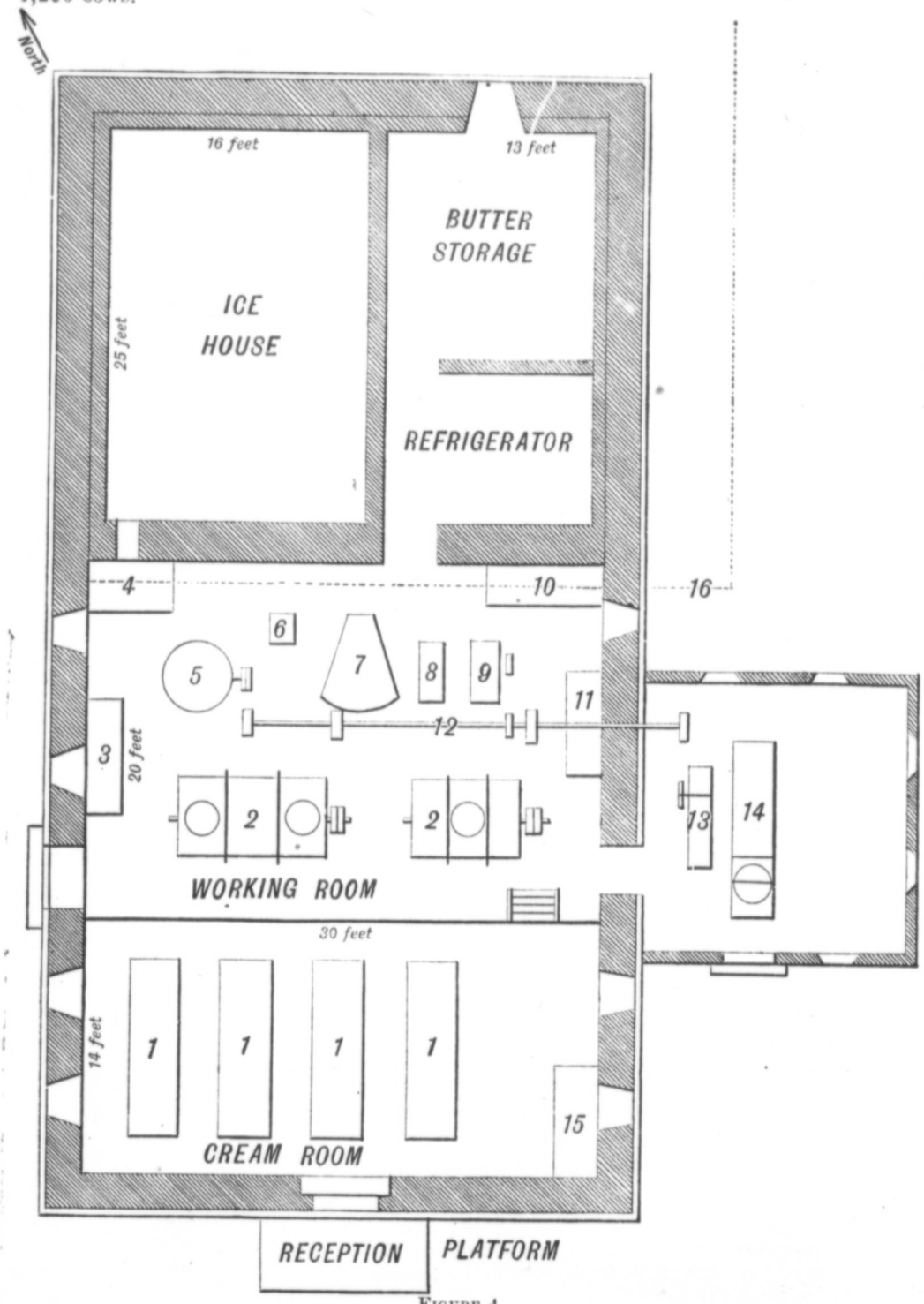


FIGURE 4.

A. Cream rooms, 30 by 14 feet.
B. Working room, 30 by 20 feet.
C. Ice house, 25 by 16 feet.
D. Butter storage, 14 by 16 feet.
E. Refrigerator, 28 by 14 feet.
F. Engine house, 15 by 15 feet.
G. Reception stand, 5 by 10 feet.

1, Cream vat; 2, churn; 3, shaft; 4, butter worker; 5, salt box; 6, water tank; 7, ice box; 8, boiler; 9, engine; 10, test churn; 11, table; 12, desk; 13, test churn; 14, prepared tub; 15, table; 16, drain.

Plan No. 3 is meant for parties wishing to start on a small scale. When an increase of business necessitates a large building, all that is required to be done is to pull down the partitions extend the platform across the entire width of the building, and put up an addition at the back of it for an ice house and butter store room. The engine, shafting, the churns, and even the doors are in the right position. By this means a creamery building equal in size to No. 4 is obtained.

It is in the cream transportation can that the cream is carried from the farm to the factory. It holds twenty to thirty gallons. The body is generally made of the best XXXX tin, the jacket of galvanized iron, with a dead air space to keep the cream cool. With some cans this space contains several thicknesses of building paper, which affords still more protection against the heat. A float placed inside of the can prevents the churning of the cream during transport.

FIGURE 5.—THE TRANSPORTATION CAN.

In some cases large wooden vessels lined with tin are used for transporting the cream.

The covered skimming pail is used by drivers to transport the cream from the farmer's milk house to the cream waggon. In this pail the cream is sometimes measured with a steel rule. A butter inch of cream in the pail should be equal in bulk to two inches of the same liquid in the 8½x20 inch setting can.

The cream vats are used to hold the cream, and to cool or warm it, if required when it comes to the factory. They are constructed somewhat like cheese vats, with the difference that the space between the tin and wood vats is much larger. It is from four to six inches at both sides, and at one end. This space is made larger for the purpose of filling with ice in order to cool rapidly the cream obtained in warm weather. (See Fig. 6)

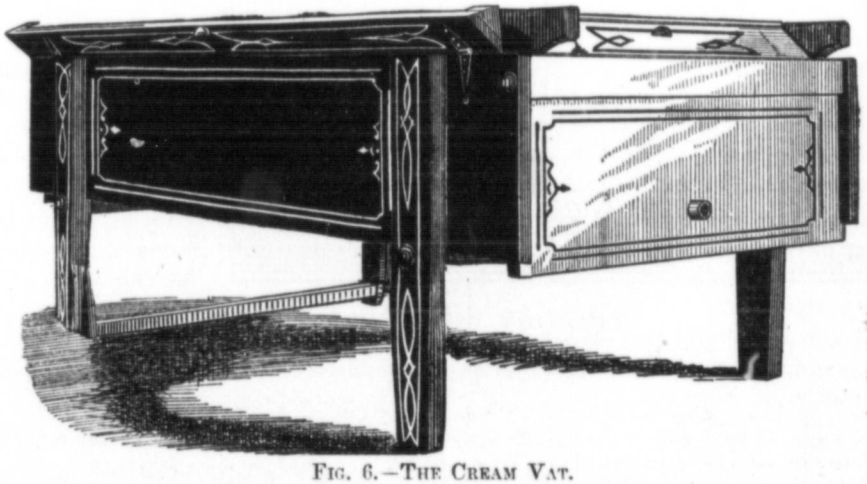


FIG. 6.—THE CREAM VAT.

Following are the specifications for a 200 gallon cream vat :—

Inside length of wood vat, 6 feet 8 inches ; inside width of wood vat, 4 feet 8 inches ; inside height of wood vat, 14½ inches. Length of tin vat (inside measure) at the top, 6 feet 11 inches ; length of tin vat (inside measure) at the bottom, 6 feet 9 inches ; width of tin vat (inside measure) at the top, 3 feet 1½ inches; width of tin vat (inside measure) at the bottom, 2 feet 11 inches. Height of tin vat (inside measure) 16 inches.

The tin is nailed inside to a frame 2x4 inches. It rests on 2½x1 inch slats, nailed to the bottom of the wood vat. The tin vat is hooked to the wood vat. These vats are also provided with water and cream faucets. The cream faucet is 1¾ to 2 inches in diameter.

The extremity of the vessel upon which are fixed the faucets is called the front part, the opposite end is called the back part of the vat.

A cold water inflow consisting of a rubber pipe fixed to the back part enters the wooden vat near the bottom of it. A cold water outflow is found in the front part of the vat, one inch from the top of the wooden vat. The height of the vat is two feet ten inches from the floor. It stands on four or six legs. The lumber used is 2½x6 inches. The length of the legs is nineteen and a half inches, with the exception of the front ones, which are only seventeen and a half inches. The dumping arrangement is very simple. To the front legs is bolted a moveable frame (see fig.), which when placed vertically, raises the front of the vat on a level with the back. When this frame is moved out of the vertical line the vat is inclined forward.

The Cream Strainer is used to strain the cream into the vats and churns. This strainer is of tin, with perforated bottom and sides, and made to fit the openings of the churn. It can also be held on a frame stretched across the cream vat.

Fig. 7.—The Cream Strainer.

The Churn.

I know of no better factory churn than the revolving box. It is made to hold from 100 to 500 gallons of cream. To churn to the best advantage, it ought not to be filled more than half full. Thus, a 400 gallon churn will churn 200 gallons of cream. The wood used in the construction of the churn may be of white pine, white wood, oak or beech, free from sap, knots, shakes or pitch. It is generally put together with white lead cement, to insure durability and tightness in all the joints. It is strengthened with heavy braces (3x2 inches) fastened with iron rods, tightened by nuts.

Large churns should have two openings, one at each extremity of one of the sides. A strong piece of glass one and a-half inches in diameter, fixed in one of the sides, allows the operator to examine the contents during the operation. The churns may be of the following sizes :—

For 400 and 500 gallon churns, from seven to eight feet long by two feet nine inches wide ; openings, sixteen inches in diameter ; the axle is from two to two and a half inches in diameter.

For a 300 gallon churn, four feet ten inches long, by two feet nine inches wide ; one opening in the center, sixteen inches in diameter.

Each churn should be provided with fast and loose pulleys so that it may be stopped at any time, without interfering with the rest of the machinery. A continuous and self-acting vent placed in the axle is very desirable for churning gathered cream. The churns are generally hung on eight inch square posts, running from floor to floor. The axles may stand two feet ten inches from the floor.

Steam power workers are used in some of the large creameries, but the lever is yet the best of the two. The use of a power worker for kneading butter requires great care and attention. As a rule such workers are very apt to injure the grain of the butter.

A factory lever worker is made V shape, five feet wide at one end and one foot at the other. The height is two feet four inches at the highest extremity, and two feet at the lowest, giving a slant of four inches; length, four and three-quarter feet Some use one lever, others use two. These levers are generally made octagonal in shape. The worker described above requires levers six feet long by four inches in diameter.

The test churn consists of an uncovered flat box fixed on a frame, which, when in operation, moves to and fro. In the box can be placed horizontally from twelve to twenty-four tin jars. Springs hold the jars in place. They can be put in or removed while the churn is in operation.

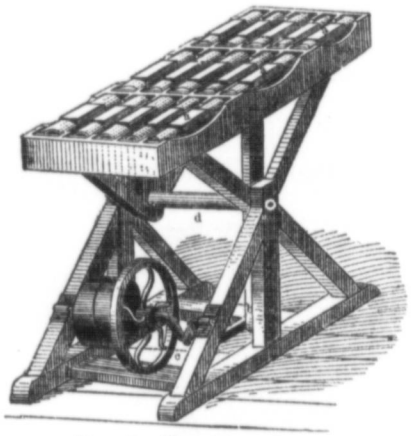


FIG. 8.—THE TEST CHURN.

Fig. 9 represents a number of test collecting tin cans, holding exactly one quart. A number is stamped on the top, and a tin tag with corresponding number is furnished with each.

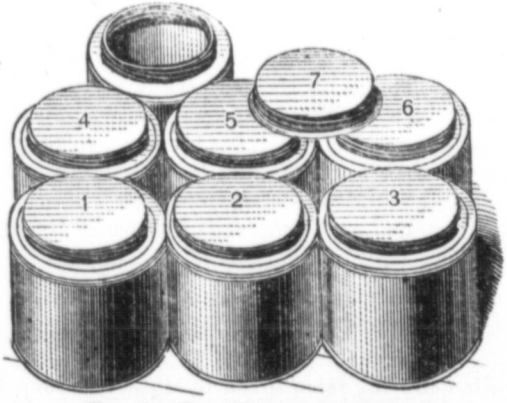


FIG. 9.—THE COLLECTING CANS.

The quantity of cream used for a test is exactly one quart. This quantity is supposed to be equal in bulk and value to one inch of cream on the setting can ($8\frac{1}{2}$ x 20 inches), or half an inch in the measuring pail.

Supposing that a sample of cream yields half a pound of butter, it would indicate that the patron's cream was going one pound to the butter inch of cream, either in the setting can or the pail ; so the standard of results is half a pound of butter per quart of cream.

The samples of cream are collected by the drivers. After thoroughly mixing the cream to be tested, by turning it three or four times from one vessel into another, a sample is taken, and the test can be completely filled. No skum should be allowed to accumulate at the top of the test can and so reduce the quantity of cream contained in it. The number of the can is registered in a book opposite the patron's number, and brought to the factory. After filling the churn jars from the collecting cans, place your thumb over the vent tube and shake violently several times ; let the gas escape, and repeat the operation of shaking at least three times. Then place the jars in their respective places in the churn, and when the churn is filled to one-half its capacity set it in motion ; the remaining places can be filled while the churn is in motion. In this way the butter will come in the jars at different times, and will keep the operator busy putting in, working and taking off. When a jar is sufficiently churned remove it and pour full contents into a dipper having a perforated bottom. After the butter-milk has drained off, the dipper is moved up and down in a pail of clean cold water, until every trace of butter-milk is removed from the butter. Allow all the water to drain out, shake the butter into a mass, weigh it, and credit the amount to patron. The difference over or below the standard is added to or taken from the number of inches. A ready-reckoner is used, showing at a glance the number of pounds of butter contained in a given number of inches of cream, at any number of ounces per cent. obtained by testing.

The Rubber Mop is quite handy in butter and cheese factories. The iron should be strong and the rubber " pure gum " about a foot in length.

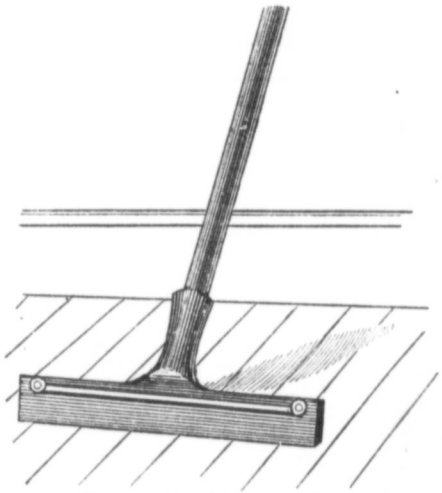


FIGURE 10.—RUBBER MOP.

THE CENTRIFUGAL PLAN.

The centrifugal plan requires the milk to be brought once a day to the factory. It consists in separating the cream from the milk by centrifugal force.

Fig. 11 represents an apparatus for straining and cooling the milk kept on the farm over night. It is made in three parts—1. The base, a dish-shaped receptacle. 2. Into the receptacle is placed a vessel like an inverted butter-tub. 3. On this latter is placed a pail with a perforated bottom. The inverted tub-like vessel is simply a cooler containing the cooling medium.

The warm milk is emptied into the pail ; it is distributed in a thin sheet over the cold conical surface ; it collects into the dish below, and finally falls into a pail or milk can

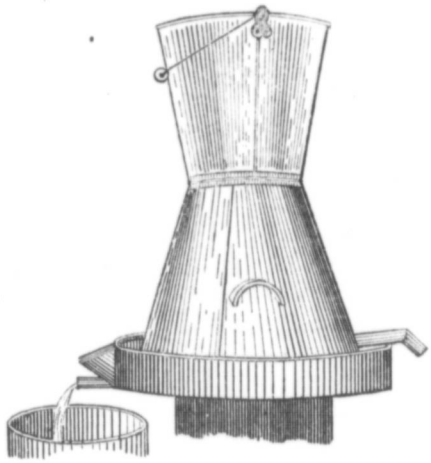


FIGURE 11.—THE MILK COOLER.

The milk carrying can is made with a solid pressed iron bottom and hoisting handles. It holds from 15 to 40 gallons of milk.

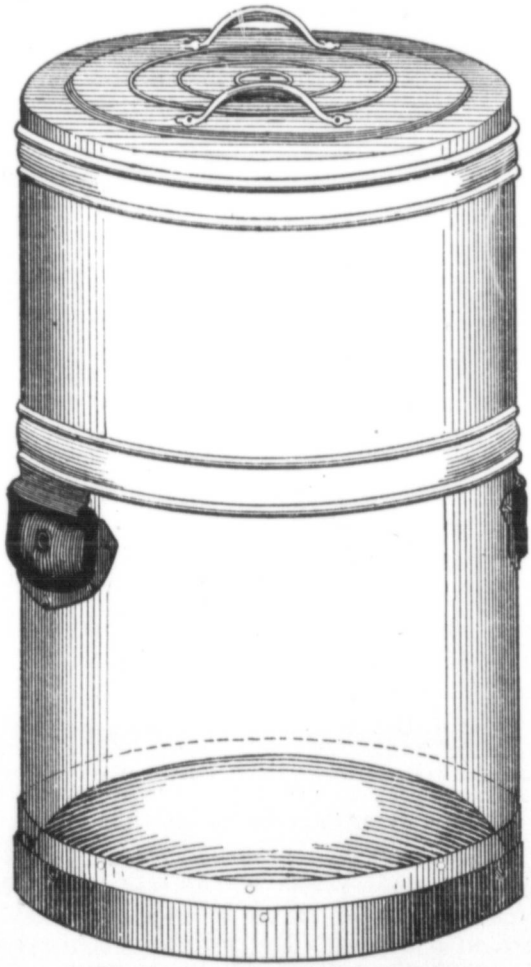


FIG 12.—THE MILK CARRYING CAN.

The Building.

For the construction of building see instructions given on page 194 and the following :

The centrifugal method requires a building having six divisions. 1. A churning room. 2. A working room. 3. A butter store room. 4. An ice house. 5. An engine room. 6th. A general storage.

The centrifugal room contains the milk vat, the centrifugal separators and heaters, the churns, the cream cooler, the cream vat, etc. It should occupy the front part of the building.

Centrifugal factories require a cool room for butter-making, in which the butter is worked and salted. In it are found the butter worker, salt box, butter scale, etc.

For the construction of butter store rooms and ice houses, see page 195.

The engine and boiler-room should be placed against one of the sides of the centrifugal room, so as to allow of easy communication between the two.

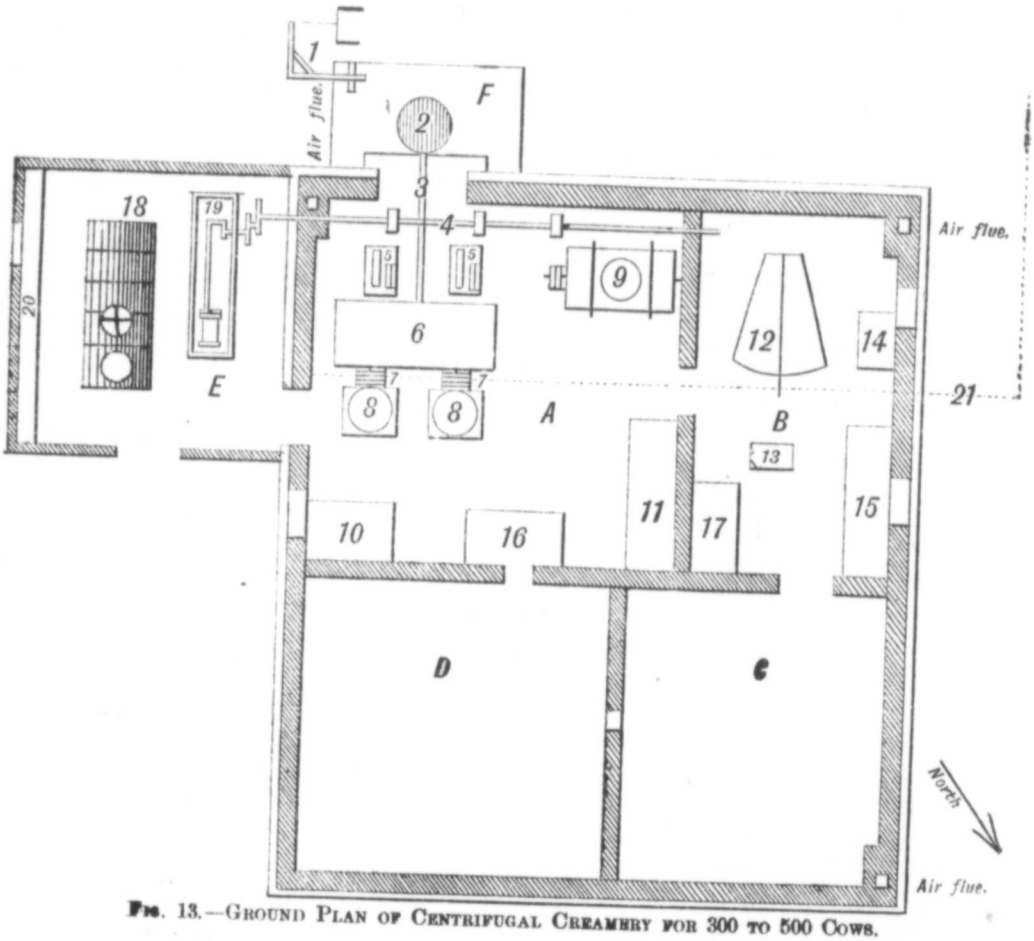


Fig. 13.—Ground Plan of Centrifugal Creamery for 300 to 500 Cows.

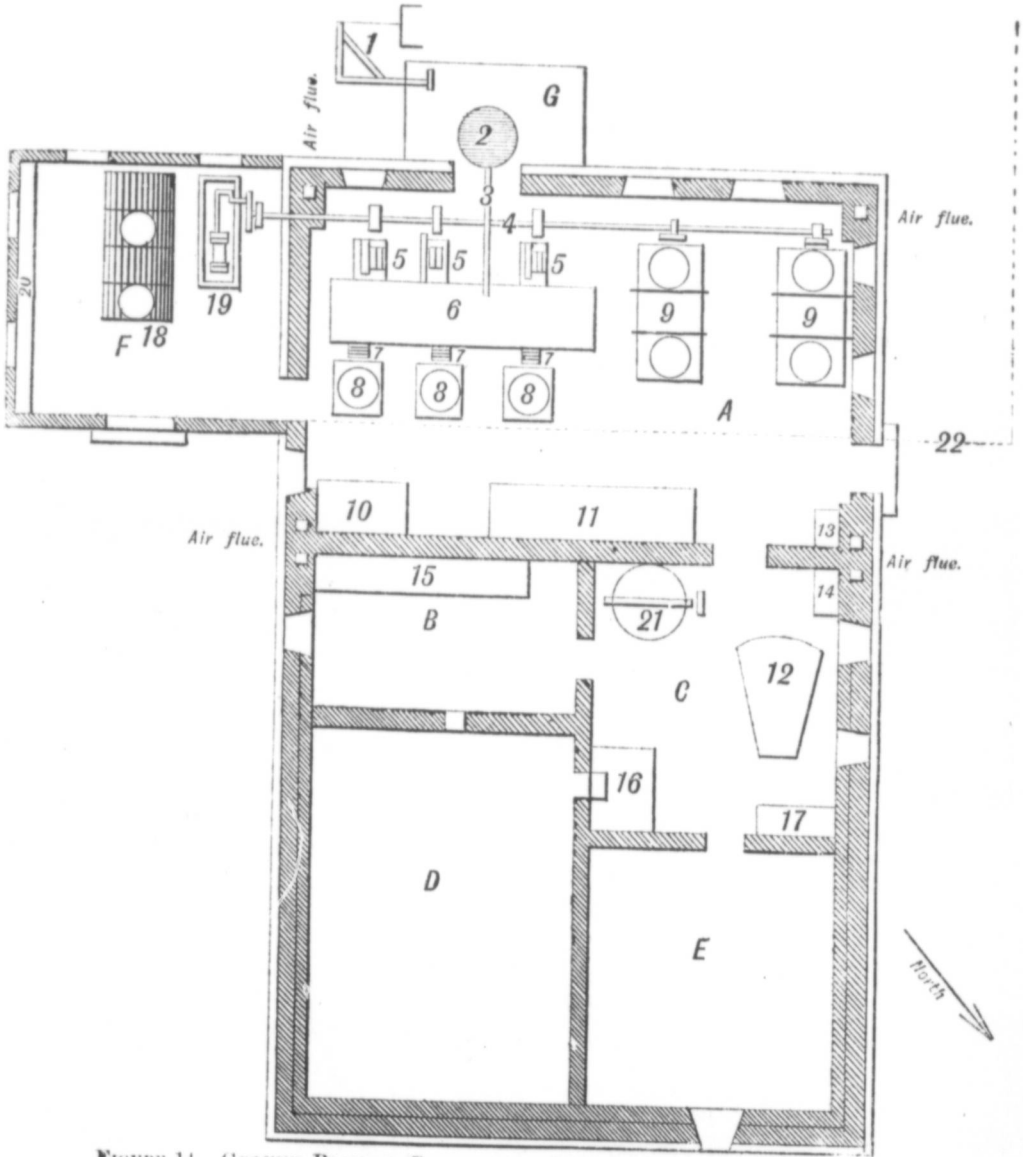
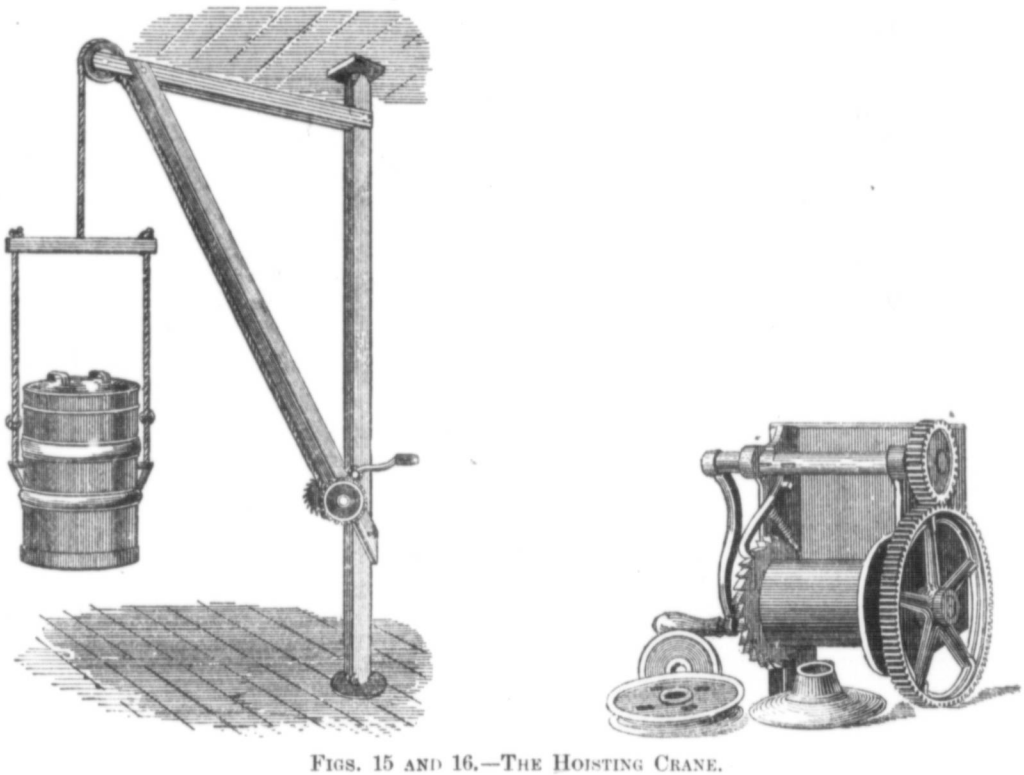


FIGURE 11.—GROUND PLAN OF CENTRIFUGAL CREAMERY FOR 800 TO 1,000 COWS.

Fig. 15 and 16 represent a hoisting crane for lifting milk cans from the waggon to the reception stand.



FIGS. 15 AND 16.—THE HOISTING CRANE.

The Platform Scale is provided with double and sometimes treble beams, and enables the operators to weigh three or four cans of milk before emptying the weighing can.

The Factory Weighing Can is made with large heavy sheets of tin, with convex bottom, pitched so as to empty quickly. It is provided with a $2\frac{1}{2}$ inch to 3 inch discharge gate, and contains from 40 to 80 gallons of milk.

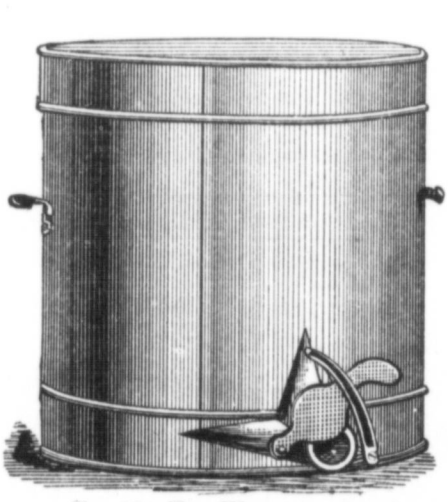


FIG. 17.—THE WEIGHING CAN.

Hereen's Lactoscope is a simple and convenient instrument used in the following manner:—Place a drop of milk over the centre of the round piece of ebonite. Next place the varnished side of the round glass over it in such a manner that the varnished part of the glass will correspond with the central ring of the ebonite.

FIGS. 18 AND 19.—HEREEN'S LACTOSCOPE.

On account of its opacity, the milk will resemble in color one of the parts of the painted glass, according to its quality. The quality of the milk is indicated by the words:

Cream.	Less Fat.
Very Fat.	Poor.
Normal.	Very Poor.

This instrument will in a moment detect poor milk, but can not determine the quantity of water added or cream extracted from it. Its purpose is to detect poor milk, which must be further examined by more efficient instruments.

Lactometers and Creamometers consist of three glass jars and lactometer. The smallest of these is a one per cent. jar, called a creamometer; the other two are equal in size. The lactometer, when plunged into the milk will sink more or less, according to the density of the liquid. This instrument is generally used at a given temperature, generally 60°. It can also be used at any temperature by using a correction table to get at the exact result. In the creamometer a small quantity of milk is set, and the cream is raised; a graduated scale on the sides of them. When filled with milk they should be kept in a cool place 24 hours.

In order to be complete, this mode of testing requires three operations:—1. The testing of the new milk with the lactometer. 2. The raising of the cream from the same milk in the creamometers. 3. The testing of the skim milk with the lactometer. Good new milk should indicate from 97 to 102 on the lactometer. Doubtful milk would show from 103 to 105, and very poor or skimmed milk, from 106 to 112. Good milk should give no less than 8 per cent. of cream in the creamometer. The difference between the results of the whole milk and skim milk tests by the lactometer should be at least 7. That is, a sample of new milk showing 103 should indicate 110 when skimmed.

Milk-testing tubes serve to test the quality of the milk obtained from different patrons. They are very good to indicate which sours first, taints, etc.

FIG. 20.—MILK TESTING TUBES.

Fjord's centrifugal milk controller is the best and most accurate instrument yet devised for testing milk in a butter or cheese factory. With this instrument the proceeds of the milk gathering creameries can be distributed to the patrons according to the butter value of milk furnished by each. It is also useful for determining the quantity of fat left in the skim milk. It should be used in centrifugal creameries. It can determine in a few minutes the richness of twelve or more samples of milk. It consists of a scalloped disk of copper, which can be made to revolve upon the spindle of a large size Burmeinster and Wain Centrifugal, or on any other rapidly revolving vertical pivot. To this disk can be hooked from 2 to 34 copper tubes. In these tubes are placed graduated bottles, holding samples of milk (see fig 21). When at rest, these tubes assume a perpendicular position and hang down, but when in motion they fly out and become horizontal, like the two at the right of the figure.

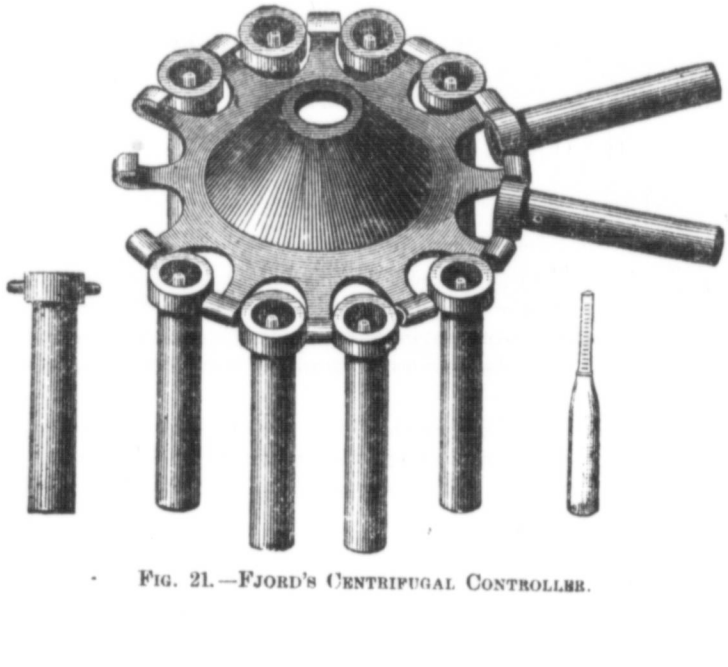


FIG. 21.—FJORD'S CENTRIFUGAL CONTROLLER.

Each bottle has on its neck a scale divided into units and halves, from 0 to 12, to indicate at the end of the operation the quantity of cream in the milk. These bottles are numbered so that they may be identified.

The separation takes place by centrifugal force in the milk bottles, the cream accumulating in the neck. The bottles are first half filled with the milk to be tested, (a mark on the outside indicates the half). The remaining space is then filled up with hot water to mark O in the neck, and the whole is heated up to 90° Fahr. When the milk has attained the required temperature the bottles are placed in the metal tubes, at the bottom of which rubber is placed to prevent breakage. The disk is then made to revolve.

Mr. Fjord estimates that 40,000 revolutions are required to completely separate the cream. This apparatus should not be made to go faster than 1200 revolutions per minute.

Allow for the time which the disk takes to reach the maximum speed one half the number of revolutions per minute that is counted when it has attained the highest speed.

For the first four minutes, while the machine is acquiring the required speed, we count 600 revolutions per minute; this gives for these four minutes 2400 revolutions. There now remain 40,000 revolutions, less 2400 to be made, equal to 37,600. The machine having acquired its speed is then running 1200 revolutions a minute. Therefore, the number of times which 37,600 will contain 1200 is exactly the number of minutes which it will take to complete the operation. This is $31\frac{1}{3}$, and $31\frac{1}{3}$ added to 4 is $35\frac{1}{3}$ minutes, the time required.

The Conductor Heads are used in connection with open conductor spouts, to carry the milk from the weigh can to the receiving vat.

A piece of strainer cloth, stretched double over a frame such as described in Fig. 22, is better than a wire gauze strainer. This strainer is placed across the receiving vat.

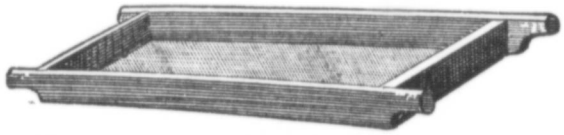


FIG. 22.—A STRAINER.

The receiving vat is simply a tin-lined box, from 8 to 16 feet long, 3 or $3\frac{1}{2}$ feet wide and about 18 inches high. Gates placed in one of the sides, near the bottom of the vat, feed the milk through heaters, into the milk separators. The bottom of the vat slopes towards the side on which the gates are fixed, in order to empty with facility. These vats stand upon legs.

Heaters are used in connection with the mill vats and centrifugal separators, to restore to cold milk a part of its cream yielding power. They consist of a copper box with an inclined ribbed surface. A perforated spout is placed across this inclined surface, at its highest extremity.

In operation, the cold milk falls through a tap from the receiving vat into the perforated spout over the inclined surface, and by the time it reaches the other extremity it has acquired sufficient heat to be led through a pipe directly into the separators. Thus the milk is constantly heated, and only in sufficient quantity to feed the separators.

The Burmeinster & Wain separator, whose action is continuous, consists of a hollow steel drum revolving on a vertical axis. This separator differs from others in the manner of removing the cream and skim milk. Two curved metallic tubes (see fig. 23) are used which are screwed on and curved around the safety cap of the drum without interfering with its workings. These tubes draw up the cream and skim milk from their respective receptacles. They are pointed at both ends, and are inserted one in the inside surface of the cream ring and the other in that of the skim milk ring. They are moved to and from the centre of the drum, thereby cream of any desired thickness (from the consistency of butter almost to the consistency of milk) can be obtained while the machine is working. The drum has attached to its inside three vertical flanges extending five inches towards the centre. These flanges extend from the bottom almost to the top. They serve a double purpose: (1) They prevent the milk from revolving independently of the drum. (2) They serve to support the cream cover. The cream cover is a horizontal, flat ring of metal which rests on these vertical flanges. It does not touch the sides. Its use is to keep the cream and skim milk separate at the outflow. With this separator the skim milk, by means of elevating tubes, may be raised by centrifugal force six or eight

feet, and led into a cheese vat reservoir, or to a great distance from the factory to a barn, etc.

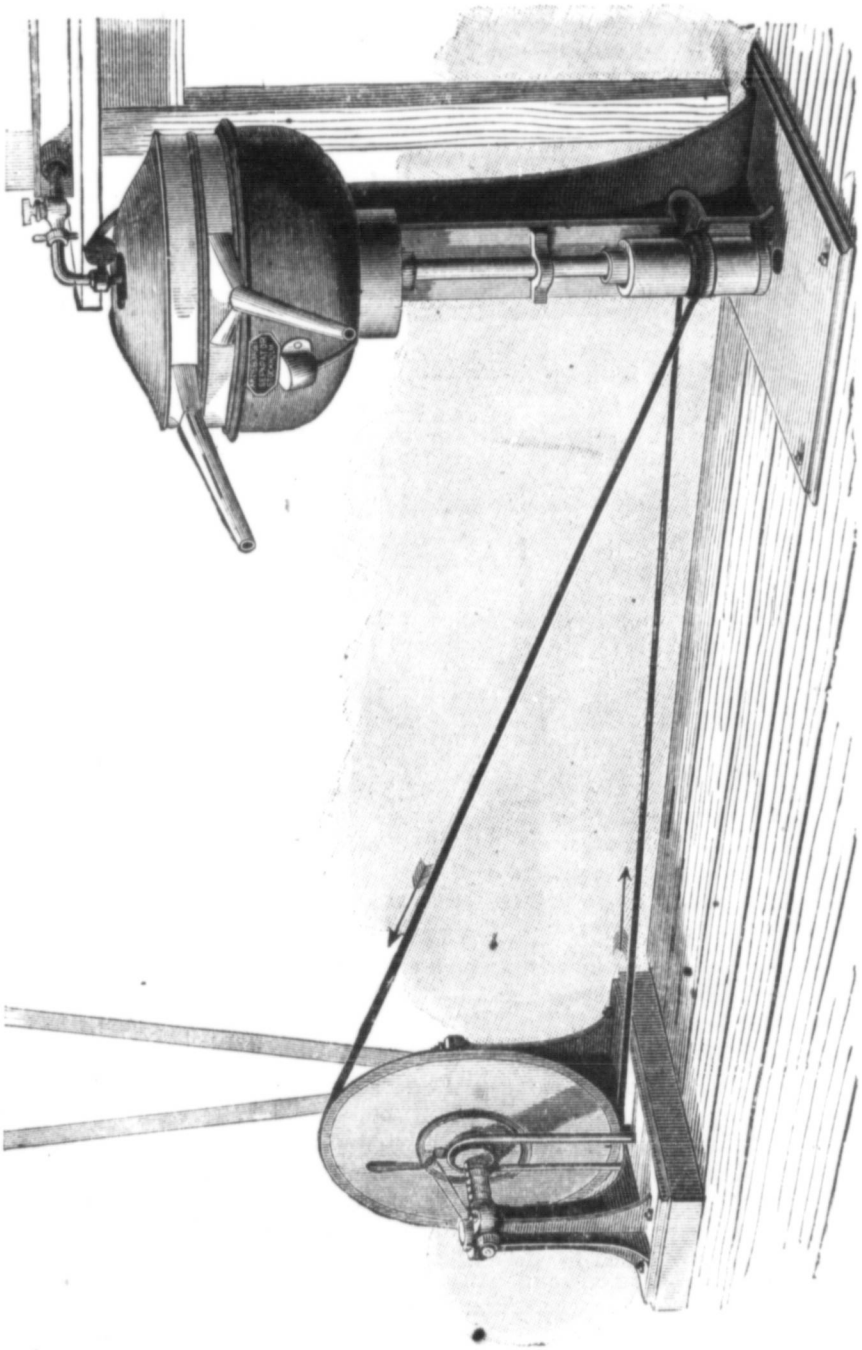


Fig. 23.—The Burmeinster & Wain Separator.

These machines are now made of three different sizes: The A, for large creameries; the B, for smaller creameries, and the C, for private dairies of 20 to 40 cows. This separator has found its way into ten of the largest creameries in Canada.

The milk flows from the milk vat into the centrifugal drum, which revolves rapidly; the centrifugal force thus generated separates the different substances according to their weight. The impurities being the heaviest, collect upon the sides of the drum. The

skim milk, next in weight, collects next, and by constant inflow of new milk it gradually rises to the top, where it is stopped by the cover and formed into the outflow pipe by a constant inflow, as well as by centrifugal force. The cream collects upon a wall upon the inner surface of the skim milk, and flows in a constant stream through another tube similar to the first. From the above description it will be seen that once started it works continuously until the whole amount of milk is separated.

The skimming of the first and last milk contained in the Separator is done in the following manner :—

For First Contents.—After filling the drum three-quarters full, the machine is started slowly, and the milk is allowed to run into the drum at the ordinary flow until it reaches the skimming tubes. The tubes must then be regulated in such a manner as to draw off the cream. It must be remembered that *both* the tubes draw off cream at the beginning. But the operator should let the flow from the cream tube run into the cream receiver, and the flow from the other tube (although it is cream and partially skimmed milk) run to the skim milk receiver. The flow should now be considerably checked, and should remain so until one-fifth of the first contents has been drawn off. At this point the milk is allowed to enter the drum at the regular flow. The tubes are then regulated so that from eighteen to twenty per cent. of the contents of the drum shall be drawn off in the shape of cream. The machine is now in full operation.

For Last Contents.—When the whole milk vat is empty, there remain but the last contents of the drum to be skimmed. Partially unscrew the skim milk tube so as to check entirely the skim milk flow, and keep up the cream flow until the end of the operation. To displace the last contents, allow an intermittent inflow of skim milk. The quantity of skim milk necessary, is equal to one-fifth of what the drum is capable of containing while in operation This operation takes from ten to fifteen minutes.

The DeLaval Milk Separator.

Fig. 24 gives an outside view of the machine when in operation. The standard and bed-plate are in one piece, so that the whole can be attached to the floor of the dairy, or to the frame of the intermediate machinery. Its action is also continuous.

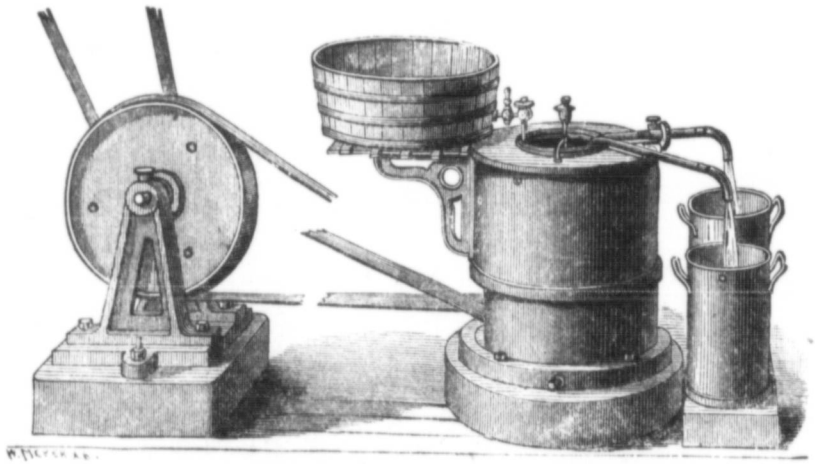


Fig. 24.—The DeLaval Milk Separator.—(Outside view of the machine.)

When in operation the standard and bed-plate are in one piece, so that the whole can be at once attached to the floor of the dairy, or to the frame of the intermediate machinery. Its action is also continuous.

The cream and skim milk flow out of this Separator by the power of gravitation alone, and such power is not sufficient to allow of the use of elevating tubes, to lead the cream and skim milk through a cooler to their respective vessels.

Fig. 24 gives a sectional view of this cream separator, consisting of a steel drum capable of resisting a pressure of 42 atmospheres ; but as these machines are not sent out from the factory until they are tested at a pressure of 250 atmospheres they are perfectly safe.

The machine is worked in the following manner : The new milk runs into the bottom of the centrifugal chamber, from which, by means of a small tube, it flows to that spot in the drum where the separation of the cream and skim milk takes place by centrifugal force. A flange fixed to the side of the milk chamber prevents the milk from revolving independently of the rotating vessel. The skim milk is forced into a pipe ; it enters an aperture in the stationery chamber and runs out by means of an exit spout. At the same time the cream collecting in the centre rises along the neck, escaping by an opening into the stationery chamber. The opening for the outflow of cream may be enlarged or diminished at will by means of a small screw placed above the chamber to regulate the amount of cream taken from a certain amount of new milk, but this regulation of the density of cream must take place while the machine is stationery. Thus it is impossible to obtain thick or thin cream while the apparatus is in operation. The spindle supporting the rotary vessel is mounted on bearings surrounded by an elastic packing, and its lower end fits in a socket upon the upper end of the shaft which is mounted on bearings, and is set into motion by a belt or band. The stand supports the machine which requires no heavy foundation. A small lubricating cup attached to the lower part of the spindle, gives through a pipe a constant supply of the oil required for lubricating the spindle. The milk drum is driven at the rate of 6,000 to 7,000 revolutions per minute. The cream cooler is very important to cool the cream from heated milk directly as it comes from the separator.

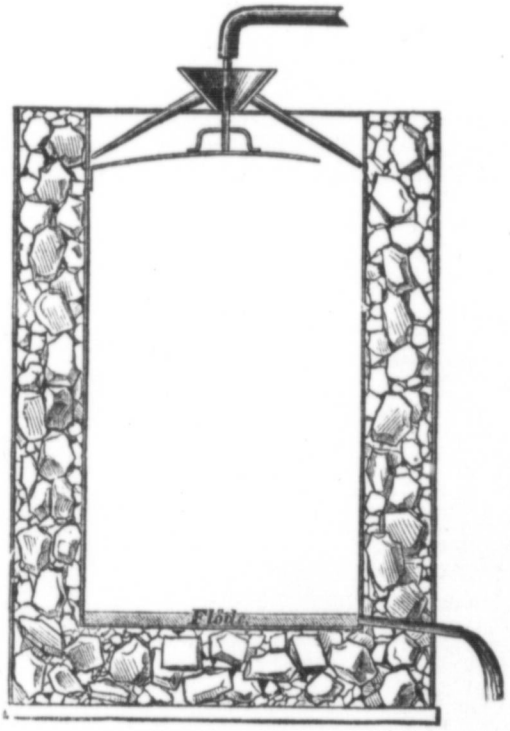


Fig. 25.—The Cream Cooler.

A cream cooler is a tin vessel placed inside another, leaving a space to be filled with ice. From the bottom of the inner can a tube extends through the side of the other on

the partial cover of the inner can. A funnel-shaped cup is placed so arranged as to revolve easily around a spindle at its lower extremity. See Fig. 25. This cup is provided with four discharge pipes extending close to the circumference of the can and bent at the ends. The cream drops from the skimmer pipe of the separator, which, if necessary, may be extended above the separator into this cup, and flowing through the four tubes it makes the cup revolve, distributing the cream around the sides of the can. Flowing down in a very thin sheet along the wall of the can, it is cooled to a temperature below 50° Fahr. before reaching the bottom. A similar apparatus may be used for cooling the skim milk.

The cream vats are similar in construction to those described on page 194 of the cream gathering plan. If a special cooler is used such vats would require no space for ice. They may be made like cheese vats.

For butter worker, butter scale, etc., see page 194 of the cream gathering plan.

Creamery Estimates.

A Creamery on the Cream Gathering Plan.

Building and outfit for from 300 to 500 cows :—

Building, wood	
Engine	$350 00
2 Cream vats	80 00
1 Churn	50 00
1 Butter worker	10 00
Collecting cans	70 00
3 Cream pails	9 00
1 Salt scale	5 00
1 Scale	15 00
Shafting, Pulleys, etc	35 00
Miscellaneous expense	50 00
1 Test churn	40 00

Building and outfit for 800 to 1000 cows :—

Building	
Engine and boiler	$350 00
3 200 Gallon vats	120 00
1 400 " churn	50 00
1 300 " "	35 00
1 Steam worker	50 00
1 Lever worker	10 00
Collecting cans	140 00
1 Test churn	40 00
5 Cream pails	15 00
1 Butter scale	5 00
1 Scale	15 00
Shafting, pulleys, etc	50 00
Miscellaneous expense	75 00

Centrifugal Plan.

Building and outfit for 300 to 500 cows.

Building	
1 Scale	$15 00
1 Conductor and head	4 50
1 Weighing can	10 00
2 small separators or 1 large one	500 00
Shafting, pulleys, etc	75 00
1 Butter worker	10 00
Engine and boiler	350 00
1 Churn	50 00
1 Cream vat	30 00
1 Milk vat	40 00
1 Heater	15 00
1 Salt scale	5 00
Miscellaneous expense	75 00

Building and outfit for 800 to 1,000 cows.

Building	
10 Horse-power boiler 8 " " engine	$450 00
2 or 3 Large separators	950 00 to $1,400 00
Shafting, pulleys, etc	75 00
1 Milk vat	50 00
1 Cream vat	35 00
Heaters	20 00
1 Scale (treble beam)	20 00
1 Weighing can	10 00
Conductor and head	4 50
2 Churns	85 00
1 Butter worker	50 00
1 Salt scale	5 00
1 Cream strainer	3 00
1 Centrifugal milk tester	60 00
Miscellaneous expense	75 00

REPORT OF WORK AT THE LONDON AND TORONTO EXHIBITIONS.

Professor Brown and I were asked to take charge of the dairy exhibition in connection with the Toronto and London exhibitions. Hoping to be able to render the dairy interests of the Province some service, we accepted. The work was divided in two departments: 1. The working dairy. 2. The milch cow competition.

It is to be regretted that the dairy buildings, particularly at Toronto, were not adapted to the requirements of modern butter making. It was thought advisable to

show not only the machinery required in a large private dairy, but also such plant as is generally used in large creameries in this country.

For this purpose two Burmeinster & Wain Separators, the heaters, pans, etc., in a word, all the plant used in a creamery, were secured. The milk vats, heaters and milk separators combined, which required only a room (space) of 12x15 feet, to skim the milk of 800 cows, attracted much attention.

A small Centrifugal Separator, to be run with a horse-gear, imported specially for the Toronto Exhibition, came in due time and was set in working order, but some party intentionally tampered with the machinery in such a manner that it could not be used.

This department was left in charge of Mr. Albert Garth, of St. Therése, Que., who is one of the pioneers of the centrifugal system in Canada. Two men attended the working creamery, and the rest of the staff were occupied with the milch cow competition.

The Milch Cow Competition.

The methods adopted by European experts in deciding competitions of the kind were used. The following card gives the scale of points, with results of the tests, given by Rose of Eden:—

——	Lbs. and Days.	Points.
1—Weight of Milk in 24 hours	24.12	
Allow 1 point for every pound		24.12
2—Butter per 100 lbs. Milk	8.81	
3.5 being standard, add or deduct 10 for every 1 above or below		53.10
3—Cheese curd per 100 lbs. milk	20.60	
Allow 1 point for every pound		20.60
4—Time since calving	114	
Add 1 point for every ten days		11.40
Total value		109.22

The morning and evening milkings were used for the test. The cows were milked under the eyes of Prof. Brown. Each cow's milk was set in separate ordinary deep cans, and kept at a uniform temperature of 40° Fahrenheit.

The tanks containing the milk were kept under lock and key. The skimming took place after twelve hours' setting. The cream was kept twelve hours, ripened and churned in an ordinary test churn. The setting and skimming of the milk, and the ripening and churning of the cream, were done under my supervision. Following are the results:—

AT PROVINCIAL EXHIBITION, LONDON, 9TH AND 10TH SEPTEMBER, 1885.

No.	Breed.	Exhibitor.	Cow and Age.	Milk per Day.	Days since Calving.	Butter per 100 lbs. Milk.	Wet cheese curd per 100 lbs. Milk.	Total Value	Prizes.
1	Holstein	J. T. Ferguson	Aggie Belle, 5.....	37.60	113	2.75	11.25	52.65	
2	Holstein	E. Macklin & Sons ...	Sunnyside, 2	26.25	83	3.62	16.87	52.62	
5	Holstein	M. Cook & Sons.....	Jenny Lord, 7.....	28.80	153	3.31	16.87	59.07	2nd.
6	Holstein	Wyton Stock Breeders' Association.....	Aggie Ida, 4.....	35.00	116	2.81	15.60	55.30	
7	Holstein	Wyton Stock Breeders' Association.....	Lapolka, 3	23.60	109	2.65	20.00	46.00	
8	Holstein	H. M. Williams	Lerena, 2.....	30.90	133	2.37	19.37	52.27	
9	Holstein	H. M. Williams	Nixil L, 6.....	25.37	207	3.36	19.62	64.29	1st.
10	Holstein	H. M. Williams	Denice, 8.....	26.00	75	2.94	13.12	40.22	
11	Ayrshire	T. Guy.....	Rosette, 8.....	18.12	161	4.53	23.75	68.27	2nd.
12	Ayrshire	A. Nankin	Lady Belle, 3.....	25.90	79	2.75	23.12	49.42	
13	Ayrshire	G. Hill	Louise, 5.....	29.50	138	5.43	21.25	83.85	1st.
14	S. H. Grade..	W. Patrick.....	Rosie, 7.....	46.80	129	3.62	20.62	81.52	1st.
15	S. H. Grade..	W. Patrick.....	Queenie of West, 6..	24.25	145	3.12	20.62	55.57	2nd.
3	Jersey	V. E. Fuller.....	Belle of Glengairn, 5.	27.00	86	5.75	20.00	78.10	2nd.
4	Jersey	V. E. Fuller.....	Rose of Eden, 6.....	24.12	114	8.81	20.60	109.22	1st.

AT INDUSTRIAL EXHIBITION, TORONTO, 16TH AND 17TH SEPTEMBER, 1885.

No.	Breed.	Exhibitor.	Cow and Age.	Milk per Day.	Days since Calving.	Butter per 100 lbs. Milk.	Wet cheese curd per 100 lbs. Milk.	Total Value	Prizes.
1	Devon	Harper	Rose of Cobourg, 3..	33.00	105	3.31	13.33	54.91	
2	Ayrshire	T. Guy	Rosette, 9.....	23.00	167	4.68	18.40	69.90	
3	Ayrshire	T. Guy	Oshawa Lass, 6.....	32.60	14	4.18	13.33	54.13	
4	Ayrshire	Smith.....	Gerty, 4	33.50	11	3.59	14.90	50.40	
5	Jersey	V. E. Fuller.....	Jessy Brown, 6.....	27.60	141	3.38	15.50	56.00	
6	Jersey	V. E. Fuller.....	Belle of Glasgow, 5..	25.40	91	4.72	17.10	63.80	
7	Jersey	V. E. Fuller.....	Rose of Eden, 6.....	24.25	119	6.87	16.80	86.65	2nd.
8	Jersey	Jeffrey.....	Sweet Brier, 9.....	17.75	190	6.72	14.90	83.85	3rd.
9	Jersey	Jeffrey.....	Princess Alexandria, 6	13.62	145	5.34	16.80	63.32	
10	Jersey	W. A. Reburn	Jolie of St. Lambert, 11	31.62	118	6.41	17.10	89.62	1st.

In London the breeds were tested against breeds, giving prizes to the best of each breed. In Toronto the cows were tested against cows, giving three prizes in all. The Jersey breed carried off the palm at both exhibitions. In London Rory Eden, the 1st prize Jersey, gave the extraordinary yield of 8.81 lbs. of butter per hundred lbs of milk. Her removal to Toronto, the miserable accomodation afforded her while in London, and the wet weather affected her yield in Toronto, where she gave 6.87 lbs of butter per 100 lbs. of milk. Difference between the results of the two tests, 1.94 lbs. of butter. This decrease under the circumstances will not surprise any person of experience.

The Ayrshires showed themselves to be valuable cows for milk and butter.

The Holsteins maintained their reputation as heavy milkers, but failed to produce butter in quantity equal to the other breeds. This is hardly expected of them. However, in this connection, it is well to remember the fact that Holstein milk is naturally "heavy," that is, the cream from such milk rises slowly and imperfectly, whilst the cream from Jersey milk comes up readily when treated by the deep setting method. It is probable that a centrifugal test would be more favourable to the Holstein.

Respectfully submitted,

S. M. BARR.

BER, 1885.

Wet cheese curd per 100 lbs. Milk.	Total Value	Prizes.
11.25	52.65	
16.87	52.62	
16.87	59.07	2nd.
15.60	55.30	
20.00	46.00	
19.37	52.27	
19.62	64.29	1st.
13.12	40.22	
23.75	68.27	2nd.
23.12	49.42	
21.25	83.85	1st.
20.62	81.52	1st.
20.62	55.57	2nd.
20.00	78.10	2nd.
20.60	109.22	1st.

MBER, 1885.

Wet cheese curd per 100 lbs. Milk.	Total Value	Prizes.
13.33	54.91	
18.40	69.90	
13.33	54.13	
14.90	50.40	
15.50	56.00	
17.10	63.80	
16.80	86.65	2nd.
14.90	83.85	3rd.
16.80	63.32	
17.10	89.62	1st.

REPORT

OF THE

ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION.

The objects of this Association are to form a bond of union among the officers and students, past and present, of the Ontario Agricultural College and Experimental Farm, and the most eminent agriculturists throughout the Province, to promote their intercourse with a view to mutual information; also to try and elevate the profession of agriculture, with its allied sciences and arts, to its proper level; to hear papers and addresses delivered by competent parties, and to meet at least once annually for these purposes.

All officers and students, past and present, are entitled to become members of the Union on payment of an annual fee of fifty cents. They are eligible to all offices of the Union, and will receive gratuitously any reports of the same which may be published after the date of their becoming members. Every officer and ex-student who is in regular accord with the Union is considered as a corresponding member thereof, and each one is entitled to the privilege of receiving, for experimental purposes, at least five samples annually of such agricultural seeds as may be on hand for distribution at the Ontario Experimental Farm—the results to be reported to the Union at the annual meeting which is held for one or more days at the College, at such time as is fixed upon by the executive committee, due notice of which is to be given to each member at least one month before such meeting is held.

GUELPH, March 12th, 1885.

The sixth annual convention of the Experimental Union opened in the class-room of the Agricultural College at 10 a.m., the President, Mr. Campbell, in the chair. After roll-calling, the minutes of last meeting were read and adopted.

The Corresponding Secretary and the Treasurer's reports were read and adopted, showing the Union to be in a better financial state than at any time heretofore, thanks to the Commissioner of Agriculture for his liberal assistance in carrying out the experiments. After the reading of communications, &c., by the Secretary, the literary part of the programme was entered upon.

THE PRESIDENT'S ADDRESS.

As you all know, gentlemen, this is the tenth anniversary of the Ontario Agricultural College and Experimental Farm, and I purpose giving a short review of its history. In 1870 Mr. John Sandfield Macdonald introduced a Bill into the Ontario House having for its object the establishment of an agricultural college. In 1871 a farm was purchased at Mimico, and the Government appointed Rev. W. F. Clarke, to visit the agricultural colleges in the several States of the Union, and report as to a suitable plan to pursue in reference to the proposed college. A commission was also appointed to look into the Mimico farm, and it advised the Government to sell it. In 1873 the present farm was purchased from Mr. F. W. Stone, and a commission of good, practical farmers was appointed to report as to the best means of adapting the farm to the purpose required of it. That commission reported that the name of the proposed institution should be "The Ontario Agricultural College and Experimental Farm," and that its object should be to give a thorough mastering

of the theory and practice of agriculture and horticulture. The report referred to the few facilities existing at the time for the attainment of that object, but did not advance any ideas in regard to the means to be pursued; they were not prepared to say anything definite, but advised the Government to go ahead and learn by experience, as they had no precedent before them. They reported that the country was hardly prepared to support such an institution, and would not recommend the Government to grant the large amount of money necessary to place it on a substantial footing. The choice of the name was rather unfortunate, and the report implied that a thorough knowledge of the principles and practice of agriculture could be acquired in two years. The College was opened in May, 1874, and Prof. McCandless, of Cornell University, New York, was appointed to manage the institution. He was not fitted for the work, and after open war with the students for some time, resigned the position. In the Legislature the College was badly used, and the attacks made upon it on the floor of the House did more injury to the College than to the Government. In the fall of 1874, Mr. William Johnston was placed in charge. He was a hard worker, conscientious, and, gifted with a large amount of common sense, and he endeavoured to put the College on a sound basis. In the fall of 1875 Prof. Brown was appointed Professor of Agriculture, and at once began to direct attention to the live stock interests of Canada, and the trade with Great Britain. In this and other ways much was done to patronize the Farm. In 1879 a committee of the Provincial Grange visited the Farm, and after a thorough inspection pronounced it a step in the right direction. In 1884, on the advice of Principal Mills, Farmers' Institutes were established. This was a recognition of the necessity of a closer intercourse between the students, the College and the farmers, and the good effect of these was very apparent.

The first difficulty met with in the establishing of the College was that such a step was far in advance of public opinion. They had no trained men competent to go into the work, or to draw out a plan for the working of the College. The students who came were not prepared to open on the course prescribed. The Commissioner made a great mistake in the prominence given to practical farming; the scientific and most necessary work was partially left out. As a Government institution it was dragged into the arena of politics, and every action and expenditure of the Government was closely criticised and opposed. Since Mr. Johnston took charge it has been in a far better position. Prominent English agriculturists, like Prof. Sheldon and Sir J. B. Lawes, gave it a high character, and the editor of the *Rural New Yorker* did not withhold the praise which he considered it merited.

In 1880 the Agricultural and Experimental Union, composed of the professors, students and ex-students of the College, was formed. Last year the presidents of agricultural societies were made honorary members of the Union, and their presence and advice were of much benefit. In experimental work, when an increase of a cent a bushel on wheat, means a gain to the country of several millions of dollars a year, it is worth while experimenting to produce a perfect grain. In horticultural work there has been rapid improvement, in fruit, flowers and vegetables. In America, Great Britain, Germany and France men are at work originating new vegetables. These are brought on the markets, and are bought by the farmer, who finds out that the new variety is not much good. Grains and agricultural products will improve in the near future, because by careful and repeated selection, improvement can be made. During the past few years the new varieties have been largely increased. One man cannot test all these, therefore some systematic plan should be devised by which it could be ascertained what improved grains and products are suitable to this country. In the experiments with grains and horticultural products at the Farm, there is the one defect, that the experiments made are not sufficiently extended and deversified, to make them of much value. This difficulty could be overcome by the establishment of agricultural stations in different parts of the Province, and it would be the duty of this Society to correct and modify the experiments made at the Farm by the reports from the stations. A committee would make a plan of the new varieties of seeds to be tested, and the same experiment could be made in different places and on different soils, and the results could be given in tabulated form and circulated through the country. If the Society would prosper and become firmly settled on a

good basis, they should have a journal, to be published, say, quarterly. It should contain short articles from the members of the Union, an account of the experiments being conducted might be given, and all matters of interest pertaining to the College and Farm might be discussed. The cost would be small, and it would prove of much benefit to the College, the Union and all concerned. A society is what its members make it.

I would also suggest the propriety of asking the Government for a small grant to help in the experiments. This is probably the last year that the grant of $10,000 to the Agricultural and Arts Association will be given, in its present shape; the money will not be withdrawn from the agricultural interests of the country but applied in different channels. This Union can relieve the Commissioner of Agriculture of the bother of deciding where to appropriate $100 or $150, and can use it with much benefit to the country.

I have sketched out a rather ambitious programme, some may say, but I think there is work to be done, and something should be undertaken by this society to advance the agricultural interests of the country.

The following paper was read by C. H. F. Major, a graduate of the College :—

THE O. A. C. AND THE UNION.

It was not without much hesitation that I ventured to discuss the work, and the worth of the work, of our Agricultural College. The wide field of agriculture embraces so many different lines of research, its problems wear so many various aspects, and the means for their solution, far from being intimately connected, are so diversified, and are only to be found among the ascertained truths of so many different sciences, that one may well pause before he undertakes to discuss so pregnant and important a subject as that of agricultural education. Moreover I felt that I was practically opening up the subject before this Union, for though now and then a short discussion has arisen upon some one or two points, the subject has never been dilated upon to any very material extent. It seems to me that if there is one subject which more than any other deserves to be well ventilated, and thoroughly exhausted by the deliberations of this assembly, it is that of the Ontario Agricultural College, its aim, and its work; and I was indeed gratified to find that agricultural education was to hold a prominent place among the subjects submitted for your discussion this year. Indeed I may say I was relieved to know that I was not after all to be the only one in the field, and that the duty of awakening interest and inviting discussion was not to devolve upon me.

I have several times asked myself why our members have never yet ventured to discuss this great question, and several answers have presented themselves. The students themselves—I was one myself nine months ago—do not like to get up at our meetings and discuss subjects which they feel can be more ably dealt with by others, whose experience is wider and knowledge greater; and above all they do not quite like the idea of criticising the different departments of the College; in fact they feel that until examinations are over "silence is golden." One reason is, no doubt, that the literary society training has not been long enough to give them that experience, and that self-confidence necessary to those who wish to express their thoughts at a public meeting. Now this is to be deplored, for if any one knows the weak points of the College work it is the intelligent student. The students know their wants; they know how far these are satisfied better than any one else. Ex-students when they leave the college, are engaged more or less with certain departments of agriculture and develop pet subjects upon which they like to dilate, leaving to others the important work of criticism. Now I do not say that there are not many subjects which, from their more detailed and confined scope, afford our members a better chance for that maturity of thought and weighing of practical experience which is necessary in order to write a paper of sufficient value to claim the attention of our Union, but I have yet to be shown the reasons why such subjects as "Underdraining," "Beef Raising," "Fertilizers," and others, all I grant of importance, are to be considered by this Union of greater interest and importance than the question "Why is our College

useful or popular?" or "Why is it not?" This institution does not stand so "high in all the people's hearts," that a body so closely connected with and even dependent upon it as our Experimental Union can afford to ignore the question of agricultural education. Were the institution, which now shelters our bodies and inspires our minds, to crumble before an adverse public opinion, the Experimental Union would dissolve into dust, as the trailing and climbing Virginia creeper would wither and shrivel upon the walls it fondly clung to when a fire was destroying the house. We might be able to hold together and build from the ashes of our Alma Mater an edifice that could survive "the whips and scorns of time;" but let us, gentlemen, not waiting for that sad task, bind the interests and energies of the Agricultural College and the Experimental Union so closely together that the one shall be the inseparable auxiliary to the success, and participator in the honour, that shall crown the endeavors of the other. Let us recognize this our duty as an assembled body of students and ex-students, and others interested in this great branch of industry, banded together for the purpose of advancing the noble science of Agriculture. Let us, the students and ex-students, maintain our independence and freely speak out our thoughts, while the professors and practical farmers amongst us shall, showing us the practical ideas of all questions, and, enlarging our minds to realize the great national importance of the science and its bearings on the prosperity of the country at large, temper our zeal and render useful our knowledge, that we may all work to the best advantage in the cause which we have espoused. Let us, inviting free and searching criticism, engender that hearty discussion which shall bear the results of rendering the College an efficient and popular exponent of the principles of Agricultural Science.

The Length of the Course of Study.

The main defect in connection with the institution is the shortness of the term of study. Two years only, with holidays taken out, is, to say the least of it, not a very long time to spend in endeavoring to become proficient in some twenty-six subjects taught as the course of study, and some five outside departments embracing all the manifold operations of practical farming, taken up as the course of apprenticeship. It must be remembered that the smattering that the student gets of those twenty-six subjects is not merely a smattering, but usually only a very superficial knowledge of the elementary parts of a subject. It is needless to say that even a good insight into practical farming is hardly to be acquired in so short a time. A student going up to the University has three years in which to study. If studying for a pass degree, he takes at the end of the first year what is called the "Previous examination," the "General examination" at the end of the second year, and the "Special" at the end of the third year. If up for honours he takes the "Previous" and the "Special," skipping the "General," so that after his first year he has two years to specialize. Now, I do not mean to affirm that the agricultural community is ready to recognize that the science of Agriculture is one that more deeply affects the interests of the human race than any other, for I know that they are not. Indeed the theory has not yet been sufficiently disentangled from the practice for the subject to stand first among the sciences. But why is that science upon the development of which depend the happiness and well-being, and even the daily life of the whole human race, to hold a subordinate place, while those sciences which pamper the love of luxury and which strive to set right the many social disorders springing from the exercise of the jealousies and foibles of men, are to have the best trained intellects in the world as their advocates and devotees? The bread and meat of the world, the daily, hourly existence of mankind are allowed to hang upon the results of the exertions of the most indifferent class, and in some cases of the most illiterate numskulls of society, while the best men turn to other occupations more retired in scope, and of far less importance than this great and honorable profession. If society recognizes the doctor as a saviour of life, the lawyer as a harmonizer of life, and the artist and the musician, the poet and the sculptor as refiners of life, why will not they recognize the agriculturist as the supporter of life, and allow him position and education as it does to members of the other learned professions? Common sense has made many a successful farmer, aided by education—there would have been few if it

had not, but that is no reason why education should not aid common sense to make far more than it has already, and those, far more successful men. Society has done something for us; this college is evidence of that, but not enough, and the reason I think can be found in these words of Cassius—

"The fault, dear Brutus, is not in our stars,
But in ourselves, that we are underlings."

We must have three or more years in which to fit the students of this college for their life work. I am inclined to advocate one year's general and two years' special instruction, or at least half and half. To be a graduate of the Ontario Agricultural College may not sound so well as to be a batchelor or master of arts, but if we have the substance of a sound practical education without its corresponding flunky, we need neither grumble nor be ashamed. Many will no doubt advocate two years' general education and one year's special, but I am inclined to adhere to the belief that Lord Chesterfield's advice, "Be a whole man at one thing at a time," is sounder than the advice, "Be jack of all trades and master of none."

Some will ask, Why lengthen the course of study when so few stop here two years? There, gentlemen, you have the question I would like to hear answered, with the remedy suggested, by your discussions. Why do so few stop here? Why is this called the *Ontario* Agricultural College, and why were there only nine *Ontario* farmer's sons here last spring term? Why are there only twelve second year students here this year? I should be inclined to answer: "Too much show of learning, and not enough solid acquisition; too much harrowing and rolling, and not enough ploughing and manuring of the mind." Taking the average Ontario farmer as I have found him, I have come to the conclusion that the Ontario Agricultural College is too far in advance of public opinion. I say not that it should not be ahead, but it is *too far* ahead of the country. The average farmer looks more to the weight of cash in his pocket than to the realizations of the projects of scientists and agricultural educationists. The College curriculum is too theoretical and the subjects too numerous to impress favorably the mind of the average Ontario farmor, who is after all not very many generations removed from the pioneers of the bush.

I shall endeavor now to criticise briefly the work of the Institution.

Agriculture.

I would like to call your attention to the fact that, while this department is supposed to have, as it should have, the lion's share of attention, it has only one Professor, and Natural Science has two. This is an anomaly that should not exist. I have heard the Professor of Agriculture's lectures spoken of as incomplete and not sufficiently detailed. Now will any one who thinks that ask himself, or if he asks the Professor himself, he may get a more satisfactory answer, why he is not a first class scientific and practical stock raiser, dairyman, agriculturist and arboriculturist all in one, and why, he does not give first class notes up to date on all these subjects? What the Professor's answer would be I cannot say, but I know Pope would answer—

"One science only will one genius fit,
So wide is art, so narrow human wit."

If agricultural subjects proper are to receive the greatest amount of attention, why are they only to be taught by one Professor and that Professor one of the busiest bees in our hive? People say, "Read up the subjects for yourself, don't trust only to lectures." I say, "Come and do it." We are not reading men at a University, able to put in six and eight hours reading a day. We have to pass more or less on the lectures themselves, and study very largely to that end. We have daily to hear and study the lectures, as well as work outside. If we are the muscles of the farm, we are the human, not the equine muscles.

The want of time is indeed felt in the outside department, and it is there that many students look for that instruction, which is to place them in such a position that when they leave the College they may be able to show that they have received a training which will be no discredit to their Alma Mater. But do we get that training? I think not.

It seems to me—and I have experienced it often in the field—that a knowledge of how to perform some practical operation, such as mowing or hay loading, would be of greater use to the student and do more credit to the College training than if he knew the probable constituents of a hay crop and their percentages at a certain date, and knew not how to harvest the crop. It seems to me that it is more desirable for a graduate of this place to be able to take his place on the waggon and load hay, than for him to be obliged to tramp hay in the mow while he shoots off to his comrade about this crop containing probably somewhere in the region of 76.19 per cent. of H^2O, and only 23.81 per cent. of solid matter.

Now I know very well that the College does not expect to turn out practical farmers of thirty years' experience in two years, for that is impossible, and the country, I hope, does not expect that from it; but, be it remembered in a practical country which judges the College by its practical results, the practical training is what shows well to advantage now is what benefits us now, while the benefits of our scientific training must be evolved after years of patient work. But why, may I ask, was there only one student last summer who learned to load hay? Why were no students allowed to drive the mower? Some will answer, that anyone who can drive a team can also drive a mower behind it. I imagine there is all the difference in the world, if only the difference of increased confidence. Again I ask, Which is the most important for a student to be able to say, that he has learned to appreciate Shakespeare and Milton, or for him to be able to cut down a meadow and draw it in? Some years ago I believe two teams ran away with the students on the the mowers, and that has stifled all attempts at education in that line. My answer is, that if it will pay a farmer to give a man wages to walk behind the plough all day, it will also pay the Government to give a man enough to remunerate him for walking behind a mower until students get used to the work. The question boils down to this: What are we aiming at? Is it to train students as practical farmers, letting no one graduate here who cannot worthily uphold the position of a hired man? or is it merely to educate the farmer's son, with a view to giving him a higher education than he now gets, without alienating him from his profession? The latter is the inevitable result if he seeks mental advancement in our city schools, presupposing that he is trained practically at home, while he merely sees enough work at the College to show the relation existing between science and practice, and while we tell city boys to go to the farmers for the practice of their profession while the College gives them the science. Let us by all means know what we are aiming at, and how far we are from the realization of that aim.

I take it upon myself to say that the College report and circular are too full in their descriptions of the course of instruction. There can be nothing gained by saying that a student receives instruction in certain things when he does not. All that is stated may be very desirable, but if the country is taught that the College is a model dictionary of instruction when it is not, not seeing wherein the course of instruction is incomplete, they will neither make enquiry nor instigate any needful reform. I recognize as fully as any one, for I have been in places where I have heard adverse criticism on the College—springing sometimes from the highest reason and common sense, and sometimes from the most lowminded and bigoted ignorance—that an undue exposure of defects could be made to a very damaging extent by anyone who was against the College, and had been behind the scenes and used his knowledge with sinister political or personal intentions. But I put it to your common sense, I put it to your principles of rectitude and honour, do you think the College will approach that high state of perfection which we would fain see her attain to if we, her well-wishers and upholders, see fit to cover up her imperfections by such deplorable short-sightedness, enabling the country to see her only as she should be and not as she is? I think you will allow that in this honesty will be found to be our best policy, while it will cover more sins in the eyes of our opponents than we can possibly hope to do by the opposite course.

I have never been able to see why there should enly be one instructor at the College. Let all the men, at least such as are competent, and I hope there are some such, be recognized as instructors. Let them also teach the students that essential part of our profession, the details of its practice. Why, when I have only a few odd half-days in which to learn

ploughing before the examination, am I to wait for my turn to go to the instructor, who is perhaps teaching ploughing in field 11, while the other four men are ploughing say in field 13? The instructor himself says all he can do is to see that a student can turn a passable furrow by the time examinations come on, and to that end can do little better than let him go ahead almost as best he can, neglecting that valuable instruction which every experienced ploughman can give. Plowing is but one example.

A large covered place is needed very much for such winter instruction as handling cattle and veterinary operations, which is uninteresting in the extreme when a Guelph wind happens to be playing with the snow. Handsowing could also be taught in here. The taking to pieces of harness, cleaning it, and putting it together again, would be a not to be despised item of winter instruction. I would here mention how inadequately the shop is fitted up, and how little time there is for real solid useful instruction in this department. All these subjects deserve more than a passing notice, but space and the length of your patience have to be considered.

Forestry.

Would that I had time and space to do justice to this interesting and important subject. It deserves it, and, to one who has studied it, it would seem to be the vital question concerning Ontario's future prosperity. Those who would like to ignore this subject should read Mr. Phipps' report of two years ago on the "Necessity of Preserving and Replanting Forests." When one reads, learns and believes what wonderful factors the leafy denizens of the forest are influencing, controlling, and to a large extent determining the fertility of a country's soil and the character of its climate, one stands aghast to think that those who cry out against the fearful waste of resources that is yearly going on, and point out the inevitable impoverishment which will end in national disaster, should be in such a minority. When one learns that whole tracts of land in the Old World, which were once smiling with all the beauty and wealth of fertility, have been rendered waste and desolate solely by the ruthless hand of improvident man, and when we learn that Ontario's climate is year by year becoming more capricious, her streams drying up, and her fertility vanishing with those wonderful conservators of a country's health and wealth, with which the provident hand of God has so richly clothed our country, how can we lie in apathy, and live on with contented minds, and talk wildly of the future prosperity and growth of our beloved land? And as we are clearing away the forests from the head waters of our streams, denuding the land of those mighty condensers and vast resovoirs of water from which truly issue the springs of life and the waters of wealth, annually sending in part to the heavens and in part to other lands our stable climate, and our country's fertility in exchange for cold and wind, drought and deluge, hard labour, and little to live for, we might, had we the close observation and acute hearing accorded by Nature to some of her most lowly forms, be able to detect that the decreasing resources of Niagara himself were enabling him to thunder less loudly year by year his own majestic *Te Deum* of praise for the wisdom and bounty of a beneficent Creator, whose loving kindness man so loudly vaunts in his churches while he spurns His mercies from his door.

Gentlemen, what are you here for? Are you here to discuss the minor operations of field work, or are you here to undertake duties of a higher nature and try and fight your way to demanding a settlement of those questions of vital importance, whose non-settlement must cause anxious misgivings in the minds of all true lovers of their country? In the north of Bruce county, where I have been working this winter, whole acres of swamp and rock have been sacrificed to the relentless butchery of fire and axe. What was Prof. Brown's paper for last year on this subject, before this union? What was Mr. Phipps' report for, if things are to drag slowly, and the remedies come too late? Are you here to read and to enjoy hearing papers, acquiesce in their sentiments, and then go away and forget them, waiting till next year's passing pleasure? These questions need time for settlement; they can be pushed, but only by earnest, energetic action, springing from resolutions that have realized the truth. How, may I ask, with the limited time and

educational materials at the College, can students be imbued with a sense of this and kindred national responsibilities, and none should leave here without a knowledge of their nature?

A Variety of Subjects.

It is to be hoped that the question of the bi-annual cropping of wool will not be overlooked by this union, nor research discontinued by Prof. Brown. Who knows what it may not mean to the country? A select committee was appointed by the House of Commons at Ottawa last year to obtain "information as to the agriculture interests of Canada," and their report is one of very great interest to every intelligent Canadian farmer. Had the Experimental Union furnished their members with copies and asked them to read up with the intention of discussing nothing only some of the most important questions there dwelt upon, the time would indeed have been well spent. The committee examined several members of our several Canadian agricultural industries, and also issued a series of questions, twenty-two in number, by which means they obtained a large amount of very valuable information as to the present state and future prospects of Canadian agricultural interests, and were able to probe the mind of the agricultural community. It is a report which all intelligent farmers should study and ponder privately, and discuss among themselves very fully.

Mr. Barnard, the Director of Agriculture for Quebec, says: "The loss occasioned to the Dominion and to the farmers themselves is stupendous, and equals annually the whole agricultural production of Canada—a loss amounting to over two hundred millions of dollars every year. In other words, our farmers in the aggregate do not produce over one-half of what they might and should." Take that statement, gentlemen, and make the most of it.

The exportation of eggs alone exceeds in value by forty per cent. the value of our exports of horses, and also that of sheep. Yet what farmer seeing the hens picking at the manure-pile imagines that the united efforts of our feathered allies, annually bring in to the country over $2,200,000 for the exportation of eggs alone, which, added to the estimated home consumption of eggs and fowls, reaches a grand total of ten millions! And, be it remembered, this crop beyond housing and winter feed is practically left to take care of itself. What might not be done?

Hay and coarse grains are exported in quantities sufficient to raise easily ten times more horses than at present. "Why not," says Mr. Barnard, "keep this coarse feed, raise excellent horses, benefit by the very high profits in so doing, besides securing to the farm the not to be despised manure." Mr. Barnard estimates that Canada loses over fifteen millions annually on butter and cheese, from inferior quality, not counting what they fail to make, I presume from inferior appliances. We are told by a gentleman from Halifax that a cheese company has given up cheese and gone into condensed milk with Winnipeg for a market, and the prospect of handling eight tons of milk the second year after starting. Ontario can raise milk and is a little bit nearer.

I cannot but mention the information given on the subjects of the adaptabilities of sorghum and beets to Canada for making sugar. Sorghum is analagous to maize in treatment and the climate needed. Russia, the chief beet sugar producing country of Europe, has a climate similar to Canada, and finds that the percentage of sugar is higher the farther north the beets are grown. All these questions are well worthy the attention of the Experimental Union. How far the Ontario Agricultural College is equipped for imparting instruction and aiding re-search in all these various subjects, I leave you to say, as I also leave you to decide whether it is worth your while to endeavor to see her placed in a position to meet, if not the public wishes, at least the public needs.

Veterinary Department.

It is a mystery to me why, in a stock raising country, the veterinary education at its Agricultural College should be in comparison with its importance so inadequately

provided for. Why is our Veterinary Professor obliged to make his college work more or less subservient to his own professional work, when their relation should just be reversed? I mean that our surgeon should not be a Guelph man lecturing here, but a college professor practising around Guelph. He should live at the college and be able to work among us. He should have an infirmary here, and be able to treat those animals he deemed advisable, where he could not only study their diseases better himself, but could also instruct the students by actual cases before their eyes, while not materially interfering with his own practice. What an advantage for him to be living here during the lambing season and be able to study sheep birth and life, which he said in one of his reports was a great desideratum among members of his profession. If a blacksmith had his shop on the college grounds, instructions could be given in that important branch of work, while all college and farm work could be done here, and the department could be profitably made to work in with the veterinary and mechanical department. The professor might also thus be enabled to study and introduce the best modes of shoeing. I see that the Rev. J. G. Woods has studied shoeing in England, and people are following his advice to leave their horses unshod, and are even unshoeing them, with no evil results. That could hardly be done during our winter, however. Farm hygiene is a subject we are not taught very much about. Is this, the veterinary department, to be ignored by you or not?

Theory and Practice.

Much as I would like to, space prevents me from dilating upon the many, various, and all of them important subjects of natural science. The chief trouble seems to me to what extent to subordinate the theoretical to the more practical subjects, or to what extent to equalize them. Farmers believe more in the practical exposition of the principles of agriculture than they do in what many of them would term "the chimerical dreams and learned hobbies of crazy scientists." We must remember that we are advocating agricultural education in young and practical Ontario, and not in old and scientific Germany or England. When we read in Dr. Hare's report that a firm in New Jersey is able to charge the innocent farmer, who often knows "as much and more about agriculture as any book scientist," as he will call him, $58 for every ton of a certain fertilizer worth only $4.08 a ton, thus guzzling him out of $53.92 on each ton, we are inclined to think that the study of chemistry can hardly be worth nothing to the farmer, and that the agricultural chemist who can thus practically show the farmer the advantage of not giving for nothing over half a hundred dollars is hardly the crazy scientist some would deem him. We ought also not to neglect the discussion of the question of the Select Committee concerning the appointment of a public analyst, and that question should be answered by this Union in connection with the thorough maintenance of the chemical department of the College. You have only to read the report to see that the question concerning the appointment of a public entomologist is equally worthy of your attention. When I closed that report after a cursory perusal of its contents I realized, as I have never done before, what untold wealth lies buried beneath the broad surface of the science of agriculture. And as I thought of the immense and diversified possibilities which energy, intelligence, and perseverance may turn into reality, I contrasted them with the universal lethargy and indifference of the farming community, while I could not but lament my own.

I trust that recognizing not merely what can be done, but also what ought to be done, you will consent to employ the latent energies and intellects of our Union to promote the efficiency of our Alma Mater, whose object is to further that science which, seeing that it forms the groundwork of our chosen calling, should be the study and the pride of our lives. I know that to-day's dinner and to-morrow's dollar are of greater immediate vital importance than even the discussion of the fulfilment of the most vivid, patriotic, and high-minded conceptions, for it is only by the continual attainment of the former over and over again that we can hope to realize the latter; but do not let the practical and material interests of life crush out its underlying sentiment.

English Department.

It would be hard to overestimate the importance of instruction in this department. Many a farmer will give a grunt and laugh at this department of instruction, and affirm with a self-sufficient grin and many grammatical errors, "that learning 'ow to speak and rite good pure Henglish, hand hacquiring a taste for Henglish literature will never 'elp 'im to make a cent out of 'is farm." Possibly it will not; probably it will. At any rate it will help his money to do what it could not do alone. It will give him not only the substantial position in society, but society's respect as well; it will enable him to employ his talents and the experience of his life to the best possible advantage to himself and others, and giving him the power to look after and advocate his own interests himself, instead of having to get others to do it for him, will give him that fullness of independence which belongs to the sons of the soil, but which refined intelligence alone can give them; and allow him the means of gaining and guarding "the purest treasure mortal times afford," which Shakespeare tells us "is spotless reputation." And above all, it will give him that field for the exercise of his reason and imagination, supply him with those materials for the elevation of the ambitions of his life and those means of appreciation and profiting by all that is pure and noble, true and manly, in the utterances and writings of great minds past and present, which alone can render him capable of living his life in its best, its fullest, its widest and its grandest sense, and prepare his soul for the realization of the inevitable unknown experiences which await us all in "That undiscovered country from whose bourn no traveller returns."

The study of political economy is an essential training now-a-days for the mind of every man who hopes intelligently to perform the higher duties of citizenship. Farmers must realize that it is not mere book farming, but education, the sound *mind* in the sound body, which the advocates of agricultural education affirm alone can aid the farmer to be the man he should be, and occupy his proper position in the community. In the present two years' system of instruction this department of study is but touched upon.

Work and Play.

Gentlemen, it was with infinite regret that I saw the old gymnasium, incomplete as it was, taken away from us, even though it was to promote the cause of chemical science. I believe that many of the disturbances which Mr. Mills has had cause to regret, and certain students to lament, can be traced partly to that cause. To put it on the simple ground of conduct, I consider that a gymnasium is intimately connected with the internal maintenance of discipline. In fact, the rule that says we are to avoid all boisterous conduct in or about the building I have always looked upon as unkind, to say the least about it, if not a restraint involving a point of cruelty to animals. Sometimes when sitting in this room, listening to what we in our respectful language call a "Speech from the Throne," I have said to myself, "It is all very well for you to ask us to be young men and be orderly and quiet. All very well theoretically, but practically it will not work; we are half of us boys, and boys we can but be." The animal spirits of youth must have room for effervescence; cork them up and they will inevitably burst out by forbidden channels. "We have worked half a day; that's work. We have had lectures three hours and study two hours; that, also, is work. Now we want some fun." "Go outside and play like good boys, or read or talk in your rooms." "Thanks, it's pitch dark outside, freezing or snowing hard, and talking and reading are too intellectual." "Then, be quiet." "Can't possibly," says nature. The result, endless row in the halls till lights go out, half an hour's quiet, then the glorious fun of a sound old bolster fight by fifty students, or perhaps a feather-covered floor, or some other form of so-called youthful deviltry. If there was a good gymnasium much of that sort of work would be stopped, the students would develop healthy and manly frames, and the college would be left quiet for those who wished to study, read or talk. A good gymnasium would be an inducement to the boys to take an interest in gymnastics and drill, and Adjutant Clark, who does not care to put in an appearance in order to drill four or five enthusiasts on

cold wet days, would show us his welcome military face more often. The idea of a steward to help look after the college could be carried out in this connection.

Text Books.

Much as has been said about the importance of different subjects, much remains to be said as to the manner of instruction. Far too much dictation is done here. Professors stand on the platform dictating sentences and spelling long words and technical names. Silence while one sentence is being written does not seem much time to lose, but time lost during two years while the students are writing down several note books of lectures, professors standing silent meanwhile, is not to be despised in our short term of study. If a text book will not suit, printed lectures interleaved with blank spaces for explanations would be useful in many cases, especially in that of veterinary science. Lectures will not get out of date sufficiently often to prevent such a system, and much practical information and many useful hints could be given. Time would be saved, knowledge gained, and our writing would not be spoilt, which is usually the effect of the present system.

Conclusion.

Gentlemen have expressed their opinion in former years that this Experimental Union will become one of the leading Canadian agricultural societies. I trust that it will. If it does, it will not be by confining ourselves too closely to details while we neglect to lay down a broad and well-defined policy, which shall recognize the importance of dealing with, and if need be, of taking the initiative in the settlement of those many questions of national import which are inseparably connected with the country's weal and wealth. Above all, gentlemen, the life of our society will not be full of beneficial influence and respected power if we neglect to rally round the institution whose inborn auxiliaries we are, and do something more than annually come here to sit under the shade of the tree which has sheltered so many of us, to discuss questions of restricted scope, while we allow that tree to live untended and unpruned. The stability of our Alma Mater should be our engrossing care now ; and I may say that I am of opinion that the importance of the work lying before you entitles you to ask on your own behalf and that of the college such a hall as is necessary for the successful prosecution of public business, and that you will find two days utterly inadequate for the expounding and deciding of the questions submitted to your consideration.

And now, gentlemen, when the Provinces are urging the establishment of Agricultural Colleges and the idea of a Dominion College has even been mooted, I leave it to you whether, having been first started, our college is to keep ahead. I leave it for you to decide upon the best means to be taken to remove it from the blighting breath of political supervision, and I leave it for you to decide upon the manner in which the duties incumbent upon you shall be performed.

I have not sought to instruct you, for that is beyond me, but I have sought to inspire you with the thought that it is necessary to instruct yourselves, that you may be capable by the influence exerted where it is needed, which shall be the outcome of your deliberations of carrying out those duties whose performance, stretching beyond narrow confines of individual or even class success, touches the welfare and prosperity of the whole community.

It is to you now that I appeal,—students, ex-students, professors and farmers—to unite all your energies to the attaining of this great object,—the rapid advancement of that branch of human labour and research upon which the very life of the human race depends, and consequently the fulfilment of the immutable designs of the Creator, Agricultural Science.

Some discussion followed the paper in the afternoon session arising out of the reference in it to the independence of the Union, but the general conclusion was that no formal expression of opinion on this subject was necessary.

Prof. Panton asked permission to make a few remarks as he would be absent when the question came up again. He thought the essayist forgot to take into account what a motley group of students the professors had to deal with in this institution, and how hard it was to combine the theoretical with the practical. Some of the students wanted a lot of outside practical work ; others again, the farmers' sons, more especially, wished to attend the lectures and not be required to perform work with which they were already fully acquainted. This rendered it a very difficult matter for the persons who had to draw up the curriculum to suit everybody. Again, some of the students had only the rudiments of an English education, while others were undergraduates of universities. If the professor in charge pursues a simple line of instruction the advanced students grumble because they do not get along faster, while if they are less minute in their explanations the less advanced students fail to catch the drift of the meaning intended. Some are well up in practice and not in theory ; others in theory but not in practice. It had been suggested to establish an honor class, and by placing the more advanced students in it get them on faster in their work ; but for this they required a large staff. They might devote their attention to one subject exclusively, and when through at Christmas with one study take up another for the next term. The professors had often consulted on the question but never could see their way clear, under the circumstances he had explained, towards overcoming the difficulties. The students required a longer course. Some did come back the third year, but there was no course provided for them, and very few will study long without lectures ; so those that came back did not derive much benefit by so doing.

SCIENCE IN CONNECTION WITH AGRICULTURAL EDUCATION.

Prof. Panton read the following paper :

It affords me great pleasure to be present with you to-day, and particularly so to have the privilege of addressing you upon a subject which is of great importance to agricultural progress at this period of Canadian farming. I consider the subject which has been given me by your secretary especially opportune, when farmers' sons seem to be exceedingly desirous to secure a sort of practical knowledge of some things which come under the province of farm knowledge, but which in many respects lamentably fail to supply an education. To an observing mind the term of years which indicate Canadian farming appears capable of being divided into several distinct periods, which may for convenience be termed the clearing, crude farming, ploughing, machinery and scientific periods. These may be compared with each other by reference to the condition of home life in the period ; to what extent woman worked in the field ; the beast of burden employed ; the machinery used ; the amount of cultivation done ; the rewards returned for the toil, and the relation of physical to mental labor.

From these standpoints each period will be found to be in advance of the preceding until the last is reached. The scientific period stands above all others, and is especially distinguished by a desire on the part of farmers for education and greater knowledge in agricultural science. It is with this last period we have most to deal, and without further reference to the preceding periods I shall endeavour to address myself to the method by which an agricultural education is to be obtained.

At the outset it is necessary to remark that agricultural knowledge is not an agricultural education. The former is a cultivation of some facts ; the latter is a disciplined mind capable of grasping with problems which are usually met with in farm life.

It is unfortunate that there are at times students found within these walls who do not seem to understand this, and appear to be satisfied to pass away with a few facts learned in some of the departments. As far as an education is concerned, they have derived little or nothing. I do hope that if there are any before me this day who have had an inclination to neglect *education*, they will bestir themselves and endeavour by application to study to reach that state of culture which can only be attained by systematic study, close application and mental discipline. Those of the faculty who appeared

at the Farmers' Institutes during the early part of this year were struck with the desire manifested by farmers for more knowledge in agricultural science. Among the old, or better, those whose opportunities for attending school are past, the only remedy is Farmers' Institutes, where men of experience may read papers, and instructive discussions arise. But to the young our College is open, where an agricultural education is obtained in the most practical manner. I say practical, because the means by which the faculties of the mind are developed and improved are facts which are continually coming under notice in the work of after life, and thus the knowledge by which his education has been improved is retained, and frequently proves of service in the field. When those of us who have passed through long years of study recall some of the subjects we spent weary hours in learning, we find that we have remembered very little of the knowledge we then acquired, but our disciplined minds remain educated though the facts have passed away and are now of no further use.

Had we been like some of our exceedingly practical students who imagine that unless every lecture can be shown to directly bear on the farm the time is lost, and who, unless what is said will come up almost in every day life, feel disposed to turn away from the lecture-room and desire to linger around what they imagine is more practical—had we, I say, been so exceedingly practical, our education would have been of a very rudimentary nature indeed. One of the great strides in education now is reaching it by this practical method, viz.: the study of subjects which are of such a nature as to be continually brought into notice in after life. By such means the knowledge is retained and education obtained.

It is in this way, I feel confident, that science will occupy a very important place in the curriculum of study in Colleges and High Schools as the years roll on. During the past fifty years it is wonderful what progress science has made as a subject of study. Colleges, where only one professor was found in the departments of science, have now four and even more. Scientific subjects are now taught in nearly all schools. The whole tendency is in the line of scientific knowledge as an educator, replacing some of these dry subjects which, though the study of them educated the mind, the knowledge was of little or no service afterwards. Here the question naturally presents itself, to what extent is science of service to a study of agriculture? To answer this I shall endeavour to show some advantages derived from its study.

1. There are several faculties of the mind largely developed by the study of science, and especially those subjects which we find on the College curriculum, viz.: Botany, Geology, Chemistry, Zoology, Meteorology and Entomology.

Let us examine some of these faculties. Observation is of great use to the agriculturist; as this improves, his knowledge must naturally increase. No study is better fitted to improve this than science, which consists largely in the accumulation of facts.

The successful student in Botany and kindred studies must observe, and in the course of time acquire such habits of observation that he sees much full of interest where there seemed little or no attraction before. At this period in Canadian farming, the successful man must rely upon mental power more than physical. He must be observant, thoughtful and shrewd.

2. Comparison is the result of observation, for it leads to a consideration of his facts and is a faculty well worth cultivating.

3. Induction enables the student to arrive at proper conclusions. It naturally results from his study of facts.

4. Method also is an outcome from a study of the sciences, and is certainly a faculty of immense importance to the farmer. Much valuable time is lost on the farm from a lack of method in work and arrangement. Who has not seen hours wasted in the harvest field hunting for tools to make some repair? The tool sought may be any place, for there is no system followed in having a particular place for each thing. Were farmers to charge themselves with the loss of time resulting from an unmethodical way of working, they would be surprised at the wasted time of a year. No subject in the whole curriculum of study equals science to develop system or method in work, and hence should be emphasized for that purpose. No habit can surpass industry to insure a young man success in the world's battle, and few things are better calculated to develop this than

attractive subjects of study. We are not mistaken if we claim for science many attractions, for the facts upon which it is found are all derived from the great book of nature spread open before the farmer and profusely illustrated on every page.

One more faculty I shall mention that rapidly develops under the study of science, viz: Memory. Who can suggest a better line of study to strengthen this very important faculty than Science? At first the facts may appear isolated, but as study progresses the common bond of union daily appears, and further illustrations of the great principles of science are continually being presented in farm life, so that what has once been learned remains. The second advantage claimed for science in connection with an agricultural education is, that it enables the possessor to read intelligently the current literature on agricultural science. You cannot take up an agricultural journal or magazine of any pretensions to-day without finding many references to subjects interwoven with science, and which cannot be understood unless the reader is familiar with the principles of that study.

How, then, are these great lights, flashing out from the darkened recessses of nature, to be understood by the farmer, unless he has a knowledge of science? This accounts for the desire among intelligent agriculturists for more extended knowledge, and which some thoughtful ones are eagerly striving to secure by reading and private study. Many of them would fain spend a session within these walls in order to improve their knowledge in subjects which they find have so much to do with the calling they have taken for a life-work. What shall we say, then, of the young men who, with all the lecture-rooms open, and affording every facility for the acquirement of a superior education attained by studies bearing on the plant, the soil, the atmosphere and animals, amongst which they are to toil spurn these opportunities and lead a life of comparative indolence, while they attempt at getting what they term a thoroughly practical knowledge? Will such elevate the status of the farmering community? Will they return with minds improved by the attendance at college? Methinks I hear but one answer. The farmer who seeks to win success in the coming days must possess more than physical power; he will require a well trained disciplined mind.

How sad it is to see many young men so thoughtless, so regardless of their future success, as to imagine that because some in the earlier periods of this country's history succeeded principally by physical effort, that that may indifferently sacrifice the opportunities to secure an education and expect success without mental development. They forget that they are to work a soil which has been robbed of much of its fertility by unscientific farming, and compete with innumerable producers in a market which is yearly becoming more precarious. I would emphasize the statement that you cannot read intelligently the agricultural literature of the day without a fair knowledge of science at least.

Thirdly, the study of science is a source of endless pleasure to one whose life-work is largely concerned in understanding the book of nature. What a field of interest opens out to the farmer who has a general knowledge of science! The plant he grows, the soil he cultivates, the animal he raises, the air he breathes, combine to afford his reflective mind objects of thought and study. The soil recalls its source, its origin and formation, and carries the mind along lines of interesting and entrancing contemplation. He sees a panorama of the earth's geological history as he considers the boulders lying by the roadside. These silent monuments suggest periods long receded into the past, when his clay beds were formed from the disintegration of similar rocks ground down by immense rivers of ice wending their way across the American continent, and finally passing into regions where increased temperature released from their icy grasp the "hard heads" of the field. His study of botany supplies endless thought on the appearance of every plant. The very weeds become a source of interest, and he sees they are only plants out of place. Unable to move about for sustenance, he knows how they subsist, and reflects upon the wonderful manner by which they secure the perpetuation of the species. He contemplates how wind and insects lend an aiding hand to fertilize the helpless flower. The complex problems of plant growth are continually before him for solution, and though he may never altogether know the why and wherefore, still he finds a halo of

interest surrounding his life unknown to the poor illiterate follower of the plough, whose life is less to be desired than the creatures he drives before him.

No labourer in the world's great field is surrounded by so many sources of delight as the farmer, and yet how few are able to experience this happiness. If young men could see this, and by patient study equip themselves for it, the work now looked upon by many as having a tendency to lower man would be found to elevate him, and bring him daily nearer what his Maker intended him to be: the head of all animate nature.

I do not require to enlarge upon the idea of happiness derived from the surroundings of farm life to a student of science. I have up to the present directed your attention chiefly to what might be termed questions of theory, but I now wish to direct you to something which is in all probability of a more practical nature. This is a practical age, and the cry is always heard by the student, *cui bono?*—for what good is such?—ignoring the mental discipline entirely. To answer this I shall produce one or two illustrations to show that from a practical standpoint science has strong claims upon the student of agriculture.

Some who are before me have heard much about the importance of certain constituents in animal food—that a great deal depends upon what you want to do with the animal, as well as the nature of the food it is to receive. In other words, animals for work, maintenance, fat, milk, or growth should not be fed in the same manner.

Foods differ much in composition as regards their *fat forming* and *flesh forming* properties. Consequently the intelligent farmer should ask himself the questions:—What do I require from the animal I am about to feed, and what food has most of the properties suited to serve this purpose?

This has led to what is now becoming a very important factor among cattle feeders, the *nutritive* ratio, *i.e.*, the relation of *fat forming* substances to the *flesh forming*.

From innumerable experiments carried on at great expense, and performed with the greatest accuracy, it has been found that a certain ratio is suited for the different purposes desired from farm animals; for instance, that best suited for fat production is 1:5½—one proportion of flesh forming (nitrogenous substances) to 5½ fat forming (fats, etc.) If this is the case, is it not of intense importance that a farmer has some knowledge of the chemical composition of foods, etc., and the part they play in the animal economy. During the month of January, when the members of the College faculty were attending Farmers' Institutes, one of the interesting items produced at some was a card containing the result of Professor Brown's experiments in cattle feeding over a period of some nine years. This statement showed the gain per day and the cost. Twenty-one different rations had been tried, and that which gave the best results was found on calculation to have a nutritive ratio 1 to 5½, precisely what scientific research had arrived at in Germany. Here, then, is a most important factor in making up a ration for feeding purposes.

How important, then, that more science should be known in this direction, that feeding may no longer be carried on in a sort of hap-hazard manner. If the laws which underlie scientific feeding were better known, and the chemical composition of plants understood, much waste would certainly be prevented, and a knowledge of science be found to be of the utmost practical importance.

Further, Ontario soil is rapidly becoming impoverished from unscientific culture, and, if not already at hand, the day is not far when fertilizers will require to be largely used. Now, there is nothing in which a man can be more readily deceived than the value of a fertilizer. This has been ascertained to be the case in countries where such are used more than here. Consequently it was found that some check must be made upon unscrupulous dealers in super-phosphates, etc.

The plan adopted in many of the adjacent States is to demand a chemical analysis of each. Experience shows that the most valuable ingredients in a fertilizer are nitrogen, potash and phosphorus, and that these have a comparatively regular market value: consequently, knowing these prices, and the chemical composition of the fertilizer, we can arrive at a fair estimate of the substance. Now, if the selling price is much in excess of the estimated value, you may be pretty sure that you are paying far too much for the fertilizer. In some cases in the United States it has been found that farmers paid as high as $35 per ton for what, according to the estimated value, was worth

only $1.03. The result has been that of late years a great improvement has been effected in the fertilizing mixtures sold, and now there is seldom much difference between the selling and estimated price. This has saved thousands of dollars to the farming community, and is a strong proof of the practical benefit which arises from understanding the scientific principles which underlie the use of fertilizers.

Many of the most destructive foes to the farmer are microscopic, such as rust, smut, potato blight, plum disease, etc. Before we can combat with these successfully we must know something of their life history, and this leads to a study of minute parasitic plants among the fungi. These present some of the most interesting subjects of study in the whole realm of the plant kingdom. Insects, too, are foes which do an immense amount of injury to crops of various kinds, and anything we can learn that will assist to diminish their numbers is of vital and practical importance. From what I have directed your attention to you will, I think, be constrained to believe much of practical importance is to be derived from a study of science in the pursuit of an agricultural education.

I have now reached the conclusion of my address, throughout which I have endeavored to show the importance of the study of science to a young man desiring to get an agricultural education. This has been forced upon me by circumstances which I have observed since I returned this year to assist in the education of young men who, by their presence here, confess that it is their purpose to follow farming for a calling through life. I perceive an indifference of some to study and a tendency to fall into habits of indolence by taking one or two subjects while their general education is lamentably poor. I fail to find such studying in the reading room ; I cannot find that they take more books from the library than those who attend a far greater number of lectures. At the close of a term their names are not higher on the prize lists than those who studied double the number of subjects during the term. In fact, experience goes to show that those who have the most subjects are usually the best students in the end. There seems a tendency in human nature to prove that the less we have to do the more imperfectly it is done.

Young men, if you have any desire to raise the status of Canadian farming, secure by all means an education ; not a few facts pertaining to one or two subjects of study, but knowledge that will discipline your mind, mould you into methodical habits, and, above all, develop industry in your nature. Without industry, without system and without education you must expect that in the race of life your highest place will be a hewer of wood and a drawer of water. Rise from indolence and rise from indifference to study, apply the vigor of your body to the cultivation of your mind, and

> "In the world's broad field of battle,
> In the bivouac of life,
> Be not like dumb, driven cattle !
> Be a hero in the strife ! "

EXPERIMENTAL REPORTS.

Mr. Shuttleworth, on behalf of the committee appointed to carry out experiments undertaken at the last session of the Union and to receive reports from the same, verbally reported that most of the reports had been received, but two of them were not on hand in time to prepare the summary of results that day. The experiments had been arranged last year by Prof. Hare, and nine or ten of the ex-students had volunteered to assist in the work. The plan proposed was for each experimenter to set apart, say an acre of land, divided into ten plots. The rotation for each plot was to be different, and as the experiments would be conducted in different parts of the Province, and in different soils, it could be ascertained what grains and vegetables were suited to each soil and locality. The tabulated results of the experiments would be very valuable. One rotation was: First year, turnips ; second year, barley ; then seeded down with grass the third year ; and in fourth year plow up and sow wheat. One object of the experiments was to find out the full value of clover. That subject would, however, be taken up the next day. Mr. Shuttleworth then read the following reports :

Co-operative field experiments with "natural" and "artificial" fertilizers, with a four years' rotation of crops, conducted by the following gentlemen under the direction of the Ontario Agricultural and Experimental Union :

Jas. Laidlaw, M.P.P. ..... Guelph P.O., Wellington County.
J. R. Job ..... Waterdown P.O., Wentworth County.
W. H. Stubbs ..... Drayton P.O., Wellington County.
J. & R. Ramsay ..... Eden Mills, Wellington County.
E. A. Rennie ..... Hamilton, Wentworth County.
T. R. Parker ..... Ivy, Simcoe County.
Ontario Experimental Farm ..... Guelph, Wellington County.

1. No manure.
2. Farm-yard manure, 14 tons per acre.
3. Nitrogen mixture, ($\frac{1}{2}$ Nitrate of Soda, $\frac{1}{2}$ Sulphate of Ammonia, and $\frac{1}{3}$ dried blood, 150 pounds per acre.
4. Superphosphate, 350 pounds per acre.
5. Muriate of Potash, 150 pounds per acre.
6. Nitrogen mixture, 150 pounds per acre / Superphosphate, 350 pounds per acre
7. Nitrogen mixture, 150 pounds per acre / Muriate of Potash, 150 pounds per acre
8. Superphosphate, 350 pounds per acre / Muriate of Potash, 150 pounds per acre
9. Nitrogen mixture, 150 pounds per acre / Superphosphate, 350 pounds per acre / Muriate of Potash, 150 pounds per acre
10. Quick Lime, 400 pounds per acre.

Plot.	J. & R. Ramsay.		J. R. Job.		W. H. Stubbs.		O. E. F.	
	Roots per Acre.		Roots per Acre.		Roots per Acre.		Roots per Acre.	
	Pounds.	Bushels.	Pounds.	Bushels	Pounds.	Bushels.	Pounds.	Bushels.
1	11,000	183	9,900	165	10,800	180	18,900	315
2	16,800	281	10,400	173	12,600	210	32,640	544
3	11,700	195	7,650	127	11,850	197	25,440	424
4	19,580	326	9,000	150	12,100	201	25,320	422
5	19,400	323	9,600	160	12,000	200	22,860	381
6	24,980	416	10,400	173	12,250	204	19,500	325
7	21,600	360	10,440	174	11,800	196	.....	.....
8	22,500	375	9,450	157	12,360	205	.....	.....
9	18,900	315	12,240	204	12,500	208	.....	.....
10	10,000	166	9,960	166	13,200	220	.....	.....

Mr. Shuttleworth explained that a certain sum was voted annually for experimental purposes, and on Prof. Brown's recommendation the Minister of Agriculture made a grant of $100 to the Union, enabling them to print 1,000 copies of their 1884 report, which were distributed to the members of the Union, leading agriculturists, and the press.

Mr. Campbell said the people were highly pleased with the reports, and had formed a better opinion of the Union, the College, and their work.

BENEFITS AND RESULTS OF EXPERIMENTS.

Mr. Shuttleworth wanted to hear from Prof. Hare as to the future benefits and results of these experiments.

Prof. Hare said that crop growing was an experiment of years. Have we any idea of the chemical conditions under which crops grow? Do we know the results of *flesh formers and of beef producers?* Do we know when we have the right quality of flesh-forming constituent, and when we have it abundantly enough? We have to consider and endeavour to understand fodders, their ingredients and properties. They were not in a position to analyse fodders at the College, as their laboratory appliances were very insufficient for the purposes of analysis. We cannot find if the grain of a certain district is normal or deficient. With regard to root crops, many of them had small eyes of which they had not yet been able to find out the cause. Experiments on roots were necessary. If the turnips in one district were better in quality and quantity than those in another, they should find out what element of the soil is lacking in the one district and present in the other to produce such a result, and they would find the same state of things in regard to all agricultural plants. For finding out the character of the soils of this Province, and the places where certain plants could best grow, this series of experiments was instituted. The Union wanted the experimenters to do a certain amount of practical work and report their results. He would see that the rest of the work was attended to. Botanists wanted experiments with wheat, barley, roots, etc., to ascertain whether it were possible to find out the grains and roots best adapted to the different climates and different soils of Canada. Individual plants have peculiar features; each variety of soil has peculiar elements. The soil in extensive districts was largely uniform, its geological structure consisting of a basis of limestone covered with glacial deposits. The soil in a certain large district would be found to be peculiarly adapted for wheat, another for oats, another for roots, and so on; and they wanted to find out how much per acre of a certain grain could be grown under the most favourable conditions of soil and climate. The rotation they had arranged at the Farm was wheat, turnips, hay, and barley. The rotation could be adapted, however, to the wish of the experimentors, taking into consideration the general character of the soil you till and surrounding circumstances. They wish to bring into existence the perfectly developed plant; not a poor specimen, but the best wheat, the best barley, the best roots, by the application of the manurial properties which the soil was deficient in. Farmyard manure was the best if the liquid excrement was not let run to waste and the solid manure properly kept and covered. It was all taken from the soil and should go back to the soil. But it was generally found that they had not sufficient of this manure to cover all the soil, and the soil was not so rich but that the application of manure was necessary. Then came the question, what artificial manure applied to the soil can produce the plant best adapted to that soil in a perfectly developed state? Nothing could bring more honor on the Union than an endeavor among its members to find out these things. The old hap-hazard experiments should be dropped, and the new shape and bent of the experiments should be towards definiteness, both in application and result. We should know the relation, the composition of the manure, the quantity applied, and then the definite results would be valuable. In different sections, and on different soils, different manures would have to be applied to produce a perfect plant. On some soils we would have to use phosphoric acid on another sodium, on another nitrate of potash, and so on. In some districts we might get a perfect plant, and then by analysis of the soil and observation of the climate we might arrive at some idea as to what was wanting in other soils to produce that particular plant in perfection. In the United States, by continued experiment, they have found out what one district can produce best and what another, what one soil needs and what another. In Canada the soil is harder to study. It has a distinct geological formation; rocks had been brought down on its soil at the glacial period. In conclusion he would endeavor to answer any questions that might be asked.

Mr. T. Shaw wished to know if it were possible to maintain the fertility of the soil of a country without the aid of artificial fertilizers if all the produce grown on the land is kept on it and used there.

Prof. Hare answered that, with all the conditions mentioned by Mr. Shaw, the fertility of the land would increase. Carbon, carbonic acid and nitrogen are the elements which the plants principally take from the soil and from the atmosphere, and if these elements are returned to the soil, if all grown on the farm is used on the farm, the soil will increase in fertility.

Mr. Shaw said that his opinion on the question coincided with Dr. Hare's. He wished to impress the idea on farmers of the utter folly of selling their produce off the farm and thus impoverishing it. When we can, we should increase the fertility of the soil by using artificial fertilizers also. If artificial fertilizers are largely used, the increase in fertility will follow. A farm is like a bank, and a farmer should live on his interest and not impair his principal. Farmers were foolish to send their grain to Britain, and then send their cattle there to be fed on it.

Rev. W. F. Clarke was glad to hear Dr. Hare give no uncertain sound on this matter, that it was possible to maintain and increase the fertility of the soil, contingent upon the observance of certain conditions. He would like to hear about the manurial properties of clover, which he considered one of the most important crops in the rotation; also about manure production and manure protection, how the grain should be fed to make the least waste, and how it should be cared for to have it in the best condition. He had seen weather-beaten heaps of manure which he should be sorry to put on his land. He would give Mr. Shaw a slight cautionary hint: they were not going to have live stock alone. True, no stock, no manure; no manure, no crops. But he would have not live stock alone, but mixed husbandry. He would like the Union to take in the question: How much can we sell off a farm without impoverishing it, keeping enough on it to keep up its fertility? We have no right to impoverish the land; we are not to diminish our capital, but to have a surplus. In its virgin state nature gains from year to year from the trees of the forest; the soil is enriched by the falling leaves. A farmer can raise and should raise good crops, and use them mainly in feeding stock, and thus keep the soil up to its proper fertility. This is the only proper method. All others are wickedness, robbery and spoliation. He would like the question settled as to what proper margin we can create in order to maintain or increase the fertility of the soil.

Mr. Macdonald knew that nitric acid and other elements came down in rain on the soil. But what about it when these elements got there? He wanted to know the gain or loss in drainage—whether the soluble parts would be lost.

Dr. Hare explained that last summer six lysimeters or rain guages were established at the Experimental Farm. These were large roomed wooden vessels, lined with copper and filled with soil to the depth of three feet. They were exposed in a suitable place and from only two of them was drainage water got. It was an ordinary summer, neither very wet nor very dry. There was no opportunity of any water escaping into the ground without their knowledge. Usually the rain sank down about an inch and then went back into the atmosphere in the form of vapor, leaving the nitrogen and other plant foods in the soil. One of the lysimeters was filled with clay soil, one with sandy soil, one with humus, and the other three with soils from the experimental field. Very singularly not a drop of water was lost from the sandy soil, nor from the experimental field soils and but little from the clay and the humus: very little food was lost. They reckoned the loss in the lysimeter by comparison, and could estimate the loss in an ordinary clay soil. Would there never be any waste in sandy soil? Well, that depends on the quantity of rain and how it comes down. If rain falls heavily, loss will occur; but if gradual, there will be none. In the three experimental field soils, not a drop of plant soil was lost. In pastures the rain does not wash away the plant food from the soil; there had been found not a particle of waste in two hundred acres. They had got drainage water from summer fallow, but none from wheat land. He believed that no loss occurred where the soil grew grain, hay, or pasture; the loss was in roots and summer fallow; but the waste could easily be reckoned. If the instrument goes down three feet and the waste is nothing, or very small, no plants but the clover and the thistle can use the soil at a greater depth. The results showed that but little was lost to the soil by drainage water.

Mr. Rennie wanted to know if all the water went through the soil in the lysimeter and if all the surface water was retained.

Prof. Hare said the rain guage was water-tight. Every drop of water that fell on the soil in it must either evaporate or go down into the water guage.

Mr. Rennie said that drainage was beneficial in clay soils. It would take off the stagnant water, which would otherwise rise to the surface.

Mr. Shaw thought that in the spring of the year the waste would be more, as the drains would be unable to take off all the surface water.

Prof. Hare replied that he expected waste in the spring, but when the spring came he would be in a better position to give results.

Mr. Shaw said that the fertility of the soil could be increased by drainage.

Mr. Macdonald said that from decaying vegetation ammonia was given out. If the Professor could guarantee that the ammonia from his soil would not go on Mr. Shaw's, but benefit his own soil, then he would believe that the draining of his soil would not benefit his neighbour.

Prof. Mills remarked that he had noticed that one and a-half inches of the copper lining of the lysimeters was often exposed, and on touching it with his hand he had found it quite hot. He thought this exposed heated surface would tend to materially increase the evaporation of the water, and vitiate Prof. Hare's results considerably.

Prof. Hare explained that when the rain fell it would make the exposed copper the same temperature as the soil; but after the rain was below the surface of the soil the copper would exercise no decided influence upon it. The lysimeters were filled in winter, but possibly not so full as might be. He did not think the influence of the heated copper would amount to much.

Prof. Mills still thought that the presence of a heated surface in the lysimeter must have some appreciable effect on the evaporation of the water in it.

Prof. Hare maintained that the heat given to the soil by the copper was not worth taking into account, the specific heat was so little. Three of the lysimeters were filled to the top, and from two of these no drainage water was taken. Therefore he thought no particular influence was exercised, as the results were similar whether filled to the top or nearly so.

CATTLE-FEEDING.

Mr. Rennie then read a paper on Cattle-feeding in its different phases, which gave rise to an interesting discussion.

Mr. Macdonald said he had had high hopes of nutritive ratio when at the Farm, but in his reading and observation he had met with no such system as they had here. Prof. Sanborn, of the Missouri station, had made extensive experiments in feeding. For instance, he fed peas as against corn, corn against roots, and so on, and although he made no comparison of nutritive ratios he believed a high nutritive ratio to be the best. This rotation had the disadvantage of the animal being fed on one food all the time. He claimed the necessity of changing food, and advised the making a study of the combination of foods. In the co-operative method the food was changed every day and meal was also given. If the food was given in the right proportion, it did not matter much what it was. He thought the facilities at the Farm insufficient, but yet the experiments were not up to a correct principle. He was not satisfied with the method of feeding. If bulk grain was fed, the nutritive ratio would necessarily be small; if concentrated foods were fed, the ratio would be large. He advised the using of concentrated food, such as cut hay and roots. He thought it was important to be careful in this, rather than in an analysis of food. Prof. Sanborn has deviated from the standard in studying out differences in ratios. It was not wise to depend too much on Wolff's standard of 1:5½. Sanborn thought 1:10 a good ratio. For himself, he thought 1:6 gave the best results, but he advised a wider limit of ratio. He thought some reason ought to have been given for the new departure. He had seen nothing of it in his reading.

Mr. Rennie said farmers were continually experimenting on a small scale and the results are handed down from father to son, and from neighbor to neighbor. The farmers

are now experimenting on combinations of grain and fodder. The experiments at the Farm were like these, but much more accurate. Previous to the scientific advances in Germany, no scientific experiments were made. This system was the old one, only more accurate. In new experiments, it was found that the proper nutritive ratio was 1.5½. In practice, it was found that the ratio of 1:5½ was good; therefore, it was good in practice as well as in theory.

Prof. Hare stated that Prof. Brown's experiments were along the same lines as the old experiments. Definite amounts of food were given to each animal according to its choice, and they had found the best result. He had not looked into the matter with a view to any public result, but when out last summer he found that he had been able to increase his animal 2½ lbs. a day. He then hunted up the feeding tables and found that the result gave a nutritive ratio of 1:5½, which was exactly what had been claimed as a standard. The nutritive ratio affects the progress in fattening animals very materially, and by experiment they had found that the best and most thorough results were obtainable by feeding a ratio of 1:5½. He honored the farmers for finding out by practical experiment what the scientist had maintained was the correct ratio. If a farmer will go in for experimenting he will find by feeding what ratio is best. This was not necessary, as farmers now thoroughly understood that the nutritive ratio of fodder producing the best results by practical experiment agreed with that of the scientist, and tallied with the old experiments made when the ratio was established. They should not laugh at the German scientists; he agreed with Mr. Macdonald there. We are better able to feed rightly by our scientific knowledge in comparison and combination of foods, and of liquid and solid excrement. These experiments conducted at the Farm were accurate. If one food has a nutritive ratio of 1:5½ and another 1:6 the latter is not as good as the former. He thought the Sanborn ratio of 1:10 a little weak. It was opposed to the best results of the German experiments in chemistry. He would pass judgment on the Missouri Station experiments when he had read their report.

Prof. Mills enquired if it was an established fact that if any foods were combined in such proportion as to give a nutritive ratio of 1:5½ it would produce the best results. If so, what necessity of further experimenting?

Prof. Hare said albumen in the food produced flesh. Enclosing this albumen there was certain albumenoid material which is not used. The animal is not able to take out of one albumenoid as much flesh forming material as out of another. By comparing one fodder with another in the same ratio we obtain different results; one albumenoid has been digested better than the other, and by experiment we find out which one it is. He thought there was no further use of experimenting for a nutritive ratio.

Mr. Macdonald thought there was no misunderstanding as to that. Professor Brown's experiments were supposed to be conducted on a practical method. He knew when he was at the Farm, during the course of these experiments, animals had been fed for three weeks on the same food, and their appetite not consulted at all. If the practical method gives the same result as the scientific, what is the use of comparing them? He took a practical objection to the Wolff method. In feeding hay at one time the hay food would be good; at another time it would be somewhat deteriorated, and its relative value for nutritive purposes would be lessened; it would vary with the state and condition of the food. He wanted to know whether these experiments in fodders were to be carried on on a practical or scientific basis. The Chicago *Live Stock Journal* thinks there is altogether too much fat in the marketable beast of to-day. There is more demand for lean, and farmers should feed and exercise their animals to produce this lean. Sanborn was of opinion that in the earlier days, when the country was poor and cold, the necessity of fat was more apparent than it is with our modern advantages. He said that there was no necessity for so much fat. Sanborn experimented with a view to producing lean meat, feeding dried blood and other concentrated foods in a ratio of 1 to 1½, against a corn ratio of 1 to 8, and he came to the conclusion that a high nutritive ratio would have effect in producing fat, while a low nutritive ratio would produce lean. This question would be well worth studying out. In pigs a high nutritive ratio produces fat, and a low ratio lean. As to the matter of the digestive albumenoids in one food being better than

in another, science was as yet not pronounced. He would feed the nutritive ratio without reference to the character of the food outside the digestible elements.

Dr. Hare said he was along the same line as Mr. Macdonald. By experience they had found that a high ratio gave better results than a low one. We want to produce flesh as well as fat, and he thought that the chemical method should be used. By feeding a high ratio of 1 to 10 and exercising your animals you will make the flesh stiffer than by feeding a ratio of 1 to 5½ without much exercise. The albumenoids produce a quick fat. Albumen is not used to produce flesh. The animal cannot use all the albumen in making lean, but it is used in fat and heat. The albumenoids are not wasted because they do not produce lean. He would call a healthy animal one that has increased at the rate of 2½ pounds a day. In answer to a question the doctor stated that, although a high nutritive ratio produced less fat than a low one, he believed that the lean in a fat animal was more tender and more in quantity than in a lean one. There were some diseases incident to the fat animal, but he did not take these into consideration as they could be prevented.

Mr. Rennie had heard that a judicious amount of exercise was good for a beefing beast.

Professor Hare had found that a short walk every day produced as much lean as was necessary.

Professor Panton wished to speak a few words about the nutritive ratio. He thought when facts were against you, you should adapt yourself to the facts. In Germany, by long and careful experimenting, they have come to the conclusion that the best ratio for feeding purposes was 1 to 5½. Professor Brown did not think of the nutritive ratio in his nine years of experiments; but they had found out that the food which produced the best results had a nutritive ratio of 1 to 5½. The American experiments point to a higher ratio, say 1 to 10. He thought it would be wise to wait before accepting that. The young farmers had facilities for experimental work on a small scale: let them watch their nutritive ratio closely, and when they come together again and find, for instance, that a ratio of 1 to 8 suits the Canadian climate better, then adopt it. Let them think and watch over the ratios which produce the best results. It might be worth their while to start another nutritive ratio, to give different animals different fodders, in different ratios, to find out whether carbohydrates in different fodders produce different results.

Mr. Macdonald asked whether Professor Panton thought that the experiments at the Farm were rightly conducted.

Professor Panton had no information that would lead him to think that they were not.

Mr. Shaw asked Mr. Macdonald whether he looked upon the experiments as conducted at the Farm as being of no value.

Mr. Macdonald did not say so. He thought the basis not accurate enough, and made some practical objections, as to the hay being uncut and to the smaller grains. He believed some things were not right.

Mr. Rennie thought that it was a blessing that Professor Brown had no thought of nutritive ratio in his experiments, as their testimony was so valuable in favour of 1 to 5½.

Mr. Macdonald said that if they fed a nutritive ratio of 1 to 4 last year, then that year's experiments were no good.

Mr. Holterman delivered an address on the habits of bees, their diseases, and the best means of caring for them. A discussion followed in which Rev. Mr. Clarke and Mr. Ramsay took part.

HIGHER EDUCATION OF FARMERS' SONS.

A paper on this subject was read by Mr. Campbell, and a discussion followed.

Mr. Shaw remarked that although not one line of communication had passed between them, the previous speaker had gone over all the ground which he had thought to speak on, and he could only clench the nails driven home. It was humiliating to think that farmers were so little alive to privileges within their reach. In no phase of human life are men less alive to their opportunities. Neither in social nor spiritual life are they living up to the privileges within their reach. In their attitude towards this institution they did not attach enough value to the privileges offered therein to their sons, and it was so in other matters. They were not open to conviction as to the benefit of keeping better stock ; they were not doing enough to advance their stock. So in considering these things, the first question was as to whether there was any money in it, and he was not at all surprised at the reference in the paper to farmers' sons. Mr. Campbell had placed his recommendations under three heads: First, a two years' course on a farm for those coming from cities and towns. In no single instance would he admit a town-bred youth without a two years' course with a farmer. It would be doing him a kindness ; it would injure no one, and would have the interest of the institution at heart. He would have it imperative if a young man did not come from a farm. Young men from cities and towns did not know what farming is ; they have not gone through the hard work of the farm. He would not have them deceive themselves: life at the college is not life on the farm. There were things which a man would learn in one year's practical work on a farm which the professors had not the power to teach him, and to a person ignorant of farm work one year on a farm would fit him better for the life of a farmer than the whole College course. Here he looks on the outside work in the summer, now and then takes up a pitch-fork, works for an hour or so, and then reads. But let the farmer insist on him rising early in the morning; let the sun burn brightly ; let him work hard and at night he will envy the dog. Let him be roused in the middle of a cold winter night to attend to the sheep ; and then he will have some idea of the hard side of farm life. Some of the young men from the College know nothing about this and are disappointed when they go from the College to the hard routine of the farm, and often disgrace both the Experimental Farm and themselves. The Union could urge this change and accomplish it. It was important that every intending student not brought up on a farm should have a two years' course on a farm and a certificate of character and fitness from the farmer with whom he put in his time. He often pitied the professors in the institution: he had an idea of what they had to put up with. He was delighted to hear of the improvement in the morals of the College during the past few years. He had an idea of the doings of some of the students in the past, and such conduct by incapables of other lands should not be tolerated. If a young man from Great Britain comes to the College with an earnest desire to learn and work, he will be assisted and respected, but young men had come out in the past because their fathers could not manage them at home. Young men should come here to learn, not to make mischief. He asked the privilege of publishing these papers. He was rather in favor of narrowing the course, but of keeping up the standard. Do not lower your standard, raise it. Do not let the earnest student go away half equipped. A lot of information is imparted here which can be got much better elsewhere. Get it there, and both professors and students will then gladly turn to the work which can be done here far better than anywhere else, and the result will be beneficial on all hands. A tree is judged by its fruits. Newspapers and professors and friends can talk of the advantages of the College, but unless the men going from it do not prove themselves the better for their stay thereat it is of no use. A little while ago feeding cattle was looked upon as foolish, and now there are so many cattle feeders that 60,000 head of cattle are sent annually to Great Britain to cheer the hearts of the people there. If young men from the college distance the farmers' sons alongside of them, then farmers will believe in the college. He was inclined to be in favor of shortening the hours of labor if a two years' preparatory course were required, as the student having a thorough training in farm work could make it his business at the college to acquire the knowledge he wants; but he never felt justified in giving an opinion until

he had thought the subject out. He believed the board of representative farmers to be a step in the right direction. It would do away with the idea that the College was a Reform institution. If the board were composed of farmers of both sides of politics, it could then be called an institution for farmers. The agricultural institutes had done good work, and he had no doubt but that they would reap the result of their work in an increased attendance of students next year. The professors had done a great and a good work; they had instructed many and changed minds that were disposed to oppose their ideas and methods. And yet the work was not so complete as it might be. No address on the subject of agricultural education could ignore the College, and no college professor was in a position to handle the college as it should be handled in speaking along this line. Agricultural education brought out the prominence of the college, and its benefits could not be so well pointed out by the professors as by others, outsiders. Some person or persons fluent in speech and reliable in character should be appointed to attend at the next Farmer's Institute to discuss agricultural education in all its bearings, with special reference to the college. It would bring out a large attendance.

Prof. Brown contended that they should talk endowment first. Nothing could be done independently without endowment.

Mr. Hannah, of Clinton, thought we could not expect that yet. He was much pleased with the paper and the discussion, and could endorse nearly every sentiment uttered. With reference to the independent board of management he was of opinion that the board as proposed to be constituted by Mr. Campbell would not work. In the Dairymen's Association there were few farmers. There were some prominent farmers, of course, but more of other professions. In the Agricultural and Arts Association they had not all farmers. Such a scheme should be adopted only after due caution and consideration. The necessity and benefit of a good agricultural education should be brought prominently before farmers. You could supply a lecturer but not an audience. The great mass of the agricultural community are hard to reach on that subject; they don't believe in it; the attendance is often poor and only those alive to the importance of the subject are there. The meeting at Clinton was poorly attended, but the feeling left there by the professors did more to instil a longing for a better agricultural education and to dispel many erroneous ideas about the college than anything else could have done. One prominent farmer there was always opposed to the college, and has talked hard against it, but after hearing Prof. Mills' address on agricultural education he has gone away with his ideas considerably shaken up and changed. The institutes do a great deal towards awakening an interest in this institution, but it is the work the students of the institution do that make for it enemies or friends. If the education given here makes a boy better, not in the line of sentiment, literature, etc., but in practical agricultural work, it will come home quicker to the farmers than any other way. It is a practical matter; a farmer must make a little money to have a little comfort, and unless the education given here will pay farmers will oppose it. If they see such an education can be made to pay they will get it. Just complaints had been made against the High Schools. Farmers often send their boys there with the idea of giving them a little better education than they themselves possess, and then of having them back again on the farm. But the whole drift of the High School is away from the farm. No subject in connection with agriculture is taught; the studies they pursue lead them away from agriculture and are of no practical use. If a boy spends four or five years of the most impressionable part of his youth far away from what is destined to be the business of his life, he does not take much interest in the farm when he returns to it. That is the reason so many High School pupils are failures on the farm. He believed it was a great mistake not to give farmers' sons a liberal English education, but agriculture had more followers and was a wider subject than any other and it should not be neglected. Young and old have to learn by their own experience, and also from the experience and teaching of others. It was no good to go it blindly. You should get all the outside information you can, but also use your own judgment. He thought that reading the report either of the College or of the Union would have an influence for good. He was glad to hear of the improvement in the conduct of the students, as they had given the College a hard name in the past.

Mr. Owen, as an English student, strongly censured those who had dubbed them "incapables," "loafers," and other choice names. They did not get fair play. The English student of the present should not be condemned to suffer, or be compelled to rank with those of the past, whose actions may not have been what they should be. He referred to an article in the *Live Stock Journal* in which they were called "incapables from other lands," and denounced it as a libel on the present English students. They were not incapables. They were of a higher class than those who had thus spoken of them. (No! No!) All they wanted was to be treated justly.

Mr. Shaw believed the last speaker had spoken conscientiously, and that he came to the college to learn, and not to misconduct himself. He would be glad to be his friend. But he wished he would read again the article of which he complained. There was a reference in that article to incapables from other lands, but he was certain that it was qualified by the statement that others came with a laudable purpose. Again, in that article, the English student of the present was not referred to; it was the student of the past, the rascals who had made the college a by-word and a stench in the nostrils of respectable and respecting people. And they were not all Englishmen; some were Canadians, he was sorry to say. He was afraid that the idea had gone abroad that this institution was an asylum for hard seeds and riffraff, instead of a school for scientific education in agriculture. It was intended mainly for Ontario, but they did not intend to shut out young men from England and other countries, provided they put in their two years hard tack on a farm. He had no intention of insulting the English students. On the contrary, he should be pleased to help them in any way that lay in his power.

Mr. Workman was very glad to hear the English students defended. He had come out to Canada with the idea of farming. He had made up his mind that the life was rough, and he was prepared to face it. He did not hear of the Agricultural College until he got to Canada, and then he came to the College, where he was told the course was partly practical and partly theoretical. It was difficult to find men in England who would spend two year's on an English farm and then come out here to study at this College. He thought the two year's rule would shut the Englishmen out altogether; two years on some farms would take away all desire for farming. To insist that all should have two years' preparatory training in practical farm work might be all very well for Canadians, but where would the Englishmen get this training? The majority in England are not farmers; the majority in Canada are. Canada is more different from England than it is supposed to be; very largely different. If the chairman knew anything about English wages, he would not advise a two years' preparatory course. England overflows with the educated classes, large numbers of whom come to Canada. The Canadian farmer looks upon an Englishman not accustomed to manual toil as a non-paying speculation, and where is the Englishman to get the necessary education? There was no other place than the College to come to. Before passing this two years' restriction, they should remember that these Englishman will pick up knowledge faster than an uneducated man would. This matter should be thoroughly considered with an eye to Canada's interest; these men bring out large sums of money with them which is invested in the country, and this benefits the Canadian taxpayer. With reference to the proposition to form a syndicate of farmers to run the Institution, he thought the Government would object to handing over the management and still paying the expenses of working. He had read over the article in the *Live Stock Journal*, and was grieved that the editor of a Canadian journal of such influence should make such statements. If the wrong was done in the past, he should have said so, and not let the onus of the accusation rest on the present students. From what little he knew of Canada, he thought that the farmers did not know much about the College, and this would give them a bad opinion of it. He considered that the matter ought to be explained. All he asked for the Englishmen was fair play and kindness.

Rev. W. F. Clarke, from his past connection with the College, had given these recommendations a great deal of thought. In its past history these things had been brought forward; he had advocated a one year's preparatory course years ago, for those in towns and cities whose fathers wanted to send them to learn farming. The original recommendation with reference to the practical work of the College was three hours compulsory, and six hours optional labor. He thought three hours necessary to bring them

up to the physical standard required. A Board of Management has been thought of, but there was no provision for endowment. All the colleges in the States were independent of the State; they had handsome endowments from lands, and the sale of lands, making them every one independent. Without independent means of support it cannot be independent of the Government, and nothing can be done without this. This change must be made step by step, but it was too long in advance for the present temper of the people. Hon. A. M. Ross is in favor of an Advisory Board. He thought it better to move for that first, not as an ultimatum, but as a step towards the goal they were seeking. An Advisory Board to advise him, not the Professors. If the Board were made up of farmers from both sides of politics the Commissioners would be free from party attack if he acted on their advice, but entirely independent management would meet the case better. The Agricultural College is the people's college as such, and he was surprised to learn that in the composition of the students the Grits were so largely in the majority. He had no idea that political prejudice against the college could have gone so far, and he regretted it. He was every day losing faith more and more in party principles. This was not an incidental case. "Pairty" does not spell purity, as *Grip* says. Let this spirit of party be exorcised from the College. He was glad to find that the pulse of the students beat fair and true. He thought the general plan authorized by Mr. Campbell for education in High Schools an excellent one. This was not an infant class, but of a higher grade. They should not restrict the standard of this institution, but rather raise it. We want practical farmers. It would be a good idea for the meeting to give expression to its views; they would have great weight. He regretted to see the little jealousy springing up between Canadians and Englishmen. Whatever may have been true in the past concerning incapables from both sides of the water, and that there had been such there was no denying, still all felt that wherever they came from, or whatever they were, they were all British and under the old "flag that braved a thousand years the battle and the breeze." He was sorry this feeling had been brought out. Mr. Shaw was a kind-hearted man, and he could promise on Mr. Shaw's behalf an explanation in a future number.

Mr. Workman asked, if a two years' preparatory course was decided on, who would find the farmer with whom to put in the two years?

Mr. Holterman thought a one or two years' preparatory course right, and considered the speakers from the English point of view admitted this. Many things could be learned by practical work on a farm which would be dollars in a learner's pocket. Then bring out ten or twenty thousand dollars to the North-West, and spend money every year in getting experience which every farmer's boy possesses. This step would also do away with so many who take only a short course. He would not say two years, but certainly one.

In response to an opinion that it would not be very hard to find farmers to take new beginners, Prof. Brown said he was glad to hear it, but he doubted it. They had great difficulty every year in finding places for a few, and they could fill easily all the places that were offered.

Mr. Holterman thought the objection the farmer had to the English student was, because he was not willing to put up up with the hard lines many Canadian farmers had to endure. If they are in earnest in their work there is no trouble, but they choose what work they will do and what they do not feel inclined to do, and the farmer objects to this way of doing things.

Mr. Workman knew a little about farming in Canada. He had come out determined to put up with any kind of hardship. He had not openly objected on the farm where he was put. Many things were distasteful to him, but he thought his forbearance had gone far enough when the farmer's wife objected to his washing in his bedroom before dinner. She wanted him to wash in the kitchen with the others.

Rev. W. F. Clarke thought that was a very fair example to show how the English and Canadian ways did not hitch. Mr. Workman probably forgot of how much he increased the labor of the farmer's wife by adhering to these habits which were not suited to a farm. He thought Mr. Workman ought to have given in on that point. Everything possible should be done to lighten the labors of the farmer's wife. She has more than she ought to do now. Many a time, when pastoral visiting, he had washed on the old log at the back door of the house. There were a great many inconveniences perhaps in this

country which we never noticed, but which would come hard on one from a country where everything is up to the nines. Some people pride themselves on their roughness; this goes hard against English pride and ideas. Young men from England cannot earn their salt when they first come on a farm, and yet expect good wages. Farmers are sometimes unreasonable. He was not greatly surprised; the gauge of a man's ability on a farm is often muscular strength. These and other things must be recognized and mastered, and it is months before they are worth much.

[The meeting then adjourned till two o'clock, when the morning's discussion was continued.]

Mr. Owen looked upon this college as a preparatory course—a training for the work that came afterwards. College first, work afterwards in other professions, and why not in this? not farm first, college afterwards.

President Mills thought the college should not be a preparatory school for those wishing to become farmers.

Mr. Owen said too much time was occupied in teaching inside elementary work, and not the higher work. They had direct instruction there, but no direct instruction outside. They were looked upon as simply labourers, and instead of being taught and trained as students, they had to work five hours a day as labourers.

Mr. Files was of opinion that the speakers on the side of the city and town youths furnished enough forcible argument for the two years' preparatory course without advancing anything further.

Mr. Ramsay, Eden Mills, said that it had narrowed down to the question, Ontario *vs.* England. Was this college to be a preparatory school for city youths and Englishmen? No, but for the higher education of the sons of Ontario farmers. They were all agreed to do away with a certain amount of work. Let the education given be confined to stock, chemistry, etc., for the boys know the practical work of the farm. He thought there was a lot of unnecessary stock kept. He could not see how to take the institution out of the control of the Government. It would be a white elephant on the farmers' hands. The principle of the Advisory Board should be looked up and considered. He thought this board should make recommendations, but he objected to its composition as outlined by Mr. Campbell. Three representatives from the graduates was too many. The Agricultural Societies should also have a representative.

Mr. Rennie considered that two hours' work each day should be imperative, and five hours optional. The winter class had too much lecture, too little time for study, and too much cram. Some came to the college to be farmers others came with no definite idea, and therefore are dilatory in their work. He maintained that they cannot have more than two or three hours a day work, and study properly.

Mr. Holterman thought if a person did not want to derive benefit from the lectures he certainly would not.

Mr. Files believed the farmer's son came to get instruction which he could not get at home, and not to work, which he knew all about.

Mr. Muir said it was not possible to keep up with the lectures, do outside work, and read up besides. Let them have less outside work and more reading.

Mr. Workman, as a member of a special class, had plenty of time outside and plenty of time inside.

Mr. Carpenter fully agreed with Mr. Muir about the farmer's sons. They come to the college to improve themselves by study and reading, and would do it if they had the time. Of course there were a certain class who would waste this extra study time, but not many.

Mr. Ramsay, jr., found that some occupied their time, others did not. They could change their time every other day and have five hours work. The professors could then look after them on somewhat the same system as had been followed before in the evening class by the resident master. Farmers' sons do not read enough. They have not the time at home.

Mr. Major advised that this personal feeling be buried, and not to have any further squabbling as to the respective rights of Englishmen and Canadians. He did not believe special legislation would be necessary; events would remedy themselves. He thought

working on a farm a great benefit; by it he was able to see where the College was wrong and where it could be improved. As Englishmen, they should remember that this College was instituted, paid for, and carried on by the Ontario farmers. Farmers' sons had not much time to read at home, and therefore wanted all the time they could get at the College for reading and studying.

Mr. Shuttleworth wanted the English students; they had no desire to shut them out. The Ontario farmer's son wanted more time to study; the city youth and the Englishman wanted more time to work. He believed a preparatory course would settle the difficulty.

Mr. Raynor found that to a farmer's son there was certain time thrown away. He thought a certain amount of manual labor necessary; he believed in working, and working heartily. Outside work improved them. But farmers' sons should have time to read the papers and books at the College. There were two alternatives—either the division of lectures and labour should be changed, or the course lengthened. The latter was neither advisable nor necessary. He felt for the English students. He suggested that the students and ex-students outline some plan to give them the training which they want.

Mr. Ballantyne said two hours' work was impracticable. They should be shown how to work, not work for work's sake. With regard to the constitution of the Advisory Board, he did not believe in three men retiring each year; their term should be lengthened.

Mr. Lehman did not think that the outside work should be compulsory. Some distinction should be made between the work done by farmers' sons and that by those unaccustomed to the farm. The farmer's son gets no more credit for his intelligent labor than the other, and so gets discouraged and falls into a habit of scamping his work. If the city men had a year's preparatory course, the value of their work would be more on a par. If the outside work were not compulsory, farmers' sons could turn their attention to reading. Students from the cities cannot learn farming unless they learn what real manual labor is.

Mr. Mark considered that too much time was spent in work. As he had been through the mill, he knew that more reading would have done him good. It took all his time to study and attend lectures.

Mr. Owen was pleased with the discussion, but thought it hardly fair to apply the same rule to those not accustomed to a farm as to those who had been brought up on it. It took them some time to get accustomed to the work.

Mr. Sturge agreed with Mr. Owen that the English boys could not work very hard when they first came. Two hours' work was as hard on them at first as five hours on others.

Mr. Ramsay moved the following resolutions, which were carried:—

Resolved, That the following changes would be beneficial to the Ontario Agricultural College:

1. That no student be admitted to the College without having at least one year's practical experience on a farm, and a recommendation from his employer.
2. That the time of daily manual labor required of students be reduced one-half.
3. That an Advisory Board, composed of practical farmers, be appointed to assist the Commissioner of Agriculture in the oversight of the institution.

Prof. Mills suggested further consideration of the matter.

Mr. Clarke would disagree with the shape of the petition. He thought a memorial should be presented by a committee to be appointed.

Mr. Ramsay, jr., said he did not want to be dictatorial, but wished to expedite business.

Mr. Clarke said the resolutions would bear smoothing off.

Mr. Anderson thought the English boys and city boys might have a one year's preparatory course at the Farm.

Mr. Clarke thought that would complicate matters more than they were at present. It would be apt to create a feeling in the College against the "greenhorns."

Mr. Anderson—There are greenhorns in all colleges.

Mr. Rennie believed if the resolutions were carried into effect the College would be half empty for awhile.

After further desultory discusssion by Messrs. Joyce, Shuttleworth and Clark, it was resolved to memoralize the Government in the purport of Mr. Ramsay's resolutions, and a committee was appointed to submit the memorial.

POINTS OF HORSES, AND THE HEAVY BREEDS.

On this subject Prof. Grenside read the following paper:—

No one but the tyro expects to find perfection in any breed, or even in any individual member of a breed of horses, so that those who are most conversant with horse-flesh are content to define a good horse as one possessing a number of good points and few bad ones. Let us advert to some of the more important points in a general way. First and foremost we have the nervous system, the central portion of which is the brain and spinal cord and it also may be termed the fountain from which flows streams of nervous force to the various pards of the body, and on which all portions are dependent not only for their existence but also for their power to perform their respective functions. The manner in which this nervous force is supplied has an important influence upon the physical ability of a horse. Although this nerve power may be abundantly supplied, it depends upon the intelligence of the individual as to whether it is economized or dissipated; so that if plenty of power of this kind is possessed it is of no advantage if not under proper control. Horsemen are wont to observe the dimensions of the forehead as an index to proper brain development, and although this is somewhat valuable it cannot be considered an encouraging guide as to the amount of intelligence possessed. Courage, tractability and good temper can only be determined with certainty by making a practical trial of an animal. The mechanism may be perfect, but in use the instability for a French dancing master may be shown, or on the other hand the dullness of a bovine. In order that this nervous power can be generated adequately, the brain must receive a blood supply of proper quantity and quality. The digestive and respiratory organs co-operate in furnishing this, the former in providing nutriment and the latter is in a great measure accountable for its purity. The volume of the chest is an index of the capacity of the lungs, and it is very important that it should have a full proportionate development. The lighter breeds get this capacity by depth rather than by breadth of chest, for excessive breadth is opposed to the free and rapid action of the blade bones, and consequently speed would be impaired from such a formation. In the heavier breeds a chest roomy in all directions is desirable, and in addition to depth the ribs should be well arched, thus affording breadth and giving roundness to the barrel, a point so often spoken of and admired. A horse so formed is pretty sure to have good wind, but well sprung ribs in addition to decided length of the hind or false ribs has another signification; or, pointing to the likelihood of well developed digestive organs being possessed, and consequently of ability to consume and convert nutritious matter into healthy blood. These points are among the most important, for it is on their perfectness that the thrift, vigour and staying power of a horse largely depends. But unfortunately we too often find them coming very far short of what is desirable, so that poor feeding, easily fatigued unthrifty horses are by no means rare.

We have so far concluded that a sufficiency of nerve power, properly economized and regularly supplied by a nervous system that receives adequate material to work with, is essential to an animal machine. In order that this power may be used to the best advantage, the machine upon which it acts should be made up of parts of sufficient strength to endure severe taxing, and that these parts may be so put together, and related to one another, as to enable them to take advantage of all the motive power. In looking critically at the points of an animated machine from a structural standpoint, it is only rational to look at the foundation or skeleton first, primarily considering whether the constituent elements possess bulk or volume sufficient to afford support and stand the

strain of the muscles; and secondly, whether the material of which the bones are composed is good. Texture of bone is of more importance, in so far as durability is concerned, than mere size, for we know that the comparatively slight and compact bone of the thoroughbred will stand concussive shocks with impunity which the spongy bone of the heavy draught would succumb under. It is, therefore, desirable in addition to a sufficiency of weight that the texture be good, in order to form a substantial framework. The external evidence of proper quality of texture is afforded by flatness of the cannon bones, so that the nearer these bones approach the formation the closer approximation there is to perfection. In addition to finding flatness and good size of the cannons, it is very essential that they should be short, for this improves the animal's power of co-ordination, as the muscular force is economized. Good bone development is further evidenced by prominence of such eminences as the point of the elbow, hock and hip, in addition to conferring leverage to the muscles acting upon them. The organs of motion and locomotion, called the muscles, are not secondary in importance to the framework; and it is very essential to the judge of horseflesh in the selection of an animal, with the power to move heavy weights, and to proceed with agility or speed, to be able to detect indications of such ability, and to be able to discriminate between muscle and fat. There are several situations to be observed for such indications, and first we may look at the forearms and gaskin, and notice whether there is a swelling out or prominence of these organs, for in those situations we don't find fat accumulating to any extent, so that what we find there we can rely upon as being muscle. By raising the tail and glancing between the quarters, defecting muscular development can be detected by the existence of a space in this region, commonly described by saying that such an animal is "slit-up," and such a formation is regarded as a sure accompaniment of a lack of staying power. Narrowness of the loin is sure to be associated with a sparse clothing of muscles, which deficiency is well marked when compared with a well furnished loin, where the muscles are broad, prominent, and well defined.

Horses with bull necks are generally hardy ones, and this thickness is due to bulky muscles, but the seeming excess of volume is rather the result of shortness of the organ, a formation which certainly does not add to the horse's appearance, and cannot be compared in this respect with one of moderate length, but clean cut, and with a feeling of firmness.

There is another factor in the locomotory apparatus which is by no means to be ignored if full benefit is to be derived from proper bone and muscle, and that is the joints. If an animal is to possess freedom and elasticity of motion with plenty of surface for the attachment of muscles and ligaments, the joints should be large; but this, however, does not necessitate roughness, which is a usual accompaniment of large, round and spongy bone.

We have so far discussed some of the more important elements in forming equine perfection; there are a great many minor ones, which, however, it would be tedious to advert to.

I may perhaps be pardoned if I touch upon one of these, and that is the subject of hair on the legs. I would ask of what benefit is this superabundant growth of hair on the lower extremities, and in answer can only quote the reason assigned for desiring it by its most ardent admirers, and that is that it adds to their appearance, If this can be called a good and sufficient reason for the cultivation of this feature in breeding, it can hardly be held to counterbalance the many disadvantages its presence entails. A profusion of hair presupposes a coarse skin, and a course skin means a corresponding decrease in vitality, and consequently a greater tendency to diseases of mal-nutrition, such as grease, thick legs and cracked heels. Bushy hair is also a splendid harbourer of dirt, and being very retentive of moisture it leads to excessive irritation and itching. It is doubtful, however, if where horses are bred for weight at any expense for docking purposes etc., whether such a feature could be bred out of them, for the whole tendency is to grossness of constitution; but where 1,500 weight horses are required—and surely this is heavy enough for most purposes—it is quite possible to breed without long, coarse hair. It is strange that hairy legs should be looked upon as a point of beauty in heavy draughts, and its absence equally pleasing to the eye in the thoroughbred.

The four heavy breeds to which the attention of the agriculturist is most given in this country are the Clyde, English cart or Shire horse, Suffolk punch and Percheron.

We have no authentic date with regard to the origin of any of these breeds, which is evidence that they all had an existence at a somewhat remote period. The Suffolk horse has perhaps retained his characteristics since the earliest recorded accounts of him with fewer modifications than any of the other breeds. He has always been described as the chestnut, and the chestnut he still remains, although there are half a dozen shades of that color. Other characteristics he has retained with equal tenacity, showing that he belongs to a breed of some purity. The reason for this uniformity of the breed is attributable in a great measure to the one county only producing them, and their not being subject to living on varieties of soils, as the Clydesand Shires have been, thus suffering modification. But the chief reason for their having retained their identity is on account of the good people of Suffolk being so satisfied with their breed that they did not seek to alter it by the introduction of extraneous blood. They are a breed remarkable for their endurance and longevity, which is no doubt due to their middle piece, as it shows strong evidence of affording plenty of breathing capacity in addition to well developed digestive organs. Their contour is more calculated to impress one favourably with their hardihood and utility than with their symmetry and stylishness. They belong more to the agricultural class than the heavy draught, but during twenty-three years' when Clydes, Shires and all comers were shown, fourteen first prizes were carried off by this breed. They are frequently found fault with for not having enough bone, but it is evident that what they do possess is of good quality, for they are an unusually sound breed and very free from bone diseases. There is a marked absence of the long hair on the limbs, which is so prominent a feature in the English cart horse and the Clyde, and a proportionate freedom from skin diseases of the extremities. They are a remarkably unexcitable breed, but with plenty of pluck, and there are no truer drawing horses in the world.

In the English cart and Clyde horses we have specimens of, perhaps, the best draught horses in the world, for they possess the characteristic, which is that of great weight and consequent ability to move heavy loads, which entitles them to be put in the first rank. Neither breed, taken as a whole, can boast of great purity of blood, for there is not that uniformity of colour and other features that would allay all suspicion of the introduction of extraneous blood at no very remote period, and that interbreeding between the two breeds under discussion had been indulged in from time to time. I think it would puzzle some of the denizens of the banks of the Clyde to say in which stud book some registered animals are from their appearance. The Clydes certainly possess greater regularity of features, there being a large number of them of the same light bay colour, and, although some modification is noticable in different localities, as, for example, the Galway and Kintyre breeds, yet there is nothing like the variety seen in the English breed, for nearly every county has its own style of the same breed. Of the two breeds, the English horse is, on the whole, the heavier; he possesses a very upright shoulder, which gives him greater power in the collar, but less freedom of action than the Clyde. Both breeds possess a large quantity of bone, but I am inclined to the opinion, that the Clyde is, in the majority of cases, flatter, of better texture, and associated with a finer quality of hair, although it would seem that those who have endeavoured by careful breeding to increase the quality of bone, to meet the never ceasing cry for that element, have succeded too well, and have produced it to an extent not proportionate to the other parts of the animal in a great many cases. Dark bays or browns are much desired by breeders of Clydes now-a-days, and it certainly will be to the advantage and credit of the breed when they become more common, and take the place of the light bay, which colour the majority of the breed are at the present time. This light colour is certainly anything but pleasing to the eye, and it is held by many to be indicative of a lack of hardiness. Greys are not favoured by Clyde breeders at the present time, but are not objected to to the same extent by producers of Shire breeds—blacks, browns and greys being the recognized colours amongst them. Both breeds, as a rule, show well developed and muscular hind and fore quarters. These points, so much to be desired and admired as agents of propulsion, show prominently the defects of the middle piece, and render conspicious long backs, shallow, flat sided chests, short back ribs and weak loins. In comparing the

two breeds, I am of the opinion that these last named imperfections are more frequently seen in the Clyde than in the cart horse. So that in comparing the constitutional strength of the two breeds, it is to the advantage of the latter.

It is only within the last few years that our acquaintance with the Percheron has become at all intimate, and during that time they have made a good many friends amongst the admirers of horse flesh. It certainly seems to be a breed of some purity, for they present a very uniform conformation, and a very large proportion of them are grey, being a very good grey at that. Their popularity is, to some extent, owing to the flashiness of their colour having an influence upon some of their supporters; but they undoubtedly possess merit of more sterling worth than mere colour, and there are those that think this their worst point. They are lighter, as a breed, than the Suffolks, consequently, lay no claim to be called heavy draughts, but they are more correctly classed as agricultural, and are not inappropriately styled general purpose, if there is such a thing. Being as a rule rather oblique in the shoulder, manyof them are pretty good travellers; they are, however, of rather a dull temperament, which disposition seems intensified in the progeny of a cross with our common mares, endowing such offspring with a want of style, ambition and animation. They are well topped horses, in a great measure, but show a marked want of length of neck, which suspends a head of rather interesting character. Although they have very little long hair on the legs, their skin is rather inclined to be thick; that envelopes a common bone with a tendency to roundness, locked up with a lack of tissue development.

Prof. Brown asked Prof. Grenside if breeding out the hair would cause the horse to deteriorate.

Prof. Grenside thought it would not.

Mr. John Duff said if he had time he could refute Mr. Grenside's arguments. Mr. Grenside thought the Suffolk Punch was ahead. [Mr. Grenside.—I did not say so.] He Mr. D. maintained that the Clydesdales were away head. This was proved by their high prices, and by the many leading authorities in their favor. If hair was not a benefit to a Clydesdale, what benefit was a topknot to a Cotswold sheep? It was in the nature of the animal. Leading English agriculturists say that the Clydesdales are ahead of both the Shire and the Suffolks. The Suffolk Punch has degenerated. At the York Show you cannot find one now where you could find any number ten years ago. It was as impossible to get a thoroughbred Clydesdale without hair as to get a thoroughbred blood horse with hair. With reference to purity of breeding, the Clydesdale dated back to the 16th century. They were bred from Belgian horses. Shire horses were bred from Clydesdale horses and English mares. The Clydesdale will sell for more money than any other heavy draught horse.

Mr. Ramsay thought it would be a hard job to make two breeds of the Clydes and the Shires. They had been so often crossed that you could not tell which was which. In the Old Country purebred Clydes were registered in the stud book, but ineligible Clydes and Shires made a magnificent class.

Prof. Grenside said Mr. Duff had misunderstood some of his remarks. In the docks of England they are now using English cart horses. They complain that although there are plenty of Clydes they are too small for their use, having too much hair and bone. By crossing the Suffolk Punch with the thoroughbred we get cobs and hunters.

Mr. Clarke wanted to know the best general purpose horse for the Ontario farmer. Also, whether clipping hair off a horse was advisable?

Mr. Grenside did not think clipping was wise, but horses would get accustomed to it. He considered the Suffolk Punch a good general purpose horse for this country. Clydes have a tendency towards weakness in their middlepieces, but they possess endurance and action. In crossing Clydes with Canadian mares he had found the result discouraging. The produce was a horse extra heavy in the quarters, but weak in the middlepiece.

Mr. Long said hair was an index of the Clydesdale breed. The Suffolk Punch has been a good horse, but it is not keeping up; the Shires are now ahead. There are one hundred Clydes imported to one Suffolk. He would not approve of the Clyde in this country, but the majority of general purpose horses here are got from Canadian mares by Clydesdale horses. The Americans want the Clyde cross, and so these horses sell better

and bring the most money. The purest breed of horses in the world are the Clydesdales. Percherons were originally bred from the Arabian horse, but by being crossed with horses imported from England the breed had been spoiled. It was now taking a higher place. The Clydes were an established breed.

Mr. Duff thought the long hair of the Clydesdale was bred in the blood of the breed. When the Clydesdale Stud Book was first started, all the animals in it were not pure bred, but now each animal entered in it has a recognized pedigree.

The last paper of the meeting was read by Prof. Brown, on—

WHAT IS NOT KNOWN IN THE DAIRY.

After referring to the value of milk as an article of human food, and of the growing importance of the cheese and butter-making industries, the paper concluded with some pertinent enquiries for more light. My thoughts in preparing this paper took the form of a catechism, which to some extent only I have been able to answer; but as an unanswered question is usually more suggestive than the other, it will be better to try and cover part of the field, and that briefly. Do we know—

1. How to detect adulteration in milk?
2. What it costs to produce milk?
3. The exact physiological source of milk?
4. That all beefing breeds give rich milk?
5. What "heavy" milk implies?
6. What is meant by "character" in milk?
7. Why so few cows respond to "*milking indications*?
8. What is the *education* of a cow?
9. Why there is no such thing as either quantity and quality in milk?
10. Why milk is not valued and paid for according to its kind?
11. The possibilities of the *Centrifugal Separator*?
12. Why dairying is not prosecuted in winter?
13. That churning is more a matter of "climate" than "temperature?"