FOURTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM,

1888.

Printed by Order of the Legislative Assembly.

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1889.

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Dairying.

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8. Captain Walter Clarke.
Instructor in Drill and Gymnastics.

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Ontario Agricultural College, Guelph, Ontario.

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To the Honourable

DEAR SIR,—I
of the Ontario Agr
In this Report
heads, as follows:—

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PART IV.—REPO
PART V.—REPO
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PART VII.—REPO

FOURTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM.

GUELPH, January 2, 1889.

To the Honourable CHARLES DRURY,
Minister of Agriculture:

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

In this Report we have reviewed briefly the work of the year 1888 under seven heads, as follows:—

PART I.—REPORT OF THE PRESIDENT.

PART II.—REPORT OF THE PROFESSOR OF GEOLOGY AND NATURAL HISTORY.

PART III.—REPORT OF THE PROFESSOR OF CHEMISTRY.

PART IV.—REPORT OF THE FOREMAN OF THE HORTICULTURAL DEPARTMENT.

PART V.—REPORT OF THE PROFESSOR OF DAIRYING.

PART VI.—REPORT OF THE PROFESSOR OF AGRICULTURE.

PART VII.—REPORT OF THE PHYSICIAN.

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

JAMES MILLS,
President.

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PART I.

REPORT OF THE PRESIDENT.

AGRICULTURAL OUTLOOK.

The prospects of the agriculturist are, perhaps, a little brighter than they were a year ago. Farmers are adapting themselves more or less to the altered circumstances in which they find themselves. They are relying less on wheat than they did formerly, and many of them are earnestly studying how they can reduce the cost of production in every branch of their business.

The comparatively light crops in certain localities have been more than counterbalanced by the higher prices which are paid for farm produce. In some sections, however, especially in portions of the counties which border on the Georgian Bay and on the River St. Lawrence as far east as Brockville, the drouth of June and July was so disastrous in its effects that no price can make up for the great falling off in the yield of nearly every kind of crop.

The law of supply and demand and of equal interest must ultimately prevail, and I have no doubt that before very long the condition of Ontario farmers will be much improved. In the meantime, however, there is need of economy, better methods, better markets, and closer attention to business.

EDUCATIONAL TENDENCIES.

For some years past the leaders of educational work in England, the United States, and Canada have given much prominence to written examinations on elaborate programmes of study, as the most reliable and satisfactory means of accomplishing the objects aimed at in universities and in schools of all grades, from the highest to the lowest. Much has been said in favor of this method; and some strong objections have been urged against it. Able and learned men may be quoted on both sides, and we shall not attempt an argument in support of either, but simply call attention to the fact that there are, at the present time, in all the countries named, a marked reaction in favor of simpler methods, and a growing desire to make the work in primary and intermediate schools, that is, the schools of the great majority, point more directly to the duties of every day life.

Two things have been urged against elaborate courses of study in primary and intermediate schools:

(1) That they have a tendency to make the instruction and training in the fundamental branches of an English education less thorough and satisfactory than it otherwise would be.

(2) That they educate a large number of people away from the occupations to which they are best adapted, by developing within them a desire for some sort of employment in which they can make a living without manual labor.

Thus, it is claimed, the more thoroughly equipped teachers and more valuable appliances of the present time, are not producing any better results than we formerly had in the elements of an English education, while the introduction of more advanced branches of a purely literary character is making many people dissatisfied with their lot, and inclining them to leave the farm and the workshop for the overcrowded professions, and for various would-be genteel occupations in which men are trying hard to make a living by their wits.

The stipulation of the City of Toronto, in its bargain with the University, to the effect that the School of Practical Science be enlarged and strengthened ; the action of the Baptist denomination in organizing and equipping a mechanical department in their College at Woodstock ; the outcry for technical instruction in the United States ; and the strong articles on educational results which have lately appeared in some of the English papers and periodicals—are all only so many indications of a reaction against prevailing methods, and of a growing desire for such modifications of our system as will cause it to strengthen and develop, rather than weaken and cripple, the great producing industries of the country.

As regards our programme of studies, especially in our Public Schools, I am not sure that it is anything like so elaborate as it has been represented ; and I am inclined to think that the results, even in the most useful elementary branches, are considerably in advance of what they were twenty or thirty years ago. But be that as it may, I agree entirely with those who maintain :

(1) That the primary and constant aim of our Public Schools should be to teach well the elements of an English education—to make all the pupils who attend these schools proficient in reading, writing, spelling, arithmetic, English grammar, composition, and an outline of geography.

(2) That whatever is done in the Public Schools, over and above the elementary branches given above, should have more or less direct reference to the important industries in which the great majority of the pupils will engage after they leave school.

(3) That the standard for admission to the High Schools should be raised, with a view to keep children longer in the Public Schools, and thereby make them more proficient in those elementary branches which are most likely to be of service to the great majority in the work of after life. If this were done, we think the results of Public School work would be better than they now are, and the number of boys drafted into the High Schools and thus weaned away from the most important occupations, would not be nearly so large as it is at the present time.

We, of course, admit that the mere passing of the entrance examination does not place on boys any obligation either to leave the Public School or to enter the High School; but it should be borne in mind that the work of the teacher is of necessity judged very largely by the results of various examinations. He teaches with that fact more or less prominently in view ; and, therefore, those pupils who stay in the Public School after they have passed the entrance examination or have done the work prescribed for it, very frequently have either to prepare for the third-class examination or continne their studies with but little attention from the teacher. For that reason, we think, the fifth class in the Public Schools generally amounts to little or nothing, and, therefore, we would raise the standard for the entrance examination, so that candidates could not pass it without a much more thorough and exact knowledge of the elementary branches than is now required.

AGRICULTURE IN THE NORMAL SCHOOLS.

Our progressive Minister of Education, who is anxious to keep abreast of public opinion in everything that seems likely to improve our school system, has not only taken the first steps toward providing elementary training in some of the mechanic arts for those who may desire it, but has already arranged for a course of lectures on agriculture in the Toronto and Ottawa Normal Schools. This is certainly a step in the right direction, and we only hope that the instruction given may be such as will fit the teachers for undertaking the work which will soon be required of them in the Public Schools.

CHANGES IN OUR STAFF.

Changes in the staff of a school or college always cause more or less anxiety; and, generally speaking, the less frequently they occur, the better for all concerned.

William Brown, C.E., as Professor of Agriculture and Farm Superintendent, held a very responsible and important position in this institution for the period of thirteen years; and during that time he did his full share, not only in lecturing on agriculture and live stock, but in a great variety of experimental work, by the reports of which he became widely and favorably known throughout the United States and Great Britain. Professor Brown was a zealous and energetic worker, and a racy, vigorous writer. He was obliging and kind-hearted almost to a fault, and always a very agreeable companion.

On the 1st July last Professor Brown resigned his professorship and started for Australia with a view to securing a similar position in that great colony; and I need only say that I wish Professor Brown abundant success in whatever may engage his attention.

Professor Brown's successor is Thomas Shaw, Esq., of *The Canadian Live Stock Journal*, Hamilton, a man whose sterling honesty, untiring industry, long apprenticeship on a Canadian farm, and varied experience as a journalist, seem eminently to qualify him for the position to which he has been appointed. Professor Shaw has entered on his duties with honest congratulations from professors and others, and it is hoped that before long he will put every part of our farm into first-class shape and work it in such a way as to exhibit the best methods of agriculture and show a handsome financial return for the money expended from year to year.

LEVELLING, GRADING, ETC.

No doubt many who have visited us within the last two or three years will remember the unsightly ruins of the old farm buildings which lay a few rods south of the College. A little more than a year ago our new Chemical Laboratory was erected on a portion of those ruins; and during the past summer we removed all the old foundations, filled the deep pits, cut new roads, and graded the whole of the ground between the College and the new farm buildings.

We also removed our large weigh-bridge from the edge of the lawn and placed it under cover near the new barn; constructed a new farm office, a large silo, and a new piggery; built an experimental barn, and painted the waggon shed, the implement house, and the old carpenter-shop.

DESTRUCTION OF FARM BUILDINGS.

After all that is mentioned in the preceding paragraph was done, we began to congratulate ourselves on the improved appearance of things generally and on the completeness of our equipment for instruction in most of the outside departments, when the hand of the incendiary destroyed in a few minutes nearly the whole of our splendid farm buildings—the barn, horse stable, silo, sheep house, and bull shed, with harness, cutting-boxes, threshing machine, grinding mill, pulpers, belts, shafting, rack-lifter, and the whole of last year's crop. We had on hand an exceptionally large amount of hay, oats, pease, wheat, barley, turnips, mangels, and other crops—all in the buildings just named; and with them it was consumed in an incredibly short space of time.

The live stock was saved; but, had it not been for the energy, good judgment, and heroic courage of our students, the cattle, pigs, and horses would have perished in the buildings.

The discouragement is great, and the interference with our work is a very considerable trial to both students and officers; but it has already been determined by the Advisory Board and the Government to erect new and equally good buildings at the earliest possible date. With this prospect in view, our students are hopeful; and the outlook for the institution is not nearly so gloomy as it might have been.

AFFILIATION WITH THE PROVINCIAL UNIVERSITY.

The addition of a third year to our course of study was announced in our last report; and it was then our intention to apply for power to grant degrees. The matter was discussed by the Government; and the decision arrived at was that we should affiliate with the University of Toronto and have the Senate of that institution prescribe the course of study for the third year students, conduct the examinations, and grant the degree of B.S.A. (Bachelor of Science in Agriculture) to those candidates who should be passed and recommended by their examiners.

By the courtesy of Vice-Chancellor Mulock and Sir Daniel Wilson, the affiliation was effected with as little formality and delay as possible; special examiners were appointed; and five candidates for the degree of B.S.A. were examined in the month of June. These candidates all passed very creditably; and, at a special Convocation called for the purpose, they received three degrees on 1st October last. The list is as follows:—

BACHELORS OF SCIENCE IN AGRICULTURE.

Craig, J. A.	County of Russell, Ont.
Creelman, G. C.	County of Grey, Ont.
Fee, J. J.	Toronto, Ont.
Paterson, B. E.	Ottawa, Ont.
Zavitz, C. A.	County of Middlesex, Ont.

Of these young men, three already have good situations. Mr. Zavitz is Assistant Superintendent of Experiments, and acts also as Assistant Chemist in this institution; Mr. Craig is Editor of the *Canadian Live Stock Journal*; and Mr. Creelman has lately been appointed Lecturer on Botany and Geology in the Mississippi Agricultural College, which is one of the largest and best institutions of the kind that we have on this Continent.

STUDENTS IN ATTENDANCE.

The outlook for a large attendance is more promising than it has been for several years. The number of new students admitted in October was 51; and the great majority of these are strong, energetic sons of farmers, of from seventeen to twenty-three years of age. The total number on the roll for 1888 is 131, which is 21 more than we had in 1887. Thirty-four of the counties of Ontario are represented, and the largest representation is from the counties of Middlesex and Grey.

NAME.

*Craig, J. A.
*Creelman, G. C
*Fee, J. J
Hutton, J. R.
Harcourt, G.
Lehmann, A
Morgan, H. A.
Orsman, C. P
*Paterson, B. E.
Raynor, T.
Soule, R. M.
Stover, W. J
Sharman, H. B.
*Zavitz, C. A.
—14

NAME.

Horrocks, T. J.
Willans, N.
Willans, T. B.
—3

NAME.

*Austin, A. M.
*Bayne, S. R.
*Birdsall, W. G.
*Bishop, W. R.
*Budd, W.
Brodie, G. A
*Brown, S. P.
*Carpenter, W. S.
*Dean, H. H.
De Mauritz, R.
Derbyshire, J. A.
*Elton, C. W.
*Elton, R. F
Gelling, J. A.
*Harrison, R. E.
*Heacock, F. W.
Jarvis, E. M.
King, R. E
*Knowlton, S. M.
Linfield, F. B.
Marsack, F

COLLEGE ROLL FOR 1888.

Third Year Students.

NAME.	P. O. ADDRESS.	COUNTY, Etc.
*Craig, J. A.	Russell	Russell, Ont.
*Creelman, G. C	Collingwood P.O.	Grey, Ont.
*Fee, J. J	Toronto	York, Ont.
Hutton, J. R.	Welland	Welland, Ont.
Harcourt, G.	St. Ann's	Lincoln, Ont.
Lehmann, A	Orillia	Simcoe, Ont.
Morgan, H. A.	Kerwood	Midd'esex, Ont.
Orsman, C. P	Bathurst	Lanark, Ont.
*Paterson, B. E.	Ottawa	Carleton, Ont.
Raynor, T.	Rose Hall	Prince Edward, Ont.
Soule, R. M.	South End	Welland, Ont.
Stover, W. J	Norwich	Oxford, Ont.
Sharman, H. B.	Stratford	Perth, Ont.
*Zavitz, C. A.	Coldstream	Middlesex, Ont.
—14		

*Obtained the degree of B. S. A. in October.

Associates Doing Special Work.

NAME.	P. O. ADDRESS.	COUNTY, Etc.
Horrocks, T. J.	Toronto	York, Ont.
Willans, N.	Leeds	England.
Willans, T. B.	Leeds	England.
—3		

Second Year Students.

NAME.	P. O. ADDRESS.	COUNTY, Etc.
*Austin, A. M.	Thornholm, Sunderland	England.
*Bayne, S. R.	Lee, Kent	England.
*Birdsall, W. G.	Birdsall	Peterborough, Ont.
*Bishop, W. R.	Brussels	Huron, Ont.
*Budd, W.	Delhi	Norfolk, Ont.
Brodie, G. A	Bethesda	York, Ont.
*Brown, S. P.	Whitby	Ontario, Ont.
*Carpenter, W. S.	Simcoe	Norfolk, Ont.
*Dean, H. H	Harley	Brant, Ont.
De Mauritz, R.	Belleville	Hastings, Ont.
Derbyshire, J. A.	Brockville	Leeds, Ont.
*Elton, C. W.	West Kensington, London	England.
*Elton, R. F.	West Kensington, London	England.
Gelling, J. A.	Bridgewater	Nova Scotia.
*Harrison, R. E.	Lincoln, Nottingham	England.
*Heacock, F. W.	Kettleby	York, Ont.
Jarvis, E. M.	Toronto	York, Ont.
King, R. E.	Decewsville	Haldimand, Ont.
*Knowlton, S. M.	Newboro'	Leeds, Ont.
Linfield, F. B.	Dunlop	Huron, Ont.
Marsack, F.	Tunbridge Wells	England.

COLLEGE ROLL.—SECOND YEAR STUDENTS.—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, ETC.
Marsack, H.	Tunbridge Wells	England.
McCallum, W.	Ailsa Craig	Middlesex, Ont.
McEvoy, T. A.	London	Middlesex, Ont.
McKergow, J. G.	Montreal	Quebec.
McLaren, P. S.	McGarry	Lanark, Ont.
Monteith, S. N.	Fairview	Perth, Ont.
*Palmer, W. J.	Charlottetown	P. E. Island.
Price, V.	Selby Oak, near Birmingham	England.
Rendall, W.	Camperdown	Grey, Ont.
Rennie, E. A.	Hamilton	Wentworth, Ont.
Robson, J. W.	Liverpool	England.
Scott, J. A.	Stoke, Devenport	England.
*Serson, W. E.	Antrim	Carleton, Ont.
*Shantz, A.	Waterloo	Waterloo, Ont.
*Sinclair, J. J.	Ridgetown	Kent, Ont.
Somerville, A. R.	Huntingdon	Quebec.
*Stevenson, C. R.	Fingal	Elgin, Ont.
*Sweet, H. R.	Selby	Lennox, Ont.
Tinney, T. H.	Oakwood	Victoria, Ont.
*Valance, R.	Osnabruck Centre	Stormont, Ont.
*Wilmot, A. B.	Oromocto	New Brunswick.

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*Received Associate Diplomas in June.

FIRST YEAR STUDENTS.

NAME.	P. O. ADDRESS.	COUNTY, ETC.
Asbury, E.	Delaware	Middlesex, Ont.
Bate, E. H.	Brighton	Northumberland, Ont.
Bayne, P. R. C.	Calcutta	India.
Benyon, A. G.	Bracknell	Surrey, Eng.
Bertram, H.	Toronto	York, Ont.
Buchanan, D.	Hensall	Huron, Ont.
Campbell, C. W.	Ospringe	Wellington, Ont.
Campbell, W.	Elphin	Lanark, Ont.
Campbell, C. S.	Brantford	Brant, Ont.
Cargill, H. S.	Kensington	England.
Cathcart, W.	Liverpool	England.
Cowan, R. E.	Galt	Waterloo, Ont.
Cowan, J. H.	Galt	Waterloo, Ont.
Dolsen, W. J.	Chatham	Kent, Ont.
Duke, E. W.	Chelsea (London)	England.
Dunne, H. R.	Ottawa	Carleton, Ont.
Elliot, R.	Seaforth	Huron, Ont.
Farlinger, F. E.	Morrisburg	Dundas, Ont.
Field, H.	Cobourg	Northumberland, Ont.
Globensky.	Montreal	Quebec.
Golden, J. H.	Amherstburgh	Essex, Ont.
Graham, M. H.	London	England.
Grant, R. S.	Byng	Haldimand, Ont.
Greenwood, A. E. S.	Bradford	England.
Hadwen, G. H.	Mons en Bareul, near Lille	France.
Harcourt, J.	St. Ann's	Lincoln, Ont.
Hewgill, E. A.	Heathcote	Grey, Ont.
Holliday, W. B.	North Shields	England.
Hutt, H. S.	South End	Welland, Ont.
Jackson, F. A.	Dorset	England.
Kitchen, B. E.	Waterford	Norfolk, Ont.
Lansdowne, F. R.	Clifton, Bristol	England.
Lea, H. F.	Toronto	York, Ont.

COLLEGE ROLL.—FIRST YEAR STUDENTS.—*Continued.*

NAME.	P. O. ADDRESS.	COUNTY, ETC.
McDonald, H. M.	Lower South River	Nova Scotia.
Macfarlane, T. W. R.	Ottawa	Carleton, Ont.
McCrea, H. E.	Brockville	Grenville, Ont.
Makinson, T. C.	Harbor Grace	Newfoundland.
Monk, W.	South March	Carleton, Ont.
Mott, C. J.	London	England.
Mulholland, F.	North Toronto	York, Ont.
Musgrave, J.	Cowichan	British Columbia.
Nelles, S. W.	York	Haldimand.
Noxon, H. S.	Ingersoll	Oxford, Ont.
Paterson, L.	Harbor Grace	Newfoundland.
Pownall, G. F.	Kensington (London)	England.
Ransom, S.	Sydenham	England.
Rorke, J. R.	Heathcote	Grey, Ont.
Rowen, E.	Halt	York, Ont.
Seabrook, P. S.	Delaware	Middlesex, Ont.
Seymour, F. B.	Toronto	York, Ont.
Shaw, P. G.	Thornton Heath, Surrey	England.
Shipley, L. J. W.	Denfield	Middlesex, Ont.
Smith, D.	Montreal	Quebec.
Sleightholm, J. B.	Humber	Peel, Ont.
Stagg, J. C.	Brockville	Leeds, Ont.
Stewart, A. W.	Lanark	Lanark, Ont.
Thompson, H. C.	Hamilton	Wentworth, Ont.
Thompson, J. P.	Uptergrove	Ontario, Ont.
Tuck, H. F.	Orangeville	Dufferin, Ont.
Urquhart, W. H. A.	Newberry	Middlesex, Ont.
Warner, W. A.	Napanee	Lennox & Addington, Ont.
Watson, G. C.	Varney	Grey, Ont.
Weber, E.	Hamburg	Germany.
Webster, F. E.	Creemore	Simcoe, Ont.
Wells, E.	Chilliwhack	British Columbia.
White, J.	Heathcote	Grey, Ont.
Whitley, C. F.	Enfield (Middlesex)	England.
Wilkinson, J. J.	Winterbourne	Waterloo, Ont.
Wilkinson, J. B.	Hamilton	Wentworth, Ont.
Wilson, F. G.	Green River	Ontario.
Wood, W. D.	Cornwall	Cornwall, Ont.
Wolverton, E. L.	Grimsby	Lincoln, Ont.
—72		

Total 131

ANALYSIS OF ROLL.

Counties, etc.	No. of Students.	Counties, etc.	No. of Students.
Brant	2	Hastings	1
British Columbia	2	Huron	4
Carleton	2	India	1
Cornwall	1	Kent	2
Dufferin	1	Lanark	4
Dundas	1	Lincoln	3
Elgin	1	Leeds	3
England	26	Lennox	2
Essex	1	Middlesex	8
France	1	New Brunswick	1
Germany	1	Newfoundland	2
Grenville	1	Norfolk	3
Grey	6	Northumberland	2
Haldimand	3	Nova Scotia	2
Hamilton	1	Ontario (county)	3

ANALYSIS OF ROLL—*Continued.*

Counties, etc.	No. of Students.
Ottawa	3
Peel	1
Perth	2
Peterborough	1
Prince Edward County	2
Quebec	4
Russell	1
Simcoe	2
Stormont	1
Toronto	7
Victoria	1
Waterloo	4
Welland	3
Wellington	1
Wentworth	2
York	3
Total	131

Religious Denominations.

Episcopalians	45	Roman Catholics	3
Presbyterians	33	Christians	2
Methodists	25	Mennonites	1
Congregationalists	9	Evangelical Reform	1
Friends	6		
Baptists	6	Total	131

Age of Students.

4	16½ years of age.	12	22 years of age.
11	17 "	10	23 "
18	18 "	8	24 "
17	19 "	10	25 "
16	20 "	2	26 "
21	21 "	2	28 "

Average age—20 years.

COUNTY STUDENTS.

Of those in attendance during the year, twenty-eight were nominated by county councils, and, as a consequence, were exempted from the payment of tuition fees. The counties represented were the following: —

Addington, Brant, Carleton, Cornwall, Dundas, Elgin, Essex, Grenville, Grey, Haldimand, Huron, Kent, Lanark, Leeds, Lennox, Lincoln, Middlesex, Norfolk, Northumberland, Ontario, Peel, Simcoe, Stormont. Victoria, Waterloo, Welland, Wentworth, York.

CLASS-ROOM WORK.

Nothing specially noteworthy in the work of the college has occurred during the year. The regular routine of lectures, recitations, and examinations has been gone through as usual. The syllabus of lectures given in Appendix 1 conveys some idea of the class-work, and the class lists in Appendix 3 indicate the standing of each student better than anything I could say.

EXAMINERS.

The Examiners on the first and second year work were the professors of the college and two other gentlemen, to whom we are much indebted, viz., S. C. Smoke, B.A., of Toronto, examiner in English Literature; and W. A. Douglas, B.A., of the same city, examiner in Political Economy.

RECIPIENTS OF DIPLOMAS.

Twenty-seven young men having completed the course of two years, received diplomas admitting them to the status of Associates of the College. The diplomas were presented by the Hon. Charles Drury, Minister of Agriculture, and the names of the recipients are as follows :—

*Austin, A. M.	Sunderland, England.
Bayne, S. R. S.	Lee, Kent, England.
Birdsall, W. G.	Birdsall, Peterboro', Ont.
Bishop, W. R.	Brussels, Huron, Ont.
Brown, S. P.	Whitby, Ontario, Ont.
Budd, W.	Delhi, Norfolk, Ont.
Carpenter, W. S.	Simcoe, Norfolk, Ont.
Dean, H. H.	Harley, Brant, Ont.
Elton, C. W.	West Kensington, London, England.
*Elton, R. F.	West Kensington, London, England.
Harcourt, G.	St. Ann's, Lincoln, Ont.
Harrison, R. E.	Lincoln, Nottingham, England.
Heacock, F. W.	Kettleby, York, Ont.
Horrocks, T. J.	Toronto, Ont.
Hutton, J. R.	Welland, Welland, Ont.
Knowlton, S. M.	Newboro', Leeds, Ont.
Palmer, W. J.	Charlottetown, P.E.I.
Serson, W. E.	Antrim, Carleton, Ont.
Shantz, A.	Waterloo, Waterloo, Ont.
Sinclair, J. J.	Ridgetown, Kent, Ont.
Soule, R. M.	South End, Welland, Ont.
Stevenson, C. R.	Fingal, Elgin, Ont.
Sweet, H. R.	Selby, Lennox, Ont.
Vallance, R.	Osnabruck Centre, Stormont, Ont.
Willans, T. B.	Leeds, England.
†Willans, N.	Leeds, England.
*Wilmot, A. B.	Oromocto, N.B.

*Required to take another examination in practical work.
†Required to take Mensuration again.

FIRST-CLASS MEN.

The work in the college is divided into five departments, and all candidates who get an aggregate of 75 per cent. of the marks alloted to the subjects in any department are ranked as first-class men in that department. We would like to have a larger number of such men, but we are determined that none shall be so ranked unless they really deserve it. The following list contains the names of those who gained a first-class rank in the different departments at the examinations of last year :—

First Year.

1. *Jackson, F. A.*, Dorset, England.—In three departments: Natural Science, Veterinary Science, Mathematics and Book-keeping.

2. *McCallum, W.*, County of Middlesex.—In one department: Mathematics and Book-keeping.

3. *Rendall, W.*, County of Grey.—In one department: Mathematics and Book-keeping.

SECOND YEAR.

1. *Harcourt, G.*, County of Lincoln.—In four departments: Agriculture, Natural Science, Veterinary Science, English Literature and Political Economy.

2. *Dean, H. H.*, County of Brant.—In five departments: Agriculture, Natural Science, Veterinary Science, English Literature and Political Economy, Mathematics and Book-keeping.

3. *Elton, C. W.*, West Kensington, London, England.—In four departments: Agriculture, Natural Science, Veterinary Science, English Literature and Political Economy.

4. *Hutton, J. R.*, County of Welland.—In four departments: Agriculture, Natural Science, English Literature and Political Economy, Mathematics and Book-keeping.

5. *Soule, R. M.*, County of Welland.—In two departments: Agriculture and Veterinary Science.

6. *Shantz, A.*, County of Waterloo.—In two departments: Agriculture and Veterinary Science.

MEDALISTS.

Medals were awarded to the three second year students who ranked highest in general proficiency in the theory and practice taken together. The competition was close and keen, as usual, with the following results:—

Gold Medalist.—George Harcourt, St. Ann's, County of Lincoln, Ont.

First Silver Medalist.—H. H. Dean, Harley, County of Brant, Ont.

Second Silver Medalist.—R. M. Soule, South End, Welland, Ont.

PRIZE MEN.

FIRST YEAR.

Agriculture, Live Stock, Dairying.—1st, G. A. Brodie, County York; 2nd, W. McCallum, Ailsa Craig, Middlesex, Ont.

Natural Science.—1st, F. A. Jackson, Dorset, England; 2nd, W. McCallum.

Veterinary Science.—1st, F. A. Jackson; 2nd, F. B. Linfield, Dunlop, Huron County.

English Literature and Composition.—1st, F. A. Jackson; 2nd W. McCallum.

Mathematics and Book-keeping.—1st, F. A. Jackson, 2nd, W. Rendall, Thornbury, Grey County, Ont.

General Proficiency.—1st, F. A. Jackson; 2nd, F. B. Linfield; 3rd, W. McCallum.

SECOND YEAR.

Agriculture, Live Stock, Dairying.—1st, H. H. Dean; 2nd, G. Harcourt.

Natural Science.—1st, G. Harcourt; 2nd, J. R. Hutton.

Veterinary Science.—1st, R. M. Soule; 2nd, G. Harcourt.

English Literature and Political Ecouomy.—1st, C. W. Elton; 2nd, G. Harcourt.

Mathematics and Book-keeping.—1st, J. R. Hutton; 2nd, H. H. Dean.

General Proficiency.—1st, G. Harcourt; 2nd, H. H. Dean; 3rd, C. W. Elton.

VALEDICTORY ADDRESSES.

The second year men chosen by the students to deliver the Valedictory Addresses, on their behalf at the closing exercises, on the 30th June, were T. B. Willans, of Leeds, England, and H. H. Dean, of Harley, Brant County, Ont.

STANDING OF THIRD YEAR MEN.

The standing of the third year students at their final examinations for the degree of B.S.A. will be found in the Class Lists at the end of Appendix 3.

ASSOCIATES.

The total number of Associates up to the present time is 164; and the list is as follows:—

Date.

A.

1888—Austin, A. M.
1880—Anderson, J.
1880—Ash, G. E.

B.

1881—Ballantyne, W. W.
1879—Bannard, E. L.
1888—Bayne, S. R. S.
1888—Birdsall, W. G.
1888—Bishop, W. R.
1888—Budd, W.
1885—‡Butler, G. C.
1884—Black, P. C.
1882—Blanchard, E. L.
1886—Broome, A. H.
1886—‡Brown, C. R.
1888—Brown, S. P.

C.

1886—Calvert, S.
1877—Campbell, J. A.
1880—Campbell, D. P. L.
1884—*Carpenter, P. A.
1888—Carpenter, W. S.
1886—Cobb, C.
1880—Chapman, R. K.
1882—Charlton, G. H.
1882—Chase, O.
1879—Clark, J.
1879—Clinton, N. J.
1880—Clutton, A. H.
1887—Craig, J. A.
1887—Creelman, G. C.
1878—Crompton, E.

D.

1878—Davis, C. J.
1880—Dawes, M. A.
1882—Dawson, J. J.
1888—†Dean, H. H.
1882—Dennis, J.
1881—Dickenson, C. S.

Date.

D.

1887—Donald, G. C.
1887—Donaldson, F. N.
1877—Douglas, J. D.
1877—Dunlop, S.

E.

1888—Elton, C. W.
1888—Elton, R. F.
1882—Elworthy, R. H.
1887—Ewing, W.

F.

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

G.

1883—Garland, C. S.
1887—Gilbert, W. J.
1879—Gillespie, G. H.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindley, A. W.

H.

1882—Hallesy, F.
1888—*Harcourt, G.
1887—Harkness, A. D.
1888—Harrison, R. E.
1887—Hart, J. A.
1887—Hart, J. W.
1888—Heacock, F. W.
1886—Holtby, R. M.
1880—Holterman, R. F.
1882—Horne, W. H.
1888—Horrocks, T. J.
1887—Howes, J. S.
1882—Howitt, W.
1888—Hutton, J. R.

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

ASSOCIATES—*Continued.*

Date. **I.**

1886—Idington, P. S.

J.

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

K.

1888—Knowlton, S. M.

L.

1882—Landsborough, J.
1887—Leavens, D. H.
1884—‡Lehmann, A.
1887—‡Lick, E.
1877—Lindsay, A. J.
1887—Livesey, E. M.
1880—Lomas, J. W.
1878—Logan, T.

M.

1880—Macaulay, H.
1885—Macpherson, A.
1886—*Madge, R. W.
1882—Mahoney, E. C.
1884—Major, C. H.
1877—Mason, T. H.
1877—Meyer, G. W.
1887—Morgan, J. H. A.
1881—Motherwell, W. R.
1885—†Muir, J. B
1887—McCallum, E. G.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.
1883—McPherson, D.

N.

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

O.

1877—O'Beirne, A. C.
1887—Orsman, C. P.
1886—Owen, W. H.

Date. **P.**

1888—Palmer, W. J.
1887—Paterson, B. E.
1883—Perry, D. E.
1881—§Phin, R. J.
1881—Phin, W. E.
1881—Pope, H.
1886—Power, R. M.
1884—Powys, P. C.

R.

1882—‡Ramsay, R. A.
1879—Randall, J. R.
1885—*Raynor, T.
1885—Reid, P.
1883—*Robertson, W.
1879—Robertson, J.
1881—Robins, W. P.
1879—Robinson, C. B.
1881—Ross, J. G.

S.

1884—Saxton, E. A.
1888—Serson, W. E.
1888—Sinclair, J. J.
1882—Silverthorne, N.
1888—Soule, R. M.
1877—Sykes, W. J.
1883—Schwartz, J. A.
1887—†Scrugham, J. G.
1888—Shantz, A.
1887—Sharman, H. B.
1877—Shaw, G. H.
1882—†Shuttleworth, A.
1884—†Slater, H. (ob.)
1887—*Sleightholm, F. J.
1885—Smith, E. P.
1884—Steers, O.
1888—Stevenson, C. R.
1878—Stewart, W.
1882—Stover, W. J.
1886—†Sturge, E.
1888—Sweet, H. R.

T.

1879—Toole, L.
1883—Torrance, W. J.
1884—Tucker, H. V.
1885—Thompson, W. D.

* Gold Medalist. † First Silver Medalist. ‡ Second Silver Medalist.
§ Winner of the Governor-General's Medal—the only medal given that year.

ASSOCIATES—*Continued.*

V.

1888—Valance, R.

W.

1879—Warnica, A. W.
1884—Wark, A. E.
1878—Warren, J. B.
1880—§ Webster, J. L.
1879—Wells, C.
1882—Wettlaufer, F.
1879—Wilkinson, J. P.
1888—Willans, T. B.

Date. **W.**

1888—Willans, N.
1879—Willis, J.
1883—Willis, W. B., (ob.)
1888—Wilmot, A. B.
1882—White, C. D.
1879—White, G. P.
1884—Wroughton, T. A.

Z.

1886—Zavitz, C. A.

GRADUATES.

Bachelors of Science in Agriculture.

Degree of B. S. A.

Date. **C.**

1888—Craig, J. A.
1888—Creelman, G. C.

F.

1888—Fee, J. J.

Date. **P.**

1888—Paterson, B. E.

Z.

1888—Zavitz, C. A.

FARMERS' INSTITUTES.

The work of the Farmers' Institutes, we are glad to say, is rapidly increasing in magnitude and importance. These institutes come right home to the farming community; and no other organization in this Province at the present time seems to be doing so much to rouse the dormant energies and draw out the latent talent of farmers, young and old.

The professors of our College assisted at about sixty institute meetings last year; and, during the month of January of this present year, we hope to attend a meeting in nearly every Riding in the Province.

I had the honor of organizing the first of these institutes; and I did the work and correspondence involved in arranging for the winter meetings from that time till last November, when John Dryden, M.P., as representative of the Central Farmers' Institute, joined me in the work and rendered valuable assistance in arranging for the meetings which are to be held during the next three or four weeks.

So far, we have had very little machinery in connection with our institutes. We have done the best we could in a very simple way; and I venture to say that there is not another province or state on this continent that is holding so many successful meetings as our province, with so small an expenditure of public money.

§ Winner of the Governor-General's Medal—the only medal given that year.

FINANCIAL STATEMENT.

I.—College.

Expenditure.

No. 1.—College Maintenance.

1. *Salaries and wages*		$13,229 08
2. *Food*—		
Meat, fish and fowl	2,852 28	
Bread and biscuits	595 84	
Groceries, butter and fruit	3,987 33	
3. *Household Expenses*—		
Laundry, soap and cleaning	174 79	
Women servants' wages	1,311 84	
4. *Business Department*—		
Advertising, printing, postage and stationery	1,018 76	
5. *Miscellaneous*—		
Chemicals, apparatus, etc.	192 26	
Medals	91 50	
Library and reading room (books, papers and periodicals)	249 53	
Unenumerated	699 40	
		$24,402 61

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

Furniture and furnishings	$749 26	
Repairs and alterations	534 23	
Fuel	2,724 10	
Light	811 40	
Water	575 00	
		$5,393 99
		$29,796 60

Revenue.

1. Tuition fees	$1,833 33	
2. Balances paid for board, after deducting allowances for work	4,234 03	
3. Gas and chemicals used by third year students and associates	62 50	
4. Fines, breakage, etc.	112 95	
5. Supplemental examinations	30 50	
6. Well curbs	9 00	
7. Refund from the University of Toronto of money paid to presiding examiners	33 20	
8. Old iron	60	
		$6,316 11
Net cash expenditure of College		$23,480 49

The net sum voted by the Legislature for the expenditure of the College was $26,685. Consequently, the unexpended balance for the year is $3,204.51.

II.—Farm.

1. Salaries (Farm Foreman and Foreman of Mechanical Department)		$1,400 00
2. Wages of men—cattlemen, ploughmen, etc		2,152 74
3. General farm maintenance—seed, twine, fuel, blacksmithing, stationery, etc		777 01
4. Farm machinery, implements, furnishings, etc., with repairs of same		989 37
5. Maintenance of stock, etc.—bran, oilcake, medicine, service of animals, advertising sale, auctioneer's services, freight on animals sold by auction, with hay, straw and oats bought since fire		1,285 01
6. Cattle and sheep purchased		1,910 42
7. *Permanent Improvements*—		
(1) Fence posts, wire and lumber; drain tile; wages of carpenter; digging post-holes, etc		1,439 01
(2) Foundations, material, painting, etc., of new farm office, piggery, experimental barn, and house to cover weigh-bridge		1,661 26
		$11,614 82
Less revenue from sale of stock, service of animals, etc		3,840 28
Net expenditure of farm		$7,774 54

III.—Experiments.

1. Salary of assistant superintendent		$500 00
2. Experimental plots and feeding—seed, labor, feed, express charges, etc		686 73
3. Laboratory expenses		209 44
4. Experimental dairy—labor on corn crop for green fodder and for silo; feeding, milking and weighing milk; meal; fitting up stable and filling silo; utensils, stationery, and repairs; a portion of Professor's travelling expenses attending dairy meetings and visiting factories		1,000 04
5. New silo		470 25
6. Centrifugal separator		125 00
7. Paid for eighteen cows, one horse and six pigs		733 40
		$3,724 86
Less amount received for cows and calves sold	$260 28	
" " cream	109 82	
" " butter	23 22	
		$393 32
Net expenditure of experimental department		$3,331 54

IV.—Garden, Lawn, Vinery and Tree Clumps.

1. Salary of foreman	$700 00
2. Wages of men	2,126 53
3. Seeds, tools, manure, pots, repairs, etc.	468 99
4. Levelling and grading foundations of old farm buildings, making new roads, etc. (not in estimates)	1,146 10
	$4,441 62
Less revenue from fruit and vegetables sold	261 86
Net expenditure under this head	$4,179 76

Total Net Expenditure of all Departments in 1888.

	$23,480 49
College	7,774 54
Farm	3,331 54
Experiments	4,179 76
Garden, lawn, levelling grounds, etc.	
	$38,766 33

The net sum voted by Legislature for all departments was $39,456. So the unexpended balance for the year is $689.67.

Notes on Financial Statement.

The farm expenditure for the year was considerably increased by the purchase of harness, hay, oats, straw, etc., to replace a portion of what was destroyed by the burning of the barns and stables in November; the erection of three new buildings—a farm office, a piggery, and an experimental barn—involved a considerable outlay on capital account; and the payment of freight on animals sold by auction and sent free of charge to different parts of the Province, made a material reduction in the revenue for the year—a reduction which a farm worked merely for profit could not afford to make.

The total sum voted for the experimental department was $2,500, of which $500 was the salary of the assistant superintendent. When this estimate was made, we did not count anything for the experimental dairy, which proved to be the most expensive branch of the department. On the return of Professor Robertson to the college, he expressed a desire to conduct a number of experiments with corn grown for green fodder and for silage; and, with that object in view, the Advisory Board authorized the special cultivation of corn for the purposes just named, the purchase of eighteen cows, and the construction of a new silo, which, taken together, involved an expenditure of $2,300 over and above the items included in our estimate for the year. Owing to this unexpected outlay, we had to cut down the expenditure in other departments, or we should have had an over-expenditure to report in this statement.

In connection with the horticultural department, also, there has been an unexpected outlay during the year, amounting to a considerable sum. When the estimates for the lawn and garden were prepared, we had not made up our minds to remove at once all the foundations of the old farm buildings, which covered something more than an acre in the immediate neighborhood of the college; so nothing was asked for that purpose; but the new Minister of Agriculture, with the approval of the Advisory Board, decided that all such ruins should be removed without delay, and the whole of the grounds about the college put in proper shape and seeded down. Consequently we went to work and made a thorough job of the whole plot between the college and the new farm buildings. W

dug up and removed the old foundations, filled the excavations, graded the surface, and made several new roads—all at an expense of $1,146.10, which is a large addition to the regular estimated expenditure of the horticultural department.

Considering all these items, we feel disposed to congratulate ourselves on the fact that our entire expenditure for the year is $689.67 less than the total sum voted for all departments.

Buildings Needed.

The erection of new farm buildings will be quite an undertaking for the year 1889; and it may interfere more or less with our plans for the construction of other buildings which we require. Our chemical laboratory is now complete, and we have a small but convenient botanical laboratory. Our museum, also, is in very fair shape; but we are much in need of—

(1) New green and propagating houses.
(2) A house for the Professor of Chemistry.
(3) A building to be used as a convocation hall and gymnasium.

I hope the Ontario Government may take a lesson from the action of the Dominion Government, within the last year or two, in erecting at once all the buildings which they require on the Central Experimental Farm at Ottawa. For eleven years we continued our appeal for a chemical laboratory, and at last we got a very good one; but I sincerely hope that we may not have a similar experience in regard to the other buildings. The buildings named above should be provided at as early a date as possible; and I venture to hope that our request will receive your most favorable consideration.

I have the honor to be, sir,

Your obedient servant,

JAMES MILLS,
President.

APPENDIX I.

SYLLABUS OF LECTURES.

Lectures began as usual on the 1st October, 1887, and continued till the 30th June, 1888, which latter date was the end of the scholastic year, 1887-8.

The following syllabus of lectures will convey some idea of the class-room work done by the several Professors in the nine months just mentioned :—

FIRST YEAR.

Fall Term—1st October to 22nd December.

Department 1.—Agriculture.

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

Soils.—Natural conditions of soil and plant ; examination and classification of soils ; physical properties of each kind.

Rotations 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 ; stables for horses, sheep and cattle ; arrangement of farm buildings.

Miscellaneous.—Roads, lanes, fences.

Department 2.—Natural Science.

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

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

Human Physiology and Hygiene.—Description of the different tissues of 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 ; distinction between plants and animals ; basis and classification among animals ; leading character of each sub-kingdom, with special reference to classes or 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 Scott's "Lady of the Lake."

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 animal to keep.

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

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

Department 2.—Natural Science.

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

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

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

Lectures illustrated by specimens and diagrams.

Department 3.—Veterinary Science.

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

DEPARTMENT 4.—ENGLISH.

Composition.—Exercises continued ; abstracts of speeches and essays ; letter writing.
English Classics.—Critical study of "Cowper's Task," Books 3 and 4.

DEPARTMENT 5.—MATHEMATICS AND BOOK-KEEPING.

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

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

FIRST YEAR.—(Continued.)

Spring Term—17th April to 30th June.

DEPARTMENT 1.—AGRICULTURE.

Preparation of Soil.—Modes of preparation for different crops, and various kinds of soil.

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

Improvement of Lands.—Drainage ; ordinary cultivation ; sub-soiling ; fallowing ; manuring. Farm-yard manure and management of the same ; the properties, application and uses of special fertilizers—lime, plaster, salt, bone dust, superphosphates, etc.

Roots.—Cultivation of roots and tubers—effects of each kind on soil.

Green Fodders.—The cultivation and management most appropriate for each.

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

DEPARTMENT 2.—NATURAL SCIENCE.

Geology—Connection between geology and agriculture ; classification of rocks—their origin and mode of formation, changes which they have undergone after decomposition ; 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 designs.

Botany.—Full description of seed, roots, stem, leaves and flower. Plants 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 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 Grammar and Composttion—Authorized Grammar and Williams' Practica English.

Department 5.—Mathematics.

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

SECOND YEAR.

Fall Term—1st October to 22nd December.

Department 1.—Agriculture.

Experimental Plots.—The results of last season's experiments with crops and animals; liability to disease; effects of various manures on different crops, etc.

Farm Management.—Detailed account of the treatment of each field; results from different kinds of seed and soil; effects of manure; harvesting, storing and threshing of crops; fall ploughing, sub-soiling, 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; preservation, development and renovation of soils; manures classified; the chemical action of manures on different soils; commercial valuation of fertilizers.

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

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

Department 3.—Veterinary Science.

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

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

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

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

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

Department 4.—English.

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

Department 5.—Mathematics.

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

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

SECOND YEAR—(Continued).

Winter Term—22nd January to 16th April.

Department 1—Agriculture.

Capital required in farming; laying out of farms; general management and economy; cost of production; buying, selling and marketing.

Management of cattle, sheep and other animals in winter; breeding generally considered; special management of ewes before, during and after the season of lambing; treatment of other animals in parturition; rearing of lambs, calves and pigs; washing and dipping of sheep, etc., etc.

Arboriculture.—Importance of the subject and its special application to North America; what is being done in the conservation and replanting of forests in other countries: the objects of conserving and replanting—shelter for crops, animals and dwellings, regulation of temperature and rain-fall, ornament and profit; requisite proportion of tree surface to that under agricultural crops; existing condition of forests in North America; adaptability of soils and climate to rapid results; what parts of the country should be conserved, and what parts replanted; conservation of indigenous forests generally considered; special attention to the care of young natural forest trees.

Department 2.—Natural Science

Agricultural Chemistry.—Constitution of the subject from preceding term, as follows: Composition of plants in relation to the soils upon which they grow; rotation of crops; the classification of fodders according to their chemical composition, and a general treatment of the science of cattle feeding; relation of feeding to manure; chemistry of the dairy.

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

Lectures illustrated by specimens.

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

Lectures illustrated by instruments referred to.

Department 3.—Veterinary Science.

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

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

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

Urinary System.—Nature, cauees, 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 "Macbeth."

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

Department 5.—Mathematics.

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

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

Book-keeping.—Review of previous work.

SECOND YEAR—(Continued).

Spring Term—17th April to 30th June.

Department 1.—Agriculture.

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

Department 2.—Natural Science.

Determination of soils and fertilizers by physical properties.

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

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

The following
22nd December.

Hours	Monday.
8.45	Composition.
9.30	English Literature.
10.15	Chemistry.
11.00	Dairying.

Hours	Monday.
8.45	Horticulture.
9.30	Grammar.
10.15	English Literature.
11.00	Veterinary Pathology.

Hours	Monday.
8.45	
9.30	Agricultural Chemistry.
10.15	Geology.
11.00	

APPENDIX 2.

TIME TABLE FOR FALL TERM.

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

TIME TABLE.

First Year.

Hours	Monday.	Hours	Tuesday.	Wednesday.	Thursday.	Hours	Friday.
8.45	Composition.	8.45	Agriculture.	Agriculture.	1. Bookkeeping.	8.45	Agriculture.
9.30	English Literature.	9.45	Arithmetic.	Physiology and Hygiene.	2. Arithmetic. 3. Physiology and Hygiene.	9.30	English Literature.
10.15	Chemistry.					10.15	Grammar.
11.00	Dairying.	10.45	Chemistry.	Chemistry.	Veterinary Anatomy.	11.00	Veterinary Anatomy.

Second Year.

Hours	Monday.	Hours	Tuesday.	Wednesday.	Thursday	Hours	Friday.
8.45	Horticulture.	8.45	Mathematics.	Mathematics.	Horticulture.	8.45	Dairying.
9.30	Grammar.	9.45	Agricultural Chemistry.	Agriculture.	Drawing.	9.30	English Literature.
10.15	English Literature.					10.15	Agriculture.
11.00	Veterinary Pathology.	10.45	Judging Horses, etc.	Veterinary Pathology.	Agricultural Chemistry.	11.00	Agricultural Chemistry.

Third Year.

Hours	Monday.	Hours	Tuesday.	Wednesday.	Thursday.	Hours	Friday.
8.45		8.45	Bacon's Essays.	Dairying.	Agriculture.	8.45	Geology.
9.30	Agricultural Chemistry.	9.45	Natural History and Microscopy.	Pope's Essay on Criticism.	Drawing.	9.30	
10.15	Geology.					10.15	Agricultural Chemistry.
11.00		10.45	Rhetoric.	Natural History and Microscopy.	Themes.	11.00	Pope's Essay on Criticism.

APPENDIX 3.

CLASS LISTS:

I.—EASTER EXAMINATIONS, 1888.
II.—MIDSUMMER EXAMINATIONS, 1888.

I.—EASTER EXAMINATIONS, 1888.

FIRST YEAR.

Class.	Live Stock. (Cattle.)	Live Stock. (Sheep.)	Judging Cattle and Sheep.	Inorganic Chemistry.
HONORS. I.	1 Linfield, F. B. Jackson, F. A. Monteith, N.	1 Wilkinson. Jackson. Linfield. 4 Brodie. Monteith. 6 McCallum. 7 Jarvis. Marsack, H.	1 Wilkinson.	1 Jackson. 2 Marsack, H. 3 Linfield. 4 Rendall. 5 Brodie. 6 McCallum. 7 Marsack, F.
HONORS. II.	1 Brodie, F. A. Rendall, W. Jarvis, E. M. 4 McCallum, W. 5 Marsack, H. Campbell, W. 7 Paterson, L. 8 Makinson, T.	1 Paterson. Rendall. 3 Musgrave. 4 Tinny. Makinson.	1 Marsack, H. Monteith. 3 McEvoy. 4 McCallum. Linfield. 6 Tinny. 7 Paterson. Brodie.	
PASS. III.	1 Tinny, T. 2 Smith, D. 3 Marsack, F. Musgrave, J. 5 Globensky, E. A. 6 Monk, W. D. 7 McEvoy, T. A. 8 Seabrook, P. S. Wilkinson, J. Gelling, J. A. 11 Asbury, E. 12 Cargill, H. S. 13 Derbyshire, J. 14 McKergow, J. Campbell, C. W. Tuck. Mott.	1 McEvoy. 2 Monk. 3 Marsack, F. 4 Globensky. Smith. 6 Seabrook. 7 McKergow. 8 Cargill. 9 Derbyshire. 10 Gelling. 11 Campbell, C. W. Asbury. Campbell, W. Tuck. Mott.	1 Monk. 2 Mott. 3 Jarvis. 4 Rendall. Seabrook. 6 Campbell. 7 Globensky. Jackson. 9 Makinson. 10 McKergow. Smith. 12 Musgrave. 13 Marsack, F. 14 Derbyshire. 15 Asbury. Gelling. 17 Campbell, C. 18 Cargill. Tuck.	1 Monteith. 2 Tinny. 3 McKergow. 4 Musgrave. 5 Patterson. 6 Jarvis. 7 Cargill. 8 Monk. Derbyshire. Gelling. 9 McEvoy. Asbury. Makinson. Seabrook. Globensky. Smith. Wilkinson. Campbell, C. W. Campbell, W. Tuck. Mott.

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

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

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASS.	ORGANIC CHEMISTRY.	NATURAL HISTORY.	ENGLISH LITERATURE.	GRAMMAR AND COMPOSITION.
HONORS. I.	1 Jackson. 2 Linfield. 3 Marsack, H. 4 Marsack, F. 5 Rendall. 6 McCallum.	1 Jackson. 2 Linfield. 3 Monteith. 4 Brodie.	1 Jackson. 2 Marsack, H. 3 Cargill. 4 Musgrave.	
HONORS. II.	1 Tinny.	1 Marsack, F. 2 McCallum. 3 Musgrave. 4 Marsack, H.	1 Linfield. 2 Tinny. 2 McCallum. 4 Brodie. 5 Paterson. 6 Monteith. 7 McKergow. 8 Marsack, F. 9 Rendall.	1 Linfield. 2 Brodie. 3 McCallum. 4 Jackson. 5 Tinny.
PASS. III.	1 Brodie. 2 Musgrave. 3 Monteith. 4 Gelling. 5 McKergow. 6 Jarvis. 7 Derbyshire. 8 Paterson. 9 Makinson. Globensky. Monk. Wilkinson. McEvoy. Asbury. Campbell, C. W. Cargill. Smith. Seabrook. Campbell, W. Tuck. Mott.	1 Paterson. 2 Makinson. 3 Rendall. 4 Tinny. 5 Cargill. 6 McKergow. 7 Jarvis. 8 Globensky. 9 Gelling. 10 McEvoy. 11 Wilkinson. 11 Asbury. Monk. Derbyshire. Campbell, C. Smith. Seabrook. Campbell, W. Tuck. Mott.	1 McEvoy. 2 Derbyshire. 3 Jarvis. 4 Monk. 5 Gelling. 6 Makinson. Asbury. Campbell, W. Seabrook. Smith. Campbell, C. Globensky. Wilkinson. Tuck. Mott.	1 Rendall. 2 Monteith. 3 Musgrave. 4 McKergow. 5 Derbyshire. 6 Asbury. 6 Campbell, C. W. 6 Marsack, F. 6 Marsack, H. 10 Makinson. 10 Gelling. 10 Jarvis. 10 McEvoy. 10 Paterson. Monk. Seabrook. Smith. Cargill. Campbell, W. Globensky. Wilkinson. Tuck. Mott.

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CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

FIRST YEAR.

CLASS.	VETERINARY ANATOMY.	ARITHMETIC.	BOOK-KEEPING.	GENERAL PROFICIENCY.
HONOURS. I.	1 Linfield. 2 Jackson. 3 Marsack, H. 4 Brodie. 5 Rendall.	1 Jackson. 2 Rendall. 3 Linfield. 4 Monteith.	1 Jackson. 2 Linfield. 3 Rendall.	1 Jackson. 2 Linfield.
HONOURS. II.	1 Marsack, F. 2 Monteith.	1 McCallum. 2 Tinny. 3 McKergow.	1 McCallum. 2 Tinny. 3 Monteith. Jarvis. 5 Brodie. 6 Musgrave.	1 McCallum. 2 Brodie. Rendall. 4 Monteith. Marsack, H.
PASS. III.	1 Tinny. 2 McEvoy. 3 McCallum. 4 Musgrave. McKergow. 6 Asbury. 7 Paterson. 8 Seabrook. Monk. Gelling. Derbyshire. Makinson. Jarvis. Cargill. Wilkinson. Smith. Globensky. Campbell, C. Campbell, W. Tuck. Mott.	1 Jarvis. 2 Brodie. 3 Wilkinson. 4 Derbyshire. 5 Marsack, H. 6 McEvoy. 7 Asbury. 8 Monk. 9 Gelling. 10 Cargill. Seabrook. Campbell, C. W. Musgrave. Marsack, F. Globensky. Smith. Paterson. Makinson. Campbell, W. Tuck. Mott.	1 McEvoy. 2 Monk. 3 Marsack, F. 4 Gelling. 5 Marsack, H. Derbyshire. 7 Campbell, W. 8 Asbury. 9 McKergow. Wilkinson. Seabrook. Cargill. Makinson. Campbell, C. W. Paterson. Smith. Globensky. Tuck. Mott.	1 Tinny. 2 Marsack, F. 3 Musgrave. 4 McKergow. 5 Gelling.

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

CLASS. AGRICULT

HONOURS. I.
1 Harcourt,
2 Dean, H.
3 Elton, C. Serson, Shantz, Soule, R.
7 Stevenso Robson,

HONOURS. II.
1 Budd, W.
2 Bayne, S.
3 Bishop, Willans, Palmer, Brown, S. Hutton, Willans,
9 Sweet, H.
10 Carpenter,
11 Sinclair, J. Horrocks,
13 Knowlton Heacock, Birdsall, Scott, J.

PASS. III.
Vallance,
Price, V.
Wilmot, A.
Elton, R.
Austin, A.
Harrison,
Somerville.

Names unnumbered
The minimum for fir
33 per cent.

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

SECOND YEAR.

CLASS.	AGRICULTURE.	LIVE STOCK.	ARBORICULTURE.	JUDGING CATTLE.
HONOURS. I.	1 Harcourt, G. 2 Dean, H. H. 3 Elton, C. W. Serson, W. E. Shantz, A. Soule, R. M. 7 Stevenson, C. R. Robson, J. W.	1 Dean. Elton, C. W. 3 Shantz. Hutton. Harcourt. Carpenter. 7 Soule. 8 Bishop. Serson.	1 Dean. Harcourt. Soule. 4 Carpenter. 5 Stevenson. 6 Hutton. 7 Budd. Elton. 9 Robson. Bayne. Shantz. Willans, T. B.	1 Sweet. 2 Robson. 3 Heacock. 4 Bishop. 5 Brown. Stephenson.
HONOURS. II.	1 Budd, W. 2 Bayne, S. R. 3 Bishop, W. R. Willans, T. B. Palmer, W. J. Brown, S. P. Hutton, J. R. Willans, N. 9 Sweet, H. R. 10 Carpenter, W. S. 11 Sinclair, J. J. Horrocks, T. J. 13 Knowlton, S. M. Heacock, F. W. Birdsall, W. G. Scott, J.	1 Budd. 2 Stevenson. Knowlton. 4 Willans, T. B. Palmer. Willans, N. Harrison. Sinclair. Brown. 10 Vallance. 11 Heacock. 12 Robson. Sweet. 13 Somerville. Horrocks. Bayne.	1 Sweet. Bishop. Willans, N. 4 Brown. 5 Serson. Sinclair. 7 Knowlton. Vallance. 9 Palmer.	1 Elton, C. W. 2 Birdsall. Shantz. 4 Knowlton. Palmer. 6 Dean. Carpenter. 8 Budd. Soule. 10 Hutton. Vallance. 11 Harcourt.
PASS. III.	Vallance, R. Price, V. Wilmot, A. B. Elton, R. F. Austin, A. M. Harrison, R. E. Somerville.	1 Elton, R. F. Austin. 3 Price. Wilmot. Scott. Birdsall.	1 Somerville. 2 Austin. Heacock. Scott. Wilmot. Harrison. 7 Elton. Horrocks. Birdsall. 10 Price.	1 Elton, R. F. Bayne. 3 Austin. 4 Sinclair. 5 Serson. Willans, T. B. 7 Somerville. 8 Price. Harrison. 10 Horrocks. Scott. 11 Willans, N. Scott.

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.*

SECOND YEAR.

Class.	Judging Sheep.	Agricultural Chemistry.	Entomology.	Meteorology.
HONOURS. I.	1 Dean. Robson. 3 Sweet. 4 Sinclair. 5 Knowlton. Hutton. 7 Soule. 8 Harcourt. Harrison.	1 Elton, C. W. 2 Harcourt. 3 Hutton. 4 Dean.	1 Harcourt. 2 Shantz. 3 Hutton. 4 Elton, C. W. 5 Robson. 6 Bayne.	1 Shantz. 2 Hutton. 3 Harcourt. 4 Stevenson. 5 Dean.
HONOURS. II.	1 Palmer. 2 Carpenter. Heacock. 4 Willans, T. B. 5 Vallance. Wilmot. 7 Somerville. Brown. 9 Shantz. 10 Bishop. 11 Elton, C. W. 12 Serson. Stephenson.	1 Shantz. 2 Harrison. 3 Bishop. 4 Robson. 5 Stephenson. 6 Brown. 7 Palmer. 8 Willans, T. B.	1 Soule. Bishop. 3 Dean. 4 Knowlton. 5 Stevenson. 6 Brown. 7 Palmer. 8 Elton, R. F.	1 Knowlton. 2 Robson. 3 Bishop. Brown. Willans, T. B. Soule. Horrocks.
PASS. III.	1 Price. 2 Willans, N. Budd. 3 Bayne. 5 Horrocks. Austin. 7 Scott. Birdsall. Elton, R. F.	1 Soule. 2 Serson. 3 Knowlton. 4 Sweet. 5 Sinclair. 6 Heacock. 7 Carpenter. 8 Budd. 9 Bayne. 10 Vallance. 11 Elton, R. F. 12 Austin. 13 Horrocks. 14 Wilmot. 15 Birdsall. Willans, N. Price. Somerville. Scott.	1 Horrocks. 2 Willans, T. B. 3 Somerville. 4 Serson. 5 Willans, N. 6 Austin. 7 Carpenter. 8 Sinclair. 9 Budd. 10 Sweet. 11 Harrison. 12 Heacock. 13 Birdsall. 14 Wilmot. 15 Vallance. 16 Price. Scott.	1 Sinclair. 2 Willans, N. Palmer. 4 Elton, R. F. 5 Harrison. Serson. 7 Budd. 8 Somerville. 9 Vallance. Heacock. 11 Austin. 12 Carpenter. 13 Sweet. 14 Wilmot.

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.	Veterinary Pathology.
HONOURS. I.	1 Soule. 2 Harcourt. 3 Dean. 4 Elton, C. W. 5 Hutton.
HONOURS. II.	1 Shantz. 2 Palmer. 3 Bishop. 4 Brown.
PASS. III.	1 Robson. 2 Knowlton. 3 Stevenson. 4 Carpenter. 5 Elton, R. F. 6 Willans, T. 7 Somerville. 8 Budd. Birdsall. 10 Sinclair. Sweet. 12 Willans, N. 13 Serson. Vallance. Austin. 16 Harrison. 17 Heacock. Bayne. Horrocks. Price. Wilmot. Scott.

Names unnumbered
The minimum for fi
33 per cent.

CLASS LISTS (EASTER EXAMINATIONS)—*Continued.*

SECOND YEAR.

CLASS.		VETERINARY PATHOLOGY.	JUDGING HORSES.	ENGLISH LITERATURE.	POLITICAL ECONOMY.	GENERAL PROFICIENCY.
HONOURS.	I.	1 Soule. 2 Harcourt. 3 Dean. 4 Elton, C. W. 5 Hutton.	1 Harcourt. 2 Dean. 3 Soule. 4 Elton, C. W. 5 Shantz. 6 Brown.	1 Elton, C. W. 2 Robson. 3 Soule. / Harcourt. 5 Bishop. 6 Hutton. / Dean. 8 Shantz.	1 Hutton. 2 Dean. 3 Elton, C. W. 4 Harcourt. 5 Shantz.	1 Harcourt. 2 Elton, C. W. 3 Dean. 4 Hutton. 5 Shantz. 6 Soule.
	II.	1 Shantz. 2 Palmer. 3 Bishop. 4 Brown.	1 Bishop. 2 Hutton. 3 Elton, R. F. 4 Austin. / Robson. 6 Knowlton. 7 Stevenson.	1 Palmer. 2 Price. 3 Harrison. 4 Stevenson. 5 Carpenter.	1 Bishop. 2 Stevenson. 3 Robson. 4 Sweet. 5 Harrison. 6 Brown. 7 Sinclair.	1 Bishop. 2 Robson. 3 Stevenson. 4 Brown. 5 Palmer. 6 Knowlton.
PASS.	III.	1 Robson. 2 Knowlton. 3 Stevenson. 4 Carpenter. 5 Elton, R. F. 6 Willans, T. B. 7 Somerville. 8 Budd. / Birdsall. 10 Sinclair. / Sweet. 12 Willans, N. 13 Serson. / Vallance. / Austin. 16 Harrison. 17 Heacock. / Bayne. Horrocks. Price. Wilmot. Scott.	1 Palmer. 2 Harrison. 3 Sinclair. 4 Willans, N. / Bayne. 6 Somerville. 7 Horrocks. 8 Sweet. 9 Heacock. 10 Budd. 11 Birdsall. 12 Carpenter. 13 Willans, T. B. Vallance. Wilmot. Serson. Price. Scott.	1 Elton, R. F. 2 Wilmot. 3 Willans, T. B. 4 Brown. 5 Bayne. 6 Birdsall. 7 Heacock. 8 Sweet. 9 Austin. 10 Knowlton. 11 Sinclair. 12 Willans, N. 13 Budd. / Serson. 15 Horrocks. 16 Somerville. Scott. Vallance.	1 Serson. 2 Soule. 3 Birdsall 4 Bayne. / Palmer. 6 Elton, R. F. 7 Austin. 8 Heacock. 9 Wilmot. 10 Price. 11 Knowlton. 12 Horrocks. 13 Budd. 14 Carpenter. 15 Somerville. 16 Willans, T. B. 17 Willans, N. 18 Vallance. Scott.	1 Harrison. / Sweet. 3 Carpenter. 4 Willans, T. B. 5 Sinclair. 6 Bayne. 7 Budd. 8 Elton, R. F. 9 Heacock. 10 Austin. 11 Birdsall.

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.

II.—MIDSUMMER EXAMINATIONS, 1888.

FIRST YEAR.

Class.	Agriculture	Geology.	Botany.	Veterinary Materia Medica.
Honours. I.	1 McCallum. 2 Brodie.	1 Brodie. 2 McCallum. 3 Greenwood.	1 McCallum. 2 Brodie. 3 Tinny.	
Honours. II.	1 Wilkinson. 2 Jarvis. 3 Tinny, 4 Makinson. 5 Musgrave. 6 Gelling. 7 Monteith.	1 Tinny. 2 Monteith. 3 Rendall. 4 Makinson. 5 Linfield.	1 Gelling. 2 Paterson. 3 Montieth.	1 Brodie. 2 Tinny.
Pass. III.	1 Paterson. 2 McKergow. 3 Linfield. 4 McEvoy. 5 Rendall. 6 Monk. 7 Smith. 8 Watson. 9 Cathcart. 10 Cargill. 11 Asbury. 12 Greenwood. 13 Derbyshire.	1 Jarvis. 2 Gelling. 3 Watson. 4 McEvoy. 5 Musgrave. 6 Wilkinson. 7 {Asbury. Cathcart. 9 Monk. 10 McKergow. 11 Derbyshire. 12 Paterson. 13 Cargill. 14 Smith.	1 Jarvis. 2 Greenwood. 3 Rendall. 4 {Linfield. Asbury. 6 Derbyshire. 7 Makinson. 8 Musgrave. 9 {Monk. McEvoy. 11 McKergow. 12 Watson. 13 Cathcart. Cargill. Wilkinson. Smith.	1 Musgrave. 2 {Rendall. 3 {McEvoy. 4 McCallum. 5 Linfield. 6 Paterson. 7 Monteith. 8 {Cargill. 9 {Gelling. 10 {Watson. 11 {Greenwood. 12 {Cathcart. 13 {Jarvis. 14 {Makinson. Monk. Derbyshire. McKergow. Wilkinson. Asbury. Smith.

Names unnumbered are those of students who failed to pass in the subject.
The minimum for first-class honours is 75 per cent.; for second class honours, 60 per cent.; for pass, 33 per cent.

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

FIRST YEAR.

CLASS.	ENGLISH GRAMMAR.	ENGLISH COMPOSITION.	MENSURATION.	DAIRYING.	GENERAL PROFICIENCY.
HONOURS. I.	1 McCallum. 2 Tinny.	1 Greenwood.	1 Rendall. McCallum. 3 Linfield. 4 Tinny. 5 Brodie.	1 Derbyshire. 2 Linfield. 3 Brodie. 4 Rendall. 5 Tinny. 6 McCallum.	
HONOURS. II.	1 Greenwood. 2 Brodie. 3 Linfield. 4 Paterson. 5 Derbyshire.	1 McCallum. 2 Musgrave. 3 Gelling. 4 Tinny.	1 Asbury. 2 Greenwood.	1 Monteith. 2 Jarvis. 3 Gelling. 4 Musgrave. 5 Paterson.	1 Brodie. 2 McCallum. 3 Tinny. 4 Linfield. 5 Rendall.
PASS. III.	1 Rendall. 2 McKergow. 3 Musgrave. 4 Monteith. 5 Jarvis. 6 Gelling. 7 Monk. Watson. 9 McEvoy. 10 Asbury. Cargill. Cathcart. Makinson. Smith.	1 Brodie. 2 Linfield. 3 Paterson. 4 Jarvis. 5 Monteith. 6 Cargill. 7 Watson. Rendall. 9 Makinson. 10 Derbyshire. 11 McKergow. 12 McEvoy. 13 Cathcart. 14 Monk. 15 Asbury. 16 Wilkinson. Smith.	1 Watson. 2 Gelling. 3 Monteith. 4 Jarvis. 5 McKergow. 6 Cathcart. 7 Musgrave. 8 Derbyshire. 9 Wilkinson. 10 McEvoy. 11 Makinson. 12 Paterson. Cargill. Monk. Smith.	1 Wilkinson. 2 Makinson. 3 McEvoy. 4 Greenwood. 5 Monk. 6 McKergow. 7 Cathcart. 8 Cargill. 9 Watson. 10 Asbury.	1 Greenwood. 2 Monteith. 3 Gelling. 4 Jarvis. 5 Musgrave. 6 Paterson. 7 Watson. McEvoy. 9 Cathcart.

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

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

CLASS LISTS.

MIDSUMMER EXAMINATIONS, 1888.

SECOND YEAR.

Class.		Agriculture.	Analytical Chemistry.	Systematic and Economic Botany.	Practical Horticulture.
Honours.	I.	1 Dean. 2 Harcourt. 3 Soule. 4 Hutton. 5 Shantz. 6 Bishop. 7 Brown. 8 Carpenter.	1 Harcourt. 2 Stevenson. 3 Elton, R. F. 4 Marsack, H. 5 Brown. 6 Knowlton.	1 Soule. 2 Hutton. 3 Harcourt. 4 Dean. 5 Shantz.	1 Hutton. 2 Dean. 3 Shantz. 4 Harcourt.
	II.	1 Vallance. 2 Stevenson. 3 Knowlton. 4 Budd. 5 Serson. 6 Harrison. 7 Willans, T. B. 8 Palmer. 9 Marsack, H. 10 Sinclair. 11 Somerville. 12 Sweet. 13 Heacock. 14 Marsack, F. 15 Austin.	1 Marsack, H. 2 Harrison. 3 Hutton. 4 Dean. 5 Budd. 6 Bishop. 7 Valance. 8 Palmer.	1 Carpenter. 2 Brown. 3 Stevenson. 4 Budd. Bishop.	1 Soule. 2 Bishop. 3 Marsack, F. 4 Harrison. 5 Marsack, H. 6 Palmer. 7 Willans, B.
Pass.	III.	1 Willans, N. 2 Elton, R. F. 3 Horrocks. 4 Wilmot.	1 Soule. 2 Heacock. 3 Shantz. 4 Horrocks. 5 Sinclair. 6 Willans, T. B. 7 Willans, N. 8 Austin. 9 Wilmot. 10 Sweet. 11 Carpenter. 12 Serson.	1 Marsack, F. 2 Serson. 3 Harrison. 4 Willans, B. 5 Austin. 6 Palmer. 7 Marsack, H. 8 Vallance. 9 Knowlton. 10 Elton, R. F. 11 Sweet. 12 Sinclair. 13 Willans, N. 14 Horrocks. 15 Wilmot. 16 Heacock. 17 Somerville.	1 Brown. 2 Stevenson. 3 Willans, N. Knowlton. 5 Sweet. 6 Budd. 7 Horrocks. 8 Serson. 9 Sinclair. 10 Heacock. Carpenter. 12 Somerville. 13 Elton, R. F. 14 Austin. 15 Vallance. 16 Wilmot.

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

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

CLASS LISTS (MIDSUMMER EXAMINATIONS)—*Continued.*

SECOND YEAR.

Classes.	Veterinary Pathology and Obstetrics.	English Literature.	Road-making, Levelling and Surveying.	Dairying.	General Proficiency.
Honours. I.	1 Harcourt. 2 Soule. 3 Hutton. 4 Dean.	1 Dean. 2 Soule.	1 Hutton. 2 Harcourt. 3 Shantz. 3 Dean.	1 Harcourt. 2 Dean. 3 Shantz. 4 Hutton. 5 Soule. 6 Sweet. 7 Bishop. 8 Budd.	1 Harcourt. 2 Dean. 3 Hutton. 4 Soule.
Honours. II.	1 Shantz. 2 Carpenter. 3 Bishop.	1 Hutton. 1 Harcourt. 3 Palmer.	1 Soule. 2 Stevenson. 3 Bishop.	1 Brown. 2 Serson. 3 Vallance. 4 Somerville. 4 Knowlton. 6 Sinclair. 7 Palmer. 8 Willans, B. 9 Elton, R. 10 Stevenson. 11 Carpenter.	1 Shantz. 2 Bishop. 3 Stevenson. 4 Brown. 5 Budd.
Pass. III.	1 Willans, T. B. 2 Serson. 3 Brown. 4 Marsack. 5 Somerville. 6 Heacock. 7 Harrison. 8 Budd. 9 Sweet. 10 Wilmot. 11 Elton. 12 Palmer. 13 Vallance. 14 Horrocks. 15 Stevenson. 16 Knowlton. 17 Willans, N. 18 Marsack, F. 19 Sinclair. 20 Austin.	1 Harrison. 2 Stevenson. 3 Shantz. 4 Carpenter. 5 Wilmot. 6 Serson. 7 Elton, R. F. 8 Budd. 9 Brown. 10 Bishop. 11 Vallance. 12 Willans, B. 13 Knowlton. 13 Marsack, F. 15 Sinclair. 15 Willans, N. 15 Austin. 18 Heacock. 18 Marsack, H. 18 Sweet. 21 Horrocks. 21 Somerville.	1 Marsack, F. 2 Brown. 3 Elton, R. 4 Somerville. 5 Knowlton. 5 Palmer. 7 Sinclair. 7 Harrison. 9 Sweet. 10 Budd. 11 Horrocks. 12 Willans, B. 13 Heacock. 14 Vallance. 15 Carpenter. 16 Wilmot. 17 Serson. 17 Willans, N. 19 Austin. 19 Marsack.	1 Horrocks. 2 Marsack, H. 3 Harrison. 4 Heacock. 5 Willans, N. 6 Wilmot. 7 Marsack, F. 8 Austin.	1 Knowlton. 2 Palmer. 3 Harrison. 4 Elton, R. F. 5 Carpenter. 6 Vallance. 7 Marsack, H. 8 Willans, B. 9 Serson. 10 Marsack, F. 11 Sweet. 12 Sinclair. 13 Heacock. 14 Horrocks. 15 Willans, N. 16 Wilmot. 17 Austin.

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

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

APPENDIX 4.

COLLEGE IN ACCOUNT WITH FARM AND GARDEN.

(*a*) With Farm.

To 128 bags potatoes, at 75c	$ 96 00
" 3,465 gallons of milk, at 12c	415 80
" Cartage for College	25 00
" Feed for President's horse (without attendance)	75 00
" Feed for Bursar's horse (without attendance)	75 00
" Carpenter work by students, etc	20 00
	$706 80

(*b*) With Garden.

To fruit and vegetables (for items and prices see Mr. Forsyth's Report, Part VI.)	708 60
Total receipts	$1,415 40
By amounts paid by College for Student labor on farm and garden	2,716 59
Balance to credit of College	$1,301 19

UNIVERSITY OF TORONTO.

SPECIAL CONVOCATION FOR CONFERRING DEGREES IN ARTS AND AGRICULTURE, MONDAY, OCTOBER 1st, 1888.

B.S.A.

Craig, J. A.
Creelman, G. C.
Fee, J. J.
Paterson, B. E.
Zavitz, C. A.

DEPARTMENT OF AGRICULTURE.—CLASS LISTS, 1888.

THIRD YEAR.

Inorganic Chemistry.	Organic Chemistry.	Animal Chemistry and Cattle Feeding.	Agricultural Chemistry.	Analytical Chemistry.	Botany, Physiological and Structural.	Cryptogamic Botany.
Class I. 1 Fee, J. J. 2 Zavitz, C .A.	Olass I. Fee.	Class I. 1 Craig. 2 Paterson. 3 Fee.	Class I. 1 Craig. 2 Fee. 3 Zavitz. 4 Paterson. 5 Creelman.	Class II. 1 Paterson. 2 Creelman.	Class I. 1 Craig. 2 Paterson.	Class I. Craig.
Class II. Craig, J. A.	Class II. Zavitz.	Class II. 1 Zavitz. 2 Creelman.		Class III. 1 { Fee. { Zavitz. 3 Craig.	Class II. 1 Zavitz. 2 Creelman. 3 Fee.	Class II. 1 Fee. 2 Creelman. 3 Zavitz.
Class III. 1 Paterson, B.E. 2 Creelman, G.C.	Class III. 1 Craig. 2 Paterson. 3 Creelman					Class III. Paterson.
English.	Drawing.	Geology.	Euclid.	Latin.	Dairying.	Entomology.
Class II. 1 Fee. 2 { Creelman. { Zavitz. 4 Paterson. 5 Craig.	Class I. 1 Craig. 2 Paterson.	Class I. 1 { Craig. { Fee. 3 Paterson.	Class II. Zavitz.	Class II. 1 Creelman. 2 Fee. 3 Craig. 4 Paterson.	Class II. Zavitz.	Class II. 1 Fee. 2 Craig.
	Class II. Zavitz.	Class II. Creelman.				Class III. 1 { Creelman. { Paterson 3 Zavitz.
	Class III. 1 Creelman 2 Fee.					

PROFESSOR

To the President of

SIR,—In subm
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Mrs. R. Gibson,
John Ramsay,
glaciated rock.
John Higinboth
Miss Aiken, Mi
Prof. Wm. Brow
Mr. Frank Dian
W. H. Wardrop
W. S. Carpenter
J. R. Conon, Es
G. Watson, stud
Mr. Cavan, Stra
A. Lehmann, 3r
H. Gummer, E
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PART II.

REPORT OF THE
PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December 31st, 1888.

To the President of the Ontario Agricultural College:

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

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

1. COLLEGE MUSEUM.

During the past year this important adjunct to College work has been greatly improved by the addition of a gallery and several cases more suitable for the arrangement of geological specimens than any we have had before. We purpose devoting the space upstairs to the divisions of geology and entomology. We are still in need of cases for the purpose of exhibiting plants, especially weeds. These might be placed upon the wall in the lower room and so arranged as to be of great practical value to visitors in assisting them to identify the weeds of their respective localities. To do this will require some outlay, which I hope you will be able to secure during the next year.

We have been favored by several persons contributing to our collection during 1887, and here I wish to express my thanks for their kindness, and hope that as years roll on the number of donations suitable for instructive purposes will increase. The following list comprises the donors and donations:—

Mrs. R. Gibson, Grimsby. A large and excellent specimen of fossil seaweed.

John Ramsay, Esq., Eden Mills, fossils of Guelph formation, pudding stone and glaciated rock.

John Higinbotham, Lethbridge, cretaceous fossils.

Miss Aiken, Milton, petrified moss and leaves.

Prof. Wm. Brown, O. A. C., skulls of the Buffalo.

Mr. Frank Diamond, Brantford, collections of butterflies, moths and beetles.

W. H. Wardrope, Esq., Guelph, an excellent collection of Scotch plants.

W. S. Carpenter, Simcoe, coral from modern seas.

J. R. Conon, Esq., Elora, a large pothole stone.

G. Watson, student, specimens of chess.

Mr. Cavan, Stratford, a very symmetrical pothole stone.

A. Lehmann, 3rd year student, a collection of Canadian plants (35 species).

H. Gummer, Esq., Guelph, specimen showing a fungoid growth on the May beetle in pupal condition.

2. Library.

The Library at present is very convenient, and is becoming each year more valuable for educational purposes—yet we require books for reference, that have not so far been obtained. Some of these we cannot get without considerable expense, and it does seem that we should have a larger grant for expenditure in connection with the Library than hitherto. The present grant is used chiefly in the purchase of papers, journals, etc., for the reading-room.

It contains 5,370 volumes, of which 117 have been added this year. The books added may be grouped as follows:—

Reports, chiefly agricultural	40
Natural History	9
Veterinary	5
Agriculture	13
Chemistry	8
Literature	17
Encyclopædias	3
Hygiene	1
Microscope	1
Drawing	2
General Science	3
Parliamentary reports	10
Examination papers, bound	3
Dairying	2
	117

3. Reading-room.

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

Rules regarding the proper use of the reading-room are posted in conspicuous places.

The following is a 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. Canadian Baptist	Toronto.
3. Christian Guardian	"
4. Canada Presbyterian	"
5. Monthly Weather Review	"
6. Presbyterian Review	Chicago.
7. Sheep Breeder and Wool Grower	Winnipeg.
8. Manitoba Weekly Free Press	St. Catharines.
9. Canadian Horticulturist	London, Ont.
10. Canadian Entomologist	Springfield, Mass.
11. Farm and Home	Beeton.
12. Bee Journal	Newmarket.
13. North York Reformer	Acton.
14. Acton Free Press	Chicago.
15. Dairy World	Erin, Ont.
16. Ontario Evangelist	

(b) *Furnished by the College.*

1.	Daily Globe	Toronto.
2.	" Mail	"
3.	" Empire	"
4.	" Mercury	Guelph.
5.	" Herald	"
6.	Rural Canadian	Toronto.
7.	Grip	"
8.	Poultry Review	"
9.	Farmer's Advocate	London, Ont.
10.	Canadian Stock-Raiser's Journal	Hamilton.
11.	Nor'-West Farmer	Winnipeg.
12.	Popular Science News	Boston.
13.	Rural New Yorker	New York.
14.	Breeder's Gazette	Chicago.
15.	North British Agriculturist	Edinburgh (Scotland).
16.	Farmers' Gazette	Dublin (Ireland).
17.	Mark Lane Express	London (England).
18.	American Garden	Greenfield (Mass.)
19.	American Naturalist	Philadelphia.
20.	Veterinary Journal	London (England)
21.	Veterinarian	"
22.	Cultivator and Country Gentleman	Albany, N. Y.
23.	Scientific American	New York.
24.	" Supplement	"
25.	Live Stock Journal	England.
26.	Live Stock Journal	Chicago.
27.	American Agriculturist	New York.
28.	American Dairyman	"
29.	Nature	London (England).
30.	Botanical Gazette	Crawfordsville, Indiana.
31.	Agricultural Science	Geneva, N. Y.
32.	American Bee Journal	Chicago.
33.	Canadian Honey Producer	Brantford.

4. Practical Work.

When opportunity was afforded, my efforts in the line of practical work were employed in collecting data of use in the preparation of bulletins, and in trying to improve facilities for the purpose of rendering instructions in science of a thoroughly practical nature.

We have now a portion of the garden selected and set out with plants, representing the most common species, genera and order discussed in lectures on Botany.

The beds are so arranged that the students may take their note-books to the garden, and there find the plants referred to, labelled and arranged in regular order, as they are discussed in the lecture room.

Thirty-two orders; 150 genera and 250 species are thus arranged, and it is intended to increase the number next year. Visitors are much pleased with this collection of herbaceous plants, for here, on examination, they find some beautiful flowers associated with some much less attractive. The cabbage and mustard grow side by side, the heliotrope and the detested burr, and other striking examples of plants related in structure, though widely separated in form.

During the year the following bulletins have been prepared on Raspberries and Rust:—

Cultivation of Raspberries.

Having had considerable experience at the Agricultural College during the past seven years in growing raspberries, I purpose in this bulletin to give our results.

The area planted in 1881 consists of about four acres and forms part of the orchard set apart at that time, so that while the apple trees have been growing the land has not been idle, but bearing yearly a crop of raspberries. As the trees are now reaching a considerable size the raspberry plot will be changed and the land used solely for the orchard.

Conditions surrounding the Canes.

Location: Latitude north 42° 38′, height above sea level 1,100 feet, above Lake Ontario, 858 feet.

Exposure: Westerly inclined to north; no shelter of any account as yet.

Soil: Clay loam and somewhat gravelly on the north and west sides; partially drained.

Meteorology: Mean annual temperature of 1880-6 42.2°; mean summer temperature 57.1°; winter 27.3°; highest temperature (1881) 98°, lowest (1884) 35° below zero; average number of days rain fell per year 72; rainfall, including snow, 24.7 inches; prevailing winds, south-west 43 per cent., northtwest 31 per cent.

Management.

The canes are in rows six feet apart, while the plants are about five feet apart in the row. This renders cultivation with the horse-hoe comparatively easy, and thorough cultivation is carried on during the summer so as to keep down weeds and render the soil loose and friable. In summer, during the time of growth, the young canes are kept cut back to about two feet so as to encourage a bushy habit. The plot is manured at least every second year. We have pruned in the spring, believing that an advantage is gained in leaving the old canes through the winter with a view to their assisting in holding the snow around the bushes, and thus serving as a protection in a climate comparatively severe. Early in the spring the old canes are cut out and the number of canes each hill reduced to not more than six (usually four) and cut back to about 3½ feet in length. We do nothing to protect the canes during winter, except leaving the old ones which serve to keep the snow upon the hills.

Varieties and Number Planted.

Red.—Philadelphia, 617; Cuthbert, 376; Thwack, 84; Turner, 96; Herstine, 115; Niagara, 98: Clarke, 44; Highland Hardy, 114; Brandywine, 86.

Black Caps.—Davidson's Thornless, 94; Dorchester, 12; Gregg, 217; Mammoth Cluster, 150.

White.—Caroline, 12; Saunders' Hybrids, No. 53, 50; No, 70, 18; No, 72, 16; No. 57, 12; No. 50, 12; No. 67, 5.

Results of Cultivation.

Red.—Cuthbert has proved to be by far the best with us. Though somewhat tender, it has stood our severe climatic conditions well and proved itself to be prolific, large, good color, firm and of delicious flavor. The severe winter of 1886-87 injured many of the canes. It is somewhat late but extends the time of berries, and is a variety which should be found in every raspberry plot. Growing side by side with the Philadelphia, an excellent opportunity is found for comparison; and, as, from time to time I have gone to the ground in the berry season with visitors, I have always found they soon judged in favor of this variety, popular both for home and market use. Philadelphia with us ranks second. It is very prolific, hardy, but not a firm berry, and thus not so marketable. It makes a fine show on the bush, but does not pick so readily as the Cuthbert. It has rather a poor color and ripens comparatively early. Turner comes next, of good flavor but not very firm berry, and consequently not a good shipper; hardy and seems as if it would grow under adverse conditions better than most varieties, but not an early berry. Herstine has not done much with us. Its bearing season seems short; berry soft and canes fairly hardy. Niagara has given a fair yield, but late. Clarke is a large

bright, luscious berry, but soft and not very prolific here; canes tender. Highland Hardy is a small bush, and a poor grower, tender with us, killing down and bearing soft berries. Brandywine has produced some fair crops, but on the whole has done poorly. Thwack has not fruited well.

Black.—None have done remarkably well. All have suffered considerably from our cold seasons, many hills having died out completely. Davidson's Thornless, though killed badly, has proved to be a strong grower and has furnished some good fruit. Gregg is a little late in season and has also suffered, but has yielded a fine, large firm berry. Mammoth Cluster has killed out very much; it is medium early. Saunders' Hybrids have proved themselves to be prolific; the berries are inclined to be soft; a good flavor, but a very poor color, being a cross between the red and black, they have the color of neither the one nor the other, but a sort of mouldy-like appearance. This no doubt would affect their sale, but for home use these berries are worthy of a good place. They seem to possess the flavor of black more than red berries.

White.—Caroline has been fairly prolific and comparatively hardy.

Conclusions.

1. We have been very successful in obtaining a satisfactory yield from red raspberries, especially the first mentioned on the list.
2. We are inclined to believe that leaving the old canes till spring aids in keeping the snow about the hill and thus serves as a protection during the winter months.
3. Our climate is rather severe on black varieties.
4. Ground for raspberries should be well drained and thoroughly cultivated.
5. The best Red varieties are: Cuthbert, Philadelphia and Turner. Of Black: Gregg, Mammoth Cluster and Saunders' Hybrid (57). Of White: The Caroline. These make up a collection likely to do well in most places in Ontario.
6. Farmers, with a little care and a small amount of labor, might easily grow raspberries for home use, and thus save many a toilsome tramp and weary hour to members of their household who strive to gather wild raspberries from patches where fruit is obtained under most adverse conditions.

Rust (*Puccinia graminis*).

In reply to many questions referring to rust, the writer has thought it expedient to furnish information in a bulletin that will answer these questions, and also those of other enquirers who are equally desirous to get some light upon this invisible foe:

Life History of the Rust Plant (Puccinia graminis.)

Rust is the product of a minute plant belonging to a very extensive group, called the Fungi. Many of these are microscopic and live upon other plants, feeding upon the juices of the latter to such an extent as to affect their vitality. In this comprehensive group we find plants producing rust, must, mildew, ergot, blight, potato rot, and countless other diseases, that affect the higher forms of plant life. In the case of the so-called rust we find that a spore, which serves the purpose of a seed in higher plants, reaches the leaves or stalk of the plant attacked. If conditions are favorable it germinates and soon finds its way into the plant affected, and gives rise to a mass of threadlike structures (*mycelium*) which permeate the host plant and feed upon its juices. Not long after this vegetative condition has been attained, spores are produced in myriads on the threads of which it is composed. So numerous do they become that they burst the thin covering of the leaf or stalk and show a rust colored rupture. If the powdery-like substance thus exposed be examined under a microscope, say 200 diameters, it will reveal that what appears to be dust is really a mass of regularly formed seed-like bodies, consisting of one cell, oval in shape and reddish in color. Now these spores (*uredo*), finding their way to wheat plants, soon germinate, and again myriads of spores are produced, so that in a very short time, if conditions are favorable—damp, close sultry weather—a whole field will be affected. The rapidity of growth in these lower forms of plant life is almost incredible,

but the facts are too flagrant to doubt it. The rust plant does not stop here. A little later in the season, on the same threadlike structure (*mycelium*), another form of spore is produced ; but these are usually more common on the lower part of the stalk, and are destined to carry the trouble into another season. The former are frequently spoken of as "summer spores," the latter as "winter spores." These last formed spores (*teleuto*) are two-celled, pear-shaped and black. Affected plants are then said to be attacked with "mildew" and suffer severely from the effects of this parasite, just at a time when the plant has reached a stage to mature its seed. These black spores proceed no further that season, and will not again give rise to mildew on wheat until another plant has served as nurse for a while. In spring the dark spores germinate and give rise to another form of simple spores (*sporidia*) formed at the end of threads growing from each cell of the black spores. These (*sporidia*) as yet have not been discovered to germinate upon wheat ; but when they reach the leaves of the Barberry shrub they germinate, enter the leaf and soon give rise on the underside to masses of cup-like structures, in which are produced innumerable round golden colored spores (*æcidium*), which will produce a vegetative growth only when they germinate on the wheat or some other closely allied plant. They then give rise to the condition referred to as "rust." Such is the life history of this common foe, and to the reader must appear a very complicated one indeed ; there being no less than four kinds of spores produced—*uredo*, *teleuto*, *sporidia* and *æcidium*. These, for convenience, we might name summer, winter and spring spores ; spring referring to the last two. Two grow on the wheat plant (*uredo* and *teleuto*, one in the spring on stubble or fragments of straw (*sporidia*), and one on the leaves of the Barberry (*æcidium.*)

The Barberry as a Host.

The question naturally arises here, Is the Barberry shrub to be blamed for all the rust ? In order to defend this shrub against such a charge, several views have been set forward, which are as follows :—

1. *Uredo* spores may be carried over the winter upen plants that do not perish like wheat at the close of the season, *e.g.*, couch grass, etc.
2. *Sporidia* may germinate on wheat without the intervention of another plant.
3. *Sporidia* may develop on other plants than the Barberry.

But as yet these are merely guesses at the truth. That such a common enemy has so long eluded the investigation of scientists may seem remarkable ; but when it is remembered how many conditions are required to be observed in searching such a minute foe, the surprise is not so great. However, it does seem that a sufficient case has been made out to prevent the further use of this shrub as a hedge plant in the neighborhood of wheat fields. The extreme minuteness of the *æcidium* spores enables them to be carried long distances in the air, so that it is not necessary that the source of trouble should be close at hand. We may reasonably hope that other sources than the Barberry may be found, but in the meantime farmers are acting in harmony with the teaching of science in continuing no longer the use of this plant for a hedge.

Conclusions.

From extensive enquiries into the presence and cause of rust, the following conclusions have been reached :

1. Seasons are the chief cause of rust ; sudden changes of temperature and rain, accompanied with close still weather, are favorable to its increase.
2. Low-lying rich soils are most subject to attack.
3. An excessive use of manures, rich in nitrogen, encourage the disease.
4. Late sown grain is most subject to attack.
5. Thinly sown crops seem most liable to injury.
6. Red wheats are less affected that white varieties.
7. Rust is more common in the vicinity of Barberry hedges than at a distance.

To lessen the attacks of this troublesome parasite farmers should avoid, as far as possible, the conditions referred to above, as favorable to its propagation. By so doing, they are following in the line of practical and theoretical teaching, and may expect favorable results.

In Bulletin VIII, 1886, referring to grapes, some notes were given relative to the ripening of the varieties in our vineyard. In the report of '87 I again referred to the ripening of our grapes, to show what a marked difference there is in one season compared with another, and in this report I give the notes for three years, presuming that they may be of interest to some readers. We have now stopped growing the varieties which we have learned from experience do not ripen with us, and will confine our attention to the cultivation of those we find that are likely to ripen in this locality.

The dates indicate when the varieties were gathered :—

1886.

September 8th—Brant, Janesville, Champion, Moore, Early Dawn, coloring and ripe before the week ends; Wilder commencing; Othello freely colored but unequally.

September 14—Lindley, Hartford, Wilder, Massasoit, just showing color; Telegraph, Ives' Seedling, Cottage, Israella, Eumelan, Barry and Concord apparently later than the preceding.

September 21st—Creveling and Concord about the same, and Cornucopia nearly so.

October 2nd—The best were cut, viz.: Lindley, Delaware, Moore, Salem, Massasoit, Wilder, Merrimac, Eumelan, Herbert, Concord.

October 7th—Clinton, Brighton, Agawam and Martha, ripe.

1887.

September 5th—Champion, Janesville, Maxim, Brant.

September 7th—Moore's Early, Cottage, Early Dawn, Ives' Seedling, Alvey, Croton.

September 10th—Hartford, Prolific, Massasoit, Agawam, Cornucopia, Black Hawk, Black Eagle.

September 15th—Eldorado, Brighton, Advance, Aulochon.

September 17th—Salem, Delaware, Concord, Wilder, Gaertner, Warden, Lady Jessica.

September 20th—Draucut's Amber, Herbert, Lindley, Merrimac, Eumelan.

September 24th—Amber Queen, Barry, Clinton, Martha, Rogers' 41.

September 26th—Dempsey 4, 18, 25, Poklington, Prentiss, Transparent, Walter.

September 28th—Elvira, Eva, Green's Golden, Iowa, Lady Washington, Maxatawny, Naomi, Noah.

September 30th—All varieties gathered in; while in 1886 a note says, October 2nd, "the best were cut, viz.: Lindley, Delaware, Moore, Salem, Massasoit, Wilder, Herbert, Merrimac, Eumelan, Concord." October 7th, "Clinton, Brighton, Agawam and Martha, ripe."

1888.

September 15th—Maxim, Champion.
September 18th—Moore's Early.
September 20th—Massasoit, My Red, Delaware.
September 22nd—Worden, Cottage, Early Dawn.
September 24th—New Haven, Creveling, Lindley, Jessica and some Concord.
September 26th—Brant, Purity, Eldorado.
September 28th—Barry, Gaertner, Herbert, Rogers' 28, 33, 41.
October 1st—Transparent, Rogers' 5, Waverly.
October 3rd—Faith, Canada, Dempsey, Prentiss and Jefferson.
October 5th—Munroe, Martha.
After this date no more were gathered.

The following seed tests have been made in the Botanical Laboratory. They show a marked deficiency in the germinating power of some seeds, and teach us that it is of great importance to the farmer to ascertain, as far as possible, the vitality of the seeds he purchases :—

FIGURES at the head of columns indicate the number of days the seeds had been planted, those in the columns the percentage of seeds germinated, when counted.

	3 Days.	4 Days.	5 Days.	6 Days.	7 Days.	8 Days.	10 Days.	12 Days.	15 Days.	
										Per cent.
No. 1, Barley	8	36	90	100	....	....	....	....	....	
" 2, "	12	68	96	96	....	....	....	....	....	
" 3, "	34	74	98	98	....	....	....	....	....	
" 4, Oats heated	2	24	31	35	....	....	....	....	....	
GRASSES.										
No. 5, Rye, perennial	....	2	29	44	50	....	70	71	71	
" 6, Meadow, foxtail	....	....	5	25	35	....	54	....	54	
" 7, Fine-leaved fescue	....	....	....	....	4	....	9	13	18	
" 8, Hard fescue	....	....	....	12	32	....	49	49	57	
" 9, Tall "	....	....	7	24	37	....	53	58	60	
" 10, Meadow fescue	....	....	6	43	67	....	88	90	93	
" 11, Meadow grass	....	2	3	3	1	....	4	4	5	
" 12, Wood, meadow	....	....	....	....	....	....	7	9	9	
" 13, Crested dogstail	....	....	....	....	8	....	30	32	40	
" 14, Timothy	....	....	6	40	70	....	78	78	79	
" 15, Blue	....	....	....	....	1	....	....	1	2	
" 16, Sweet vernal	....	....	....	3	4	....	11	20	24	
" 17, Italian rye	....	6	29	34	41	....	46	49	49	
" 18, Cocksfoot	....	....	....	7	12	....	20	21	21	
" 19, White clover	16	22	48	60	68	....	70	71	71	
" 20, Red "	10	25	57	....	....	....	....	....	....	
GRAINS.										
No. 21, Six-rowed barley	38	96	100	....	....	....	....	....	....	
" 22, White oat	....	24	68	....	....	....	92	....	....	
" 23, Peas slightly green	52	86	86	....	....	....	....	....	....	
" 24, " well ripened	40	82	92	....	....	....	....	....	....	
" 25, Wheat	....	....	....	10	....	....	18	26	30	....
" 26, Barley	19	28	58	62	....	....	64	68	68	....
" 27, Oats	....	2	2	4	....	....	4	6	12	....
" 28, Wheat	2	2	4	12	....	....	18	36	40	....
" 29, Oats	....	....	....	4	....	....	4	....	4	....
" 30, "	....	8	12	14	....	....	30	36	36	....
" 31, "	....	....	2	2	....	....	2	4	20	....
" 32, "	....	....	....	....	....	....	2	4	20	....
" 33, "	....	....	....	2	....	....	4	16	28	....
" 34, "	....	....	....	....	....	....	4	14	22	....
" 35, Wheat	....	....	....	16	....	....	24	38	40	....
" 36, Oats	....	....	30	38	....	....	62	64	66	....
" 37, Wheat	....	....	10	18	....	....	30	42	50	....
" 38, " rusted	....	....	....	....	....	....	....	4	6	12
" 42, Oats	2	90	100	....	....	....	....	....	....	....
" 43, Rye	36	40	40	....	....	....	....	....	....	....
" 44, Barley	16	86	90	....	....	....	....	....	....	....
" 45, Wheat	22	54	60	....	....	....	....	....	....	....
" 46, "	88	90	92	....	....	....	....	....	....	....
" 47, Peas	22	40	58	....	....	....	....	....	....	....
" 48, "	16	50	62	....	....	....	....	....	....	....
" 49, "	8	16	20	....	....	....	....	....	....	....
" 50, Wheat	42	74	82	....	....	....	....	....	....	....
" 51, "	68	88	96	....	....	....	....	....	....	....
" 52, Barley	90	94	....	....	....	....	....	....	....	....

Nos. 4 and 38 are especially instructive.

SEED TESTS—*Continued.*

	3 Days.	4 Days.	5 Days.	6 Days.	7 Days.	8 Days.	10 Days.	12 Days.	15 Days.	
GRAINS—*Continued.*										
No. 53, "	96	100	....	....	....	....	....	....	....	Per cent.
" 54, Wheat	90	92	....	94	....	....	....	....	....	
" 55, "	24	30	40	40	74	....	....	....	....	
" 56, "	66	70	....	70	74	....	....	....	....	
" 57, Peas	30	72	94	98	....	....	....	....	....	
" 58, Wheat	68	78	80	82	86	....	....	....	....	
" 59, Peas	80	100	....	....	....	....	....	....	....	
" 60, Wheat	70	84	88	....	90	....	....	....	....	
" 61, "	70	76	78	....	84	....	....	....	....	
" 62, Rye	48	50	54	....	54	....	....	....	....	
" 63, Wheat	20	80	90	....	90	....	....	....	....	
" 64, Oats	....	80	84	....	84	....	....	....	....	
" 65, Barley	90	92	96	....	96	....	....	....	....	
" 66, Oats	....	8	62	....	67	....	....	....	....	
" 67, "	6	84	100	....	....	....	....	....	....	
" 68, "	22	60	96	....	96	....	....	....	....	
" 69, "	2	72	100	....	....	....	....	....	....	
" 70, "	....	58	96	....	96	....	....	....	....	
" 71, "	....	42	86	....	86	....	....	....	....	
" 72, Barley	60	98	100	....	....	....	....	....	....	
" 73, Rye	84	88	88	....	....	88	....	....	....	
" 74, Wheat	14	84	62	....	....	66	....	....	....	
" 75, "	22	50	62	....	....	64	....	....	....	
" 76, "	26	66	82	....	....	84	....	....	....	
" 77, "	68	84	86	....	....	86	....	....	....	
" 78, "	40	44	44	....	....	50	....	....	....	
" 79, Barley	62	66	68	....	....	68	....	....	....	
" 80, Wheat	78	88	....	....	....	88	....	....	....	
" 81, "	40	54	56	....	....	56	....	....	....	
" 82, "	78	90	94	....	....	96	....	....	....	
" 83, "	82	92	....	....	....	92	....	....	....	
" 84, "	32	58	56	....	....	68	....	....	....	
" 85, "	20	54	62	....	....	70	....	....	....	
" 86, "	62	70	76	....	....	76	....	....	....	
" 87, "	76	84	84	....	....	90	....	....	....	
" 88, "	43	56	62	....	....	66	....	....	....	
" 89, "	52	70	....	....	....	70	....	....	....	
GRASSES.										
No. 90, Timothy	....	45	58	....	....	....	....	67	....	
" 91, Cocksfoot	....	1	1	....	....	....	....	6	....	
" 92, Rye grass	....	49	56	....	....	....	....	74	....	
" 93, "	....	8	10	....	....	....	....	24	....	
" 94, Cow grass	64	....	....	....	....	....	....	64	....	
" 95, Frefoil	12	19	20	....	....	....	....	22	....	
" 96, Fall oats	....	4	8	....	....	....	....	22	....	
" 97, Loin blue	....	1	2	....	....	....	....	6	....	
" 98, Timothy	....	18	33	....	....	....	....	56	....	
" 99, Clover	39	45	58	....	....	....	....	70	....	
" 100, Red clover	64	73	73	....	....	....	....	75	....	
" 101, Rye	....	54	65	....	....	....	....	76	....	
" 102, Alsike clover	56	67	67	....	....	....	....	67	....	
" 103, Red top	....	3	3	....	....	....	....	14	....	
" 104, Alsike clover	54	54	60	....	....	....	....	60	....	
" 105, Lucerne	27	....	....	....	....	....	....	27	....	
" 106, Tall oat	3	3	23	....	....	....	....	46	....	
" 107, Meadow foxtail	....	....	4	....	....	....	....	9	....	
" 108, Red top	....	....	....	....	....	....	....	....	....	
" 109, Fescue	....	....	5	....	....	....	....	40	....	
" 110, Italian rye	16	21	29	....	....	....	....	29	....	

SEED TESTS—*Continued.*

GRAINS.	3 Days.	4 Days.	5 Days.	6 Days.	7 Days.	8 Days.	10 Days.	12 Days.	15 Days.	
No. 111, Oats	18	20	34	....	....	....	....	76	....	Per cent.
" 112, Barley	96	....	....	....	....	....	....	96	....	
" 113, Wheat	14	18	30	....	....	....	....	46	....	
" 114, Barley	94	68	84	....	....	....	....	94	....	
" 115, Oats	94	....	....	....	....	....	....	94	....	
" 116, Barley	80	82	84	....	....	....	....	84	....	
" 117, Oats	10	22	58	....	....	....	....	98	....	
" 118, Wheat	68	76	82	....	....	....	....	82	....	
" 119, "	4	18	30	46	50	....	....	50	....	
" 120, "	....	24	36	46	....	....	....	46	....	
" 121, Oats	....	....	2	64	88	....	....	96	....	
" 122, "	....	....	20	60	60	....	....	62	....	
" 123, Wheat	....	28	100	....	....	....	....	100	....	
" 124, "	26	74	90	94	96	....	....	96	....	
" 125, "	2	10	22	36	40	....	42	44	....	
" 126, "	4	16	54	76	86	....	100	....	....	
" 127, "	6	20	32	40	42	....	42	52	....	
" 128, "	....	18	26	34	....	....	34	36	....	
" 129, "	....	28	40	44	44	....	50	....	....	
" 130, "	18	44	52	52	60	....	64	....	....	
" 131, Oats	4	12	50	54	56	....	56	....	....	
" 132, Barley	28	52	54	54	58	....	58	....	....	
" 133, "	2	26	68	74	76	....	....	....	....	
" 134, "	....	30	82	90	98	....	....	....	....	
" 135, "	4	34	56	60	70	....	....	....	....	

The following (especially No. 3) are some of the methods we adopted in making these tests. There is nothing to prevent any farmer from testing seeds with sufficient accuracy for practical purposes. It is not necessary that the temperature should always be the same. We do not find it so in nature. Consequently it is possible to get conditions quite suitable to ascertain whether the vitality of seeds has been impaired or not, without resorting to the construction of a complicated apparatus.

Methods.

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

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

3. The following method is much more complicated than the preceding, and can only be adopted where the subject is made a study. This is the apparatus used at the College. It consists of a hemispherical copper boiler one foot in diameter, fastened to the bottom of a galvanized iron pan, two feet wide, four feet long and five inches deep. The water passes from the copper boiler into the pan, through four small holes, and is made to circulate over part of it by guides three-fourths of an inch high. Another bottom, resting on the top of these, is firmly soldered around the edges; at one corner a tube passes through the bottom, for the purpose of filling the boiler and under pan with water. After coming from the copper vessel the heated water runs back and forth several times in the lower pan, and is finally conducted by a return tube back to the copper boiler, entering near the bottom. Some sand (about two inches deep) is put in the upper part of the pan, and

on this rest the boxes, etc., containing the seeds to be tested. This tin box and boiler is set in something like an office desk, about four feet high, standing on four legs, and having a hinged glazed top. Heat is produced by a small coal oil stove placed below. This germinator is well adapted for testing many samples at the same time.

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

Concerning this department, much attention has been given to make the study of science popular and practical. Excursions have been made from time to time with the students, for the purpose of studying botany and geology in the field. Elora, Rockwood and other places were visited. The result of these trips is a greater interest in agricultural science; travelling thus from place to place, they observe the condition of farms, etc., in the different localities and cannot fail to have their practical knowledge greatly increased.

Reference has already been made to the plants set out in a part of the garden to illustrate lectures on botany. The purchase of a superior magic lantern, by which excellent views of objects discussed in the lectures can be exhibited, also does much to impress scientific facts upon the minds of our students. Already its usefulness has been shown in the vivid way it illustrates sections of plants, microscopic organisms and other objects connected with the study of agricultural science. No half hour is more popular among the students than that in which these magnified views are projected upon canvas before the class.

To make the lectures on horticulture as practical as possible, the chief points discussed theoretically in the lecture room were written out, numbered and given to Mr. Forsyth, superintendent of the garden, so as to enable him to see what he might be expected to show the students practically. Experience had taught us that owing to the method of sending our students to the various departments, instances occurred where some had not seen a practical demonstration of these things. To overcome this liability to overlook some and repeat work to others, the form below was prepared. The practical instructor repeatedly consulted this, and was thus at a glance able to see whom he had instructed and what had been taught.

Blank form illustrating the method of keeping a record of practical instruction:

Names of Students.	1.	2.	3.	4.	5.	6.	7.	8.	Etc., to 20.
.....		X		X	X		X		
.....									
.....	X			X	X		X		
... .			X			X			
....	X							X	

Nos. 1, 2, 3, etc., to 20, represent points to be illustrated in practical horticulture; these are written out in full in the instructious referred to, so that a number indicates at once the subject *e. g.* 5 is grafting, 8 pruning grape vines. As each student is taught, the space opposite his name and under the number is marked X, and thus the instructor sees at once the work accomplished from week to week.

METEOROLOGY.

Report of Observations taken at the Ontario Agricultural College during 1888.

Observations are regularly taken at the hours of 7 a.m., 2 p.m., and 9 p.m. daily, and recorded in a book printed for the purpose. The instruments in use are as follows:—

Anemometer—Recording the direction of the wind and indicating the number of miles travelled.

Barometer—Showing the atmospheric pressure at the time of observation.

Maximum thermometer—Indicating the highest temperature between times of observation.

Minimum thermometer—Indicating the lowest temperature between times of observation.

Hygrometer—With *dry* and *wet* bulb thermometers, for the purpose of showing the condition of the atmosphere with reference to moisture.

Pluviameter—Used in measuring the rainfall.

Thermometer—For observing ordinary temperature.

Besides taking observations from these instruments, the cloudiness of the sky is observed, and general remarks on the weather for the day are recorded in the daily register. At the close of each month a summary of the month's observations is given to the Guelph papers for publication. From these monthly summaries the condensed statement of the year's meteorology is made out.

Form of Monthly Summary.

Meteorology.

A summary of the meteorological observations taken at Ontario Agricultural College during the month of .....

Normal height of barometer at Guelph (1.100 feet above sea level and 858 feet above Lake Ontario, 28.86 inches, Latitude north 43°-38',

Barometer—
- Highest barometer.
- Lowest "
- Highest mean barometer.
- Lowest " "
- Monthly " "
- Monthly range.

Thermometer—
- Highest thermometer.
- Lowest "
- Highest mean thermometer.
- Lowest " "
- Monthly " "
- Monthly range.

Pluviameter—
- Days rain fell.
- Greatest rainfall
- Days snow fell.
- Greatest snowfall.
- Total precipitation.

Anemometer—
- Direction of wind.
- Greatest number of miles travelled in twenty-four hours.
- Greatest velocity per hour.
- Mean velocity per month.

Clouds—
- Cloudy days.
- Clear days.
- Mean cloudiness for the month

Mean Meteorological Results for the Year 1888.

——	1888 — Guelph.	Average of 40 years. — Toronto.
Barometer.		
Month of highest mean pressure	January.	September.
Highest mean monthly	29.524	29.664
Lowest " "	28.198	29.572
Month of the lowest mean	October.	June.
Highest pressure	29.748	30.358
Lowest "	28.032	28.692
Thermometer.		
Mean temperature of the year	41.04°	44.17°
Warmest month	July.	July.
Mean temperature of the warmest month	67.6	67.64°
Coldest month	January.	February.
Mean temperature of the coldest month	11.4°	22.73°
Highest temperature	June, 95°	91°
Lowest temperature	February, -18.5°	11.9°
Range of the year	113.5°	102°
Pluviameter.		
Total depth of *rain* in inches	17.79	28.30
Number of days on which *rain* fell	91	110
Month in which the greatest depth of *rain* fell	June.	September.
Greatest depth of *rain* in one month	2.78 in.	3.55
Month with most *rainy* days	October.	October.
Greatest number of *rainy* days in one month	14	13
Total depth of *snow* in inches	26.44	.....
Number of days on which *snow* fell	41	.....
Month in which the greatest depth of *snow* fell	January.	.....
Greatest depth of *snow* in one month	10.8 in.	.....
Month with most *snowy* days	January.	.....
Greatest number of *snowy* days in one month	12	.....
Total precipitation in inches	20.78	.....

Diagram Illustrating the Mean Meteorological Results for 1888.

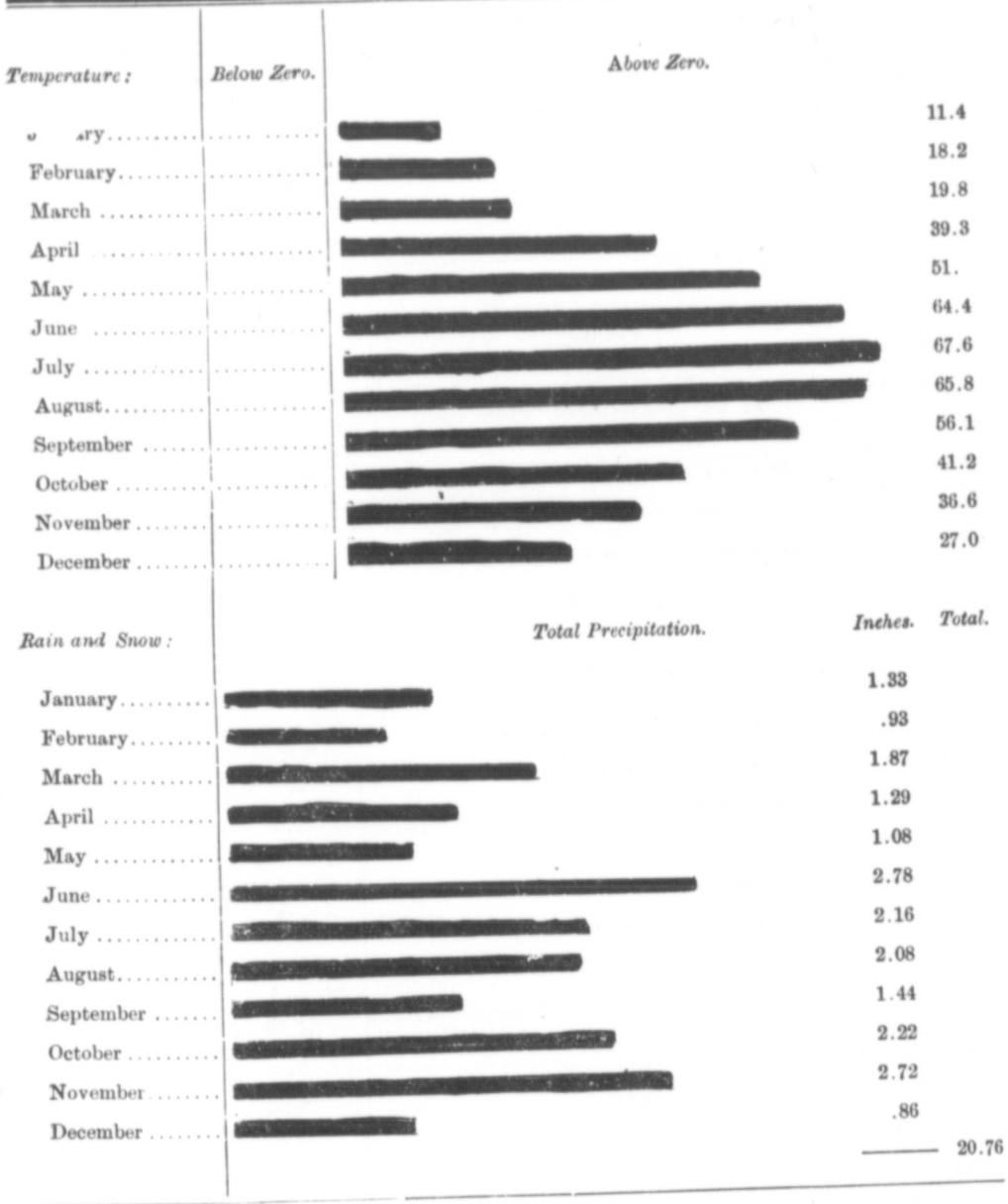
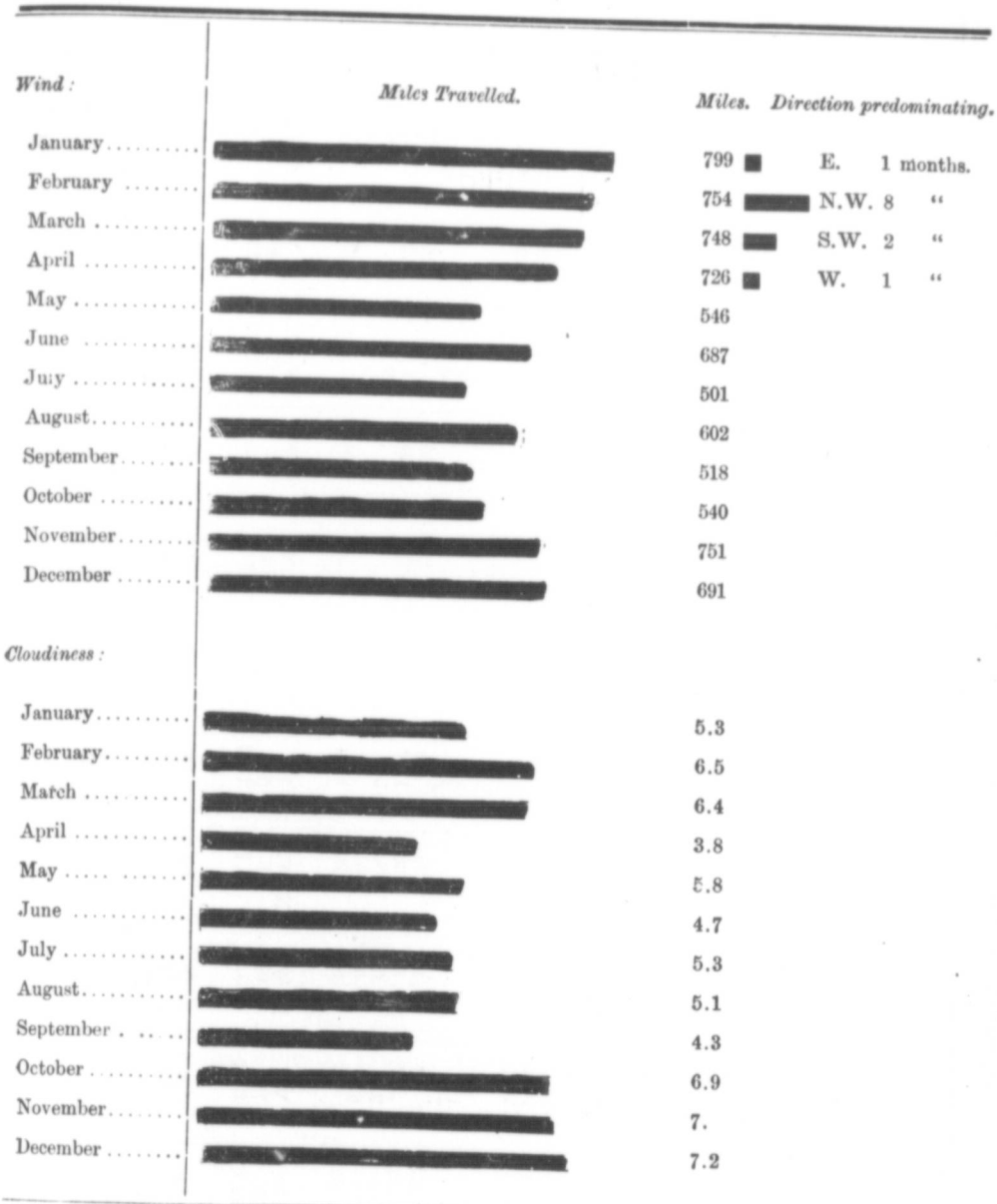


Diagram Illustrating the Mean Meteorological Results—*Continued.*



Summary of Meteorological Results for 1888.

——	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	29.544	29.464	29.246	29.334	29.194	29.748	29.088	29.144	29.318	29.146	29.402	29.245
Lowest barometer	28.369	29.124	28.126	28.403	28.392	28.494	28.542	28.032	28.350	28.170	28.076	28.298
Highest barometer	29.524	29.424	29.226	29.295	29.160	29.124	29.063	29.137	29.219	29.036	29.349	29.197
Lowest barometer	28.561	28.420	28.275	28.499	28.475	28.624	28.601	28.614	28.420	28.198	28.347	28.407
Mean barometer	29.039	28.919	28.131	28.923	28.790	28.894	28.891	28.889	28.871	28.813	28.921	28.893
Monthly range	1.175	1.340	1.120	0.931	.802	1.254	—.546	1.112	.968	.976	1.326	.950
Monthly mean barometer	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.	degrees.
Thermometer—	41.2	53.6	83.3	79	95.0	91.	87.9	39.0	29.6	23.6	12.4	41.8
Highest temperature	-14.1	-7.9	17.0	28	-4.6	42.2	74.6	76.3	67.4	54.3	58.9	11.4
Lowest temperature	29.0	40.6	63.1	65.5	78.5	74.6	52.3	56.3	36.6	33.3	18.2	27.0
Highest mean temperature	-4.0	-12.6	0.33	26.7	36.2	49.9	64.4	65.8	56.1	41.2	36.6	47.4
Lowest mean temperature	11.4	18.2	19.8	39.3	51.08	64.4	67.6	48.9	51.4	40.6	59.2	
Monthly mean temperature	55.3	59.1	61.5	66.3	51.	50.4	48.8					
Monthly range												
Pluviameter—	1	1	6	5	8	9	11	10	9	14	13	5
Number days rain fell	12	7	6	2	2	0	0	0	0	0	7	5
Number days snow fell							1.28	.50	.83	.61	1.23	.390
Greatest rainfall, inches	.25	.27	.46	.75	.38	1	2.16	2.04	1.44	2.22	2.57	.491
Rainfall for month, inches	.25	.27	1.37	1.20	1.00	2.78	0	0	0	0	1.00	.3
Greatest snowfall, inches	2.0	2.5	2.00	.90	0	0	0	0	0	0	1.56	1.17
Snowfall for month, inches	10.8	6.6	5.00	.91	.4	0	2.16	2.04	1.44	2.22	2.72	.608
Total precipitation	1.33	.93	1.87	1.29	1.04	2.78						
Anemometer—	N. W.	W.	N. W.	N. W.	E.	N. W.	N. W.	N. W.	N. W.	N. W.	S. W.	S. W.
Predominating wind	799	754	748	726	546	687	501	602	518	540	751	691
Greatest No. of miles in 24 hours	13.3	15.2	15.8	14.7	12.2	12.01	10.4	12.1	11.1	13.3	14.15	16.4
Mean velocity for the month												
Clouds—	14	16	12	11	14	8	9	14	10	18	19	21
Cloudy days	13	12	11	18	13	20	17	13	17	9	9	4
Clear days	5.3	6.5	6.4	3.8	5.8	4.7	5.34	5.13	4.3	6.9	7.0	7.2
Mean cloudiness for month												

Your obedient servant,

J. HOYES PANTON,
Professor Natural History and Geology.

PART III.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

ONTARIO AGRICULTURAL COLLEGE,
GUELPH, December, 1888.

To the President of the Agricultural College:

DEAR SIR,—At the time of submitting my report of 1887, our new chemical laboratory had been finished but a short time; since then, the internal arrangements have been rendered more complete, and many improvements made for the purposes of experiment and analysis. I have had the opportunity of visiting other chemical laboratories during the past year, and my conclusion is that, so far as our building, arrangement of rooms, working tables, heating, ventilation, and general furnishings are concerned, we could make few, if any, improvements, considering our present requirements and the money expended. We certainly are not equipped with apparatus such as that possessed by the laboratories of rich universities, but we hope to add to our supply from year to year until we shall in all respects be fully equal to any chemical laboratory in America, and possess facilities which the agricultural wealth of this Province certainly warrants and the agricultural interests demand.

LECTURES.

A proper appreciation of the great importance of chemistry to scientific agriculture, and to the other sciences involved in agriculture, leads to the belief that we are not giving undue prominence to this subject. Our aim is to teach and study the subject practically as far as possible. The full importance of the subject is appreciated only by taking in the full course which at present is as follows:

First Year.—A theoretical and practical study of all the chemical elements and compounds found in soils, fertilizers, plants and animals, taken under the two heads, Inorganic and Organic Chemistry.

Second Year.—Agricultural Chemistry, involving the application of the first year's work to the operations and products of the farm; a short course in qualitative analysis is also taken.

Third Year.—When our students complete the third year's work, and are ready for their degree of Bachelor of Science in Agriculture, they are supposed to have a thorough acquaintance with theoretical chemistry, to be familiar with the latest and most advanced work in Agricultural Chemistry, and to be able to analyze water, milk, soils, fertilizers and foods (in part, if not in whole).

The carrying out of the above course of instruction leaves me but little time for analytical work beyond the oversight of what is done. Much of the analysis is done by Mr. Zavitz, the assistant in the experimental department. Mr. Zavitz has proven himself a careful and painstaking experimenter and analyst. As our work developes I am becoming more and more convinced of the advantage and necessity of appointing a permanent assistant chemist who could devote his whole time to the analyses of soils, fertilizers and foods. In this respect we cannot now of course keep up with the

J. HOYES PANTON,
Professor Natural History and Geology.

Your obedient servant,

analytical work being done in other American laboratories, where two, three and four chemists are permanently employed. I have carefully considered the whole question, and I think the Government would be wise and prudent in incurring the extra cost. We could thus have one man for laboratory work alone, and one man for experimental work who could be a valuable assistant to Prof. Shaw.

Prompted by many enquiries from farmers and others, I issued in May a condensation of the following bulletin on

Phosphoric Acid and Phosphates.

Plants require phosphorus for the development of their seeds, and animals also require it for the structure of their bones. When we speak of phosphoric acid in connection with soils, plants and animals, we refer to a compound of phosphorus and oxygen (P_2O_5): it is the white fume that comes from the burning tip of an ordinary match. It is not found, however, in this condition in soils, plants and animals, but it exists, combined with such substances as lime, iron, and alumina, forming salts which are termed *phosphates*. To say, therefore, that a soil, a fertilizer, a grain of wheat or a bone contains so much of phosphoric acid means that the acid is present in the combined state of a salt. The most common form is the compound with lime, known as phosphate of lime, or calcic phosphate.

The ash of milk contains phosphoric acid: 100 lbs. of milk generally contain about one-fifth (0.20 per cent.) of a lb. of phosphoric acid, while fresh bones contain about 25 per cent. of phosphoric acid. The requirements of plants (showing amount of phosphoric acid removed per acre by the several crops—Warington) can be seen as follows:

Crops.	Grain.	Straw.	Total.
Wheat, 30 bush.	14.3 lbs.	8.4 lbs.	22.7 lbs.
Barley, 40 "	16.2 "	4.4 "	20.6 "
Oats, 45 "	11.8 "	7.1 "	18.9 "
Meadow Hay, 1½ tons			12.7 "
Red Clover, 2 "			25.1 "
	Roots.	Tops.	
Turnips, 17 "	22.4 lbs.	10.7 lbs.	33.1 "
Swedes, 14 "	16.9 "	4.8 "	21.7 "
Mangels, 22 "	34.0 "	15.1 "	49.1 "
Potatoes, 6 "	24.1 "	2.7 "	26.8 "

Soils, therefore, require phosphoric acid for the development of plant life and are often deficient in this regard. Hence the application of phosphates in one of the several forms will often convert an unproductive soil into one of great productiveness.

Three samples of soil lately analyzed here gave 0.31 per cent. of phosphoric acid, while one that was said to be unproductive gave little trace of it. Let us take a soil of average quality as possessing 0.20 per cent. of phosphoric acid. Twelve inches of surface soil will weigh from one thousand to two thousand five hundred tons per acre, and will contain from four thousand to ten thousand pounds of phosphoric acid to the acre. There is in the average soil, therefore, a supply of phosphoric acid (as of other mineral materials) sufficient for many years crop production. That crops cannot thus live upon the constituents of the soil without the regular return to the soil of fertilizers can be explained in two ways: 1st, the plant, through its roots, is brought into close proximity to only a small portion of the soil; 2nd, The food is, for the most part, in an insoluble or unavailable form. Hence we need a much larger supply of plant food in the soil than is required for the immediate necessities of the plant, and some of this food must be in soluble form.

The difference in value, owing to the state of solubility, will be seen at once from the following trade values used by the analysts of the eastern states during the present year :

Phosphoric Acid—	Soluble in water	8 cts. per lb.
"	Reverted form	$7\frac{1}{2}$ "
"	Fish, fine bone	7 "
"	Fine medium bone	6 "
"	Medium bone	5 "
"	Coarser bone	4 "
"	Fine ground rock phosphate	2 "

A value is thus arrived at by considering the solubility, the size of particles, and the source.

Let us next distinguish between soluble, reverted or partially soluble, and soluble phosphates. We shall take the different phosphates of lime. The relationship of the various forms can be most easily seen from the following arrangement:

Pure Acid.	*Soluble Phosphate.*	*Reverted Phosphate.*	*Insoluble Phosphate.*
Water Water Water } Ph. Acid.	Water Water Lime } Ph. Acid.	Water Lime Lime } Ph. Acid.	Lime Lime Lime } Ph. Acid.

Or, in chemical notation :

H_2O H_2O H_2O } P_2O_5	H_2O H_2O CaO } P_2O_5	H_2O CaO CaO } P_2O_5	CaO CaO CaO } P_2O_5

The change from the pure acid to the insoluble form is a removal of water and an introduction of lime. In our rock phosphate, and in bones, the form is that of the insoluble phosphate. The treatment by sulphuric acid changes this, more or less, into soluble phosphate, the lime that is removed being changed into sulphate of lime or gypsum. Superphosphate thus made, therefore, consists of soluble phosphate, gypsum, and variable quantities of the other two phosphates.

In harmony with the above, we can represent the formation of superphosphate in simple form as follows :

$$2\left\{\begin{matrix}\text{Water.}\\ \text{Sulphuric}\\ \text{Acid.}\end{matrix}\right\} + \left.\begin{matrix}\text{Lime}\\ \text{Lime}\\ \text{Lime}\end{matrix}\right\}\text{Ph. Acid} = \left.\begin{matrix}\text{Water}\\ \text{Water}\\ \text{Lime}\end{matrix}\right\}\text{Ph. Acid} + 2\left\{\begin{matrix}\text{Lime.}\\ \text{Sulphuric}\\ \text{Acid.}\end{matrix}\right\}$$

Or, in chemical notation :

$$2\left\{\begin{matrix}H_2O\\ SO_3\end{matrix}\right\} + \left.\begin{matrix}CaO\\ CaO\\ CaO\end{matrix}\right\}P_2O_5 = \left.\begin{matrix}H_2O\\ H_2O\\ CaO\end{matrix}\right\}P_2O + 2\left\{\begin{matrix}CaO\\ SO_3\end{matrix}\right\}$$

Sulphuric acid and insoluble phosphate of lime react on each other, forming soluble phosphate of lime and sulphate of lime or gypsum.

Bone superphosphate, or dissolved bone, is considered more valuable than mineral or rock superphosphate. The mixing of lime with superphosphate tends to change the soluble phosphate back to the less soluble form, the *reverted*. Decaying organic matter, whether in a compost heap or in a soil, will have the effect, to a small extent, of changing the insoluble forms to soluble.

Phosphates are of most service with organic fertilizers on black humus soils, along with farm-yard manure or nitrogenous fertilizers, and are of less benefit in connection with lime.

Phosphatic fertilizers give good results when applied to pastures, cereals, and roots, especially turnips.

Sources of Phosphoric Acid.

I. Farm-yard manure contains from 0.15 to 0.75 per cent. of this acid, having an average of about 0.50 per cent., or 10 lbs. to the ton. Poultry droppings have about four times as much.

II. Ashes (fresh and leached) have from $\frac{3}{4}$ to $1\frac{1}{4}$ lbs. per bushel.

III. Fresh bones (sold as crushed bone, bone meal, or float bone, according to texture) should contain about 4% of nitrogen and 25% of phosphoric acid.

A good fertilizer may be obtained by mixing 500 lbs. of bone with 25 bushels of fresh ashes per acre.

1V. Bone ash, the ashes obtained by burning out all of the organic matter. Little used in Ontario.

V. Boiled or steamed bone, the refuse bone from which most of the organic matter has been boiled or steamed for glue, this is more easily ground and made into superphosphate than III.

VI. Bone char, animal charcoal, bone black, or bone charcoal, the refuse charred bone after being used for the refining of sugar. A sample analyzed here gave 30% of phosphoric acid.

VII. Bone superphosphate, or dissolved bone, made by treating bones (especially V. or VI.) with sulphuric acid—15 to 25 per cent. phosphoric acid.

VIII. Guano contains from 10 per cent. to 30 per cent. phosphoric acid. Buy this only from reliable dealers on guaranteed analysis.

IX. Dried blood and scrap have 3 to 10 per cent.

X. Apatite—Canadian, containing about 80 per cent. of phosphate of lime, should have over 35 per cent.

XI. A good superphosphate should have about 25 per cent.

XII. Marls: The presence of phosphoric acid greatly adds to their value; those we have examined have never given much more than traces.

XIII. Basic Slag, Thomas Slag, Thomas Scoria, Phosphate Meal: These are all names for the finely ground slag from smelting iron containing phosphorus. The phosphorus is removed by lime and the slag therefore contains phosphate of lime. It is being experimented with in Europe, promises well, sells in Eastern States at $15 per ton, and is claimed to be the cheapest available form of phosphate. It contains an excess of caustic lime.

In the month of August the following bulletin was issued, based on some analysis which I made. The bulletin needs no elaboration :—

Linseed and Oil Cake.

In Ontario oil meal and oil cake generally refer to the ground and unground bye-products remaining from the flax seed or linseed out of which the linseed oil has been extracted by pressure. In other countries, and to some extent in this, linseed cake is used to designate the bye-product from linseed, while oil cake is used to include all the bye-products obtained from such oil-bearing seeds and nuts as cotton seed, rape seed, sesame seed, earth nut, palm nut, etc. In this bulletin oil cake and linseed cakes are identical.

With a view to bringing some facts in reference to oil cake before the Ontario farmers, I have analyzed whole linseed, ground linseed, and linseed cake or oil cake. The whole linseed was a mixture of two samples grown in the counties of Peel and Lambton; the ground linseed and oil cake were taken from the supply on hand used this season for feeding stock at the stables of the Ontario Experimental Farm.

The chemical analyses are as follows:—

	Water.	Crude protein.	Fat.	Sugar & Starch.	Crude fibre.	Ash.
Whole Linseed	8.30	20.47	32.10	30.80	4.87	3.46
Ground Linseed	7.89	20.31	30.50	30.21	5.01	6.08
Oil Cake	8.61	30.00	11.14	36.77	7.01	6.47

From the foregoing table the following conclusions are drawn:

The samples analyzed were all exceedingly dry, drier than usual; this resulted principally from their having been stored for some time in a dry place.

The only striking difference between the whole seed and the ground seed is in amount of ash, or mineral matter. Some increase in the latter case is possibly due to natural causes (difference in nature of plant, soil, etc.); but most probably it is due to dirt. Ground fodders are always more likely to be dirty and adulterated than unground.

The difference between the oil cake and the linseed is that the former contains less oil or fat and more of all the other constituents, the cake has more muscle-forming food (protein or albuminoids), more starch, more woody fibre. By pressure the oil is extracted from the linseed, all the other constituents remain; therefore, in the cake we shall expect a smaller percentage of oil and a larger percentage of everything else.

As seen from the above table, linseed and oil cake are exceeeingly rich foods, in fact, are among the richest in every constituent of all the fodders at the command of the Ontario farmer. They are also among the most expensive. Hence, every feeder should understand their true value and be able to employ them intelligently and successfully.

From their chemical composition we can make a pretty correct valuation of these foods. If we allow three cents a pound for protein, two cents a pound for fat, and one cent a pound for sugar and starch (the digestible carbohydrates), we obtain the following values:—linseed, $31.28 per ton; ground linseed (as above), $30.42 per ton; oil cake, $29.85 per ton.

A point often overlooked in the feeding of such foods as oil cake and bran is their fertilizing or manurial value. The cake contains on the average 5 per cent. of nitrogen, 2 per cent. of phosphoric acid, and 1½ per cent. of potash. Then if we calculate the value of a ton of oil cake, using the current prices of commercial fertilizers, we have the following:—

100 lb.	of nitrogen @ 16½c	$16 50
40 "	phosphoric acid @ 7c	2 80
30 "	potash @ 4¼c	1 28
	Total value of one ton of cake	$20 58

This means that applied directly to the soil as a fertilizer the oil cake is worth $20.58. But the most economical way is to apply it through the animal, for in that case the fat and starch are used by the animal; a return is obtained in the animal increase from the fat, starch and part of the protein; the rest of the protein (nitrogenous materials), and about all of the phosphoric acid, potash, lime, etc., are obtained in the excrement. The economy of feeding oil cake may in great measure depend upon the preservation and utilization of the excrement. It has been proven in England that the excrement from oil cake feeding decomposes more slowly in the soil than that from many other sources.

There are two classes of oil cake now on the market, the *old process*, such as the one analyzed, containing from ten to twelve per cent. of fat, and the *new process* containing from two to four per cent. of fat. Improved methods of extracting the linseed oil, involving greater pressure and higher temperature, enable the manufacturers to press out more oil and leave a bye-product poorer in oil but richer in protein. In purchasing oil cake it is well, therefore, to clearly understand the difference between the two classes of cake, and the great variation there is in different cakes.

To show the variations of different cakes and also the composition of other cakes than linseed, I append the following table :—

——	Water.	Protein.	Fat.	Starch.	Fibre.	Ash.
Oil meal, Ontario Agricultural Coll. '86	12.87	24.02	8.71	35.20	13.25	5.95
Linseed cake, Mass.	dry	37.25	5.69	40.85	8.69	7.52
Linseed meal, N.Y., old process	8.07	31.71	8.20	34.38	12.31	5.33
do do new do	8.55	32.35	2.13	38.13	13.77	5.07
do Conn., n. p.	12.70	33.25	3.64	37.19	8.08	5.14
do N. J., n. p.	10.59	34.19	4.00	36.74	8.33	6.15
Linseed cake, England	12.00	28.10	12.00	30.30	11.00	6.60
do Russia	10.37	34.28	13.47	26.63	9.14	6.11
do Poland	15.16	24.56	15.47	27.11	9.37	8.33
do U.S. (Stewart), o. p.	9.10	32.40	11.60	31.50	7.30	8.20
do do n. p.	9.70	33.20	2.30	38.70	8.80	7.30
Oil cake, U.S. (Stover), o. p.	9.30	34.50	5.70	35.40	8.70	6.40
do do n. p.	10.00	33.00	3.60	38.40	9.00	6.00
Oil meal, U.S. (Armsby), o. p.	9.20	31.50	7.80	36.30	9.30	5.90
do do n. p.	10.70	32.90	3.10	38.30	9.50	5.60
Linseed cake, U.S. (Jenkins), o. p.	9.04	29.70	11.25	35.03	8.54	6.44
do meal, do n. p.	11.30	35.50	4.50	34.18	8.80	5.80
Cotton seed meal, U.S. (Stover)	8.00	44.00	13.70	21.50	5.70	7.10
Palm nut meal do (Jenkins)	8.04	43.97	13.72	21.44	5.68	7.15
Rape cake do (Armsby)	11.50	31.60	9.60	29.30	11.00	7.00
do extracted do	8.50	33.10	3.00	34.10	13.40	7.90
Palm nut cake, U.S. (Stewart)	7.90	13.50	14.80	41.00	18.80	4.00

Linseed and oil cake are too rich to be used alone as food, they are supplementary foods ; *i. e.*, they can be added to poor fodder to obtain a sufficient, wholesome ration ; or they can be added to a maintenance ration to obtain a richer ration. By the intelligent use of these and of similar concentrated foods, food which otherwise would be unavailable on account of its deficiency of fat and protein may be utilized, and at the same time the farmer can obtain a supply of rich fertilizer for his fields. For instance, straw is comparatively rich in starch and fibre, but is insufficient alone to form a ration on account of its lack of fat and protein ; oil cake also is insufficient alone to form a ration on account of its richness in fat and protein—the mixture of the two renders both available. In the use of such strong foods as oil cake, no fixed rule or standard or ration can be blindly followed. Intelligence and common sense combined with a proper understanding of the nature of the foods are a feeder's best and safest guide. Begin with a small quantity, say ½ lb. or 1 lb., gradually increase the allowance, observing the effect and limiting the amount by the effect produced ; thus suit the ration to the animal and to its ability to properly digest the food, do not try to force the animal or its digestive powers to any fixed ration.

The harmony of science and practice in the mixing of skim milk and flax seed may be clearly seen from the following table, the deficiency of fat in the skim milk being supplied by the excess in the flax seed and the proportions of the whole milk being restored thereby :—

——	Water.	Protein.	Fat.	Sugar and Starch.	Fibre.	Ash.
Whole milk	87.30	3.40	3.80	4.80	.....	0.70
Skim milk	90.70	3.10	0.70	4.80	.....	0.70
Flax seed	8.30	20.47	32.10	30.80	4.87	3.46

Conclusions.

1. Linseed cake should be reddish in color, not too dark, somewhat resembling whole flax seed.

2. It should present a granular structure on the surface, a clean uniform appearance when broken, showing the smooth, oily coats of the original seeds. This granular appearance is to a great extent a test of its oiliness, the more compressed or broken the seeds the less oil it contains.

3. The cake should be decidedly oily to the taste.

4. Upon examination with the eye or magnifying glass few, if any, foreign seeds should be seen.

5. It should be clean, free from dust and grit.

6. It should not be damp, other than with oil. If damp, examine carefully for mould; if mouldy, do not use. Keep it in a dry place.

7. The ground cake or meal is more likely to be dirty and adulterated than the unground cake.

Composition of Foods.

I have been requested at many meetings of Farmers' Institutes to publish a table giving the composition of foods and feeding stuffs. From various reliable sources I have selected the following, which, I trust, will prove interesting and instructive to many of our farmers. The table is not exhaustive—it contains the foods available to the Ontario farmer; the table is one of averages—it may differ slightly from some other published analyses, but is sufficient for the feeder's purpose.

——	Water.	Protein.	Fat.	Starch & Sugar.	Fibre.	Ash.
Milk, whole	88.0	3.3	3.5	4.5	.....	0.7
Milk, skimmed	90.0	3.6	0.7	5.0	.....	0.7
Whey	92.8	1.0	0.6	5.0	.....	0.6
Buttermilk	90.1	3.0	1.0	5.4	.....	0.5
Pasture Grass	75.0	3.0	0.8	13.1	6.0	2.1
Meadow Hay—poor	14.3	7.5	1.5	38.2	33.5	5.0
" extra	16.0	13.5	3.0	40.4	19.3	7.7
" average	14.3	9.7	2.5	41.4	26.3	6.2
Red Clover, average	16.0	12.3	2.2	38.2	26.0	5.3
Wheat Straw	14.3	3.1	1.2	37.5	40.0	3.9
Oat Straw	14.3	4.0	2.0	35.6	39.7	4.4
Pea Straw	14.3	7.3	2.0	32.3	39.2	4.9
Corn Stalks	14.0	3.0	1.1	37.9	40.0	4.0
Wheat	14.3	13.2	1.6	66.2	3.0	1.7
Barley	13.8	11.2	2.1	65.5	5.2	2.2
Corn	14.7	10.6	6.5	65.7	2.8	1.7
Oats	13.7	12.0	6.0	56.6	9.0	2.7
Peas	13.2	22.4	3.0	52.6	6.4	2.4
Mangels	88.0	1.1	0.1	9.1	0.9	0.8
Turnips	91.5	1.0	0.2	5.8	0.7	0.8
Carrots	85.9	1.3	0.3	9.6	1.9	1.0
Potatoes	75.0	2.1	0.2	20.7	1.1	0.9
Fodder Corn (green)	82.5	1.0	0.4	10.1	5.3	0.7
Linseed	11.8	21.7	35.6	19.6	7.9	3.4
Oil Cake (old process)	8.6	30.0	11.1	36.8	7.0	6.5
Oil Cake (new process)	9.7	33.2	2.3	38.7	8.8	7.3
Oatmeal	12.0	17.7	6.0	63.9	.....	.....
Cornmeal	18.4	8.0	3.0	68.0	1.4	1.2
Wheat Bran	13.0	14.5	3.5	53.6	9.4	6.0
" Middlings	12.9	14.6	3.0	63.8	3.1	2.6
" Shorts	12.7	13.8	4.1	57.6	7.5	4.3
Malt Sprouts	10.3	23.0	1.8	48.6	10.7	5.7
Brewers' Grains	75.0	5.6	1.7	12.9	3.9	1.0
Distillers' Grains	90.7	1.9	0.4	5.3	1.2	0.5

Notes on the Above Table.

Water.—From the analysis we see that milk and its bye-products, roots and grass, have the most water, 75 per cent. to 90 per cent. Grains, hay, straws and the concentrated foods have only from 10 per cent. to 16 per cent. Excess of water alone in food is not enough to condemn its use—the natural foods, *i.e.*, the foods first provided by nature, milk and grass, being among the most watery. The combination of the two classes, watery and dry, will best utilize both.

Protein.—This food-constituent is also known as albuminoids, flesh-formers and muscle-producers. It contains nitrogen, and is the only constituent that can make flesh and muscle. It can also, when given in excess, form fat or be burned for animal heat. From its great importance in the body it is most valuable. The above represents *crude* protein; it contains, also, some other compounds of nitrogen called amides, which are not quite so valuable, as they cannot form flesh and muscle.

Fat.—The fat, or oil, or ether extract contains some other substances, as the green coloring matter of leaves. The fat can be deposited as fat or be burned for heat. One thing is to be remembered, that the animal fat does not come from the fat of the food alone, but may be formed from protein also, and probably from sugar and starch.

Starch and Sugar.—These and other similar compounds are generally classed in tables of analysis as *carbohydrates*. They generally form a large part of plants. Their first use is to afford heat by being burned in the body. There is some dispute as to whether they can be changed directly to fat—so far experiments tend to the opinion that they can; a full supply of them, however, prevents the wasting of the other more valuable parts for heat, such as fat and protein.

Crude Fibre.—This is partially digestible, the digestibility differing with different animals and different foods and mixtures.

Ash.—The importance of the ash or mineral matters is at once evident from the fact that it is the material from which are formed the solid bones. Ash is as necessary for life and growth as any other constituent. The feeding of concentrated foods rich in ash (such as bran, oil cake, grain,) will produce a rich manure.

Corn.

During the past season Prof. Robertson started an experiment in the production and feeding of corn ensilage. It was our intention to analyze the corn, ensilage, milk, etc., and publish the results from the two departments. The destruction of the silo in the burning of the barns has prevented the completion of the experiments and the analysis of the ensilage. We have, however, the analyses of the ensiled corn, and to them have added some analyses of corn that will be of some interest.

First, I shall give an analysis of green corn placed in the silo. It was Mammoth Southern Sweet Corn, drilled and broadcasted. This report should, of course, be read and studied in connection with Prof. Robertson's report on the same as to quantity produced per acre and results of feeding.

Ensilage Corn.

——	Water.	Crude Protein.	Crude Fat.	Starch & Sugar.	Crude Fibre.	Ash.
Whole plants, drilled	81.32	1.22	0.32	9.76	5.97	1.41
" broadcasted	83.62	0.83	0.42	9.93	4.57	63
Leaves, drilled corn	76.73	1.53	0.61	4.48	15.18	1.47
" broadcasted corn	78.51	1.18	2.16	5.68	11.38	1.09
Stalks, drilled corn	85.26	0.03	0.16	10.44	3.88	0.23
" broadcasted corn	88.59	0.14	0.16	7.57	3.33	0.21
Maize Fodder, (Dr. Armsby)	86.86	1.10	0.20	6.50	4.10	1.29
Corn Ensilage, (Dr. Jenkins)	80.50	1.50	0.70	10.30	5.70	1.30

Comments and Conclusions.

1. Ensilage corn is very watery, has little or no true fat (the crude fat is nearly all chlorophyll), and is valuable for its sugar and starch (carbohydrates), its protein and the digestible portion of its fibre.

2. The drilled corn had less water, chlorophyll and carbohydrates and more protein, fibre and ash than the broadcasted corn. It was more matured. The above must be carefully read in connection with Prof. Robertson's report as to the amount of each produced per acre.

3. The drilled corn (whole plants), gave us a remarkable proof of the ability of corn to assimilate silica, which is not needed for the growth of the plant. We found in No. 1 (which was a different sample from Nos. 3, 4, 5 and 6 taken from different parts of the field), 4.43 per cent. ash, of which 3.02 was silica. Part of the drilled field is very sandy or gravelly; the presence of the excess of silica was, therefore, accidental, so I have omitted it in making comparisons. It simply proves what is often mentioned elsewhere, that corn or maize has the ability of assimilating large quantities of silica not necessary for its growth.

4. The leaves are drier than the stalks, contain more protein, chlorophyll, fibre and ash. The stalks contain more sugar and starch than the leaves. The above is in accordance with the fact that the leaves are the workshop, the stalks the storehouse of the plant.

5. A comparison of No. 3 with No. 4, and of No. 5 with No. 6 bears out our comparison of Nos. 1 and 2 in the main.

Next we shall give the results of an analysis of the seed or grain of the corn. We analyzed five samples as follows:

1st. Yellow Gourd corn, Essex County, Ontario, grown in 1887.
2nd. White Gourd corn, Essex County, Ontario, grown in 1887.
3rd. White Gourd corn, Essex County, Ontario, grown in 1888.
4th. Yellow corn, common sixteen-rowed, Middlesex County, grown in 1888.
5th. Mammoth Southern Sweet corn, used for ensilage corn above.

——	Water.	Protein.	Fat.	Starch & Sugar.	Fibre.	Ash.
Yellow Gourd, Essex, 1887	10.08	10.31	5.02	71.79	1.29	1.51
White Gourd, Essex, 1887	10.27	9.18	3.79	74.35	1.07	1.34
White Gourd, Essex, 1888	14.93	8.87	3.52	70.08	1.46	1.14
Yellow, Middlesex, 1888	15.24	10.62	3.82	68.14	0.82	1.36
Mammoth Southern Sweet	12.17	10.25	4.07	70.90	1.44	1.17

Essex County, Ontario, is pre-eminently a corn-raising county. The two varieties above named, the White and the Yellow Gourd corn are extensively raised, the seed having first been brought from Ohio. I am indebted to Mr. Richard Golden, Amherstburg, for the above samples, as well as for much information in regard to the raising and disposing of Essex corn. All the corn in the county is planted in hills 3ft. 9 to 4ft. apart in every direction. The crop during the past season has, in many districts, averaged 100 bushels of ears per acre. The corn shells half grain, half cob, after which the cob shrinks more than the grain. The white ear is usually larger than the yellow.

Both kinds are extensively grown, and each has its ardent advocates. For manufacturing purposes the white is preferred for glucose, the yellow for distilling. For feeding purposes, both kinds are used. The chemical analysis gives the yellow a little more protein, fat, fibre and ash, the white more sugar and starch. All constituents considered, the yellow corn is a little richer, but the difference is so slight that if many more samples were taken from different localities, the two varieties might be so nearly alike in composition as to give no appreciable difference.

I would suggest to some of the enterprising farmers of Essex, that they undertake the experiment of feeding the two corns. Why should not the Farmers' Institute inaugurate the work, and thus accomplish something of a most practical nature?

Now let us compare the corn stuffs on the same basis, water free. If we calculate their composition when entirely freed from water, we shall have the following:

——	Protein.	Fat.	Sugar and Starch.	Fibre.	Ash.
Stalks—Ensilage corn—drilled	0.20	1.08	70.84	26.32	1.56
Stalks—Ensilage corn—broadcasted	1.16	1.40	66.40	29.20	1.84
Leaves—Ensilage corn—drilled	6.58	2.62	65.24	19.24	6.32
Leaves—Ensilage corn—broadcasted	5.50	10.05	52.93	26.45	5.07
Ensilage corn—whole plants—drilled	6.95	1.83	49.48	33.70	8.04
Ensilage corn—whole plants—broadcasted	5.03	2.56	60.64	27.92	3.85
Yellow Gourd, Essex County, 1887	11.46	5.57	70.86	1.43	1.68
White Gourd, Essex County, 1887	10.22	4.22	82.88	1.19	1.49
White Gourd, Essex County, 1888	10.44	4.14	82.37	1.72	1.33
Yellow corn, Middlesex County, 1888	12.54	4.50	80.50	0 86	1.60
Mammoth Southern Sweet corn	11.68	4.64	80.71	1.64	1.33

N. B.—The fat, or ether extract, in the case of the ensilage corn leaves and stalks, is not true fat, but contains a large quantity of chlorophyll, or green coloring matter.

The ensilage corn, that is the whole plant cut before maturity to put in the silo, contains an excess of fibre, and about half as much protein as the matured grain. It contains very little true fat, and about three-fourths as much sugar and starch. In the ensilage corn sugar is in excess, in the grain, starch.

To render more complete our discussion of corn, I shall take the liberty to add a few condensed notes from other reports.

The most comprehensive work yet published in America on the composition of corn, is found in two bulletins from the Department of Agriculture, Washington, D. C., by Mr. Clifford Richardson, who, in 1883 and 1884, gathered together the analyses of corn made at the Department of Agriculture; also those of Professors Johnson, Atwater and Kedzie. The average of 114 American samples is here given, as also the averages of other investigators, Koenig, Wolff and Jenkins:

——	Richardson.	Koenig.	Wolff.	Jenkins.
Water	10.04	13.12	14.40	10.50
Protein	10.46	9.85	10.00	10.60
Fat	5.20	4.62	6.50	5.50
Sugar and Starch	70.69	68.41	62.10	69.90
Fibre	2.09	2.49	5.50	2.10
Ash	1.52	1.51	1.50	1.50
	100.00	100.00	100.00	100.10
Number of Analyses	114	145	.....	192

It will be interesting to state results by locality. In addition to giving each separate analysis, the results are grouped as follows:

——	Water.	Protein.	Fat.	Sugar and Starch.	Fibre.	Ash.
Northern States	9.98	10.64	5.11	71.32	1.41	1.54
South	8.96	10.95	4.94	72.06	1.72	1.37
Middle West	12.33	10.89	4.97	68.16	2.22	1.43
Far West	9.50	10.43	5.30	70.75	2.47	1.55
Pacific Slope	9.78	8.14	6.40	72.13	2.07	1.48
Mexico	9.58	10.34	5.48	71.34	1.68	1.58

Taking all available analyses into consideration, this conclusion is reached, that "there is apparently the same average amount of ash, oil, and albuminoids (protein), in a corn wherever it grows, with the exception of the Pacific Slope, where, as with wheat, there seems to be no facility for obtaining or assimilating nitrogen."

Subsequent analyses confirmed the above conclusion: "Corn may be said, therefore, without doubt, to be very constant in its composition within narrow limits."

"It can only be said here that our results have shewn that it is the quantity per acre, and not the quality of corn which is affected most by conditions of environment."

Corn Stalks or Stover.

By consulting the table of foods given in this report, it will at once be seen that there is a great difference in the composition of the straws from the various grains or serials. The value of straw, stalks, or stover from matured corn is often underestimated. I quote an analysis and comparison from Dr. Armsby's report (Pennsylvania Station Report, 1887).

	Armsby.	Jenkins.
Water	15.53	22.83
Crude Protein	5.76	5.38
Fat	1.99	1.45
Sugar and Starch	44.49	40.30
Fibre	25.87	25.18
Ash	6.36	4.86

The experiments to determine the digestibility of the various parts, place all higher than expected, especially the fibre. Corn stalk fibre is quite highly digestible.

A careful comparison of the composition of the corn stover, with those of the grain, and a thoughtful enquiry into the whole subject of corn feeding, will uphold Dr. Armsby's important remarks as to the place of stover in feeding. Since it may be of practical value to some of our farmers, I shall quote his words (pp. 153, 154):—

"A glance at the analysis of corn stover, as given above, will show that while it contains a large amount of digestible carbhydrates, (sugar and starch), it is quite deficient in digestible protein (flesh and muscle formers), so that its special value lies in the fact that it furnishes an abundant and cheap supply of digestible carbhydrates. Alone, it is not adapted to be the exclusive food of domestic animals, except perhaps for the simple wintering of stock. If any material growth or production of milk or meat is desired, the stover must be supplemented by some other feeding stuff which will make good its deficiency in protein. Such feeding stuffs are, for example, cotton seed meal, malt sprouts, brewers' grains, gluten meal, oil meal, etc."

In conclusion I shall give the composition of a few other corn products:—

———	Water.	Protein.	Fat.	Starch & Sugar.	Fibre.	Ash.
Corn fodder, field cured, (Jenkins)	32.1	4.3	1.2	36.0	22.1	4.3
" bran, (Jenkins)	7.7	6.9	4.0	80.00		1.4
" cob, (Jenkins)	9.3	2.5	0 5	56.0	30.4	1.3
Cornmeal, (Armsby)	8.4	8.0	3.0	68.0	1.4	1.2
Distillers' grains from corn, (Armsby)	91.6	2.0	1.0	4.9	1.0	0.5
Corn ensilage, (Jenkins)	76.3	3.3	1.0	10.2	6.7	2.5

Soil Analysis.

Several samples of soils have been sent in for analysis. Where it was considered that available knowledge would result the work was undertaken. The present publication of these, together with the analyses, partial or complete, of some rocks, waters, etc., would be of no particular advantage here, hence they are omitted. I have also had some correspondence in regard to the extensive analysis of soils, and I think it opportune to make a brief and concise statement of the case.

The question to be answered is about as follows :—

Some one sends by mail a small package of soil, asking to have it analyzed and to have a report on its good qualities, its deficiencies, the crops suitable, the fertilizers most requisite—in fact, a short essay on the value and uses of the field of which this is a sample.

The difficulties met with may be thus summarized :—

1st. Most fields vary somewhat in texture and composition from place to place ; soils are not perfect mixtures.

2nd. It is almost impossible to obtain, say half a pound, that shall fitly represent an acre of soil which weighs say 3,000,000 lbs.

3rd. Small differences or errors in the sample give large appreciable differences per acre. Take half a pound of soil. Let us take 80 per cent. as water and insoluble matter. Then 20 per cent. or one-fifth is to be determined as organic matter, lime, potash, phosphoric acid, etc. We find it contains 0.43 per cent. of phosphoric acid. That would give us .00215 lb. of our sample, or 12,900 lbs. per acre. If we were to find 0.44 per cent., our sample would have .00220 lb. and the acre 13,200 lb. of phosphoric acid, a difference of 300 lbs. per acre and a difference of only .00005 lb. in our sample. The question here is : how nearly will that half pound represent the average of the field? For every error of .00005 lb. or $\frac{5}{10000}$ of a lb, in our sample, an error of 300 lbs. per acre will ensue. A crop of wheat yielding 30 bushels per acre removes only about 22.5 lbs. of phosphoric acid per acre. The error of 300 lbs. is enough for over thirteen good crops.

The above is an underestimate of the error, as, in reality, in making the final analysis, much less than half a pound is taken.

Or, let me put it in another way. A soil is utterly destitute of phosphoric acid and the owner applies 1,000 lbs. of superphosphate, containing 300 lbs. of soluble, available phosphoric acid. Certainly it contains enough for the wants of a crop, if assimilated immediately. But we analyze it and we should get 300 lbs. out of 3,000,000, only .01 per cent. We would, from the chemical analysis alone, be apt to condemn it.

4th. Chemical analysis does not give us full information as to the form of combination in the soil. A soil is fertile only as its food is available. A wet swamp soil is often excessively rich, but unfertile ; the land must first be drained, and limed, perhaps, before its constituents are available for plants.

Enough has been said. My conclusion is : if the chemical analysis of soils is to be of any practical value, it must be done very thoroughly and systematically, and the sample should be obtained as carefully as the analyses are conducted.

I could quote to support my opinions, but I need only say that all chemists are agreed on my conclusion. To the farmers I would say : before sending a sample of soil correspond, stating your case ; if any practical results will accrue to you we will gladly undertake the work, if not it is better to save our time, your trouble, and the annoyance of misleading results that might be obtained.

Chemical analysis of soils is not yet as complete and reliable as that of foods and fertilizers. One analysis is reliable, that of actual experiment in the field by the farmer himself.

Soil Temperatures, Rain Fall and Drainage Waters.

The taking of daily observations, and the keeping of the record is in the Experimental Department, and is attended to by Mr. Zavitz, who makes observations three times every day.

Our Lysimeters, described in previous reports, have, during the past season, given little or no drainage water. In 1887 the amount drained through and collected was smaller than in 1886, this year it was almost nothing. Only one gave any drainage during the whole summer, viz., the clay. The seasons can hardly account for the peculiar behavior of our lysimeters during the past two years. At present we can simply say we have no reliable report or conclusions to draw.

Rain Gauge.

The rain which fell during the summer, as compared with that of last year, was as follows:—

	1887.		1888.
May	1.58	inches	1.079
June	2.36	"	2.918
July	.61	"	2.205
August	2.71	"	2.162
September	1.52	"	1.548
Total	8.78	"	9.912

Mr. Zavitz has furnished me with the following condensed summary of the observations taken in soil temperature. I trust that the immense amount of work here represented will be found interesting and instructive to some students of soils. Such work as this must be patiently accumulated until, in good time, some patient, intensely interested student of nature, shall develop, conclusions and read results of great practical value to the farmers.

AVERAGE OF EACH THERMOMETER FOR EACH MONTH AND FOR WHOLE PERIOD.

INSTRUMENTS.	May.	June.	July.	August.	September.	Average for the whole period.
Barometer	28.767	28.849	28.909	28.881	28.923	28.864
Attached thermometer	53.22	67.58	70.43	64.93	57.96	62.77
Temperature of air	50.98	64.36	67.22	66.56	54.96	60.78
" wet bulb	47.65	62.52	61.62	61.30	52.51	57.05
Temperature maximum	60.31	74.72	80.53	77.23	67.81	72.10
" minimum	41.05	51.42	51.43	53.12	42.87	50.25
Soil temperature at 1 inch in depth	50.71	68.93	68.42	67.06	58.65	62.64
" 3 "	53.59	68.79	69.88	69.31	59.77	64.09
" 9 "	48.88	63.01	66.13	66.45	58.18	60.33
" 24 "	45.61	57.02	61.61	61.33	57.45	56.38
" 36 "	45.26	55.19	60.22	60.19	58.87	56.03
" 48 "	42.74	52.39	57.73	60.17	57.95	54.52
" 3 " in sand	51.78	63.99	69.86	67.89	58.25	61.93
" 3 " in clay	45.04	67.02	69.55	68.32	57.99	63.06
" 3 " in loam	52.20	65.56	67.57	68.06	57.60	62.05
" 9 " in sand	50.54	63.18	67.07	67.34	57.88	61.02
" 9 " in clay	50.18	64.95	67.24	67.00	58.60	61.42
" 9 " in loam	49.68	63.04	67.57	67.05	57.84	60.85

THE INCREASE AND THE DECREASE OF THE AVERAGE OF EACH THERMOMETER FOR EVERY MONTH.

\+ represents increase; — represents decrease.

	May to June.	June to July.	July to August.	August to September.
Air	+ 13.38	+2.86	— .66	—11.60
Thermometer 1 inch in soil	+ 18.22	— .51	—1.36	— 8.41
" 3 "	+ 15.20	+1.09	— .57	— 9.54
" 9 "	+ 14.13	+3.12	+ .32	— 8.27
" 24 "	+ 11.41	+4.59	— .28	— 3.88
" 36 "	+ 9.83	+5.03	— .03	— 1.32
" 48 "	+ 9.65	+5.34	+2.44	— 2.22

GREATEST VARIATION IN TEMPERATURE of each Thermometer between two readings.
(*a*) Increase. (*b*) Decrease.

—	Increase.				Decrease.			
	Date.	From.	To.	Variation.	Date.	From.	To.	Variation.
Temp. air	May 23	49.1	74.9	25.8	Aug. 1	91.2	62	29.2
Temp. soil 1 inch deep	Sept. 10	48.0	80.8	32.8	Aug. 27	78.6	44.1	34.5
" 3 inches deep	June 19	63.6	100.0	36.4	Sept. 24	86.5	55.9	30.6
" 9 "	Sept. 15	55.4	79.2	23.8	Sept. 15	79.2	60.8	18.4
" 24 "	June 22	61.8	65.6	3.8	June 23	65.6	61.3	4.3
" 36 "	May 8	41.0	42	1.0	May 8	42.0	41.0	1.0
	May11,1	43.0	44	1.0	Sept. 22	58.1	57.1	1.0
" 48 "	Aug. 23	60	61.6	1.6	Aug. 23	61.6	60	1.6
" 3 " in sand	Aug. 1	57.6	87	29.4	Aug. 2	79.3	52.5	26.8
" 3 " in clay	Aug. 28	51	82.2	31.2	Aug. 22	72.2	47	25.2
" 3 " in loam	June 19	62.5	90.2	27.7	July 11	81.9	57.9	24
" 9 " in sand	Sept. 7	48.9	58.4	9.5	July 28	70.1	60.4	9.7
" 9 " in clay	June 4	42.3	53.1	10.8	Aug. 8	71.9	63.0	8.9
" 9 " in loam	July 2	61.1	72	10.9	July 3	72	63.5	8.5

TABLE OF HIGHEST SINGLE READINGS OF THERMOMETERS at different depths with date of same (for air also).

Situation of Thermometer.	Date of Maximum Temperature.			Maximum Temperature.
	Month.	Day.	Hour.	
Thermometer in air	August	1st	2 p.m.	91.2
Thermometer in soil at depth of 1 inch	June	19th	2 p.m.	96.2
" " " 3 inches	June	22nd	2 p.m.	103.2
" " " 9 "	September	15th	2 p.m.	79.2
" " " 24 "	August	8th	2 p.m. / 9 p.m.	65.0
" " " 36 "	August	9th	2 p.m.	63.5
" " " 48 "	August	10th	2 p.m.	60.7
Thermometer in sand at depth of 3 inches	June	21st	2 p.m.	91.0
" clay " 3 "	June	21st	2 p.m.	89.0
" loam " 3 "	June	22nd	2 p.m.	91
" sand " 9 "	June	22nd	9 p.m.	80.2
" clay " 9 "	June	26th	2 p.m.	77.2
" loam " 9 "	June	23rd	9 p.m.	77.9
	June	26th	2 p.m.	

TABLE of Readings for each day of Recorded Rain; also of following day.*

TABLE of Readings for each day of Recorded Rain; also of following day.*

Inches of Rain.	DATE.	Barometer.	Attached Thermometer.	Air.	Hygrometer.	1 inch.	3 inches.	9 inches.	24 inches.	36 inches.	48 inches.	3 inches in Sand.	3 inches in Clay.	3 inches in Loam.	9 inches in Sand.	9 inches in Clay.	9 inches in Loam.
.374	May 4	28.650	47.9	58.0	51.0	50.3	55.6	44.4	42.0	41.7	40.0	41.3	50.8	48.3	42.7	44.2	42.5
	" 5	28.830	48.3	47.3	44.7	45.4	45.8	45.6	41.9	41.7	40.3	45.6	45.6	45.3	45.0	44.8	.....
.235	" 8	28.883	46.0	44.9	43.3	44.1	44.5	44.3	41.8	41.7	40.0	44.0	44.6	43.8	43.9	44.3	43.3
	" 9	28.694	59.5	56.2	55.3	56.2	57.7	47.9	42.1	42.0	40.9	54.3	55.0	55.0	48.9	46.9	47.7
.100	" 14	28.683	36.7	37.1	35.8	38.6	41.9	46.5	46.4	45.6	42.9	43.3	45.6	43.6	46.1	47.4	46.0
	" 15	28.717	40.7	38.6	35.0	42.9	43.0	43.4	45.6	45.1	43.0	40.1	44.6	43.6	44.7	45.9	44.9
.100	" 19	28.875	40.1	42.6	40.8	43.8	44.0	44.9	44.0	44.0	42.6	44.5	45.2	44.8	45.5	45.3	45.0
	" 20 (Sunday)	29.080	40.1	39.5	37.6	41.0	42.6	41.8	44.0	43.9	42.5	45.0	40.7	37.1	43.0	36.2	41.8
.150	" 25	28.721	65.4	61.6	38.6	64.0	66.0	57.4	48.9	43.7	44.3	62.4	61.0	61.3	59.1	57.3	57.9
	" 26	28.705	62.9	62.3	60.3	63.9	63.7	57.4	49.7	47.9	45.0	62.3	61.5	62.4	59.0	60.4	58.0
.100	" 31	28.631	52.0	48.7	46.9	51.6	52.0	55.8	52.0	50.2	47.2	53.4	55.1	53.2	56.8	57.5	56.0
.010	June 1	28.647	52.1	50.8	47.0	56.8	57.0	54.7	51.7	50.4	51.0	56.1	57.2	56.4	55.6	52.5	55.0
.318	" 2	28.725	49.1	47.1	46.0	49.7	53.1	53.6	51.4	50.2	47.7	50.5	51.5	50.6	54.2	54.7	54.1
	" 3 (Sunday)	28.886	42.9	42.0	40.1	47.2	48.3	48.9	51.0	50.2	47.8	40.1	42.3	42.6	47.8	51.1	49.0
1.4	" 10 (Sunday)	28.598	69.0	67.0	65.2	66.5	66.9	62.0	54.2	52.1	49.3	66.0	65.7	65.4	64.8	65.4	63.2
	" 11	28.779	50.0	54.6	50.6	58.8	57.1	62.9	55.0	53.0	50.0	59.5	60.4	59.0	61.5	61.3	60.8
.374	" 14	28.779	72.4	65.1	66.4	71.7	72.3	61.9	55.0	53.7	51.0	68.9	68.8	69.5	64.5	62.7	63.6
	" 15	28.746	75.0	71.6	68.6	72.3	72.9	64.5	56.8	54.7	51.7	72.9	72.2	72.3	67.2	66.5	67.1
.372	" 24 (Sunday)	28.659	70.0	67.9	66.0	70.1	72.2	70.3	62.9	59.9	55.9	71.8	71.6	70.7	73.5	62.5	72.1
	" 25	28.705	70.0	70.3	61.3	71.3	71.6	67.6	67.0	60.2	56.5	68.4	68.7	69.3	65.6	68.9	68.8
.527	" 29	28.992	55.0	54.7	53.3	57.0	57.4	58.5	59.7	59.0	56.2	57.2	57.2	56.9	57.6	59.8	59.0
.120	" 30	28.906	68.3	66.8	56.4	65.0	66.2	62.5	58.8	54.5	59.2	64.8	64.2	67.6	61.8	62.3	62.9
.060	July 1	28.982	67.0	60.	58.2	63.8	61.9	68.0	59.0	58.0	56.0	55.5	66.7	66.0	58.4	66.8	69.7
.174	" 11	28.644	69.8	68.4	66.0	68.6	82.8	67.5	62.1	60.7	57.7	67.7	66.7	68.0	68.7	68.0	68.2
	" 12	28.666	53.6	51.5	50.3	52.1	58.2	61.1	61.5	60.5	57.7	57.0	59.0	55.8	58.6	61.3	61.1
.235	" 18	28.823	70.0	67.5	66.2	67.3	69.2	66.3	61.1	59.8	57.8	67.5	67.4	67.6	67.8	66.1	67.1
	" 19	28.867	69.3	66.7	62.5	71.2	71.7	66.5	61.2	60.0	57.9	72.9	69.4	70.3	67.8	66.1	67.1
.190	" 22 (Sunday)	28.932	62.0	61.0	59.8	61.9	63.2	64.0	61.5	60.2	58.0	62.3	62.1	62.5	66.0	66.0	66.0
1.470	" 23	28.907	70.7	67.8	63.9	68.6	69.5	65.9	61.0	60.2	58.0	71.6	71.7	71.0	67.5	66.1	66.7
	" 24	28.972	67.5	61.0	63.3	64.1	63.9	64.4	61.6	60.4	58.0	63.0	63.3	64.3	65.5	65.5	65.5
.186	" 31	28.766	73.8	71.6	67.2	70.9	76.1	68.5	62.9	61.3	59.2	68.2	70.3	70.4	70.1	69.4	69.7

TABLE of Readings for each day of Recorded Rain; also of following day.—*(Concluded.)*

Inches of Rain.	Date.	Barometer.	Attached Thermometer.	Air.	Hygrometer.	1 inch.	3 inches.	9 inches.	24 inches.	36 inches.	48 inches.	3 inches in Sand.	3 inches in Clay.	3 inches in Loam.	9 inches in Sand.	9 inches in Clay.	9 inches in Loam.
	August 1	28.903	67.9	69.7	65.5	64.4	62.9	65.3	61.6	61.4	59.5	71.2	70.8	70 6	69.8	64.4	67.8
	" 7	28.825	75.7	76.6	69.5	76.8	79.0	71.4	64.6	62.9	60.1	75.2	76.1	76.1	73.0	72.0	72.5
.112	" 8	28.748	71.1	72.4	69.6	71.4	72.2	70.6	65.0	63.1	60.3	71.1	71.0	71.4	72.0	71.5	71.6
.448	" 9	28.954	62 4	59.7	55.5	63.4	64.2	65.3	64.6	63.3	60.4	62.3	63.3	61.6	66.8	66.2	66.3
	" 16	28.838	78.4	76.3	74.3	73.9	74.6	68.2	63.1	61.1	59.4	62.5	73.1	70.8	69.5	67.8	68.5
.300	" 17	28.840	70.8	68.6	66.3	70.3	70.5	68.5	62.6	61.5	59.5	70 0	70.4	69.8	69.8	68.9	69.1
.508	" 18	28.927	67.2	63.3	60.4	68.6	68.3	66.5	63.0	61.9	59.6	67.3	70.0	66.7	67.6	64.5	67.1
	" 31	28.779	60.7	58.9	57.6	61.8	62.4	63.9	62.6	61.7	59.9	62.6	62.2	62.0	65.4	62.8	65.1
.500	September 1	28.781	60.6	57.2	49.6	61.8	62.2	62.8	62.3	61.5	59.8	61.4	61.5	61.8	63.7	60.9	63.3
.150	" 2 (Sunday)	28.804	47.8	47.8	46.9	52.8	54.0	57.2	61.9	61.5	59.8	48.5	49.8	49.2	58.1	61.2	58.5
	" 8	28.835	66.4	64.2	61.2	62.6	62.7	60.6	69.4	59.7	58.2	62.2	62.4	62.4	62.1	60.6	60.7
.253	" 9 (Sunday)	28.818	61.0	61.3	56.9	62.9	65.0	57.1	59.5	59.5	58.2	55.9	56.9	56 0	57.5	59.2	57.9
	" 16 (Sunday)	28.635	59.8	58.1	58.0	58.9	59.5	59.4	58.8	58.9	57.9	59.0	59.1	59.0	59.5	60.7	60.0
.953	" 17	28.832	62.1	60.0	57.8	59.2	60.1	59.3	58.7	58.8	58.2	58.4	58.6	58.5		59 7	58.9

*Only the days when the depth of rain reached 1 inch were taken into this calculation.

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Milk Analysis.

We have done considerable work in milk analysis for experiments in other departments. The results will appear elsewhere. I shall not now refer to our work in connection with milk as it is our intention to review and summarize the work of the past few years and publish the results early in the coming year.

In conclusion allow me to say that as the head of the chemical department I am grateful to the Minister of Agriculture and to yourself for the improved condition of our surroundings and our appliances. We trust to still further improve the work done in this department until, by the co-operation of all concerned, it shall be second to none in America.

Trusting I have not been too lengthy in my report,

I remain,

Your obedient servant,

C. C. JAMES,

Professor of Chemistry.

HORTI

To the President of t

SIR,—As the Ho
reported on by Profes
remind you of what y
satisfactory for the ye
both vegetables and
statement will show:

VEGETABLES AND

Parsnips, 3¾ bu
Onions, 1¾ bus
Turnips, 2¾ bu
Artichokes, 2¼
Carrots, 1¼ bus
Celery, 25½ doz
Radish, 3 doze
Cabbage, 1½ do
Sundries . . . . .

Salsify, 4 bushe
Parsnips, 4½ bu
Turnips, 3 bush
Onions, 2¾ bush
Carrots, 2¾ bus
Beets, 1 bushel
Cabbage, 7½ do
Celery, 28 doze
Herbs and sund

PART IV.

REPORT OF THE FOREMAN

OF THE

HORTICULTURAL DEPARTMENT.

To the President of the Ontario Agricultural College:

SIR,—As the Horticultural Department of the institution will this year be fully reported on by Professor Panton, it is unnecessary for me to say anything further than remind you of what you have no doubt observed, that all the garden crops were full and satisfactory for the year, sufficient to meet all the requirements of the boarding house for both vegetables and small fruits, and to leave a surplus for revenue, as the following statement will show:

VEGETABLES AND FRUITS SUPPLIED TO THE COLLEGE DURING THE YEAR 1888.

January.

Parsnips, 3¾ bushels at 40 cts.	$1 50	
Onions, 1¾ bushels at $1.50	2 62½	
Turnips, 2¾ bushels at 20 cts	55	
Artichokes, 2¼ bushels at $1.00	2 25	
Carrots, 1¼ bushels at 30 cts	37½	
Celery, 25½ dozen at 60 cts	15 30	
Radish, 3 dozen at 10 cts	30	
Cabbage, 1½ dozen at 70 cts.	1 05	
Sundries	30	
		$24 25

February.

Salsify, 4 bushels at $1.00	4 00	
Parsnips, 4½ bushels at 40 cts	1 80	
Turnips, 3 bushels at 20 cts	60	
Onions, 2¾ bushels at $1.50	4 12½	
Carrots, 2¾ bushels at 30 cts	82½	
Beets, 1 bushel	35	
Cabbage, 7½ dozen at 70 cts.	5 25	
Celery, 28 dozen at 60 cts	16 80	
Herbs and sundries	70	
		$34 45

March.

	95	
Turnips, 4¾ bushels at 20 cts	$2 25	
Parsnips, 5 bushels at 45 cts	1 35	
Carrots, 1½ bushels at 30 cts	6 37½	
Onions, 4¼ bushels at $1.50	1 00	
Salsify, 1 bushel at $1.00	1 50	
Artichokes, 2 bushels at 75 cts	35	
Beets, 1 bushel	1 40	
Cabbage, 2 dozen at 70 cts	40	
Sundries		$15 57½

April.

	8 25	
Onions, 5½ bushels at $1.50	75	
Artichokes, 1 bushel at 75 cts.	1 40	
Turnips, 7 bushels at 20 cts	2 02½	
Parsnips, 4½ bushels at 45 cts.	90	
Carrots, 3 bushels at 30 cts	40	
Herbs, etc.		$13 72½

May.

	1 57½	
Carrots, 5¼ bushels at 30 cts.	1 35	
Parsnips, 3 bushels at 45 cts	1 45	
Turnips, 7¼ bushels at 20 cts	3 30	
Lettuce, 5½ bushels at 60 cts	9 80	
Rhubarb, 14 bushels at 70 cts.	23 76	
Asparagus, 594 bundles at 4 cts	4 12½	
Onions, 2¾ bushels at $1.50.	10	
Sundries		$45 46

June.

	11 40	
Rhubarb, 19 bushels at 60 cts.	3 00	
Lettuce, 6 bushels at 50 cts.	7 25	
Spinach, 14½ bushels at 50 cts.	25	
Turnips. 1¼ bushels at 20 cts	1 00	
Peas, 1 bushel	4 30	
Onions, 84 bundles at 5 cts.	32 80	
Asparagus, 820 bundles at 4 cts	11 20	
Strawberries, 160 boxes at 7 cts	2 88	
Gooseberries, 48 quarts at 6 cts	30	
Herbs, etc		$74 38

July.

	40	
Spinach, 1 bushel at 40 cts	1 60	
Lettuce, 4 bushels at 40 cts	8 50	
Peas, 8½ bushels at $1.00.	7 87½	
Potatoes, 5¼ bushels at $1.50	8 64	
Gooseberries, 144 quarts at 6 cts.	4 62	
Beans, 66 quarts at 7 cts	3 00	
Currants, black, 25 quarts at 12 cts	2 00	
Asparagus, 50 bundles at 4 cts.	50	
Onions, 10 bundles at 5 cts.	3 70	
Beets, 74 bundles at 5 cts.	2 10	
Carrots, 42 bundles at 5 cts.	20 34	
Strawberries, 339 boxes at 6 cts	36 08	
Raspberries, 431 boxes at 8 cts.		

Currants, white, 118 boxes at 6 cts.	$7 08
Currants, red, 216 boxes at 6 cts.	12 96
Cauliflowers, 7 dozen at 60 cts.	4 20
Cucumbers, ½ dozen at 6 cts.	6
Cucumbers, pickling, 180 dozen	1 00
Sundries.	30
	$124 95½

August.

Potatoes, 23 bushels at 70 cts.	16 10
Apples, 8 bushels at 60 cts	4 80
Onions, ¾ bushel at $1.00	75
Peas, 6 bushels at $1.00	6 00
Beets, ½ bushel at 25 cts	12½
Cabbage, 5½ dozen at 50 cts.	2 75
Cauliflower, 11 dozen at 75 cts	8 25
Cucumbers, table, 9 dozen at 15 cts.	1 35
Celery, 7½ dozen at 50 cts	3 75
Vegetable Marrow, 3 dozen at 50 cts	1 50
Corn, 18 dozen at 7 cts	1 26
Raspberries, 262 boxes at 7 cts	18 34
Currants, black, 15 quarts at 12 cts	1 80
Beans, 32 quarts at 5 cts	1 60
Radish, 10 bundles at 5 cts	50
Carrots, 4 bundles at 5 cts	20
Herbs, 7 bundles at 5 cts	35
Cucumbers (pickle), 900 at 20 cts	1 80
Sundries	40
	$71 62½

September.

Apples, 38½ bushels at 60 cts	3 10
" 12 " 40 cts	4 80
Carrots, 1¼ bushels at 40 cts	80
Potatoes, 275 bushels at 35 cts	96 25
Tomatoes, 7¼ bushels at 70 cts	5 07½
" green, 3 bushels at 50 cts	1 50
Crab apples, 3 bushels at 60 cts	1 80
Onions, ½ bushel at $1.00	50
Cabbages, 2½ dozen at 50 cts	1 25
Celery, 9 dozen at 50 cts	4 50
Corn, 23¼ dozen at 7 cts	1 64
Peppers, 3½ dozen at 12 cts	42
Radish, 3 bundles at 5 cts	15
Plums, 40 quarts at 6 cts	2 40
Peas, 64 quarts at 5 cts	3 20
Grapes, 263 lbs. at 5 cts	13 15
Melons, 57 at 5 cts	2 85
Vegetable Marrows, 200 at 4 cts.	8 00
Citrons, 70 at 5 cts	3 50
	$174 88½

October.

Tomatoes, 2½ bushels at 70 cts	1 75
" green, 3 bushels at 50 cts	1 50
Crab apples, 1 bushel at 40 cts	40
Apples, hand picked, 151 bushels at 40 cts	60 40

Artichokes, 1¾ bushels at 75 cts	$1 31	
Beets, 1½ bushels at 35 cts	52½	
Onions, 2¾ bushels at 80 cts	2 20	
" pickling, ½ bushel	50	
Carrots, 1½ bushels at 25 cts	37½	
Parsnips, 1½ bushels at 40 cts	60	
Salsify, 1 bushel at $1.00	1 00	
Turnips, 2 bushels at 15 cts	30	
Corn, 18 dozen at 7 cts	1 26	
Cabbage, 3½ dozen at 50 cts	1 75	
" red, 6 dozen at 40 cts	2 40	
Celery, 12 dozen at 50 cts	6 00	
Cauliflower, 1 dozen	50	
Squash, 2½ dozen at 50 cts	1 25	
Radish, 2 dozen at 5 cts	10	
Grapes, 94 lbs. at 5 cts	4 80	
" 84 lbs. at 4 cts	3 36	
" 43 lbs. at 2½ cts	1 07½	
" 52 lbs. at 1½ cts	78	
Melons, 18 at 5 cts	90	
Herbs and sundries	65	
		$95 68½
November.		
Artichokes, 2 bushels at 75 cts	1 50	
Beets, 2 bushels at 35 cts	70	
Turnips, 5 bushels at 15 cts	75	
Parsnips, 1½ dozen at 40 cts	60	
Onions, 2¼ bushels at 80 cts	1 80	
Carrots, 1½ bushels at 25 cts	37½	
Salsify, 1¼ bushels at $1.00	1 25	
Celery, 15 dozen at 50 cts	7 50	
Cabbage, 4 dozen at 50 cts	2 00	
Herbs and sundries	40	
		$16 87½
December.		
Parsnips, 4½ bushels at 40 cts	1 80	
Turnips, 5 bushels at 15 cts	75	
Carrots, 2¾ bushels at 25 cts	68	
Onions, 1 bushel, at 80 cts	80	
Beets, 1 bushel	35	
Artichokes, 1¼ bushels at 75 cts	93	
Celery, 18 dozen at 50 cts	9 00	
Cabbages, 3¼ dozen at 50 cts	1 62½	
Herbs and sundries	70	
		$16 63½
		$708 60½
Total supplied to College		270 11
Sold to hucksters and others		127 74
Garden labour given to other departments		$1,106 45½
		30 00
Less manure got from farm		$1,076 45½

JAMES FORSYTH,
Foreman of Horticultural Department.

PART V.

REPORT OF

THE PROFESSOR OF DAIRYING.

GUELPH, 31st December, 1888.

To the President of the Ontario Agricultural College :

DEAR SIR,—I have the honor to report upon the work of the Dairy Department for 1888. The catastrophe which overtook our institution in the burning of the barns is to me a cause of not only the regret of sympathy. By it a sudden and unavoidable end was put to uncompleted experimental work in the feeding and treatment of cows. That was the least part of the loss. The full record of the dairy experimental work for the year, in the book kept for that purpose, was in a desk in the stable for convenience and accuracy in the making of direct entries by the person in charge. That record was burned. In consequence my report will be a brief one, and the scantiness or absence of much new information is to be measured by the loss referred to. I still have a full record of the Creamery business ; also fairly complete notes on the growth of a fodder corn crop and the filling of a silo therewith.

I.—CREAMERY MANAGEMENT.

For parts of five seasons the Ontario Creamery has now been in operation. In my report for 1886 I briefly referred to the objects for which it was established. Its educational influence upon the butter-making of the Province is now recognized as valuable by the butter-makers and creamery patrons. Its returns have been satisfactory to its own patrons, and the prices realized from the sales of butter have perhaps been higher on the average than those from any other creamery in Ontario during the same period. The business season has been all too short. The following open letter, sent to the agricultural press at the time of its closing for the past year, has some explanation, as well as advice needed by most of our dairymen :

A LESSON FROM THE DROUTH.

The Ontario Creamery closed for the receiving of its patrons' cream on August 18th. That unusually early date points a lesson for Ontario farmers. The small quantity of cream which was being furnished by its 137 patrons was the reason for the unseasonable stopping of operations. During June and July they furnished cream to make an average of 400 lbs. of butter per day. During August the quantity averaged only 235 lbs. per day. The expense of collecting so small a quantity was too great to be allowed to continue, as the rate per trip was fixed for the season.

Scarcity of feed last winter left many of the cows poor in flesh and weak in constitution. Such a condition of affairs in cow life reduces the product rapidly after July. The imperative need for providing a suitable green fodder in the shape of peas and oats, oats and vetches, fodder corn or millet has not yet been half recognized by even the said-to-be-advanced farmers of Guelph neighborhood. All over the Province the gravest loss has resulted from neglect to prepare for and provide against the days of dry pasturage. Not

only has there been immediate loss from the lessening of direct dairy profits or returns, as well as a loss of flesh and quality in the dry or feeding cattle, but in many instances the stock will go into winter quarters in no fit state for enjoying winter thrift. But little of any cheap stable fodder has been grown. Short straw and in many districts light hay, threaten to leave a shortage of spring fodder.

In our own case, 20 common grade milking cows (to be more heard of hereafter) have been kept in good heart on 20 acres of fair pasture, with the supplementary feed furnished by *half an acre* of oats and peas and *half an acre* of mammoth southern sweet corn until 25th August. I fully expect to winter—from November until May—20 head of milking cows, so far as fodder is required, on the product of seven acres of ensilage corn.

The winter is going to be a trying one on cattle and profits; but if its threatened disasters, which in some sections have been already too intensely realized, do but awaken the stockmen and general farmers of Ontario to a prudent course of preparation for the future, the losses will have brought equivalent compensation. In the evolution of the intelligence, judgment and prudence of men, nature will not be baffled, though in her persistence she may seem occasionally dry and cruel.

The creamery is a capital school for practical dairy instruction to students. It has become, in the estimation of butter-makers, a place to which they can come or write for information upon the difficulties of their business. Such visits and correspondence are invited. Nothing is hidden or held back that can be shown or offered for the assistance of all applicants for information. The College Creamery does not afford its patrons any special advantage over what may be realized from any joint stock or private concern in any part of the Province.

Those who furnish cream are paid for it, at the price realized from sales of the butter manufactured, after all expenses for cream-gathering, management and labor and furnishings, tubs, fuel, ice, etc., etc., have been deducted. These expenses are kept as low as possible and close economy is practiced in all outlays. Notwithstanding that, the rate of expenses per lb. of butter is very high. The cost of cream-gathering depends so much upon the distance to be travelled for the quantity collected, that the number of patrons and cows within a given area largely determine the rate per lb. For the ground covered, the number of patrons and the quantity of cream supplied is still unnecessarily small. This rate of expense is correspondingly high.

The agreement with the patrons of the creamery was in substance that a cash advance was to be made to each patron after the end of the month at the following rates, viz.:

For May	14	cents	per	pound of butter.
" June	14	"	"	"
" July	15	"	"	"
" August				

After providing for these prices and paying all expenses out of receipts from the sales of butter and buttermilk, there was a balance of $624.93. That amount was distributed to the patrons by paying 2 cents per lb. above the promised price in July and the balance in the settlements for August butter.

A summary of the season's business is herewith presented:

RECEIPTS.

Sales of butter	$5,727	17
" buttermilk	336	31
Refunds from patrons and labor accounts	69	66
	$6,133	14

DISBURSEMENTS.

Patrons for cream	$4,516	34
Labor	346	96
Cream gathering	776	15
Salt, tubs, fuel, feed of horse, repairs and sundries	493	69
	$6,133	14

Butter manufactured	27,501 lb.
Average price of butter, per lb	20.82c
Number of patrons	137
Number of days in operation	84
Routes travelled by the cream waggons	7

The length of the routes ranged from 18 to 28 miles.

Cost of gathering the cream	2.82c.	per lb.	of butter.
" labor, including delivery of buttermilk	1.26c.	"	"
" furnishings, etc	1.79c.	"	"
Total	5.87c.	"	"
Cr. Receipts from sale of buttermilk	1.22c.	"	"
Net cost for collecting cream and manufacturing	4.65c.	"	"

The cream only was collected. The skim-milk was left at the farms to be used in the raising of stock or otherwise. Most of the patrons used the plain shot gun can. The skimming was performed by the patrons. The cream was measured by the collectors in cylindrical cans 12 inches in diameter. Every inch in depth in the measuring can was credited and the fractions of an inch were credited in eighths. A sample of each patron's cream was taken once a week in a glass tube carried by the driver for that purpose. By the oil test churn, the per cent. of churnable fat was in each case determined. The variation between the qualities of different samples of cream was from 7 ounces to 19 ounces of butter per inch of cream. We have thus been able to distribute the proceeds of butter sales among the several patrons according to quantity and quality of cream furnished.

By reason of the unfavorable conditions already referred to, it was considered advisable to close the Creamery on 18th August. Otherwise the expense of collecting the diminished and diminishing quantity of cream would soon have absorbed all the balance which had been accumulated above the promised prices. Guelph city market is a good one and a scarcity there puts the price for good dairy butter up just as high as creamery. Hence many of the farmer's wives are attracted after July to make up and market their own butter direct. The withdrawal of so much butter from the local market, as is effected by the creamery, improves the market for those buttermakers who do not patronize it.

The butter was mostly packed in tin-lined tubs. Nearly 1,000 lb. per week were sent to Toronto for consumption there. The home markets show a disposition to take nearly all the creamery butter made in the Province. Canadian salt was used at the rate of from three-quarters to one ounce per lb. of butter.

Under this head I take the liberty of pointing out the cause of serious loss to patrons who patronize creameries. The milk is frequently left to cool off before it is set in the pails for the separation of the cream. The fat of milk is in the form of small globules which are held in suspension. Because these are slightly lighter than the serum of milk in which they float, they rise to the surface when left undisturbed. But if the milk be of a temperature below 90° Fahr., or if it remain at a stationary temperature after being set in deep pails, they rise very slowly. When the milk is put into the pails at a temperature above 90° and then gradually cooled down, without agitation or disturbance, a circulation of the milk is started whereby the globules are quickly carried to the top. A falling temperature is advantageous, also, because it increases the difference between the specific gravity of the fat globules and serum or skim milk. Proper attention to the setting of milk would avert very serious losses to those supplying cream or making butter.

For the guidance of persons seeking information as to the best methods of separating cream and as to the comparative advantages of deep setting and the use of the centrifugal machines, let me here cite some information from previous investigations. (The record of the details of all milk setting experiments for 1888 perished in the barn fire).

I visited the farms of a large number of the patrons, and by measurement and calculation learned that on the average, 33 lb. of milk were taken to yield enough cream to make 1 lb of butter. During the same period by the ordinary 12 and 24 hours setting in

ice water, 28 lb. of milk yielded sufficient cream to make 1lb. of butter. Had the same milk been used with the centrifugal separator, 26 lb. of milk would have yielded as much cream as would have given 1lb. butter.

From these figures it follows that by the ordinary and very insufficient care given to the setting and cold-keeping of their milk by patrons, the butter yield was 3.03 lb. butter per 100 lb. milk.

By ordinary setting in ice water the yield was 3.57 lb. butter per 100 lb. milk.

By use of centrifugal separator, 3.85 lb. butter per 100 lb. milk.

From these facts it will be seen that the increased yield of butter from a given quantity of milk, set in ice water, is 17.8 per cent. on the quantity realized by ordinary practice. The increase by the use of the centrifugal separator over ordinary practice would be 27 per cent. The increase by use of centrifugal separator over setting in ice water would be 7.8 per cent. Hence, where cream only is supplied to a creamery, every patron should provide for use a liberal supply of ice.

The larger returns in butter from the centrifugal separators point to an advantage from their use where the increased cost of drawing the whole milk and returning to the farms the skim-milk would not more than absorb the value of the increase of butter realized.

As this is a live question for those interested in the starting of new creameries, I state four points for consideration in connection with the circumstances in every locality.

(1) Proportion of cream separation that may be effected.

(2) Effect of the process on the quality and condition of the cream,

(3) Effect of the processs on the quality of the skim-milk.

(4) Costs.

(1) The previously stated ratio of separation by the different methods may be taken as reliable.

(2) Where cream has to be carried a number of miles during hot weather its condition and quality are better for butter-making where the separation is effected at the creamery.

(3) For profitable calf feeding the skim-milk must be sweet. Both processes, when well managed leave it at the farm in that condition

(4) Under the head "Costs" are to be compared: (1) Cost of machines and pails; (2) Cost of maintenance; (3) Expense of operation against the increased cost for collecting the milk over the expense of gathering the cream; (4) The labor of the farm.

The foregoing information should enable those interested to intelligently decide for themselves which plan to adopt. This general guiding conclusion may be added, where a small quantity of milk is available, and then only by collecting from long distances; the setting plan would be more economical; but where a large supply of milk may be obtained within a small area, the centrifugal plan will be the most profitable.

In calling the attention of farmers to the advantages of the creamery system of butter-making over the plan of home butter-making, I need not say much about the quality of the average dairy butter. I believe the quality is improving. Still the fact remains that dairy butter brings on the average from four to six cents per pound less than creamery butter in Ontario when marketed at the same time. The foreign market will pay high prices only for uniformly fine dairy products. The cheese of Ontario has won its deservedly high reputation in English markets, mainly because of the uniformity of its excellence. That could only have been attained through co-operative factories, and would never have been possible by farm cheese-making. Over 99¾ per cent. of our total make of cheese is the product of factories, while less than 3 per cent. of the total make of butter in Ontario is manufactured in creameries. Six times as much labor per pound is involved in making butter in small dairies as is required in creameries. Six times as much capital is required for the utensils to make a given quantity in small dairies as would equip a creamery of sufficient capacity. Yet I do not advocate the establishment

of creameries for summer butter-making to compete for milk with our cheese factories. Where the experiment has been tried the creameries have generally gone to the wall. We cannot successfully contend against the natural adaptation of our circumstances. Our home market is the only one we should seek to supply with butter during the summer. During that season we cannot successfully compete with British, French, or Swedish farmers in European markets. The difficulty of finding a safe transit for fancy butter during the summer months to the distant cities of England is well nigh insuperable in business. During the winter no such hindrance is experienced. From November until April is our natural butter-making season. The same buildings that are used in cheese-making in summer could be used for butter-making upon the co-operative plan during the winter. The expense of adapting the machinery and procuring the extra utensils need not exceed $200 for 500 cows. The general use of silage from fodder corn will provide a cheap, succulent winter feed and make the possible profits from butter quite twice as much as they have been from exclusive summer dairying. In Ontario it is estimated that the milk of 260,000 cows is used in cheese-making, while the milk of 250,000 is directed to butter-making. The latter 250,000 cows should begin their milking season from September to November. A few of the advantages may be here pointed out.

(1) A longer season of income is obtained from cows when they calve between September and November.

(2) Better calves for the dairy or the feeding stalls can be raised at less cost.

(3) Remunerative employment is given to farm hands the whole year round.

(4) Butter sells on the average for at least 50 per cent. higher prices from November till April than from April till November.

(5) Transportation for export will not endanger the quality.

The quickened interest thus directed to dairying would result in cows being more suitably and economically fed; more milk would be produced at less cost; the coarse grains would be profitably consumed on the farms and increase fertility would follow. By availing themselves of the waiting-to-be-used aids of intelligent winter dairying in connection with creameries, the farmers of Ontario would lift themselves from a plane of agricultural depression to a position of substantial and permanent prosperity that was never equalled in the palmiest days of wheat growing.

II.—FODDER CORN AND THE SILO.

It was my good fortune in the month of February to visit Wisconsin to speak at Farmers' Institutes held under the direction of the State University and the able superintendence of Mr. W. H. Morrison. I went upon the urgent invitation of my friend W. D. Hoard, of Fort Atkinson, who is now Governor of the State. At two of the Dairymen's Conventions in Ontario he had enthusiastically urged our farmers to provide fodder corn for silage and had explained the success of the practice in the Western States. During the trip above referred to I had excellent opportunity for seeing what had been done by enterprising farmers in the production of cheap and nutritious fodder. Thus it was that I came back to Ontario more ardent than ever to advocate the adoption of the latest and best methods of corn culture, silo construction and use. Part of field No. 10 was turned over to my care for the purpose of putting into practice and to the proof the newer theories of thin seeding and frequent cultivation. The soil in parts of the field is a loose clay loam; in places a poverty-stricken clay crops out. It had not been manured (so I learned) for four years, and had been cropped every year. Besides it was rather foul with thistles and other weeds. An endeavor was made to clean the field while cultivating to produce a good crop.

On 21st May Mammoth Southern sweet corn was planted by the use of a common force-feed seed drill. All the spouts except two were stopped up and these were 3 ft. 6 in. apart. About one-third of a 7¾ acre plot was planted at the rate of 337 grains per 100 feet; as much more land was planted at the rate of 266 grains per 100 feet: and an equal area at 172 grains per 100 feet, lineal measure of each row. In other words the rows over the whole field were 3½ feet apart. One part of the field had the seeds in each row about 3½ inches apart. In another part they were 4½ inches distant from each other, and in a third part 7 inches was the space between the several grains. The thinnest seeding gave by far the largest crop, the difference being as between nearly 24 tons per acre of green fodder from the thinnest seeding and an average of 16¾ tons per acre for the whole field. But I must not anticipate. The seeds were put in at an average depth of 2¾ inches. Had the crop been put in two weeks earlier, which would have been a decided advantage, the grains would have been planted at less depth. When corn is planted very early, while the soil is yet cold, a shallow thin covering of earth is best; but when planted as late as June it should be put in deeper than three inches.

When the plants were from two to three inches high light harrows were dragged diagonally across the rows. A second harrowing was given a week later. That treatment was decidedly beneficial. Very few plants were injured. The smaller weeds were killed and the corn growth was invigorated. Afterwards a one-horse scuffler was used between the rows (which ran north and south), until the plants were over 5 ft. high. Shallow cultivation gives the best results. The stirred soil absorbs moisture from the atmosphere and also arrests the escape of moisture by its looseness hindering the capillary movement of the water from below. The 7¾ acres were hoed over twice to kill thistles and weeds which the scuffler had missed. Only half the cost of the hand labor was charged against the corn crop. The other half is rightly chargeable to the cleaning and improvement of the field.

On 1st September cutting was commenced. The crop was then from 9 to 11 feet high. About every third stalk had an ear, on which the grain was in the milky stage, and about two-thirds of full size. The other stalks had smaller nubbins. On August 27th a number of average stalks from the corn in rows were weighed and compared with a number from a field of the same kind of corn, sown broadcast, 3 bushels to the acre. The stalks from the former weighed 27 ounces each, while the stalks from the broadcast field weighed 4 7/16 ounces each. An analysis as to the per cent. of water was made by Mr. C. A. Zavitz. The following figures shew the result:—

	Per cent. of water in stalks.		Per cent. of water in leaves.
Corn in rows	85.26		76.73
Broadcast corn	88.59		78.51

Further analysis of the corn and silage will be reported upon by Professor C. C. James.

The cost of producing the crop is shewn in the following statement. The allowance for the ploughing and cultivation is estimated; the other items are at actual cost:—

Ploughing and cultivation	$2	50 per acre.
Harrowing		50 "
Seeding		50 "
Seed (less than half-bushel per acre)		60 "
Harrowing after corn was up		50 "
Hoeing (half cost)		75 "
Cultivating (5 times)	3	30 "
Cutting with hooks	1	25 "
Use of land	4	50 "
Total cost for labor, seed and use of land	$14	40 per acre.

The crop averaged 16.73 tons to the acre green fodder. After being wilted one day it lost one-seventh by weight. The weight of wilted fodder was 14.34 tons per acre.

specified above, the cost for the fodder, lying in armfuls on the field, wilted and ready to be put in the silo, was $14.40 for 14.34 tons, or as nearly as may be figured $1.00 per ton. Not more than every third stalk had an ear with the grain well shaped. Earlier planting and richer soil will remedy that deficiency another year.

Meanwhile a silo had been erected. The particulars of construction will be given further on. To convey the corn to the silo ordinary hay-racks on common waggons were used. The front wheels were taken off one waggon and put on the hind axle of another. One low truck was also improvised into service. The loading was thus made easier. A gangway with slats nailed across was trailed behind. The men loaded the corn by walking up with large armfuls. That wrinkle was not adopted until most of the corn had been drawn in, or the expense for labor would have been lessened. As it was, the cost for the labor of loading, teaming, running through the cutter, filling and covering the silo was 60 cents per ton. An additional sum of 12 cents per ton must be added for use of the engine and straw-cutter. Thus the cost of the fodder in the silo, cut into inch lengths and ready for feeding was—

Labor on field, seed and use of land	$1 00	per ton of silage.
Labor in loading, teaming, filling, etc.	60 "	"
Use of machinery	12 "	"
Total cost	$1 72	per ton of silage.

I think that cost can be reduced by one-third another season by the growth of a larger crop and a more economical application of labor.

Before the erection of the silo the following bulletin of information and instruction was issued :

ENSILAGE.

I have numerous enquiries regarding the proper construction of silos, and judge the present to be an opportune time for a brief bulletin of information on the subject of ensilage. No attempt will be made to recount the history of its evolution. It is enough to know and to say that whereas a few years ago "ensilage" generally meant fodder which had been kept in a succulent condition without regard to its sourness or sweetness, its partial rottenness or preservation, it now denotes a product from fodders which may be obtained of uniformly wholesome, sweet and nutritious properties. Careful investigation and experimental work mainly by the practical farmers of the continent within the last decade, have brought to light the true principles of the system. When these are followed with good judgment satisfactory results are almost certain to be realised. Absolutely sweet silage is very rare, but practically sweet, cured, or ripened silage is easily and certainly obtainable.

To aid in the better understanding of the practical parts of how to construct and fill a silo, I will first outline the theory of sweet silage.

A *silo* is simply a place where fodder is preserved in a succulent condition. It may be a pit, a box, a mow, a tank, a building, or a trench in the earth. *Silage* is the word denoting fodder so preserved. *Ensilage* is the term applied to the process or system. *Ensile* is the verb expressive of the action of making silage. *Ensilor* stands for the person using the *silo*, to *ensile* fodder for *silage* by the process of *ensilage*.

Plants during their growth absorb carbonic acid and give off oxygen. They can do so only by the aid of heat from some external source. The sun furnishes heat for plants growing out of doors. A few of the lower organisms, such as moulds and ferments have a different practice in their growth. They absorb oxygen and give off carbonic acid. Flowers and fruits while maturing do the same. That is also the function performed by animals in breathing, by which heat is generated in their bodies. The cells of the leaves and stalks of plants, after their separation from the growing root, possess a like power, and live after they are detached from the plant which bore them. While living they resist the action of minute fungi or bacteria, which when they become dead prey upon their substance and so bring about its decomposition. The primary reason for the possible

preservation of green crops in a silo is that the cells of plants are living when put into it. Spores of fungi and germs of ferments are everywhere disseminated in the air, and consequently a variety of organisms which cause decomposition are always present in a silo when first filled. After receiving their quickening impulse from contact with the air these spores and germs can continue their activity afterwards even when deprived of it. But they cannot maintain life and activity for any considerable time at a temperature above 125° Fahr. Hence when the contents of a silo are caused or allowed to heat above that temperature for a few days these germs of fermentation are destroyed. To attain that temperature (over 125°) by a natural process it is necessary that air be present. The cells of the plants ensiled then begin the action of absorbing oxygen and giving off carbonic acid. That produces heat, being really a process of slow combustion by which the cells destroy themselves. Should they continue to live, in the presence of the sugar of the plant, after the exclusion of air they will produce alcohol. The next stage of change from alcohol would be through aldehyde into acetic acid (vinegar). It follows that when plants or parts of plants of which the cells are living are put in a silo and kept from air contact after a temperature of 125° has been maintained, that the product will be sweet silage. If the temperature does not reach at least 122° the product will be sour, and if the air be not excluded the product will be mouldy or putrid.

The best fodder for the silo is ensilage corn, known as Mammoth Southern Sweet corn or B. & W. corn. It is a Virginia or Georgia corn and grows a large bulk of stalk and leaf. It is of certain vitality and when grown on good soil properly prepared and cultivated is proof against drouth. It has a high feeding value per ton. By planting in rows 3½ feet apart with 3 grains to the foot the largest feeding return per acre will be obtained. An ordinary seed drill may be used—only two or three of the seed spouts being left open. The rows should run north and south. The planting or sowing in drills, rather than broadcast, encourages every stalk to carry an ear. Abundance of air and sunshine increase the growth and the nutrition per ton of fodder. Cultivation over the rows with a slant tooth or other light harrow is beneficial until the plants are 5 or 6 inches high. Subsequent cultivation between the rows, is all the better for being shallow and frequent. The best time for cutting is just before the ears become firm or glazed. That stage of maturity makes the cells of the plants robust, fills the stalks to the butts with nourishing juices and leaves them palatable and digestible. The cutting can ordinarily be done cheapest with a reaper. The stalks should be left in armfuls in the field to wilt and dry for a day or two. From 65 to 75 per cent. of water in the plants is as much as they should contain for the making of sweet silage. A larger per cent of water hinders the heating and thus tends towards the forming of a sour product. A low truck with a plank platform extending over the wheels and not more than 3 feet high will be found serviceable for hauling to the cutter. A cheap suitable truck may have its wheels made from 6 inch sections sawn off the end of a tough log of proper diameter. A straw cutter set to cut into inch lengths should be used. An elevator after the model of straw carriers on a grain separator may be attached. If the silo is mainly in the basement of a barn and can be filled from the floor above, the elevator may be dispensed with. Fodder corn can be well preserved without the use of a cutter. By laying the stalks all one way in layers and then placing the butts over the tops of the layer underneath they will keep as well as by cutting. However, they are not so convenient for handling in the feeding.

The quantity that may be fed per head will vary as in the case of other fodders according to the stage of growth or maturity at which the crop was cut, the quantity of grain on the stalks and the degree of dryness when ensiled. The best results are not obtained from the feeding of silage alone. A mixed diet is always preferable. For milch cows the quantity that may be consumed will range from 25 to 35 lb. per head per day. Should silage be the sole feed in the ration from 50 to 60 lb. will be required. It will weigh after it is compactly settled, between 40 and 50 lb. per cubic foot. From 15 to 25 tons per acre can be grown in Ontario. From these data it will be easy to calculate either the acreage of corn or the size of a silo required for the feeding of any number of cattle. For instance, for feeding ten milking cows for six months, a good ration can be made up by 3 lb. of wheat bran, 5 lb. of mixed grain (chopped peas, oats, barley), 5 lb. of hay or straw at will, and 30 lb. of silage per head daily. (For stable feeding, better results are

realised by morning and evening feeding only than by four or five feeds per day). If straw be of good quality cut on the green side, the hay may be left out altogether and a few pounds extra of silage given instead. No roots are needed, as silage takes their place at much less cost. Thus, 10 cows using 30 lb. of silage per day consume 300 lb.; in 6 months or 181 days they consume 54,300 lb. or 27 tons 300 lb. That quantity can be grown on less than an acre and a-half, and could be packed into a silo 12 ft. × 12 ft. × 12 ft. deep, in which the silage would settle to a depth of about 8 ft. A better size would be 10 ft. × 10 ft. × 16 ft. deep.

If the silo is to be erected as a separate structure, its foundation had better be a stone wall one and a-half feet above ground. A clay floor filled to a foot above the outside level to prevent dampness will be cheapest and best. There will be no danger of such a bottom falling out of it. Planks may be bedded on the top of the foundation walls to serve as sills. These should be firmly spiked to pieces built into masonry for that purpose. A common balloon frame may be erected by using as studs 16 ft. planks, 2 × 10 or 2 × 12 placed two and a-half feet apart. To secure them safely at the bottom against lateral pressure while the silo is being filled, a good method is to have the plank sill flush with the inside of the wall, and to cut heels into the ends of the studs, allowing an inside spur from each stud, to the width of say three inches to extend to a depth of six inches or to the clay floor. They should also be securely toenailed. The roof will give additional strength to the sides for resistance to outward pressure if it is made after the truss pattern. Instead of ties or joists running straight across from the tops of the studs or the plates (where they would be in the way of the filling), they should run like false rafters from the top of each stud to the rafter opposite, being spiked to it at about one-third of its length from the ridge. On the inside of the studs should be first nailed a lining of inch lumber running horizontally. A covering of tar-paper with edges lapped four inches should then be tacked on. Over that should be put inch lumber, planed on the exposed side and tongued and grooved. The outside of the studs should be covered in a similar way. A single thickness of lumber outside can be made to do, but the double boarding with paper between is preferable since it keeps the tar-paper close against the outside boards, and makes the building frost-proof as well as air-tight. The door should be of the ice-house style. A space between two studs may be left unboarded. As the silo is filled, short boards cut to fit can be nailed in and on. Care must be taken to so place strips of paper that they will make the joints air-tight. To preserve the inside lumber it should receive a coating of coal tar. If mixed with a few ounces of rosin and applied hot and liberally the inside lining need not be tongued and grooved. Where a part of a barn or some other building is to be fitted up for ensilage uses the inside finish of the silo should be the same as for a separate structure. Any partitions required can be made of two-inch planks dropped into grooves made by nailing cleats to each side, just as boards are dropped into place in front of a granary. They should fit close and be fitted with dowel pins.

The total cost may be put at $1 for every ton of capacity, but will vary according to the finish of the building, the quantity of lumber used, the price of material, etc. The tar paper can be purchased and put on at an expense of from 2½ to 3 cents per square yard. On the clay floor cut straw or chaff should be spread to a depth of three inches.

The filling should proceed slowly. When an elevator is used a light "shoot" like a trough may be used to divert the material into the compartment to be filled. Not more than four feet in depth should be put into a compartment in one day. It should not be tramped in but left heaped in the middle as it falls from the shoot. After three days it will have attained the required heat. The heart of the heap should then be shovelled out against the sides and well tramped down. The filling may proceed as before. The task of throwing the heated silage from the centre out against the sides should be repeated at the commencement of every period of filling. *The three day period should always intervene after* four feet of cut fodder has been added. The last filling should be left for three days before any covering is put on. It should then be levelled and tramped down at the sides as in the case of other layers. A covering of tar paper lapped at the sides and having its ends and sides extending for a foot up against the sides of the silo may be

spread. Two or three feet of coarse grass, hay or straw spread upon the paper to keep it in place will complete the silo. No weighting or pressure is required.

When opened for feeding the whole surface of one division must be uncovered. The silage will be removed from the top and taken out by way of the door provided. The short boards between the two studs may be removed as the emptying goes on. Where more than one compartment is used the partition planks may be lifted out one by one. One outside door in the middle compartment may thus serve for a whole silo.

In conclusion, I would caution Ontario farmers against expecting too much from the silo. It will not add anything to the value of the material preserved in it. All that can be hoped from its use is that it will enable farmers to reduce very much the cost of the bulky part of their cattle feed. The necessities of our climate, from the frequent drouths which make grass and hay very uncertain and expensive crops, urge that ensilage corn be largely and generally sown and grown. It is a sure crop, makes a cheap summer and winter feed, is succulent and easily digested, is a cheap substitute for roots, promotes the animal vigor and health, and is well adapted for the winter production of milk of the very best quality and flavor. The cost of raising the crop will not exceed $10 per acre, including the price of the seed and rent of the land. The cost of handling and filling the silo will vary from 25c. to 75c. per ton. Mr. V. E. Fuller, of Oaklands, one of the pioneers in ensilage practice in Ontario, estimates the cost of silage in his silo at $1.60 per ton, after allowing for all expenses, including the value of the manure used. Hon. Hiram Smith, of Wisconsin, a man of superior judgment and wide knowledge, when speaking to and for the progressive dairymen of his State, says:

"The actual cost of raising and getting a corn crop into a silo is often greatly overestimated. The common dairy farmer usually has all the men, teams, and tools required to handle a corn crop for the silo, and the only legitimate charge is the wages paid the men who are doing the work. The men on a dairy farm earn their board milking twice a day, and the teams' expense is no more or less on account of the silo. What then is the cost of ensilage per acre, or for 40 acres? One man and team will plow 40 acres in the Fall in 26 working days; wages, $18. Two men and two teams will, in the Spring, cultivate and prepare the ground, plant with the horse drill, run the smoothing harrows and cultivators until June 15th, equal to five months' work, at $18 per month, $90.

. . . . . .

To recapitulate:	
Plowing 40 acres	$18 00
Plowing and cultivating	90 00
Cutting in the field and ensiling 656 tons	288 64
Seed corn 50 cents per acre	20 00
Total money expense	$416 64

This is equal to $10.41 per acre, or 69½c. per ton. If to this were added use and keep of horses, $125; interest at 6 per cent. on 40 acres at $80 per acre, $192; the use and wear of machinery, $25; entire cost of production would reach $758.64, or $1.15½ per ton. What then is the conclusion of the whole matter? Simply this: That three cows can be wintered seven months on one acre producing 16 tons of ensilage, while it required two acres of meadow in the same year, 1887, to winter one cow with the same amount of ground feed in both cases. It may justly be said that one ton of hay per acre is a light crop, and is often doubled. Sixteen tons of ensilage is not a large crop; 24 tons are often obtained."

A number of hand sketches of plans to supplement this article have been prepared and will be sent to anyone who has an intention of constructing a silo this season on application to the writer at Ontario Agricultural College, Guelph.

Our silo was constructed upon the plan recommended in the bulletin. It was 28 ft. x 12 ft. x 22 ft. 10 in. deep, inside measurements. A partition of 2 inch plank divided it into two compartments. Experience has taught us how to improve somewhat upon

the plans and structure. The foundation should be of substantial sills—not planks—upon very low stone walls. A silo not more than 20 feet deep is preferable. The studs should be at least 2 in. x 10 in; and if 18 ft. or more long, they should be 2 in. x 12 in. If a silo be built long and narrow, partitions may be dispensed with. Convenient size is 50 ft. x 12 ft. x 16 ft. deep, which will give a capacity of 150 tons. The floor was of earth. A covering of 4 inches of cut straw was put in before the filling began. The filling was commenced on September 4th. An ordinary Watson straw cutter with chain carrier was used, and the stalks were cut into inch lengths. An interval of two days was allowed to lapse after a depth of 4 feet had been put in, before the filling was resumed. The silage should be carefully and thoroughly tramped around the sides and in the corners of the silo just before each layer is filled in. It should be left lying loose until then. When putting in 8 or 9 feet of silage near the last, no such waiting was observed and the silage turned out in a very satisfactory condition. The main matter evidently is the proper growth of the crop to a state of almost maturity in each plant. The heating was progressive as the filling proceeded. The temperature began to rise first just underneath the exposed surface. Usually within four days it had reached from 128° to 150° fahr.

By 22nd September the temperatures were as under:

At a point	8	ft.	from	the surface	of the silage	and 12	ft. from the bottom	of silo, 110°.
"	14	"	"	"	6	"	"	125°.
"	18	"	"	"	2	"	"	128°.

After three days' settling two more layers were put on, the last one being added on 26th September. On 29th September a covering of 6 inches of pea straw uncut and 2½ feet of cut pea straw was put on after the silage had been well tramped around the sides and in the corners. The temperatures then were:

Near the surface of the silage				138° Fahr.
3½ ft.	from	"		82° "
10	"	"		102° "
16	"	"		122° "
20	"	"		116° "

No other covering than the straw was used and it proved to be simple, cheap and thoroughly effective.

On 8th November—40 days after the covering—one compartment was stripped of its straw. About one-fifth of the straw used had become mouldy or rotten. The temperatures then were:

At the surface of the silage				151° Fahr.
1 ft.	from	"	"	125° "
2	"	"	"	114° "
6½	"	"	"	110° "
14	"	"	"	106° "
17	"	"	"	92° "

The silage had then settled to a mass 17 ft. 8 in. deep. The total weight of the silage on the top, that was decayed or mouldy, was 690 lbs. That quantity was very wet by reason of the steam which had been held just under the straw. The mould was apparently the result of the top of the silage having cooled, after being heated, before the straw covering was put on. That damage can be avoided by the use of a light covering of straw as soon as the silo is filled. The remainder of the covering of straw can be put on two days later.

The last four feet of silage put in was from frozen corn. It was darker in color than the plants that were not touched by frost, but it was relished by the cows and its feeding value as silage did not appear to be appreciably lessened.

The records of the weights fed and the effects as far as revealed were lost in the most unfortunate calamity of the barn burning. Without the exact data, I am safe in saying that when fed in conjunction with suitable grain, every two tons of such corn silage would

produce as much milk as one ton of ordinary hay—not clover. 60 lb. of silage cost less than 5½ cents; whereas 30 lb. of day at $12 per ton cost 18 cents.

The intelligent farmers of the Province are now fully awake to the need for providing an economical feed for winter and summer use. *Fodder corn when grown to near maturity in rows or hills, wide enough apart to permit of a free circulation of air and abundant admission of light, promises to meet and satisfactorily supply the need. The silo offers the most economical means for preserving the full feeding value of the crop for cattle and swine.*

III.—SUPPLEMENTARY SUMMER FEED FOR MILKING COWS.

Upon the recommendation of the Advisory Board a series of experiments in the economical feeding of cows were undertaken. Seventeen ordinary cows were purchased at an average cost of $31.50 per head. Three of the cows which had been kept over from the dairy herd of 1886 were transferred from the farm herd. The changed appearance and increased milking power of these three cows, after two years of good feeding, were astonishing to those who do not believe in the improving virtue of good care for cattle. As has been already mentioned the records of the experiment were lost in the barn fire. Being unable to give accurate details I will nevertheless indicate some of the general conclusions which were confirmed by the summer's investigations.

I.—Milking cows need salt every day. Its withdrawal lessens the quantity and injures the quality of the milk.

II.—It pays to feed from 2 to 3 lb. of bran per cow per day even when the pasture is abundant.

III.—With only 20 acres of pasture run and that of a thin bottom, 20 cows were supplied with all the supplementary fodder required until 1st October from half an acre of oats and peas cut while green, and an acre and one-eighth of Mammoth Southern sweet corn. Each cow received a small daily allowance of bran besides.

IV.—It pays to feed bran, peas, oats, barley, linseed meal, oil cake, cotton seed meal or some other food rich in albuminoids with fodder corn.

V.—It does not pay to feed immature corn fodder when fodder grown to near maturity can be provided. The ever recurring loss during dry seasons which are hardly ever prepared for, still points dairymen to the need of and advantage from an abundant provision in the form of fodder for summer use. If not used then, the crop will be valuable for fall and winter use or for sale.

IV.—WORK IN CONNECTION WITH THE DAIRYMEN'S ASSOCIATIONS.

To indicate how part of my work as Superintendent of Dairying for Ontario became closely connected with the work of the Dairymen's Associations, let me here introduce some extracts from an address on the Education of Dairymen, delivered before the Annual Convention in Western Ontario, held at Listowel, January 11th, 12th and 13th, 1888:

Let me say that the dairymen's education should be not only practical, but should be also theoretical. It should have for its end not merely the acquisition of knowledge. The acquisition of knowledge should be pursued that it might be of use for the benefit of the man who gets it. Let me give you an illustration from ordinary school education. For what purpose does a boy learn the names of letters? He does not learn to write merely to know that certain lines of certain shapes on certain rules are called by certain names. He learns to write that he may communicate with and receive communication from others and become better acquainted with the world. Now, a man who studies dairying as a theo-

etical science should not study merely to know a lot of things for the sake of being able to repeat them. He should study it, not that he may know a lot of things, but that he may put them into practice as the boy who learns to write. Too many cheese makers have learned to know things about cheese but have not learned to put them in practice in the making and curing rooms. We want theory, but also practice. A dairyman should be a man not merely knowing some things, with power to remember, but one who is possessed of power to do things. This is the difference between education and the lack of it. Now, professional men need special education in the particular subjects lying along their line of life. I think dairymen should have as particular and thorough a training in subjects lying along their line of life as doctors, lawyers and clergymen. Dairymen need it equally with them and may profit as much by it. The primary purpose of education is to enable a man to make a living. I would not go as far as Mr. Derbyshire and say that the primary purpose of living was to make money. Even as dairymen the primary purpose of education is to make a living, and having made that to earn leisure.

There is this tendency in our age which is doing our young men much harm; they are so hungry for having money they have no appetite for being anybody. There is a difference between having a lot of things around a man and having something in one's self. Now, dairymen should educate their members that they may protect their members against every kind of fraud. It is a fraud which leads a man to believe that he can get half a cent a pound more for his cheese by palming them off on somebody while uncured. That fraud should be eliminated by better and higher education. It is a fraud which makes a man content with getting not enough from his cow for her keep to be eliminated. It is doing our business serious harm and should be fought against by higher and better education. Our common school system of education has done a great deal for us. Let me just fix a point here for dairymen. Dairymen say, "I commenced twenty years ago in this business and I had no special education for it; therefore, young men beginning now don't need it." Some men who began life on farms forty and fifty years ago had no special school education. They did not need it; competition was not so keen; the necessities of business were not so great. But no more can they succeed now on farms without common school education than dairymen can. It is a matter of life to the farmer. He requires to know more of the principles of agriculture. Competition is keener. So the dairyman will find his business increasingly hard, as it unquestionably is. When I commenced some twelve years ago I hardly knew what a floating or gasey curd was, but the last year I made cheese I had occasion to come in contract with them two or three times a day and had them for months continuously. In this way you see there is urgent need for thorough training, for a theoretical education, so that the cheese maker will know what he has to contend against and then be able to cope with the difficulties. Now, the professions manage the education of their members themselves apart from the school system. They encourage and support institutions for this purpose. Why should not dairymen do so among themselves? Dairymen are apt to think a professional man lives on a higher plane; that he requires greater ability, greater intellectual power than they do. I dispute that. A dairyman must of necessity be a business man; he must get a thorough, good business training. If he has not that as a progressive dairyman and comes in contact with such a well trained business man as my friend from Brockville he would recognize the need for a special business training in order to cope with a man with so clear a head for business. Besides that a dairyman is a tradesman. Still, I find that men who hardly know the names of the utensils in the factories do not know how to use their own tools as efficient tradesmen. For instance, they do not know which knife to use first to the most advantage. It is the same as though a joiner would be in doubt as to whether to use the long or small plane first. I find dairymen just as deficient in a knowledge of their tools as I am of the tools for carpentering. Dairymen should be good tradesmen. I should include the apprenticeship to this business. But a man who is merely a tradesman in a cheesefactory is never a success, for although a carpenter can cut wood to a given shape and size for a given purpose, he has always a similar kind of material and can depend upon it to be in the same condition every day. But the cheese maker deals with a substance which is not so easily managed, and, therefore, when he has to deal with chemical and vital forces, he

becomes a professional man and he should fit himself for his profession by special education. He may get that in many ways. He may get it by apprenticeship and private study; he may get it by apprenticeship and a course of instruction in a school specially established for this purpose; and a man will be apt to learn more in one weeks schooling from a competent teacher than in two years without that teacher. That is, he can get the first principles, and he should know afterwards how to apply them. Then he needs to be specially educated for another reason, because he occupies a most influential position in his own neighborhood. It used to be the understanding in my neighborhood that the cheese maker and young preacher were about equally influential in public affairs. The cheese maker should not only know the trade of cheese making but should be a leader of agricultural thought in his neighborhood. He should make the cheese factory a school house for agricultural education. He should be able to tell his patrons the most progressive methods of all dairying occupations, from the raising of calves and the feeding of cows up to the putting of his product on the market in the best shape. Now if he can tell his patrons how to raise calves well he will encourage them to raise them in spring before the factory opens, and so he will get more milk. He will get better stock in that neighborhood, and so he will be working for his own advantage and will be helping his neighbors to do better in their business. His work demands skill of the very highest order. And let me tell you that skill is always the product of education. Let me say a word to master cheese makers. Work in the factory is hard, and I believe it is often drudgery to the learners. Drudgery, however, is only attached to work when intelligent purpose is absent. The master cheese maker should carefully tell his apprentice the reason why and the purpose for which each bit of work is done—and so remove the element of drudgery. By such means the labor would be lightened and sweetened as would be the temper of the man and the master as well as the flavor of the cheese. We have had some good education of this sort in the past. We have had the benefit of this Convention. But that is not enough. Get any well edited sheet bearing on your business as dairymen. Read it regularly, and you will wonder how you did so long without one. Those who have heard Mr. Hoard have no doubt enjoyed his speeches. I have enjoyed the articles in his paper just as much. We have papers of our own. I read with a good deal of enjoyment the series of articles last year in the *Farmers' Advocate* on milk testing experiments. I learned a good deal from my friend Macdonald who wrote them, although I had studied the subject some time. We have the *Live Stock Journal* that looks after the dairying matter very closely from the stock feeder's point of view as well as from a practical farmer's point of view. However, be sure to get one good dairying agricultural paper. The men who need this education most are those who appreciate it least, and while we have had much help from the Convention, those who need help most are those who do not come here. We should then take a step further in our educational methods. We should make the information of these Conventions not merely available to every dairyman but indispensable to every dairyman, carrying light to his neighborhood, and by persistently taking hold of his judgment bring him into contact with knowledge. It is wonderful that the thing which a man should be reaching out for is the one thing we have to drum into him. If a man once gets an appetite for dairying knowledge he will always go where he can get it. When a man thinks that he knows all that can be known he stultifies himself and weakens his usefulness. Let me specify a few of the principal ways in which we could render this education more useful. I think we should organize special dairy classes where cheese making and handling of milk would be specially discussed. At the convention the time is so short that we cannot discuss these as we would like. One aspect would consume a whole session, leaving no room for other schemes. My plan would be this: That we should hold this spring no less than four, perhaps six, conventions of cheese makers in different sections lasting two days each for the one purpose of discussing dairy practice and cheese making. We should have convenient places and suitable dates. The meetings might be arranged in this fashion: The first day one session might be occupied with describing the use of milk testing instruments. Few cheese makers understand how to use those we have. They know their names but know very little else about them. Then we could explain the coagulation of milk. I have been at cheese making twelve years and I have learned more this last year about coagulation and its value than I ever

knew before and I think I can make better cheese by means of that knowledge. I should be glad to attend those meetings and would hope to get the help of the best cheese makers there. Instead of long speeches, we could tell experiences and ask questions. The best season of the year would be the month of March. Cheese makers say often, we cannot spare the time or afford the money. Now, if a man is going to make his living by cheese making he can afford any amount of money in reason, in order to qualify himself for his business. To supplement this we should have practical instruction all summer, because after all theory sometimes leads a man to a conclusion that practice may not sustain, because he has not got a right theory. Now, practical instruction and demonstration throughout the summer would impress the theory. Theory should not blind us to the facts, or it will become hurtful instead of helpful. Practical demonstration in the summer would enable a man to apply his theory intelligently. In the eastern part of the Province much valuable work has been done. We find competent men have been engaged for several years, and their services are in great demand by cheese makers. They have helped cheese makers all through that section, so much so, that whereas four years ago Brockville was always quoted 1½ cents below Listowel, now the quotation at Brockville is often just a little above Listowel.

These results are largely due to this system adopted by eastern men. The average price east of Toronto this year will exceed the price west of it by a large fraction of a cent not merely by market fluctuations, but before the changed market conditions had anything to do with the question. Now, I think the western part of the province should find work for four men all summer to go around amongst the factories and teach the makers the best methods of doing everything. The cost of these men through the province would be a mere bagatelle compared with the benefit to the industry. Systematic instruction by so many men would at once show its effects on the cheese makers. Frequent visits by a competent outside party would make the cheese maker mind his business better. Some men will work readily all day without supervision, but against four such men I could find a hundred who whould do better under it. The purpose of many cheese makers is to get cheese to pass the buyer's "trier" without complaint. We should have inspectors who if they found the curd sink or any utensil or fixture in the factory unclean would go to the bottom of the business and tell the cheese maker where his defects were and how to get rid of them. The very expectation of an instructor dropping in would make cheese makers do their work better, and we should have better cheese, just by the existence of this kind of inspection. It would have a good effect also on patrons, because if they expected a competent official to come once in two weeks and inspect the milk they would have a wholesome fear that the milk might not be right that morning, and so they would see that it was right every morning. So with the work of instructing cheese makers, there could be combined a very efficient system of the inspection of milk, and with economy by having them acting in both capacities. I think you all recognize the need of a more thorough system of milk inspection. We have to protect the rights of individual dairymen as well as the rights of the province as a whole, and stand between him and any man who would attempt to defraud him through the cheese factory. There is nothing will kill out a factory quicker or more thoroughly than that some man is suspected of skimming or watering his milk. The honest and honorable man who would otherwise stand by a factory will at once give it the go-by if he knows that the manager is taking in that kind of milk. The cheese maker though competent to inspect milk, is not the best man, for his position in the neighborhood, to inspect the milk and carry out a course decided on by the directors or committee. If he turns to charge a patron with being dishonest he is accused of being spiteful and having a sinister end in view. If an outside man were sent who did not know anybody, who had no interest or concern in pleasing any one, or offending any one, he could straighten the matter out. I think it is highly necessary to have this system crystalized into an organization for the coming summer. Then we need organization to extend our system of instruction in another direction. Patrons themselves do not need information given wholesale in a general way, but they need a helpful hand in the way of good sound instruction. Many men are willing to do right when they know how to do it. Many men send inferior milk just because they do not know what is the matter or how to mend it. This system of

instruction should include the holding of patrons' meetings at every factory, beginning in November. If we could get good meetings all through November and draw out from successful patrons a knowledge of any better method of dairying, they would in turn become splendid instructors of their neighbors in the best methods of producing milk and growing food. Every factory should have one or two of those meetings, and we should have some organization through which they could have some help for getting speakers from outside. Farmers as a rule will not attend a meeting merely to hear their neighbors, while they would to hear strangers. In that way business could be made more permanently profitable to every man engaged in it. We are trying to reach this end by means of Farmers' Institutes all over the Province, but the drift of the Institutes has been more to discuss the cultivation of soil and growing of food for cattle. To accomplish all this we need money, because a man cannot have a good article of any kind or knowledge or instruction on cheese making unless he is willing to pay a good price for it. I am glad your Association here has as much as $1,100 of money that belongs to the dairymen of this Province to be used for their benefit. It will receive a further grant of about $1,500 in a short time, making $2,600. Out of that I think the Association might spend nearly $2,000 the coming season in furthering this work. I know, sir, of no more sensible and profitable way to administer these funds than as I have indicated. In the east the money has been spent in this way in the past. They have no balance on hand but have managed each year to expend their money for such purposes. This year they recognize its value so fully that they have decided to ask every factory desiring such help to contribute $10 from the proceeds of cheese to a fund to be administered along with the association's fund for this purpose. Now I do not think a factory would miss $10 for a fund to be spent in this way. Each patron would not be assessed at a higher rate than from 10 to 25 cents at most, and I do not know the dairyman who would not be willing to pay 25 cents out of the proceeds of his milk, just to know that his factory was being inspected by an outside and competent authority. Thus the improvement and progress would pay us one hundred-fold for all we spent. There would be possibly an increase of price in this way. Now it is not enough that we have a reputation and have realized the highest price that is going, because if we stay here and other sections go on, instead of being first we will get to be last, even if we don't go back. We have to improve the quality of all the cheese we make and raise the standard up to the highest point for all our factories, else we will be left. We can thus protect ourselves by improving quality and increasing the price. Thus I believe Ontario would get back $1,000 in three years for every dollar spent in instruction and inspection. Directors, salesmen and owners of factories should take this thing up and carry it out. Directors and owners are not expected to be competent cheese makers. As a rule most of the directors would willingly pay $10 out of their pockets just to know that the cheese maker was doing right and that cheese was being turned out of the best quality. Every salesman knows when he goes to market that unless he knows his cheese to be first-class he cannot stick out for the last fraction of a cent.

If a man could get an inspector to visit his factory once a week, who could instruct with regard to the defects and good points of his cheese, he could make a better sale of his goods. There would be *higher* prices for better grades. Owners and directors should organize this work in their own districts. Of course, great things are made up of small things. I find that if a man tries to help twenty men at once in that direction he does not help any of them very well, but if he makes up his mind to help one man and then another he can help them all in a short time a great deal. Suppose we help twenty-five factories west of Toronto this year, we can help seventy-five next year, and one hundred and fifty the following year, and thus we will soon help all. The vastness of the work should not hinder the association from undertaking this organization. From the dairy department of the College at Guelph we could manage the correspondence as to the collection of the $10 from the factories to the fund to be administered by the Executive Committee of the Association. I have heard it said, I think, that you could get $2,000 more from factories to add to the $2,000 in the treasury of the Association, making $4,000 in all. This would pay for holding meetings, pay for the salaries of good instructors, and pay for advertising the fall meetings. I do not think dairymen could

spend $4,000 throughout the Province in any way whereby to get better help than in this way. We have also in view another part of this work by which we hope to help dairymen, that is with reference to issuing bulletins all summer, once a month, calling attention to the best practices for the whole season. The first of these will be supplied free to every factory man or cheese maker applying for them in sufficient number to give one to each patron. We are willing to do that as well as the correspondence. Our institution at Guelph is seeking a chance of serving you in the most effective way. I think we can make you recognize the value of our department there by service rendered. Now we can protect young men of our business against the evil influence of the tendency to despise manual labor by educating them to understand and appreciate and enjoy their work. I think it becomes our duty to do this and thus counteract this evil tendency, and bring out all the intelligent and intellectual power of our cheese makers. In doing that, we will protect our industry, will make more profit and will make ourselves better men. I have pointed out the need of this kind of education, and tried to point out the advantages which would accrue from it, and how it is easily attainable. Now, if we get your co-operation, I think we will make this Convention and Association tenfold more useful than it has been in the past; so that instead of the statement made yesterday being justifiable, that this Association has passed its day of usefulness, we will recognize that it is only entering upon a new area of usefulness, and has renewed its strength.

This was followed by the unanimous adoption of the following resolution :

"That the scheme for the further education of dairymen as outlined by Prof. Robertson's address be accepted as worthy of our endorsation, and that the directors of this Association be instructed to take steps to secure the services of competent cheese instructors and milk inspectors ; that we invite the co-operation of the Dairy Department of the Ontario Agricultural College, and recommend that patrons of each factory be urged to contribute $10 each to the funds to be administered for the foregoing purpose."

A resolution of similar import was unanimously adopted at the convention of the Dairymen's Association of Eastern Ontario, which assembled at Peterboro' January 4th, 5th and 6th.

Circular to Cheese Makers.

In carrying these plans into operation the following circular was addressed to the representatives of each of the 770 cheese factories in the province :

Guelph, 9th April, 1888.

Dear Sir.—The rapid and steady growth of the cheese-making industry of Ontario proclaims its adaptation to meet the needs and increase the profits of the farmers of the Province.

The educational aids of the Dairymen's Association in the past have given recognized and valuable help to those engaged in the business. Dairymen in other countries, who are our keen competitors, are now employing the services of skilled instructors, taken from our own Province, to improve the quality of their products. It becomes our duty, if we would maintain our reputation and foremost place in the English markets, to give our cheese makers similar assistance.

In this brief circular it will not be expected that I should attempt to specify the many substantial advantages that will accrue to the business, and consequently to *every patron of every factory* by an organized system of instruction and inspection.

The best factories and their patrons may expect as much benefit as those with inferior reputations.

As every pound of inferior cheese that finds its way to any consumer's table stops consumption and curtails demand, so its manufacture entails an injury on every producer of cheese. Our Provincial reputation modifies the relative price received for our cheese, and our reputation is established not at the standard of our best factories, but by the average quality of all our exports.

Most of the reresentatives of the factories to the Dairy Boards of Trade last season were more urgent than formerly in their expression *of the need* for such help as is proposed to be given by persons engaged by the Dairymen's Associations.

There is a growing impression that at many factories a few patrons tamper with the milk to a greater or less extent.

The official instructors will be provided with instruments suitable for the detection of such frauds, and will make a number of examinations of the milk received at each factory which agrees to contribute to the funds of the Association towards part payment of expenses.

Further legislation to simplify proceedings and make conviction certain, where guilt is clearly established, has been provided by the Legislative Assembly.

Some of the steps taken to bring the scheme for the further employment of instructors into effectual operation may be recited.

For two years the matter has been agitated and promoted by leading dairymen, among them Messrs. Thomas Ballantyne, M.P.P., D. M. McPherson, E. Caswell, D. Derbyshire, John Robertson, James Bissell, Robert Cleland, J. B. Lane, Wm. Symington, John Prain, B. Hopkins, Wm. Messer, and many others.

At the Annual Conventions of the Dairymen's Association, held at Peterborough and Listowel during January, 1888, I presented certain suggestions, pointing out the *needs*, *advantages*, *nature* and *means* for the further development and establishment of an educational system for the benefit of dairymen.

The following resolution will explain what has been done, and what is intended to be done. At Listowel Convention, it was moved by J. B. Lane, Esq., seconded by Wm. Symington, Esq., and

"*Resolved*, that the scheme for the further education of dairymen, and outlined in Prof. Robertson's address, be accepted as worthy of our indorsation, and that the Directors of this Association be instructed to take steps to secure the services of competent cheese making instructors and milk inspectors; also, Resolved, that we invite the co-operation of the Dairy Department of the Ontario Agricultural College, and recommend that the patrons of each factory be urged to contribute———to a fund to be administered for the foregoing purpose."—Carried unanimously.

A similar resolution was adopted unanimously at the Peterborough Convention.

At a subsequent meeting of the Directors of the Association for Western Ontario, it was decided that every factory making less than fifty tons of cheese per annum should be asked to contribute $5.00 each, and all larger factories at the rate of ten cents (10 cents) per ton of cheese.

Any factory not contributing will not be entitled to the services of the Instructors, who are expected to visit each factory, which contributes, at least three times during the season.

All the factories wishing to avail themselves of the services of the Instructors and Inspectors will please communicate with me at an early date by returning the enclosed form No. 2, duly filled up and signed.

I cordially and earnestly invite the co-operation of every factory in the Province.

The services of this Dairy Department of the Ontario Agricultural College are given freely and cheerfully to every and any dairyman; and no part of the joint fund made by the Association's grant and the contributions of the factories will be used by it. The whole will be applied to the payment of those persons engaged solely to render direct service to the factories.

Notes on the preparation and care of milk for cheese factories will be furnished free to any factory filling out the accompanying application.

JAMES W. ROBERTSON,
Superintendent of Dairying.

By a resolution of the Board of Directors of the Dairymen's Association for Western Ontario, the four milk inspectors and cheese-making instructors who were engaged for

the work indicated by the designation of their office were placed under my direction. The inspectors and instructors in eastern Ontario reported only to the President and Directors of the Dairymen's Association for eastern Ontario.

Occasionally as time could be spared from other duties, visits were made to a number of factories in company with the inspectors to examine into the efficiency and efficacy of their work. For the sake of conveying needed instruction in the making of cheese from so-called gasey milk, I wrote a brief account of a visit to one of our leading factories in western Ontario in company with the four gentlemen just referred to.

The first milk waggon arrived soon after 6 a. m. Our first task was to test the quality of the milk delivered. Out of 71 lots we found only one of rather doubtful quality; previously the milk of the same patrons had been examined and about one-half of the lots were held to be wanting in fat. Thanks to the beneficial influence and work of dairy inspectors, there is a general improvement in the quality and condition of the milk supplied to cheese factories. After the milk was all weighed, attention was turned to that in the vats, which meanwhile had been heated to 86° Fahr. By reason of the cold of the previous night, it was found to be in a condition too sweet for the immediate addition of rennet; one vat was heated to 90°, the other to 86°, and left to mature for from one and a half to three hours. The degree of ripeness, or maturity of milk, can best be ascertained by its odor. If a large dipperful be lifted from the vat and poured back into the bulk of the milk from the height of a foot or two, the odor given off by that method of disturbance, can easily be discerned. Gasey curds and porous cheese frequently results from the setting of immature milk. There is much advantage in properly ripening the milk, before the addition of rennet. Warmth and frequent stirring, or any suitable method of aeration are the means best suited to bring about the required state. The use of sour whey is objectionable since it frequently introduces some sort of bad flavor. In the cold weather of fall, a quantity of old milk, kept in a pure atmosphere and not at all thickened will serve the purpose; while during the summer months, heating in a vat and airing by stirring will suffice. Cheese makers have not paid enough attention to that matter. In point of the time required, it is better to wait for an hour or two on the ripening of the milk than twice as long at a latter stage on the ripening of the curd. But to come back to my narrative. Coloring for each vat at the rate of 1¼ oz. per 1,000 lbs. of milk was first diluted in a pailful of water and then thoroughly mixed with the milk. Rennet extract at the rate of four ounces per 1,000 lbs. of milk was used in a similar way. There has been a good deal of timidity on the part of cheese-makers in the matter of using rennet. In hot weather and with tainted milk, or milk from which gasey curds are likely to come, a very liberal use of rennet leaves less risk of inferior quality. Tainted milk is always difficult of coagulation; and cheese made from milk in which all the caseine has not been thickened will quickly go off flavor. Firm coagulation will cause the retention of more moisture in the curd. Moisture retained by such means will favor the mellowing of the curd and prevent the tendency to a "corky, pin-holey," condition. With milk sufficiently ripened, as already recommended, enough rennet should be used to effect coagulation firm enough for cutting in at least forty minutes at a temperature of 86°. With tainted or "gasey" milk thirty minutes is a better limit. A larger yield and superior quality will be obtained by allowing the curd to become quite firm before commencing to cut it. For cutting, the horizontal knife should be used first and lengthwise. The perpendicular knife may then be used crosswise and afterwards lengthwise. With knives of ordinary fine gauge between the blades, three cuttings are sufficient. In the case of a quick running curd, four cuttings will promote the drying of the curd, while the heating proceeds. The use of the horizontal knife first, leaves the curd in a state less likely to cause it to run into lumps during the heating. The cutting was carried on continuously until completed, and the stirring began immediately thereafter. The hands were used for two rounds to free the curd from the sides and bottom of the vats. Then, to save the back, a common hay rake with its handle cut off short was used to continue the stirring; when handled with care, the curd can be kept in motion and free from matting by the use of the rake, with less damage and waste than by using the hand. After ten minutes of steady slow stirring, steam was turned on;

the stirring was continued for fifteen minutes after the limit of heating (98 °) was reached. About this time an odor threatening a "gasey" curd was detected from one of the vats. I will describe the treatment of it only. The milk had been set rather unripe, and a consequent delay of two hours or more was the penalty; the temperature was kept at 98 °, and rather more than half of the whey was removed. The hot iron test was applied to the curd at intervals. As soon as fine hairs over one-eighth of an inch long were discerned, the temperature was increased two degrees and the rest of the whey drawn off; the curd was then dipped into a sink with racks and strainer cloth. It was stirred by hand until fairly free from whey. Rough stirring or bruising of the curd was not indulged in. Even in cases where the curd is unusually soft it had better be turned by gentle rolling of the pieces on the sink than by violent stirring or rubbing. When curds are inclined to be "gasey," it is not desirable to stir them so dry before the matting and packing as in other cases. The moisture favors the development of acid in opposition to the generation of gas, and any excess of it can easily be got rid of after the acid has mastered the cause of the gas formation. The curd was then covered with cloths and left at rest to mat into one mass. When it was firm enough to handle without separating again into particles, it was turned. The turnings were repeated every ten or twenty minutes, and every time the whole mass was packed closer and piled higher, until the layers were five or six deep. There was no convenience attached to the sink for heating the curd. Its surface began to cool and present a rather corky and springy body. To prevent further cooling and to correct the other fault, a few pailfuls of water heated to 125 °, was poured over the covering cloths and allowed to percolate through them on to the curd. In every case where the curd becomes gassey it should be kept warm (above 94 °) and moist. The use of hot water, poured or sprinkled on it, will be beneficial. A temperature above 94 ° favors the development of acid much more than the generation of gas, and in cheese-making these two are antagonistic. A temperature below 90 ° favors the generation of gas, more than souring, and so hinders the "coming on" of acid. With two and a half hours of such treatment after the dipping of the curd was found to be mellow, ripe, or sour enough for cutting. That condition is judged (1) by the velvety, slippy feeling of the curd; (2) by the change of the flakey texture into a stringy and fibrous one; (3) by an odor like that of freshly churned butter from slightly loppered cream; (4) by the liberation of the butter fat when a handful is tightly squeezed. After the use of the curd cutter or grinder, hand stirring to cool below 90 ° and to aerate the curd will prepare it for the addition of salt. In the case of a very bad "gasey" curd it is beneficial to cut or grind it within an hour after dipping. It should then be aerated by stirring for five or ten minutes. Hot water may be applied freely, warming the curd to 98 ° or 100 °. It may then be allowed to mat again, and its management and treatment be proceeded with as in other cases. Salt was added at the rate of 2½ lb. of Canadian salt per 1,000 lb. of milk. When the curd is sloppy or wet, rather more salt should be used to make up for the waste that goes off with the whey. The curd was put to press within fifteen minutes after the salt was stirred in. A delay at that stage often injures the flavor and prevents the securing of a uniformly solid body. Too much care cannot be exercised in the matter of finishing the cheese with a symmetrical appearance. Edges or shoulders from careless pressing, bandaging or turning are a discredit to any maker's workmanship. The press cloths should be left on the ends of the cheese until within two or three days of the boxing. On the morning of our visit cheese were being shipped, and right tastefully and neatly were the boxes gotten up. It should be always so at all factories.

The full reports of the work of these inspectors have not yet been received. They will be found in the report of the annual convention of the association, which assembles at London, Jan'y 16th, 17th and 18th, 1889. They paid 438 visits to 152 factories.

The Ontario Creamery Association also appointed two butter-making instructors to aid in the improvement of creamery butter. Our late butter maker at the college creamery, Mr. John McHardy did the work in western Ontario in a most satisfactory manner, as did also Mr. M. Sprague in eastern Ontario. Their report will be found in the report of the convention which meets at Picton, 10th and 11th of Jan'y, 1889.

The work outlined under this head, with its associated duties, necessarily occupied much time and involved some travelling and printing expenses; but the services rendered to the most important of all our agricultural interests, the cheese and butter industry of Ontario, fully justified the use of both time and money.

V.—PUBLIC MEETINGS.

Besides the meetings of the executive committees of the Dairy Associations, I attended on behalf of the dairy department of the college, their three annual conventions. I also addressed 41 Farmer's Institutes and 21 other public meetings held for the discussion of subjects relating to dairy husbandry.

VI.—COLLEGE LECTURES.

A short course of lectures, mainly relating to dairy cattle, was given to the students of the first and second years during the fall term. More and needed time is thus left for instructions during the spring term in the manufacture of dairy products. An erroneous conception has prevailed in some quarters that the dairy department comes into service only in the manipulation of milk. Dairy husbandry begins at the soil and seeks through the economical growth of plants adapted to the feeding of cattle, to increase the available food supply per acre of the whole country. The following is a specimen of the outline of one lecture, a copy of which is put in the hands of each student before the explanatory lecture is commenced.

VII.—BULLETINS.

Since my last report the following Bulletins have been issued: Of the one on Care of Milk for Cheese-making, over 40,000 copies have been sent out in response to requests from dairymen. All the bulletins were distributed as far as possible to the patrons of cheese factories and creameries.

The Elaboration of Milk.

1. Milk is secreted by and in two longitudinal glands, commonly called the udder.
2. These two are separated by a fibrous partition, which is attached to connective tissue under the skin. That tissue also spreads through the udder, apparently for its support in position.
3. The udder is spoken of as having four quarters. That is popularly correct, although the division between the two quarters on each side is not definite or distinct.
4. The gland stripped of its covering, is a reddish-grey substance. In dry cows the deposit of fat in the connective tissue give it a yellowish appearance.
5. The internal canal of the teat opens into a milk cistern.
6. The total quantity of milk held in the four cisterns or reservoirs at the top of the teats will seldom exceed one quart.
7. Numerous ducts rise from these and branch into all parts of the udder.
8. The ducts and their branches become smaller as they spread, until each one ends in a vesicle, or "ultimate follicle," about 1-30 of an inch in diameter.
9. Into these cavities, the serum of the milk—its water, caseine, sugar, albumen, etc.,—seems to pass from the arterial blood through capillary tissue.

10. A change in the cell albumen of the blood is believed to take place during that transition.

11. The inside of each vesicle is studded with innumerable cells. Through these the fat is produced supposedly by budding.

12. There are ordinarily about 1,000,000,000 of these globules in a cubic inch of milk.

13. They have no organic pellicles or so-called skins.

14. The activity of secretion depends largely upon the vigor of the blood circulation.

15. The production of fat depends mainly upon the temperament of the cow, gentle handling, and feed rich in protein.

16. Violent disturbance of her nervous system has a disastrous effect upon the cell action and capillary activity in most cases.

17. Arteries, veins and nerves together pervade the whole of the udder structure.

18. New ducts, such as those referred to in No. 7, are formed by branching or sprouting out from others.

19. Rubbing of the udder, rapid and clean milking will promote their growth and development until the sixth year.

20. A pressure of fat in the connective tissue on the gland interferes with and hinders the secretion of milk.

Short Hints on Cheese-making.

It is not the purpose of this paper to discuss the science of cheese-making, but to state in a series of simple sentences the best practice for Canadian factorymen. If many of them to the old hand seem superfluous, their advice is none the less needed in a large number of factories.

1. Use every endeavour to educate your patrons how to produce milk of the best quality, with the most profit.

2. Give each one a copy of "Points for the attention of Patrons of Cheese Factories."

3. Carefully inspect the milk cans, especially the seams inside the covers, once every week; any offensive matter appearing yellow when wet with milk is most dangerous to the flavour and keeping qualities of the cheese.

4. Insist on a careful straining immediately after milking.

5. Send a circular or note to every patron two or three times a year, urging care in the airing of all milk.

6. Visit promptly the farm, pasture, stable, milking-yard, milk-house and milk-stand of every patron whose milk comes tainted after he has been notified of its bad quality; some apparently trivial matter that has escaped attention will generally be found as the cause.

7. Where whey is returned in the milk cans, urge the owners to empty them as soon as received, and not to feed the whey near a milk-stand, milking-yard or other place where milk is kept.

8. Examine carefully the inside and outside of the opening from the weighing can into the milk conductor; and just after using look into the conductor very closely for any traces of the yellow matter referred to in No. 3.

9. Do that every day.

10. Entertain a "creepy dislike" for the use of a strainer, cloth, dipper, pail or thermometer which feels greasy, or that has a miser's store of matter-out-of-place in the corners.

11. Lift the pans of the milk vats out of their places for a thorough cleaning of the water-pans once a fortnight.

12. 84° or 86° Fahr. are satisfactory setting temperatures when the milk is in good condition.

13. Over-ripe or acidy milk may with advantage be set with as high as 96°, according to the degree of its ripeness. See also 26.

14. During October and November the milk, before setting, should be sufficiently ripened by the addition of old milk kept in a pure atmosphere, or by the application of heat to the whole volume of milk some hours previous to putting in the rennet.

15. In the use of colouring, the annatto extract should be diluted to the extent of one gallon of water to every vatful of milk, and then thoroughly stirred in.

16. Pure rennet extract of powder of *known* strength is indispensable.

17. The quantity used should be regulated according to the condition of the milk.

18. The first discernible action of rennet is to coagulate the milk into curd.

19. To perfectly coagulate the milk from fresh calved cows, more rennet is required than later in their milking season.

20. The more rennet there is used, the more moisture will there be retained in the cheese under similar conditions of making.

21. The more moisture there is retained in the cheese the more quickly will it cure under equal conditions of temperature and atmosphere.

22. For quick curing cheese, as much rennet should be used as will thicken for cutting in from fifteen to thirty minutes at a temperature of 86°.

23. For summer and fall cheese forty-five minutes should be allowed for the same process, with milk in good condition.

24. The second evident action of rennet is to effect a separation of moisture by a contraction of the curd particles.

25. The raising of the temperature up to 98° Fahr. provides increasingly favorable conditions, and thus promotes the rennet action.

26. When milk is over-ripe or acidy, a proportionately increased quantity of rennet should be used to effect a sufficient separation of the moisture from the curd (often termed "cooking,") before the presence of lactic acid is perceptible to the taste or smell, or is discernible by the hot iron test. See also 13.

27. Observation of the foregoing would remedy many so-called mushy curds, and avoid the danger of "leakers."

28. Rennet should be diluted to the volume of at least one gallon of liquid for every vat before being added to the milk.

29. It should be thoroughly mixed by vigorous stirring, otherwise coagulation will be very imperfect.

30. The results of late investigations recommend an allowing of the curd to become fairly firm before commencing to cut, except in the case of a quick curd.

31. More moisture is retained in the cheese, and a better yield is thus obtained. See also 21.

32. The horizontal knife should be used first, lengthwise, and then followed by the perpendicular knife, crosswise, after the whey has separated to half cover the curd.

33. The mesh of the knives should be so close that three cuttings would suffice, except in the case of a quick curd, which should be cut unusually fine.

34. The knives should be moved fast enough to prevent much disturbance of the curd by pushing.

35. Gentle and slow stirring should begin immediately after the cutting is completed.

36. The hand should be used to free the sides and bottom of the pan from any curd that may have adhered.

37. The application of heat should be delayed for fifteen minutes after stirring is commenced.

38. The heat should be applied through the medium of warm water to avoid scorching of the curd.

39. The temperature should be gradually raised to 98° Fahr. at a rate not faster than one degree every four or five minutes.

40. In the case of a quick curd, Nos. 37 and 39 may be disregarded.

41. Stirring should be continued till the curd is properly "firmed" or "dried."

42. When the hot iron test shows fine hairs, from $\frac{1}{4}$ to $\frac{1}{8}$ of an inch long, the whey should be removed.

43. If acid be discernible by the hot iron test before the curd is so properly

"firmed," the whey should be immediately removed and the stirring continued till that firm condition is brought about.

44. In both cases the dry curd should be kept at a temperature above 92° Fahr.

45. *After the curd is dry* or *firm enough, but not before*, it may be allowed to mat into one mass.

46. It should be frequently turned and packed close, till the layers of curd are four or five deep.

47. Whey should never be allowed to gather in small pools on the curd at this stage.

48. The conditions of the curd, as to when ready for cutting and salting, are best ascertained by the use of the senses. The usual order of reliability for that purpose is by touch, smell, taste and appearance.

49. The proper degree of change has taken place when the curd feels mellow, velvety and greasy; smells like new-made butter from sour cream; tastes aromatic rather than sour; and shows a texture passing from the flaky or leafy into the stringy and fibrous.

50. When the curd is gasey or very porous, souring should be allowed to go further before it is arrested by the cutting and salting.

51. If the curd be too moist or soft it should be cut or ground at a rather earlier stage, and hand-stirred some time before the addition of salt.

52. In both of those cases it should also be well aired by stirring before being salted.

53. It is generally beneficial to stir the curd for five or ten minutes after cutting or grinding before the salt is applied.

54. The results of the tests made last season (1886), for the Western Ontario Dairymen's Association, indicate that Canadian salt is better for cheese-making purposes than English salt.

55. One pound and three-quarters of pure salt per 1,000 pounds of milk is a maximum quantity for April and early May cheese.

56. From two pounds to two and three-quarters pounds of salt per 1,000 pounds of milk is the range for summer use on fairly dried curds.

57. Where extra rennet has been used, or where the curd is sloppy, a corresponding increase of salt should be applied.

58. One important action of salt is to dry the curd and cheese, and thus retard the curing.

59. The curd should be hooped and pressure applied within twenty to forty-five minutes after the salt is stirred in.

60. The desirable rosy flavor is lost by delay at this stage.

61. Pressure in the hoops should be continuous, at first light and gradually increasing.

62. The followers should be loose-fitting, and canvas press rings used.

63. Particular care should be taken to use only pure water when turning the cheese for bandaging, before the ends are fully closed.

64. Greasy water is sure to percolate into the body of the cheese and leave nasty flavors.

65. The curd-cutter or grinder must be thoroughly cleaned every day; wretchedly bad flavors are frequently sown in cheese from neglect of this.

66. Curd sinks should be furnished with racks having slats bevelled to an edge from both sides.

67. The racks need thorough scrubbing on both sides every day, and should be turned out for airing over night.

68. A sink cloth that shows clogging by yellow matter should be burned at once.

69. Occasional soaking over night in a strong sal-soda solution is beneficial.

70. The curd whisk has been a fruitful scatterer of bad flavors, a hair brush is more easily kept clean.

71. The hoops and press tables require to be rinsed with hot water every day, and scrubbed on both sides twice a week.

72. All cheese should be turned in the hoops in the morning to give finish to the shape and body.

73. The press cloths should be left on for a fortnight, or till within a few days of the time for shipment.

74. No cheese should be taken to the curing-room till the shape is true and the edges well made.

75. The curing-room floor should be frequently swept, the shelves thoroughly cleaned after each shipment, and the air kept pure by suitable ventilation.

76. The curing is effected by fermentation, while heat up to 70° makes a favorable condition, and cold under 60° an unfavorable condition for its operation.

77. A temperature of from 70° to 75° Fahr. should be maintained for curing spring cheese.

78. From 65° to 70° Fahr. is the best range of temperature for the curing of summer and fall cheese.

79. The cheese should be turned on the shelves once a day till at least three weeks old.

80. When press cloths are stripped off, use warm (but not hot), pure, sweet flavored grease on the rinds.

81. Just before boxing summer cheese grease them, and apply scale-boards while the grease is stilll soft.

82. Mark the weight of each cheese in neat figures on the hollow of the side of tha box.

83. Let there be two scaleboards on each end of the cheese in the box.

84. The edge of the box should be level with the cheese, and the cover should fit close.

85. The band of the box cover should be at least $\frac{1}{4}$ of an inch thick to give additional strength to the package.

86. Insist on the teamsters using only clean wagon or sleigh boxes in which to take cheese to the railway station.

87. See that the flues of the steam boiler are cleaned out every week.

88. *Finish all of every day's work each day, in the very best way you can.*

89. Keep everything in and about the factory scrupulously clean.

90. Keep a correct and detailed record of every day's make.

91. Occasionally compare the working of your factory in all its details with the foregoing recommendations.

Tests of Salt in Butter-making.

That the influence of salt on the quality of the butter to which it is added is not confined to the imparting of a salt flavor, has long been admitted. A few tests were undertaken during the season of 1886, at the Agricultural College Creamery, from which it was expected that conclusions useful for the guidance of butter-makers could be drawn; but little steady light is thrown by them on the disputed point as to which salt is the best for preserving butter. Many defects in quality, recognized after the lapse of time and which have been attributed to the use of unsuitable salt, will have to be laid at the door of some other condition or cause.

On August 12 several lots of butter were weighed from one churning and salted with salt of as many different brands, at the rate of one ounce per pound of butter.

On August 13 the same was done with the butter from another churning.

On August 15 and 21 two tests were prepared for, in a like manner, with the use of three-quarters of an ounce per pound of butter.

On August 26 and September 3 a rate of half an ounce of salt per pound of butter was applied in the same way.

From four to six lots of butter were weighed from the same churn, on each of these six occasions.

The butter was packed in tin-lined tubs and kept in a cellar where the temperature was purposly made to fluctuate from 40° to 55° Fahr., to try its keeping qualities.

The Canadian makes of salt used were Coleman's, Kidd's, Rice's and Roger's; the English makes used were Ashton's and Higgins'.

At the convention of the Ontario Creameries Association held in Toronto in March, 1887, F. W. Fearman, Esq., Hamilton; James Park, Esq., Toronto, and Thomas Johnstone, Esq., Toronto, were appointed a Committee of Examination. The judging was deferred till 22nd and 28th March. The different lots were known to the judges by numbers only, there being no indication on the tubs as to the kind or quantity of salt used. The object of the judging was, to arrange in the order of their merit the different tubs in each lot from the one churning.

There was the widest difference of opinion in some cases among the judges as to the relative merits of the different tubs in the same lot. Some butter salted with every one of the different brands of salt was awarded by merit the first place in at least one of the several comparisons. No one kind showed such superiority over the others, on the average of the tests, as to deserve special mention. The average merit of the Canadian salt was slightly higher than that of the English, but the average loss of weight by the addition of salt and working was slightly in favor of the English article.

In a comparison as to the qualities of the butter from using different quantities of the same salt in several lots from one churning at the end of six months, the butter salted three-quarters of an ounce to the pound was placed first; one ounce to the pound second; one-half ounce to the pound third; one and a quarter ounces to the pound fourth; one-quarter of an ounce to the pound last and very inferior.

In cases where the salt was slow of dissolving and where the butter had been left without the addition of fresh brine, the resultant porosity of body caused it to go off in flavor.

Contact between the salt-plaster and the wood of the tub covers seem to convey and impart a woody flavor to the top of the butter.

I would recommend—

I. The use of pure, clean salt of as nearly as possible uniform sized grains, which dissolve readily and completely before the butter is worked the second time.

II. The use of a parchment or parafine paper covering on the top of the salt-plaster.

III. Attention to the frequent brining of the tubs to replace the moisture removed by evaporation.

IV. Care in keeping the temperature of the store-room steady.

Care of Milk for Cheese-Making.

In dairy matters, as in most other affairs, continuous progress is essential to success. practice. The philosophy of successful dairying is like that of bicycle riding,—the man who does not keep going on will quickly go off. Thus, in order to maintain our reputation as dairymen, we must improve and increase the quality and quantity of our dairy products per cow and per acre.

The one aspect of dairy practice that will be presented in this Bulletin, while perhaps less interesting than others that might be treated, is nevertheless one of vital importance to the persons who have to do with the manufacture of cheese, viz., the preparation and care of milk for cheese-making purposes.

Before the dairyman undertakes to prepare milk for a cheese factory, he should make careful provision for his cows that they may have a chance to yield good, wholesome milk. While the products of milk may be easily preserved from speedy decay, it is impossible to reorganise good milk out of that which is inferior in the first place. Hence I urge upon every dairyman the importance and necessity for keeping only healthy cows. They should receive plenty of nutritious and wholesome feed. The quality of the fe

will show itself in the milk and cheese. General experience certainly points to the conclusion that unless we have well-fed cows we cannot have milk of either fine flavor or satisfactory keeping quality.

Cows should have access to *pure* water only, and that in abundance. We have found a great many farmers careless as to the quality of the water which their cows drink. They seem to imagine that if the cows drink anything liquid, the milk will not be in any way affected thereby. I have even known farmers to argue that cows like to drink stuff that is not fit nor good for them. So do some other animals; but the *animal* is not always the best judge. The superior intelligence of the dairyman is always indicated by the special care he gives to the surroundings of the cows.

I have examined milk under the microscope and found therein microbes that had been taken into the system of the cows through the water which they drank. It is possible to destroy those microbes in the process of cheese-making, but it has not been found possible to impart to such milk the fine flavor which it would have possessed had the water been pure. Cheese made from such milk will not keep sound as long as if the cows had drank only pure water. It is not possible to make cheese of fine quality unless the milk used is clean, pure and wholesome.

Another requirement is that cows should have access to all the salt they care to lick, as often as they like to take it. It is often said that if cows be allowed to take as much salt as they like they will take too much, and thereby harm themselves. When denied access to salt for some weeks, or even days, they will take too much when a chance is got.

We made a simple experiment in 1886 to define the effect of salt on milk. Eleven cows were divided into four groups, so arranged that the cows of two groups had no access to salt, while those of the other groups had access to all they liked to take. Within two days the cows of the former groups had fallen off in milk yield 17½ per cent.; while the others, on the same feed, on the same pasture, and under the same conditions and care, had not fallen off appreciably. After twelve days, a change of the groups was made, one group on and three groups off salt rations, when an almost similar result followed. The yield of the three groups not having salt was reduced on the average 14½ per cent.; while the yield of the one group with access to salt every day had not been lessened during the test. Each cow of the latter group consumed a quarter of a pound of salt per day.

The effect upon the quality of the milk for cheese-making was also shown. It was found that the milk from the cows that had no access to salt turned sour in twenty-four hours less time than the milk from cows on the same feed that had daily access to it. I have frequently had occasion to attribute the taint in milk to the fact that no salt had been fed to the cows.

The salting of cows as often as once a week is not sufficient. In Ontario we are said to be the most church-going and religious people on this continent. That is our reputation. But one practice performed with religious regularity, is all too prevalent. Many dairymen salt their cows only on Sunday afternoons. That practice is no better for the cow than for the man.

Another essential condition for the production of good milk is that the cows be kept free from all foul odors. Many farmers do not understand the delicate sensibility to smells that cows possess. Several years ago a case came under my notice where the milk from a patron owning some twenty-five cows was rejected at the cheese factory. He could not locate nor explain the cause of the trouble. I visited his farm, travelled over his pasture and found in the woods the unburied carcass of a horse which had been hauled there the previous spring. The cows often pastured in the field near by and their milk was positively offensive both to the smell and taste. The carcass was buried at once and no further trouble was experienced with the milk. It is still desirable to emphasize and impress a knowledge of the need for having all milking animals kept under such conditions of location that the air is practically pure, or free from all contaminating taints.

Foul smells in the stables result sometimes from the generosity of the man who attends to the feeding. He will feed so often and so much that every one of the cows will have indigestion, with all its accompanying disagreeable odors.

If the cow is abused in any way she inflicts upon her owner the only retaliation she can. She reminds him of his duty to be kind and good to her, by withholding the milk

which he requires. For cheese-making particularly, the flavor and quality of the milk depend largely upon the disposition of the man who manages the cows.

Trouble is frequently had with inferior milk because the cows have been chased home by "that useless dog." He is more expensive to keep on a dairy farm than a first-class cow. *Shoot him this week!*

Milk should not be used for cheese-making within four days from the date of the calf's birth. It should be protected against all contamination from foul odors that may be adjacent to the place of milking, or which may come through the air. Taint may also be imparted from the vessels used by the milkers, but oftener from their hands. When in Denmark, two years ago, I took some pains to study the methods of an excellent farmer who keeps no less than 250 cows in one stable. One of the regulations of the stable was that every milker should wash his or her hands after milking two cows. The rule was invariable, and the butter from that herd brought at least ten or twelve shillings per cwt. more than the price of ordinary first-class Danish butter. The owner attributed a large measure of his success to the observation of that one practice.

Having the drawn milk, and the pails being clean—as they generally are since the women folks look after them—the milk should be thoroughly strained. A deal of trouble has arisen from the use of strainer-pails, simply because there is often an accumulation of impurity liable to be hidden from the eyes of the washer. Children have been known to get dangerous attacks of illness from contact with that kind of stuff. The germs it contains can be killed by lactic acid, but prevention is better than cure.

The milk should be strained *immediately* after milking. Some foulness may have fallen into it and the sooner it is removed the less likelihood is there of its being made soluble in the milk.

After the straining is attended to, the milk should be aërated. Too often it is poured into one large can and left there just as the cows have given it. That neglect implies three things that are very injurious to its quality for cheese-making. (1) The peculiar odor which the cow imparts to the milk will be left in it until it becomes fixed in the flavor. (2) The germs of fermentation that come in the milk and from the air have the best conditions for growth and action when the milk is left undisturbed. (3) Then the milk will become almost unfit for thorough coagulation by rennet. Hence it is needful and advantageous to aërate milk for three reasons:

1. By either pouring, stirring or dipping, or by trickling it over an exposed surface of tin we try by evaporation to eliminate from the milk any objectionable volatile element that may be in it.

2. It has already been stated that milk contains germs of fermentation. Some of these we call vibriones. A strange peculiarity about these vibriones is that they become active only in the absence of free oxygen. When warm milk is left undisturbed carbonic gas is generated, and that furnishes the best condition for the commencement of action by these microbes. After they get started they can keep up their decomposing work even in the presence of oxygen. It is impossible to coagulate such milk so as to yield a fine quality of keeping cheese. Coagulation by rennet can never be perfect unless the milk has been thoroughly aërated immediately after it is taken from the cow. *Neglect of aëration will increase the average number of pounds of milk required for a pound of cheese.*

3. The airing seems to give vigor to the germs of fermentation that bring about an acid condition of the milk without producing the acid. So much is this so that it has been found impracticable to make strictly first-class cheese from milk that has not been aërated, or from milk that has not sufficient age before the operation of making is commenced.

The subsequent cooling of milk retards the process by which it is turned sour. A certain kind of germ of fermentation exists in milk, which in the act of multiplying itself splits one molecule of sugar of milk into four molecules of lactic acid. Thus by delaying that operation the milk is kept sweet longer. The *cooling* of the milk should never precede the aëration; it should always follow it. A temperature of from 65° to 70° Fahr. will be found cold enough for the keeping of milk over night.

Moreover the milk requires special protection against any foulness in the air

Everyone has observed that if a pitcher of cold water stand in a warm room, drops of water from the air will immediately begin to condense upon the outside surface. The colder the pitcher and the warmer the air, the greater will be the condensation. In the same way the colder the milk becomes as compared with the temperature of the air the greater is the condensation from the air on its surface. The cream is very often foul from that cause.

When the whey from the factory is drawn to the farm, a common practice is to empty the can right at the milk stand. Having done that, the owner little thinks of the impurities thereby imparted to the milk, impurities that are certain to get into the cheese.

I have heard of ladies who were so nice in the handling of milk that they objected to send to the factory "the nasty yellow scum" which rises after the milk stands over night; but I never knew a cheese-maker in Ontario to complain of receiving an excess of it.

I confidently trust that the good sense and sturdy honesty so characteristic of the farmers and their wives as a class will uphold and aid the efforts of the cheese-makers and milk inspectors in trying to stamp out the practice that has been creeping in of late, in the way of taking off cream or keeping back strippings from the milk supplied to factories.

A copy of the Act passed at the last session of the Ontario Legislature, relating to that matter is attached to this Bulletin. The Bill was recommended by the Dairymen's Associations, and was passed under the charge of Mr. Thomas Ballantyne, M.P.P.

At the risk of repeating, and for the sake of emphasizing what has been already written, the gist of the foregoing suggestions is gathered into 17 short paragraphs.

1. Milk from healthy cows only should be used, and not until at least four days after calving.

2. Any harsh treatment that excites the cow lessens the quantity and injures the quality of her yield.

3. Cows should be allowed an abundant supply of wholesome suitable food, and as much pure water as they will drink.

4. A supply of salt should be placed where cows have access to it *every day*.

5. Cows should not be permitted to drink stagnant, impure water, nor to eat cleanings from horse stables, leeks, turnip tops, nor anything that would give the milk an offensive taint.

6. All milk vessels should be thoroughly cleansed; first being well washed, then scalded with boiling water, and afterwards sufficiently aired to keep them perfectly sweet.

7. Cows should be milked with dry hands, and *only after* the udders have been washed or well brushed.

8. Milking should be done and milk should be kept only where the surrounding air is pure and free from all objectionable and tainting odors. Milking in a foul-smelling stable or yard imparts to milk an injurious taint. Sour whey should never be fed, nor should hogs be kept in a milking yard, nor near a milk stand.

9. Tin pails only should be used.

10. All milk should be properly strained immediately after milking, and for that purpose a detached strainer is preferable to a strainer-pail.

11. In preparing milk for delivery to a cheese factory it should immediately after straining be *thoroughly aired* by pouring, dipping or stirring. This treatment is as beneficial for the morning's milk as for the evening's, and is even more necessary when the weather is cool than when it is warm.

12. In warm weather all milk should be *cooled* after it has been aired but not before.

13. Milk kept over night in small quantities—say in tin pails—will be in better condition than if kept in larger quantity in one vessel.

14. When both messes of milk are conveyed to the factory in one can, the mixing of the morning with the evening's milk should be delayed till the milk-waggon reaches the stand.

15. While the milk is warmer than the surrounding air it should be left uncovered, but when colder it may with advantage be covered.

16. Milk pails and cans should be protected from the rain, and milk stands should be constructed to shade the cans from the sun.

17. Only honest milk with its full cream and full share of strippings should be offered; violation of this requirement leaves the patron liable to a heavy penalty.

So far as the Dairy Department here can further help dairymen in the direction of making their business more profitable it will freely and cheerfully give information to all who apply by letter or otherwise.

ACT TO PROVIDE AGAINST FRAUDS IN SUPPLYING MILK TO CHEESE OR BUTTER FACTORIES.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. No person shall knowingly and wilfully sell, supply, bring or send to a cheese or butter manufactory, or the owner or manager thereof, to be manufactured, milk diluted with water, or in any way adulterated, or milk from which any cream has been taken, or milk commonly known as "skimmed milk," without distinctly notifying, in writing, the owner or manager of such cheese or butter manufactory, that the milk so sold, supplied or brought to be manufactured has beon so diluted with water, or adulterated, or had the cream so taken from it, or become milk commonly known as "skimmed milk," as the case may be.

2. No person who, in the course of his business, sells, supplies, brings or sends to any cheese or butter manufactory, or the owner or manager thereof, to be manufactured, the milk of cows, shall knowingly and wilfully, in the course of such dealing and business, keep back any part of the milk known as "strippings" without distinctly notifying, in writing, the owner or manager of such cheese or butter manufactory, of his having so kept back such "strippings."

3. No person shall knowingly and wilfully sell, supply, bring or send to a cheese or butter manufactory, or the owner or manager thereof, to be manufactured, any milk that is tainted or partly sour, without distinctly notifying, in writing, the owner or manager of such cheese or butter manufactory of such milk being tainted or partly sour.

4. Any person who by himself, or by his servant, or agent, violates any of the provisions of the preceding sections of this Act, upon conviction thereof before any justice or justices of the peace, shall forfeit and pay a sum of not less than $5 nor more than $50, together with the costs of prosecution, in the discretion of such justice or justices, and in default of payment of such penalty and costs, shall be liable to be committed to the common gaol of the county, with hard labor, for any period, not exceeding six months, unless the said penalty and the costs of enforcing same be sooner paid.

5. It shall be lawful for the owner or manager of a cheese or butter manufactory to require the owner or custodian of any cow or cows whose milk is being bought for, or supplied or sent to the manufactory, to submit such cow or cows at his farm, or other premises, where such cows are usually kept, to such milk test, by persons named by such owner or manager, as may be necessary for the said persons to ascertain the quantity and quality of the milk of such cow or cows, on any day, and at such time on any such day as may be appointed by said owner or manager, and in case the owner or custodian of the cows refuses to so submit them, or obstructs in the execution thereof the persons engaged in making the milk test, or interrupts the test, or interferes in any way with the test, or the application of its result, he shall, on complaint before any justice or justices of the peace, forfeit and pay for every such offence a sum of not less than $10 nor more than $100, in the discretion of the justice or justices of the peace who may hear such complaint, together with the cost of prosecution, if so ordered, and in default of payment of such penalty and costs, shall be liable to be committed, by such convicting justice or justices of the peace, to the common gaol of the county, with hard labor, for any period not exceeding six months, or unless said penalty and the costs of enforcing same be sooner paid.

6. It shall be lawful for the owner or manager of any cheese or butter manufactory, who suspects any person of selling, supplying, sending or bringing milk to the manufactory, of any offence under this Act, to enter upon or to appoint some person or persons to enter upon, and such appointed person may enter upon the premises of the suspected person, with or without notice, and take samples of milk from the cow or cows from which the supposed offender was or had been immediately before then procuring the milk or part of the milk so sold, supplied, sent or brought as aforesaid, and any such suspected person who obstructs or refuses to permit the taking of any such sample shall, on conviction thereof, be liable to a penalty of not less than $10 nor more than $50 with costs of the prosecution, and in default of payment thereof, shall be liable to be imprisoned in the common gaol of the connty in which the offence has been committed, for a period not exceeding three months with hard labor.

7. For the purpose of establishing the guilt of any person under the first three sections of this Act, it shall be sufficient *prima facie* evidence to show that such person, by himself, his servant or agent, sold, supplied, sent or brought, to be manufactured, to any cheese or butter manufactory, milk substantially below the standard of that actually drawn, or by the accused represented as having been drawn from the same cow or cows within the then previous week, provided the comparison or test is made by means of a lactometer and cream gauge, or by some other adequate means of making the comparison.

8. Any penalty imposed under this Act shall, when recovered, be payable one-half to the informant or complainant and the other half to the treasurer of the local municipality in which the offence has been committed.

Exhibitions and Prize Butter.

The usefulness of most of our agricultural societies during the past ten or fifteen years has been mainly in the direction of holding fairs or expositions. Some critics have been severe in their censure of the responsible directors for permitting or encouraging that *one aspect* of all the work, ostensibly undertaken by these organizations, to effectually monopolise their funds and energies.

On the other hand it should be recognised and remembered that the stimulus of healthy, hearty and friendly competition which they have fostered in every branch of arts, manufactures and agriculture has been very beneficial to all connected with those occupations. Every department of farm work, even on the farms whose tillers are most remote from educational influences, has felt the quickening pulsations of industrial life, through the presentation and circulation of information resulting from the holding of exhibitions. Few farms are now so isolated from such aids by reason of their geographical location ; but many are still out of reach and touch because of the isolated and isolating mental attitude of the men and women who live on them. If any man or woman, boy or girl, can be enlivened into a fair competition with others of their fellows in the performance or production of any branch of their work, a great economic boon will have come into their lives. Hence I see a unity of aim between the *purpose* and *achievements* of the now popular Farmers' Institutes in their work of informing, instructing and educating those engaged in agricultural pursuits, and the *plans* and *action* of agricultural societies in providing expositions for comparing attainments through open competition.

The dairy industry is now recognized as the most important of all branches of Canadian agriculture ; and unquestionably profitable agriculture lies at the foundation of the economic prosperity of the Dominion. Whatever just means may be used to aid the farmers in increasing the *marketable quantity* of dairy products per acre, and in improving their *quality* and consequent *value*, cannot be considered as of only local, rural or class interest. Every inhabitant has personally, to a greater or less degree, some financial stake in the business of the farms.

The marvelously rapid growth of the dairy business in Ontario brought it into prominence after the fairs and exhibitions of the province had become respectably

stereotyped in their management. Its magnitude now entitles it to more attention from those entrusted with the expenditure of public moneys through these institutions. In a few lines can be stated facts showing its unappreciated extent. In Ontario alone there are no less than 750,000 milch cows. Of these the milk of 250,000 is manufactured into cheese; 250,000 furnish the butter for home consumption and export; about 160,000 supply the milk required for table use. The cheese factories number over 770 and the creameries now in operation less than 40. The production of cheese, steadily increasing in this province, now exceeds 70,000,000 lb. annually. Its value last year was over $7,500,000. Butter is manufactured to the estimated quantity of 30,000,000 lb., worth last year over $5,000,000.

In 1886 the annual report of the Bureau of Industries gives as the number of municipalities in Ontario, 445 townships and 206 city, towns and village municipalities. Besides the few yearly expositions of provincial scope and interest, a fair or exhibition might be held annually in at least 200 municipalities. If by such means *only five per cent.* of those engaged in dairying were benefited to the extent of *only five per cent.* of the value of their dairy products, the receipts from that source would be thereby augmented by $31,250. I think that *fifteen per cent.* of those who keep cows could be helped to the extent of *ten per cent.* of the present value of their butter and cheese. Such an increase in value would represent at least $187,500 per year.

To make expositions truly educative as well as entertaining, certain uniform methods of judging should be adopted. A scale of points should be established and butter and cheese should invariably be judged with reference to the standard recognized by these points. I present a form for use in the judging of both:

.....Exhibition., 1888. Exhibit of .....

BUTTER (or Cheese). Class ....., Section ..... Lot .....

Exhibitor's name and address..... .....

For the use of judges only.

Butter.	Perfection.	Points awarded.	Cheese.	Perfection.	Points awarded.
Flavor	40	.....	Flavor	35	.....
Grain	30	.....	Quality	25	.....
Color.....	15	.....	Color	15	.....
Salting.....	10	.....	Texture	15	.....
Finish.....	5	.....	Finish.....	10	.....
Total.....	100	.....	Total	100	.....

For the judges.....(signature).

Remarks.....

After the judging is completed such a card should be attached to each lot, clearly specifying the number of points awarded under each head. Exhibitors would thus be informed of the expert's judgment as to wherein the excellencies or defects lay. A short analytical report by an expert, voicing the verdict as to the main faults or marked good qualities and as far as possible assigning and explaining the causes of each would readily obtain wide circulation through the press. To briefly re-state the matter as related to butter and cheese, some of the uses of exhibition to the dairy industry are,—

I. By providing for competition to stimulate to better thought, plans, preparation, action and production.

II. By authoritative comparison with a fixed standard of quality to instruct and educate the producers.

III. To educate the tastes of consumers by attracting their attention to extreme differences in qualities.

The work of preparing for the fall exhibitions will be engaging the thoughts and hands of some farmers' households at this season. I could wish that such an interest were more general and intelligent. To arouse such, as well to help those who may be ambitious to take a prize on butter at one of the exhibitions, I offer the following suggestions:

1. See that the cows have an abundant supply of good wholesome feed. Supplement the grass with bran or grain. Corn and pease make firm butter. If grass be dry or scarce furnish green fodder. The quality of the feed determines to some extent the quality of the fat globules in the milk. Fine butter is mostly composed of these. Green fodder is fed with better effect on the quality of the butter after being wilted for a day or two.

2. See that the cows have a liberal supply of pure cold water. As well might a cook expect to make good palatable porridge out of musty oatmeal and stagnant water as to get pure, sweet-flavored, wholesome milk out of musty feed and foul drink consumed by a cow.

3. See that the cows have access to salt every day. They know best when to help themselves.

4. Let the cows be saved from annoyance and worry. Any harsh treatment that excites a cow lessens the quantity and injures the quality of her yield.

5. Where practicable let the cows be milked regularly as to time and by the same person.

6. The udders should be well brushed and then rubbed with a damp coarse towel before milking.

7. All milk should be carefully strained immediately after the milking is completed.

8. Thorough airing of the milk for a few minutes by dipping, pouring or stirring will improve the flavor of the butter.

9. When set for the rising of the cream, milk should be at a temperature above 90° Fahr.

10. When shallow open pans are used for setting, it is most important that the surrounding air be pure. A damp cellar is not a fit place for milk.

11. When deep-setting pails are used, the water in the tank should be kept below or as near 45° Fahr. as possible.

12. The skimming should not be delayed longer than 24 hours.

13. Cream should invariably be removed from the milk before it is sour.

14. The cream for each churning should all be gathered into one vessel and kept cool and sweet, A good practice is to mix 25 per cent. of pure water with the cream.

15. The whole of it should be well stirred every time fresh cream is added and half-a-dozen times a day besides.

16. Two days before the churning is to be done, about one quart of cream for every four pailfuls to be churned—(or equal to two per cent.)—should be set apart and kept as warm as 70° Fahr.

17. One day before the churning, that small quantity of cream—(a fermentation starter, which will then be sour)—should be added to that which is intended for churning and well mixed therewith.

18. It should afterwards be kept at at a temperature of 60° Fahr.

19. During summer the best churning temperature is 57° or 58°. During late fall and winter 62° to 64° are found to be preferable.

20. The agitation of churning should be kept up till the butter comes into particles rather larger than clover seed.

21. The buttermilk should then be drawn off and pure water at 55° added in its place.

22. By churning this for a minute or two the butter will be washed free from milk while still in a granular state

23. The milky water may then be drawn and replaced by a weak brine at the same temperature.

24. After a minute's churning, the butter may be removed from the churn and pressed for salting.

25. Pure salt of medium fineness and with a body velvety to the touch should be used.

26. Three-quarters of an ounce to the pound will be the right quantity for most markets and judges.

27. The butter should be kept cool during the working and also during the few hours while it may be left for the salt to thoroughly dissolve.

28. As soon as the salt it throughly dissolved the butter may be worked the second time to correct any streakiness, which the first mixing of salt may have caused.

29. It should then be put up neatly and tastefully with *as little* crimping and beautifying as feminine fondness for these will permit.

30. It will then do its maker credit, and if it does not receive the first prize it will be prized and praised by its eaters.

Notes on the Cheese Trade.

Reports have been received from cheese-makers in all parts of the Province, commenting on a marked improvement observable in the *quality* and *condition* of the milk received at their factories. The influence and work of the milk inspectors appointed by the Dairymen's Associations of Ontario have contributed in no small measure to that end. At the same time, complaints of a grave nature are being made by cheese buyers, stating that the quality of many of the June and July cheese of Ontario has been quite defective. That the latter state of things should have been evolved out of the former is to be wondered at and regretted. For some years the lament has been monotonous at Dairymen's Conventions that an inferior quality and unsound condition of milk were solely and wholly causative of the common faults of a portion of the summer-made cheese. Painstaking and far-reaching efforts were put forth to correct the evils. Addresses on dairying became repetitions, with slight variations, of advice to farmers on the production and care of milk. Forty thousand copies of Bulletin XXVIII. on the "Care of Milk for Cheese-making" were circulated through the representatives of the factories. The newspapers gave the same matter still wider circulation. Every milker must have heard the exhortations to cleanliness, carefulness and the aëration of milk. No dairyman can have missed all the echoes of the talks on the need for cows being kindly handled, wholesomely and generously fed, liberally watered, (a few have mistaken the can for the cow in this connection), regularly milked and daily salted. A consequence is evident in the reported improvement in the quality of the milk. An unlooked-for and unwarranted coincidence is a noticeable deterioration in the quality of the cheese made therefrom.

Apparently the persons who hold the joint positions of milk-inspector and cheese-making instructor have not been so successful in the latter branch of their work as in the former. The want of experience in the task of instructing on the part of some of the inspectors was a weakness in the system which had been discounted. The want of an ambition to improve, the lack of a keen operative desire to profit to the fullest extent by the information offered, was not so clearly perceived to exist among cheese-makers. Those who have not been considerably helped are themselves mainly at fault.

Our vast and valuable cheese-making business, the pride of the dairy agriculture of the Province, is in danger of losing its hard earned prestige by the carelessness and indifference of the makers. The commercial primacy of Canadian cheese, both in price and quality, has been with difficulty established in the English markets. Now the demand for it is being interfered with by Swedish, New Zealand and American products. The

following present themselves to my mind as some of the causes that are leading to, and which unless stayed in time are likely to end in, our losing the immense advantage of superlative reputation:

I. The employment of inexperienced, incompetent men to manage factories.

II. The relentless cutting down of the remuneration of the makers, until the able men are leaving the occupation.

III. The unmistakeable penny-wise and pound-foolish policy of using poor furnishings in the process of manufacture simply because they happen to be a very little lower in price.

IV. The inadequate and unsuitable "help" engaged by the cheese-makers.

Not more than one-fourth of the number of youths who now begin the apprenticeship possess the requisite qualifications for being successful. So much additional trouble, loss, worry and disappointment result from the putting of men without aptitude or experience in charge of large factories that I strongly urge the proprietors to exercise the utmost care and caution, and to invariably inform themselves as to the fitness of an applicant by inquiry of a reliable expert or cheese buyer. No factory should incur needless risk of a loss of reputation, of patronage, of prestige, of price or of profit.

It is still possible to remedy the damage to our reputation in the matter of June and July cheese by the production of fancy quality during September and October. I ask every cheese-maker to do what he can to aid in that, and for the refreshment of his knowledge I offer these paragraphs.

(*a*) In the matter of making-rooms, at the cost of a little labor, lumber and building-paper, let them be made so close in the walls that the inside temperature can be regulated at will. Provision for thorough ventilation is also necessary.

(*b*) Let the floors be made clean by occasional scouring with lye or ashes, and let them be kept in that state. The inspectors report a great many factories with dirty floors. It will not be creditable to a factory to be so described and distinguished in the annual report of the superintendent to the Association.

(*c*) The outsides of the milk vats are in some cases reported as being painted with *invisible* paint. Where the paint is still on the wood of the vats, presses and hoops, let it be made visible.

(*d*) Press cloths have been neglected, so that their condition could not be a reflection on the untidiness of the presses.

(*e*) I have done a few factories some service by asking for the immediate putting of the sink cloths in the fire. Sink cloths are essential, but it is essential that they be clean and sweet.

(*f*) Curing-rooms need better ventilation, and during the cold weather of autumn it is necessary that a uniform temperature of 65° be maintained.

(*g*) Bitter-flavored cheese are usually the consequence of chilling in either the making-room, press-room or curing-room. Let the cause be prevented and the consequence will be unknown.

A few years ago "October cheese" became in England the synonym for all that is objectionable in those made during the autumn. A bitter tallow-like flavor, a porous soft body, a texture like the grain of paste and putty without their uniformity, a mottled appearance, and a shape doughy and indescribable are all qualities still too often suggested to the English importer's mind by the mention of October cheese. Such an impression should receive no further justification from the character of the article produced. Cheese can be made as *firm* and *fine* during October as during any part of the season. The following instructions will be of service to that end:

(1) Let the milk be well matured by the retention or application of heat before the rennet is added.

(2) The addition of sour whey to hasten the maturing is most objectionable and should never be resorted to. Old milk, which has become well ripened, and nearly sour to the taste, may be added, but loppered or thick milk should never be used.

(3) Rennet should be added in sufficient quantity to coagulate the curd fit for cutting in from 45 to 50 minutes at 88°, and should be diluted to the volume of at least one gallon of liquid for every vat before being added to the milk.

(4) After coagulation is perfect, the curd should be cut finer than during the summer. The application of heat should be delayed for fifteen minutes after the stirring is commenced. The temperature should be raised to 98° and maintained at 98° until the whey is drawn off.

(5) Pains should be taken to cook the curd particles so dry, before the development of acid is perceptible, that after being pressed in the hand and released they fall apart when slightly disturbed.

(6) The curd should be stirred while in the whey and after it is *out* of the whey *until the whey is so well out of the curd* that it is dry enough to squeak when bruised between the teeth or otherwise.

(7) After removal of the whey, the curd should be kept at a temperature above 94°. If the temperature be allowed to fall below 94° the development of acid is retarded and excessive moisture is retained in the curd during its development. The presence of such extra moisture in the curd at this stage will leave the cheese with a weak, or pasty, or tallowy body, according to the degree of acid development permitted.

(8) A rack placed in the vat or a curd sink with steam pipes seem the simplest and most effective provisions for keeping the curd warm without risk of scorching.

(8) Just after the removal of the whey the curd should be hand-stirred till the free moisture has drained off. After the curd is dry or firm enough it may be allowed to mat into one mass, *but not before that stage is reached.*

(10) It should then be frequently turned and packed close, till the layers of curd are four or five deep. Whey should never be allowed to gather in small pools on the curd at this stage. The close packing in layers four or five deep with frequent turning prevents the outside of the matted pieces from becoming chilled or more deeply colored than the rest of the curd.

(11) The proper degree of change has taken place when the curd feels mellow, velvety and "slippy," and shows a texture passing from the flakey or leafy into the stringy and fibrous. If the curd be too moist or soft it should be cut or ground at a rather earlier stage, and hand-stirred some time before the addition of salt.

(12) Not less than $2\frac{3}{4}$ lbs. of salt per 1,000 lbs. of milk should be used; and when the curd is on the soft or moist side, 3 lbs. per 1,000 lbs. of milk should be added.

(13) Immediately after the application of salt the pieces of curd become harsh and gritty on their surface; then in from 15 to 25 minutes the harshness gives place to mellowness. At this second stage—and the temperature should not be under 88°—the curd should be hooped and pressure applied. Delay at this stage or coldness of curd destroys the desirable rosy flavor and imparts to the cheese the bitter taste of the salty white whey.

(14) Particular care should be taken to use only pure, warm water when turning the cheese for bandaging, before the rinds are fully formed.

(15) All cheese should be finished of symmetrical shape and kept in the presses until the rinds are smooth and the corners free from any projecting edges or "shoulders."

(16) No cheese-maker should continue to excuse the presence of *soft*, or *hard*, or *open*, or *leaky*, or *cracked*, or *any kind of inferior, second-class cheese* on his curing-room shelves by saying or thinking that every factory must have a few of such.

VIII.—RECOMMENDATIONS.

From its achievements and value to the people of Ontario, dairy husbandry deserves more attention from the farmers, and more encouragement from educators and the Government than it has received in the past. The special soil and climatic fitness of our Province for the production of fine dairy goods, by means of which the largest returns of value can be obtained by the farmers for their products with the least

exhaustion of the elements of plant food or fertility, clearly indicates that branch of agriculture as the most profitable one to develop and follow. With the view of more efficiently furthering that end, I have a few suggestions to offer.

I. I recommend that provision be made for demonstrating the profits of winter dairying. A suitable winter dairyhouse is needed.

II. The feeding of hogs as an adjunct to dairy profits has been neglected of late years. I suggest that two hogs be fed and fattened during the summer, and the same number during the winter for every milking cow that is kept.

III. For the economical management of true creamery experimental work I recommend that the number of creamery routes be reduced and the distance travelled by the cream waggons very much shortened.

IV. To gain further information for the benefit of cheese-makers, that the quality of that product may be still further improved and the process of manufacture defined as far as possible into scientific accuracy, I recommend that provision be made for the carrying on of experimental work in one cheese factory in Eastern Ontario and one in Western Ontario, under my supervision.

V. In view of the ever-increasing correspondence, opportunity and need for doing other valuable work for the farmers of the Province, I recommend that an assistant be appointed in the Dairy Department. Its usefulness might thereby be doubled at but little additional cost.

JAS. W. ROBERTSON.

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To the Presiden

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PART VI.

REPORT OF

THE PROFESSOR OF AGRICULTURE.

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM,
31st December, 1888.

To the President:

SIR,—I beg to submit my report for the respective departments of this Institution under my immediate supervision for the year 1888. As you are aware that I was not installed into the duties of office here until the first of October, 1888, you will readily understand that I can do but little else this year, than append the reports of Mr. Zavitz, my assistant in the experimental department, of Mr. Storey, the Farm Foreman, and of Mr. Forsyth, the Superintendent of the Mechanical Department. To Mr. Zavitz I am indebted for all information relating to the experiments of the year now closing, and it affords me pleasure to bear testimony to the evidences of accuracy that manifest themselves in the compilation of the report.

For the first two months after my arrival, my attention was largely occupied with supervising the ingathering of the root crop, the completion of autumn work preparatory to the coming of winter, the removal of rubbish in the rear of the outbuildings, to the heaping of stones preparatory to their removal with the sleigh, and to the preparation of fence bottoms and the planting of fence posts, of which some seven or eight hundred were put in during that time, in addition to the preparing and delivering of lectures to the students of the first, second and third years.

Arrangements were just being made for commencing a series of experiments in feeding calves of the different beefing breeds along with a number of other experiments relating to the feeding of live stock, when the disaster of the evening of 26th November occurred, by which the devouring flames turned into a sickening ruin in a few moments the magnificent set of barns and stables that were justly looked upon with a deserving pride by the farmers of this Province, and burying amid the ash heap our plans and purposes regarding live stock experiments for twelve long weary months.

For weeks after that occurrence, but little else occupied the attention of those connected with outside work than the disposal of a large portion of the stock on hand, the fitting up temporarily of apartments for that which was retained in the outbuildings on the south side of the road, and the removal of the endless ruins caused by the fire.

Of the ninety-eight head of live stock, consisting of horses, cattle, sheep and swine in the stables at the time of the occurrence of the fire, not one hoof was lost or injured, though but a very few minutes were available for their removal. This was owing to the gallant manner in which the students of the college came to the rescue at the critical moment. It was their persistent efforts, also, that beat back the devouring element from the new piggery, and saved it from being reduced to ashes.

By order of the advisory board the work hands of former years in the farm and experimental department were discharged, with the exception of the farm foreman and Mr. Zavitz, as there was no work of sufficient importance on hand to justify their retention during the winter season.

I can only add that a large number of improvements are in contemplation the coming year. These include the renovation of fences, the grading and boulevarding of the private roads that run far through the farm on both sides of the main public road, preparatory to the planting of the same with forest shades; the removal and utilization in fences and in road-making, of the heaps and heaps of stones that strew the bordering highways and line the fence corners, and the burial of unsightly debris generally.

As the material for about 600 loads of barn-yard manure were consumed by the flames, it is contemplated so far as practicable to secure at least one-third of that amount in the city of Guelph, to make up in part for the loss, which will be drawn in the winter season.

In reference to experimental work, it is contemplated to secure a large number of leading cereals from various northerly countries in Europe, and from Australia and New Zealand, and test them here if they arrive in time, with the view of securing some sorts that when acclimatized will be found to contain elements of superiority as compared with the respective varieties that are now being grown here.

There will also be a large number of experiments more or less directly associated with the ordinary field work of the farm, as the growth of different proportions of mixed grains along with the same grains sown alone, the growing of potatoes hilled or flat and a long and varied list which we stay not to mention now, every one of which it is hoped will be of some service to the average farmer. In this way the entire farm may be turned into an experimental plot in a wider sense, without interfering with experiments carried on in the general acceptation of the term in areas that are more prescribed. The experiments contemplated for the winter of 1888-9, in reference to live stock will be taken up in the autumn of 1889, along with a number of others as soon as the new buildings are sufficiently advanced to admit of this.

It is well, however, not to overestimate in regard to what will be accomplished in the unveiled future. With the general statement that has thus been given, I shall leave the subject for the present in the earnest hope that the end of 1889 may find these expectations much more than realized.

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

THOS. SHAW.

REPORT OF FARM FOREMAN.

To Prof. Shaw :

SIR,—I have the honor to submit to you my second annual report in connection with the work done in the farm and live stock departments :

Owing to your recent appointment to the Chair of Agriculture, I deem it advisable to go more into details than I otherwise would, had you held your position from the beginning of the year.

The duties of the Farm Foreman may be considered under two headings ; 1st. Careful distribution of student labor ; 2nd. Looking after food supplies, stock, and labor in general.

1st and of considerable importance is the distribution of students to the different departments of labor from day to day, so that they may be able to receive instruction and also to work in all the different branches. The departments consist of the following : Farm and live stock, mechanical, horticultural, dairy, experimental, and library.

The hours in which each student is engaged in outside labor is recorded each evening and rated according to the work accomplished ; the record is handed to the Bursar every week, who enters the stated amounts to the student's account. 2nd. In the second place it is the duty of the foreman to look after the food supplies for stock and its preparation. Outside help is often required, particularly in the summer months, when we have to employ four teamsters and a day laborer, which is supplemented in July and August by two extra laborers.

Besides all this, instruction is given for one hour of three afternoons in each week, in the handling of farm implements, hand sowing, etc. It will be remembered that during the time that lectures are being given, students work only in the afternoon, from 1 p.m. to 6 p.m., but during the summer vacation from 7 a.m to 6 p.m. If work is very pressing, a lunch is taken to the field at 5 p.m., and work continued later.

You are aware also, that in the month of January the college is closed, and student labor is not accepted, consequently nothing can be done more than feeding stock.

The following is the plan adopted for preparing food :—The fodder for horses consists of timothy hay and oats in the sheaf, mixed in the proportion of 4-1, and put through a straw cutter. They are fed three times a day, 6 a.m., 12 m., 5.30 p.m., except Sundays, when we give but two feeds—7.30 a.m. and 4 p.m. Each ration consists of 5 lbs. of this mixture, and 2 lbs. of bran added, also a small feed of carrots at noon. If it was observed that each horse did not eat his full allowance, the quantity was at once reduced accordingly. During times of extra work a few pounds of chopped barley was added and carrots discontinued.

The cattle food consisted of a mixture of 9 lbs. of hay, 6 lbs. straw, 25 lbs. roots, and 2 lbs. bran for each beast daily, and was given in three equal feeds. It was prepared on Tuesdays and Fridays, by passing the hay and straw through a straw cutter, which stood on the barn floor directly over the feed room, into which place the cut feed drops from the machine. The root pulper stood in the feed room, convenient to the root cellar door. Both machines were driven by the same shaft, so that the feed was mixed and prepared with very little expense. The same precaution was taken with cattle as with the horses when the animal did not consume its full ration.

February.—The greater part of the month of February was spent in storing in the ice-houses, a supply of ice for college and creamery purposes. This year the supply amounted to twenty-six hundred blocks, 20x22, 18 inches thick. The ice is taken from the Speed river, at a dam about two miles distant. Four loads per day of two tons weight is what each team hauls, as considerable time is occupied in unloading. The cutting was done by contract, but the loading, hauling and packing nearly all by student labour.

We also do the threshing in this month, as it affords more time for giving students instructions in feeding and managing the thresher and running the engine. I found the majority of students became much interested in the work, and many of them became quite expert in handling the machine. Besides this, each student in his turn is placed to work the grain chopper, straw cutter and root pulper.

March.—The month of March was spent in hauling manure from court to field No. 8, where it was piled in large square heaps and allowed to decompose. A large stone stable which stood in front of the greenhouse, was taken down and the stone hauled away. Turnips were brought into the cellar from field No. 6, where they were pitted in the fall, and the stone walls and floor of the old piggery were removed to the site of the new one which was built in September.

April.—During April the large stones from the south lane were hauled and used in filling the cellar which had been under the old experimental dairy, over which clay from a bank in rear of college, was used to level up. Seed grain was prepared, an old hardwood fence from south-east side of field No. 12 was hauled up and cut into firewood for the engine; the fence from the north-west side of No. 12 was then removed to the south-east side and carefully rebuilt six feet high and staked. The ground on north-west side was then cleared off, ploughed and levelled ready for a neat wire fence, since built by the mechanical department.

We also completed during this month a job we had been working at on stormy and rough winter days, viz., the threshing of peas with the flail, grown on twenty-four acres of land.

May.—As usual, May was a very busy month. The teams were engaged in seeding; a number of students were employed in overhauling and building fence between Nos. 15 and 16; a large amount of labor was put on field No. 12 (which was ploughed from natural pasture in the fall of 1887) and expended in removing stones, stumps and roots; we also spent considerable time in clearing off the hill side of field No. 4, (also broken from natural pasture in 1887) such as removing stones, stumps and sticks. During the greater part of this month instruction was given in the afternoons in ploughing. The experimental team is set apart for this purpose one-half of each day.

I may here state that it is very difficult to give each student sufficient practice in ploughing to make him competent to pass a creditable examination. Farmer's sons seldom require much instruction, but those coming from the towns and cities or from the Old country require a large amount, for which one team and one instructor is quite insufficient.

June.—During the month of June another stone stable was taken down and removed, turnip ground was prepared and sowed with turnip seed, field No. 13 was cultivated, all small stones removed, and the greater part manured from the barnyard. The fence which divided fields No. 11 and 12 was removed to No. 18 and rebuilt in order to secure some pasture known as the swamp part of No. 18. The midsummer examinations took place in this month, lasting nine days, after which most of the students went to military camp or to their homes, leaving us but little help on the farm. The land was fitted and planted with corn for the experimental dairy, after which work was engaged in such as improving the lawns, digging post holes, hauling out manure, picking off stones, thinning mangolds, and cutting hay around fence corners.

July.—The month of July was spent in cleaning out the root crops, cutting hay, fall wheat and barley, building a large stone culvert in lane north of barns, cultivating bare fallow, ploughing sod, and hauling manure.

August.—During the month of August barley and oats were harvested, root crops thinned out, the bare fallow prepared for fall wheat, green fodder and peas saved, as well as fall wheat sown.

September.—This is another month when no students are employed, the regular hands doing all the work, which consisted of cutting corn, filling a silo for experimental dairy department, gang ploughing all stubble ground, and shipping stock which was sold at the sale held on 5th of the month.

October.—The month when the College is reopened. Teams were kept ploughing as much as possible, and students employed in digging potatoes, pulling, topping and hauling mangolds, carrots and turnips. Potatoes were pitted in field for the want of a suitable cellar, which is being built for them. The experimental team and teamster was employed in the experimental field in the forenoons, while in the afternoons they were used for giving instructions in ploughing, chiefly to second year students. They plough sod, while first year students practice on raw land.

According to your order, I tried an experiment at the suggestion of some second year students, with regard to rapidity and cheapness in caring for the turnip crop. It was briefly this: Eighty rows were topped with the hoe, tops of two rows being thrown into one drill, leaving alternate drills free of tops, through which we passed a horse hoe with weeding knives turned outward, passing under the two rows of turnips and cutting off the tap root, after which a harrow was passed over them.

Eighty more rows were pulled by hand and the tops and roots cut off with knives made from old sickles. Four rows were thrown together in one drill. The result was that it cost almost twice as much to harvest with the knife as with the harrow, though some time was regained when hauling them in, as those harvested with the knife were much cleaner and easier gathered than those taken out with the harrow.

November.—Most of this month was spent in hauling sand and gravel for various building purposes. Parts of fields Nos. 9 and 17 were manured and prepared for root crops next season; a great deal of fence removed, ground levelled and posts put down for fences. On the 26th, which proved a black day in our history, the fine barns were burned with all our crops, and other food supplies; some valuable machinery was also burned. Owing to the fact that but little threshing had been done before the fire, I am prevented from giving the yield of our crops for the past season.

December.—After the fire farm labor was almost entirely neglected, the whole time of the students being occupied in fitting up the old buildings across the highway and known as the south barns, in caring for the stock housed in them, much of which had been kept for about two weeks in the exhibition ground stables, in securing the roots not consumed by the fire, and in removing the debris from the ruins of the burned buildings.

Report of Fields.

Field No. 1, twenty acres, was meadow, and the advisory board at their May meeting ordered that it be set apart as pasture for the experimental dairy department.

Field No. 2, seventeen acres. Ten acres were sown to fall wheat, two varieties—four acres of Clawson and six of Bonnell. In April it was seeded down with a mixture of grasses, viz., six lbs. each of timothy and red clover and one lb. each of Alsike, Lucerne, orchard red top, meadow fescue, Kentucky blue, tall oat and Italian rye grasses. The heavy seeds were sown together and the lighter ones by crossing the field the other way. The grain crop was an average one, the Clawson, if any difference, being the best.

The grass seeds were harrowed in and rolled, and notwithstanding the very dry season, did very well. The remaining seven acres were sown with mammoth sweet corn, three and one-eighth acres of which was used by experimental dairy department. After the removal of corn the ground was ploughed.

Field No. 3, twenty acres.—Four acres of this field were used for experimental purposes. Four acres were planted with trees by the horticultural department, and the balance was sown with gold vine peas, yielding a good crop. After the crop was taken off it was gang ploughed, and later on was well ploughed with single furrow ploughs.

Fields Nos. 4 and 5, twenty acres.—Was sown with white cluster oats, yielding a splendid crop. After this was taken off the gang ploughs were put on and the surface lightly turned over, and late in October it was well ploughed with the single furrow ploughs. The south-east half of No. 5 is woodland, and a portion of No. 4 also. The part of No. 4 known as the hill side was last fall broken from natural pasture, and this year planted with potatoes.

Field No. 6, twenty acres.—Was ploughed in April and sown with mensury barley, it was also seeded down with the same mixture of grasses and clovers as was used in No. 2. The crop was good, and the young grasses and clovers looked beautiful this fall.

Field No. 7, twenty acres.—This field has been meadow for three past years, during which time the clovers were completely killed out, yet a crop of $1\frac{1}{4}$ tons per acre of timothy was cut from it.

Field No. 8, twenty-one acres.—About five acres of this field were manured in Nov., 1887, the manure being spread and ploughed in as near the surface as possible. The balance was manured last spring. It was sown with carrots, 1¼ acres, one-half being the large white Belgian, and the other half white Vosges, the latter producing by far the best crop. Eight acres were sown with mangolds; three golden tankard, three mammoth red, and two yellow globe; but little difference could be noticed in the yield of the mammoth red and golden tankard, both yielding much better than the yellow globe. Two acres were planted with potatoes, one of late rose and one with a variety brought from Prince Edward Island last spring by a dealer, the proper name of which could not be ascertained. The rose potato yielded a much larger crop and is fully better for table use. Eight acres were sown with turnips, four of Skirving's and four of Rennie's improved, the latter yielding much the larger and better crop. The remainder of the field was sown with Hungarian grass, and although cut before fully matured, yielded 3¼ tons per acre, which, when cut and mixed with timothy and oats in the sheaf, furnished a first-class ration for horses.

Field No. 9, twenty acres.—Thirteen acres were sown with gold vine peas, which were an excellent crop. The balance was sown with white cluster oats, which also yielded a good crop. After the crop was harvested the ground had two ploughings, and in November six acres of it were manured for root crop next season.

Field No. 10, twenty acres.—Ten acres of this field were planted to orchard and small fruits by instructions of the Fruit Growers' Association; the other ten acres were used by the experimental dairy department for growing ensilage corn. It was well ploughed toward the end of October and stumps of corn stalks buried as deep as possible.

Field No. 11, twenty-three acres.—This field has been under hay crop for four successive years; it was kept for pasture this year; but as the advisory board ordered field No. 1 to be used by the experimental dairy department, our acreage of meadow was so reduced that we were obliged to let it grow and cut it for hay. The yield was 1¼ tons per acre.

Field No. 12, twenty acres.—This field was broken up from natural pasture in November, 1887. We spent a large amount of student labor last spring in clearing off willow roots, stumps, stones and sticks. The sod on it being very tough we had considerable difficulty in securing a good seed bed, which was obtained by the use of the Corbin disk harrow followed by the Acme harrow, both were driven across the ploughing and the sod was completely pulverized. It was sown with tares and oats in proportion of 1 to 2. A small piece of which is low and swampy was sown with dwarf Essex rape, which grew a good crop and furnished splendid feed for the grade ewes and lambs during the fall.

Field No. 13, twenty acres.—Was bare fallow. It was ploughed five times, and after each ploughing was thoroughly harrowed. The gravel ridge crossing the field was cleared of all small stones and well manured with farm-yard manure. On August 31st eight acres of the south-east end were sown with fall wheat. The balance we intend to sow with barley next spring.

Field No. 14, twenty-four acres.—The old experimental field, Seventeen acres are used for experimental purposes, the balance was sown with barley and seeded down to grasses and clovers similar to Nos. 2 and 6.

Field No. 15, twenty acres.—Was laid down to permanent pasture some years ago by Professor Brown; notwithstanding the drouth the growth was quite luxuriant and remarkably good.

Field No. 16, twenty-five acres.—This field has been used for sheep pasture for two past years. Salt was sown on it in May, 350 lbs. per acre, and it was divided into three equal parts by portable fence; one hundred and ten sheep and lambs were kept upon it until the 25th of July, when it was mown for hay, and fifteen tons of timothy were gathered. It was ploughed during the early part of November, and is intended for a crop of pease next season, followed by fall wheat.

Field No. 17, twenty acres.—Three acres of this field is used by the horticultural department for a vineyard; the remainder was mown for hay. It consisted of a mixture of orchard grass, rye grass and timothy and yielded two tons per acre. Shortly after the

hay was saved seven acres of it were ploughed 2½ inches deep. This was manured with good farm-yard manure at intervals through August and September, and was well ploughed under in November so as to be in shape for root crop next season. The remainder is calculated for sheep pasture next year.

Field No. 18, thirteen acres.—Early in May this field was sown with white cluster oats, which yielded an extra heavy crop. After crop was saved it was gang ploughed and later on was reploughed with single furrow ploughs.

Field No. 19, thirty acres.—Fifteen acres of this field was cropped with fall wheat, consisting of three varieties, Clawson, Bonnell and Democrat. About maturing time the first two varieties were slightly affected with rust, but the Democrat ripening earlier was not affected and gave fair returns. The remaining fifteen acres were sown with "Sandy" oats, imported from Scotland two years ago, and yielded a very poor crop of which fully one-third was smut. It required about eight days more time to come to maturity than the white cluster or white Australian and was very short in the straw.

Field No. 20, twenty acres.—Is about three parts woodland, the balance being a splendid natural pasture, but lacking water and a fence to divide it from No. 19.

Field No. 21, twelve acres.—Four acres of this field were under clover this year, which was partly killed out last spring; yield two tons per acre. This fall it was ploughed by students of the second year class, for sod practice. Balance was sown with white Australian oats except one acre, which was sown with "Sandy" oats. The Australian matured several days earlier than the "Sandy," and although not a full crop, it yielded more than double that of the latter.

Implements and Stock.

I now beg to give a report of the stock and implements. The implements burned in the late fire consisted of two straw cutters, one thresher, one grain chopper, one root cutter, one root pulper, one weigh scales, three fanning mills, valuation, $600.00.

Implements purchased for farm use in 1888 were: one binder, one grain drill, one cultivator, one set iron harrows, and one spring-tooth harrow, valuation, $325.00.

Valuation of implements on hand at present time, $1,900.00.

Live Stock.

	Value.	Value.
Horses:		
Working horses on farm, 5	$760 00	
Experimental and instruction, 2	300 00	
		$1,060 00
Cattle:		
One Hereford bull (Imp.)	200 00	
		200 00
One Galloway cow (Imp.)	150 00	
One " heifer, 2 years old	100 00	
		250 00
One Polled Angus bull, 1 year old	250 00	
One " cow	200 00	
		450 00
One Ayrshire bull (Imp.)	150 00	
		150 00
One Devon bull (Imp.)	100 00	
		100 00
One Holstein cow (Imp.)	175 00	
One " bull calf	75 00	
		250 00
Ten grade cows	35 00	
		350 00

	Value.	Value.
Sheep :		
Five Oxford Down ewes	$125 00	
One " ram (Imp.)	75 00	$200 00
Eight Shropshire Down ewes	280 00	
One " ram (Imp.)	170 00	450 00
Six Leicester ewes	90 00	90 00
Five Southdown ewes (Imp.)	225 00	
One " ram (Imp.)	125 00	350 00
Four Cotswold ewes	105 00	105 00
Two Dorset ewes	60 00	
One " ram	40 00	100 00
Swine :		
Two Berkshire sows, 2 years old	50 00	
One " " 9 months old	25 00	
One " " 2 "	5 00	
Six grade pigs 8 "	60 00	140 00
		$4,245 00

I have the honor to be, sir,

Your obedient servant,

JOHNSTON E. STORY.

EXPERIMENTAL DEPARTMENT.

To Prof. Thos. Shaw :

Sir,—I herewith submit for your consideration a report of the Experimental Department for the year 1888.

Owing to Prof. Brown's leaving in the middle of the summer season, the preparation of the matter for the report has been done at much disadvantage. A number of experiments in cattle feeding were conducted last winter, part of which appeared in bulletin form from the pen of Prof. Brown before he left. They are enclosed in this report as Articles II., III., V., VI. and VII. The remaining feeding experiments and the grain tests I have endeavoured to prepare in as concise and as intelligible form as possible.

I.—LIVE STOCK EXPERIMENTS.

1.—High Feeding for Milk.

Much has been done in the Experimental Department during the past few years with an object of ascertaining the comparative value of different kinds of cattle foods. Not until last winter was there any systematic work performed from which to obtain facts relating to the influence of quality and quantity of food for the production of milk. An experiment was conducted with two dairy cows, by starting with a poor allowance and gradually increasing in both quality and quantity at regular intervals throughout a succession of periods.

The two cows chosen as subjects for the experiment were under very different conditions; one (Laidlaw), a common grade, about nine years old, and five months in milk; the other (Norton), a Jersey grade heifer, three years old, and three weeks in milk.

The feeding started on March 10th, and extended over a term of three months, which was divided into six periods of two weeks each. The food was changed at the beginning of each period and one week allowed on the new food before any record of milk was taken. An exact account was kept of the quantity of milk given in the second week of each period, and immediately before each change chemical analyses of the milk were made.

All the food was weighed before feeding, and the part left was taken out and weighed before next meal. The hours of feeding were 6 a.m., 11.30 a.m. and 5.30 p.m.

The following table shows the different rations fed, and the nutritive ratio of each:

Varieties of Food for each Period.	Quantity of Different Foods Given.	Weight of Food.	Weight of Dry Substance in Food.	Nutritive Ratio.
	Lbs.	Lbs.		
I.—Hay, timothy and clover	12			
Roots, turnips 10 lbs., mangolds 10 lbs., carrots 4 lbs ..	24			
Corn (chopped)	3			
Barley (chopped).....	3	42	18.05	1:7.37
II.—Group I.....	42			
Oats (chopped)	3			
Wheat middlings	3	48	23.27	1:7.15
III.--Group II.....	48			
Bran	3	51	25.93	1:6.8
IV.—Group III	51			
Peas	3	54	28.50	1:5.99
V.—Group IV..	54			
Linseed meal	3	57	31.21	1:5.13
VI.—Group V.....	57			
Linseed meal	4	61	34.82	1:4.42

No food was left uneaten by Laidlaw. Norton left a total of 62 lbs., which was a mixture of hay, roots and meal.

The average weight of the cows was about 1,100 lbs., hence it can be observed from the table that the first ration was rather low, but at the close the quantity of the food eaten was greatly increased and of very rich quality. This experiment was not by any means conducted to uphold high feeding, but to ascertain to what degree grain feeding may be carried on to give the best returns.

We shall now see what the results show throughout the whole term. Let us first look at the yield of milk from each cow during the last seven days of each period, and also for the same length of time when on pasture.

Periods.	Weights of Milk.			
	Norton.		Laidlaw.	
	Pounds.	Ounces.	Pounds.	Ounces.
I	151	13		
II	161	10	174	
III	161	3	195	15
IV	156	13	199	5
V	142	14	205	14
VI	143	2	220	7
Pasture	158	3	257	11½

From these results we notice that Norton increased until about the end of the second period, and during the third the amount was practically the same. A considerable decrease is then shown for the fourth and fifth periods, after which it remained about the same until the change to pasture, when there was a jump of 15 lbs. Had it not been for the increase of milk after going on pasture, we might assign the cause of the decrease during the fourth and fifth periods to the length of time after calving, but we are led to conclude that this could not account for the whole difference, and that food must have had a decided influence.

The Laidlaw cow was a very hearty feeder, and an extra milker, as is shown from the above record, where she was credited with an average of 30 lbs. per day, after milking from five to eight months. The quantity of milk during the whole term of experiment increased and at the close no less than 36 lbs. of milk per day was given.

Had we the quantity of milk produced, without taking into consideration the quality, the experiment would be very incomplete, but, as previously stated, the milk was analysed at the end of each period. The following table shows the percentage of solids and of fat for each cow, being the average of two analyses in every instance.

Periods.	Norton.		Laidlaw.*		Average.	
	Solids, Per cent.	Fat Per cent.	Solids, Per cent.	Fat Per cent.	Solids, Per cent.	Fat Per cent.
1	12.62	3.52				
2	12.53	3.66	12.47	3.52	12.50	3.59
3	12.88	3.72	12.42	3.72	12.65	3.72
4	13.15	3.64	12.68	4.10	12.92	3.87
5	13.06	3.42	12.61	3.81	12.83	3.61
6	12.73	3.29	12.00	2.76	12.36	3.02

*Laidlaw was one week later in entering the test than Norton.
Chemical analyses were made of the milk after the cows were on pasture but results lost.

This table may be a surprise to many who would naturally look for a continued increase in the quality of milk produced, from an increase in the quality of food. It will be seen that the percentages of both solids and fat increased with each animal for a time, after which a gradual decrease took place, and at the end of the whole experiment—with all the high feeding—the quality of milk was inferior in every instance to that at the commencement. With Norton the highest percentage in solids was at the end of the fourth period, while the fat reached its highest at the close of the third. Laidlaw reached the greatest quantity of solids at the same period as Norton, but the fat was one period later.

Taking both quantity and quality of milk into consideration, some place between the third and fourth periods appears to have given the best results.

It must be remembered that in this, as in other experiments, it is safe to be cautious in drawing definite conclusions until experiments are repeated, because individual animals vary so much, and there are so many circumstances which go to influence results. Nevertheless, we think this experiment contains considerable information in shewing:

(1) That we should be careful in feeding grain in large quantities to dairy stock.

(2) That of the different foods used in this experiment the one with a nutritive ratio of about 1:6 gave the greatest returns.

(3) That large quantity of concentrated food may prevent proper digestion, and consequently give poor returns for the food consumed.

2.—Roots against Grain in Milk Production.

We have made tests with Roots against Grain for milk production within the last five years, but never so thoroughly as during the past winter. Our objects were, (1) cheaper production of winter milk, (2) to get milk equal at least to the average Ontario *summer* records, (3) the use of a large quantity of roots without tasting, and (4) to maintain milk flow and condition of cows *without grain*.

The plan adopted was to feed one week on each ration previous to exact testing during the second week, and thus changing every two weeks through March and April. Ordinary Shorthorn grades were handled, milking twice a day. What are the facts so far?

The root ration daily consisted of 12 lb. cut hay, timothy and clover, 33 lb. mangels, 33 lb, Swede turnips and 15 lb. white Belgian carrots, all sliced and mixed with the hay. The grain ration was 12 lb. of similar cut hay, 7 lb. oats, 7 lb. pease, and 7 lb. barley, all ground and mixed dry with the hay. Feeding at 6 a.m., 11.30 a.m. and 5.30 p.m.

The nutritive ratio of the root diet is 1:7.4, and of the grain 1:5.4, thus 27 per cent. higher for the grain ration.

The daily milk per head from roots averaged 20.9 lb. over the whole period, and 22⅓ lb. from grain.

The daily cost of food per head was 19½ cents for the root and 31 cents for the grain ration, thus being 9⅓ mills for the one and 13.9 mills for the other per pound on the milk produced, or 9½ cents and 14 cents per gallon respectively, charging the average prices of the province during the last twelve years.

On roots the animal weight was reduced 14 lb., and on the grain 12½ lb. over the period—practically nothing in the scaling of cows; nor had we to credit any left food after each feeding; neither was milk spoiled by root taste.

Now, what are the practical and scientific deductions from these simple facts?

1. That 81 lb. of a mixture of roots, an unusually large quantity per head per day, with 12 lb. hay gave almost as much milk as did the unusually large quantity of 21 lb. of a mixture of grain and 12 lb. hay.

2. That this result was accomplished—(1) without spoiling the milk, (2) without reducing animal weight, (3) at 30 per cent. less cost, and (4) even though the root ration was scientifically 37 per cent. lower in nutritive value.

3. Thus, food of a *succulent* character, four times more *bulky* and much less value proportionately than dry grain, demands a very high place in winter dairying.

4. The root ration was pitted against an unusually large quantity of ground grain, enough to fatten two store cattle, which also represents with hay the acknowledged scientific and practical standard (1:5.4) of a ration for the best results in animal growth and their productions. But, even though the roots were four times more in bulk, the cow had nearly twice as much *digestible* materials per day from grain.

5. The large relative percentage of water in roots seems to possess an influence in the production of milk which. if not exactly understood, yet seems to depend for its effect upon the fact that the natural food of milch cows contains a larger proportion of water than is found in the more highly nutritious grains.

6. Thirty-three pounds of Swede turnips per day, if fed whole and separately, will taste milk, but when sliced and mixed with an equal quantity of mangels, or when pulped and mixed with hay, will not give a bad flavor.

7. The manure values scientifically resulting from the consumption of these rations are about four cents for roots and nine cents for grain per cow daily ; thus, in balancing all the points in this experiment, that of manure must not be lost sight of.

8. Take two such cows as we have had in this test over a winter of 180 days, one upon each of these rations, and all other conditions being alike, we obtain the following comparison :—

	Milk, lb.	Value of milk.	Cost of food.	Manure value.	Net gain.
Roots.....	3,762	$47 00	$35 00	$ 7 00	$19 00
Grain.....	4,020	50 00	56 00	16 00	10 00

9. Accordingly the dairy world has yet to be taught that the extensive use of grain is or is not correct economically ; that a large quantity of a mixture of roots with hay fodder is both economical and safe for milch cows ; and that possibly there is better health with roots, though a slightly inferior quality of milk—remembering at the same time that we have to wait further tests as this is only our first systematically conducted one.

3.—Oatmeal and Wheat for Store Cattle.

The world is not yet familiar with the conduct of all her common foods under every animal condition, much as has been done by experts. There is still a wide field of enquiry even with cereals, and hence we are trying to help in that direction.

When the Ontario oatmeal millers asked us to give a place to their interest similar to other grain and feeding materials, we responded at once, and have now to report the beginning of a series of tests, having in view to ascertain the value to cattle of some of those forms of meal and grain not usually looked upon as applicable to lower animal life, because possibly of their greater value for man himself. The question is not alone the cost of producing beef or dairy products with these, but to obtain facts on the important one of the direct effects of special products on animal growth as well as milk. It is well to remember in this connection that while the testing of one kind of food can be taken in comparison with another, it should not necessarily be held as such with a mixture of them, or rather of a properly balanced ration, because no *one* kind of food is equal to the proper maintenance of life anywhere—milk for a certain period excepted. With this explanation we have pleasure in giving a brief account of what oatmeal and wheat have said to us during the past winter in the growth of store cattle.

We handled six head, three heifers and three steers, from two to three years old and having Durham, Hereford, Aberdeen, Poll and Holstein blood in their breeding average weight on entry, 1,281 lbs. These were properly paired and grouped so as to allow of rotating from one ration to another every third week, beginning January 7

and ending March 10th. One week was allowed between each change in order to over-influence the previous feeding before precise testings were noted, and of course each meal of all the animals was weighed and every other proper thing attended to as in all exact work of the kind. The oatmeal, by desire of the Miller's Association, was obtained from Mount Forest; the winter wheat was of their own growth and grinding. As a sequence of the reasoning given in second paragraph, as well as of the fact that the same agents (plants or animals) should always be allowed their normal conditions during an experiment for comparison with ordinary or well known things, we made another ration with ground pease and oats. The following were, therefore, the daily rations employed per head:

No. 1 —
25 lbs. mangels.
10 " timothy hay.
5 " oat straw.
2 " wheat bran.
All cut, pulped and mixed twice or thrice a week.
—
42
12 " oatmeal, mixed with above when served.

No. 2 —
42 lbs. pulp as above.
12 " wheat (winter) mixed as above.

No. 3 —
42 lbs. pulp as above.
8 " ground oats.
4 " " pease.
Mixed as above.

These rations may be criticised by the practical farmer in this way: About equal weights of dry fodder and of grain, and about half of the whole being roots; plenty bulk and variety; looks more like a good meal for cows than for fattening cattle.

The market value of the materials per head for the whole period of the test, under deduction of what was unconsumed and the approximate nutritive ratio of each course are:—

Oatmeal ration cost $11.30; n. r. 1:7.08.
Wheat ration cost $9.82; n. r. 1:7.98.
Pease and oat ration cost $8.10; n. r. 1:6.10.

Now in preparing ourselves for the actual results of the feeding by a study of these rations based on the chemical composition of the foods, we should expect that the pease and oats would do best, the oatmeal second and the wheat third. This is not always safe reasoning, however, as the form or mechanical composition of food has a great deal to do in animal economy and often upsets our best theories: there is no chemist equal to digestion. I am indulging thus because the prescribed article is not large enough for all details of the testing, but is sufficient for abstract criticism. Or it might be guessed that as the oatmeal ration is the most free of any crude materials, such as skin or husk of the grain, it will be more indigestible and therefore cannot give results equal to the wheat with its shell and the pease and oats with their rougher skins. But what are the practical facts in this preliminary enquiry?

Over all the period of sixty-three days with six cattle in three groups, rotated, and altogether under strict management, we have this per head per day record of increased live weight:

Oatmeal, .47, or almost one half pound.
Wheat, .93, or nearly one pound.
Pease and oats, 1.30, or about 1⅓ pound.

That there is interesting material here cannot be doubted. Rich in albumin, and particularly in fat, as oatmeal is, very considerably over all others in this testing, except albumin in pease, it may be considered that because of its compactness as a food, or rather perhaps its want of natural husk, and even though mixed with coarse, bulky fodders, it is more indigestible than either wheat, oats or pease. The theoretical feeding value of the three rations being regulated by the respective grains, and wheat being the

least in that respect, (see nutritive ratio) we would expect the poorest result in the animal report; but it has almost doubled the daily rate of oatmeal, and I find no such irregularity or back-going in its use as we had in two instances with different groups of cattle in the case of oatmeal. The most prominent back-going was when the changes were made from wheat to oatmeal.

Another look at the relative composition of these rations and of their digestibility shows that we have had a close agreement between science and practice in this testing. Of the oatmeal 77 per cent. is considered to be taken up by the animal system, 83 per cent. of winter wheat, and as much as 84 per cent. of the mixture of pease and oats is digestible.

In conclusion, therefore, it may be taken as correct to say that oatmeal is too rich, as well as valuable of course ($35 per ton), for extensive use to store cattle, and may be should only be given sparingly to calves and milch cows, as to which we should have something to say next winter. Wheat, for the second time in our experience, has given a good record in cattle feeding, when its concentrated form is considered, though much of this result is due no doubt to the coating usually called bran.

4.—Mangolds as Food for Calves after Three Months of Age.

Experimentation with varieties of food for calves has received but little attention. The custom in Ontario has been to have spring calves; therefore, most farmers are well versed in the summer methods of feeding when milk and pasture are plentiful. The system of raising fall calves with winter dairying is growing more and more in general favor, and in consequence of this system an experiment was conducted last winter that we might learn the value of some other winter foods for calves.

As milk is sometimes very scarce in winter, the question arises is there any substitute that can be used with as good results after calves are some weeks old. In the interests of this question an experiment was arranged to test mangolds with skimmed milk.

Four calves were chosen having an aveage age of about three months. On April 14th they were weighed and the experiment commenced. One week was allowed for a gradual change from one food to another; then a record was commenced of the quantity of food eaten. The previous feeding had been such as calves usually receive during the first three months.

They were divided into two groups; an Aberdeen Angus Poll grade heifer with a Hereford grade steer in the first, and an Aberdeen Angus Poll grade steer with a Hereford grade heifer in the second.

As may be seen from the following tables, when the age and weight of the separate groups are taken into consideration, we could scarcely find two lots better balanced:—

Groups.	Name.	Breed.	Sex.	Date of Birth.	Age.	Weight.
					Days.	lb.
I.	Turp	Hereford grade	Steer	January 12, 1888	93	253
	Violet	A. A. Poll grade	Heifer	Dec. 15, 1887	121	280
II.	Colon	A. A. Poll grade	Steer	February 24, 1888	50	141
	Rosa	Hereford grade	Heifer	Dec. 18, 1887	118	340

On taking the average age and total weight of each group we find them to be:—

	Average Age.	Total Weight.
Group I.	107 days.	532 lb.
Group II.	84 "	481 "

The experiment continued from April 21st to June 20th, making a period of sixty days. A record was kept of the exact quantity of food eaten. They were housed in comfortable quarters and well cared for. Pains were taken to feed all they would eat without waste.

The average daily ration for each animal in its respective group was as follows :—

Group I.		Group II.	
Meal	3.6 lb.	Meal	3.6 lb.
Hay	1.5 "	Hay	1.3 "
Mangolds	12.5 "	Sweet skimmed milk, 6 qts. or about	12.5 "

The meal was fed dry, and consisted of $\frac{3}{4}$ lb. oatmeal, $1\frac{1}{2}$ lbs. bran, $\frac{1}{2}$ lb. chopped oats, and $\frac{3}{4}$ lb. oil cake, and the hay, good quality of timothy and clover mixed. Each animal in group II. ate $\frac{1}{3}$ lb. more hay than those in group I. The mangolds were finely pulped and readily eaten, and the milk given was sweet in every instance.

At the end of sixty days, the calves were weighed and showed results as indicated below :

Food.	Names.	Weight at Start.	Weight at Close.	Individual Increase.	Total Increase.
Group I. Mangolds	Turp	253 lbs.	342 lbs.	89 lbs.	165 lbs.
	Violet	281 "	357 "	76 "	
Group II. Skimmed Milk	Colon	141 "	205 "	64 "	176 lbs.
	Rosa	340 "	452 "	112 "	

It can be seen from the above table that mangolds compared very favorably with skimmed milk, although those fed on mangolds ate a little more hay. We must keep in mind the fact that in feeding experiments the results may be much affected by the difference of characteristics and dispositions of animals; therefore, it is well to repeat experiments before drawing fixed conclusions.

5.—The Free Power of Durham Cattle.

What has been written upon the Durhams, even within the last quarter of a century, would make a large library; but England's first, and as yet her last, improvement in cattle life is not all known, or at least has not been put distinct enough for everybody.

We are induced to contribute to the historical pile, as by study of different classes of cattle here, and particularly in the practical handling and breeding of them under precisely equal conditions during the last twelve years, we have necessarily noted various features of their conduct that few are privileged to enjoy.

We have not met with anything on the subject our station desires to call "*Free power.*" What that is exactly 'tis somewhat difficult to explain. How often we feel and know something, and yet are in trouble how best to make it plain in plain language!

All animal life repeats itself by class distinctions, and by individual characteristics. The perpetuation of the species in nature is clearly a more systematic thing, and, indeed, is a law as against man's best judgment for a like purpose; hence the intensification of all that goes to make reliability is incomparably better in the one case than in the other. Man's interference has simply brought about much more difficulty in the struggle for existence.

Taking the principal breeds of cattle of the present day, it would not be difficult from their history and facts still accumulating, to make out a list indicating the order of what is usually termed "prepotency," or the ability to maintain and to stamp their characteristics by reproduction. But this term is not definite enough when applied to the great variety of distinct races of animals, nor even to our domestic cattle.

There may be said to be three easily placed lists among farm cattle in respect of character acquired by different methods of breeding—usually called improvements: 1st, Those cared for in a general way from so-called native breeds, and not having been interfered with by any outside crossing; 2nd, Those also from native breeds, but gradually selected by individuals and families from among themselves to attain certain results; and 3rd, Those nearly altogether made by man upon a system from various sources and by subsequent inter-breeding, so as to hold as permanent as possible the properties gathered.

Now we need hardly say that the Durham belongs to the third list, that the Hereford may be taken as a type of the second, and the Holstein of the first.

It is, we believe, a fact in all life, vegetable as well as animal, and necessarily more easily observed in animal, that the nearer nature the more intense and deeper in whatever special things characterise them—at the same time that such a source does not *diffuse* and *change* to such a degree as we require when applied to others. It seems to be too concentrated and *unyielding*, and in more familiar words, the two sources always necessary for reproduction do not "*nick.*" On the other hand, that which is considerably removed from nature, and is a *cultivated* thing, has the greater power of diffusion and changing when linked with another of its kind.

We desire, then, to draw attention to these important facts as part of our profession and observation here, and how much stronger the Durham cattle are when cropping value is considered.

It is not contended that Durhams are valuable in the sense of doing well under conditions outside of those that have made and maintained them, any more than that our best hybridized wheats succeed *anywhere*.. Whenever any one claims for a particular breed the universal and the best of everything, we may at once set it down as untrue—as a simple impossibility. Indeed, nature in any shape gives no example of it, and all our science and practice have never secured it; but there is the best evidence to-day that man has made a remarkable specimen of what may be termed the impossible.

Intense cultivation has made the Durham the nearest to the best of everything; from no other source and by no other method meantime, in all our experience, is it possible to get the approach to the combination of the beef and the milk.

But this is not all: We have yet to learn that any breed can, as it were, throw the whole essence of its being when coupled with any others—native, half-breed or thoroughbred—as the Durham does. The Free power of the class is astonishing, and is unquestionably the following of its cultivation. True, no doubt, as with any other profuse product, that more system—in rotation, in tillage, and in fertilizing—is required in comparison with other breeds, in order to maintain the crop, but then as in the field so here the crop is the paying one.

A Durham bull, having in his constitution much of all the virtues that run from Collings, is unquestionably the most free or liberal agent for rapid wealthy returns; the power is there, and it is a free or open power—not so tied up or conservative as other more near nature.

The Free power, then, of the Durham breed of cattle is what no other class can claim in like measure, in our experience, because it is not in their breeding. Such a property can only exist in its fullest value in stock that has been bred in a special direction. We have a prominent example of the like Free power with Leicester sheep and possibly in some pigs.

It may be impossible to explain the physiological reasons for such a difference in animals of the same species, or what it is that has been cultivated in the animal system that acts so differently so that the one *holds* and the other *gives*, but we are certain of its existence nevertheless.

We must not confuse in this study another property called "marking," or external colouring, which as a subject in our experience has been described in Bulletin XVII., and we trust to have time soon to submit some characteristically powerful things in other classes of cattle that in our experience are worth knowing.

6. Specimens of Holstein Beef.

Systematically, since our 1884 importations, we have been breeding all our bulls and rams with the common cows and ewes of the country for the purpose of obtaining specimens of grades, and thus adding to our knowledge of what is and is not of importance to our people for the dairy, for fattening, for wethers, and for breeding ewes. Meantime we desire to submit two examples of finished beef just sold, which were first crosses between a Holstein bull and ordinary cows, weighing an average of 1,100 lbs. The Holstein, is allowed to be a superior one of his kind, is now six years old and weighs over 2,300 lbs. One of the cows is a good type of the milking grade, and apparently got by a grade Durham bull; the other is a Jersey grade, or cross between a pure bred Jersey bull and such a cow as the first one named. We had bull calves from each on 4th August, 1885, and 14th April, 1886, respectively. They were submitted to ordinary management as regards time of altering, and allowed to suckle twice daily up to eight months, receiving at the same time hay, grain and green fodder according to season, and hence all through such handling as should make first-class animals; in one word, we gave them conditions similar to Durham and Aberdeen Angus Poll grade steers, that have gone from here and taken prizes at leading exhibitions in the States and Canada.

On 20th December, 1887, when the oldest Holstein grade steer was sold, and the other held over with another batch for exportation, we had the following record:

From.	Days old.	Live weight.	Daily rate of increase.
Holstein and common cow	866	1,790	2.06
Holstein and Jersey grade.....	605	1,329	2.18

Here, evidently, are facts of unusual practical importance to patrons of Holstein cattle, as well as all interested in dairying in conjunction with the production of early beef. In the first example we have a steer two years and four months old that weighed 1,790 lbs., and in the other the animal scaled actually 1,329 lbs. when only one year and eight months. We have, then, in both cases a daily record considerably over 2 lbs., and, I think, equal to the average of any dozen of any other breed of which we have records either at Chicago, in Canada, or at Smithfield, England. Of course this comparison of two with a dozen is not usual, but I put it thus in order to draw attention.

We are sure that this, our first public submission of specimens of Holstein grade beef, will make some talk, as Holstein breeders have of late been justly employed in presenting the capabilities of their subjects, with, it is considered, the usual proportion of unnecessary claims, and others have as unreasonably been making wholesale condemnation of them. We all desire actual facts, bit by bit, until the accumulation is big enough to justify confidence. Thus, then, these experiments, so far as they go, tend to prove that the Holstein is able to produce weight of steers with common cows, and, under similar management, may yet compare favorably with some of the beefing breeds.

But this question possesses other features; good beef on foot has, of course, other properties besides size or weight according to age, and these we have now to place in connection with our Holstein grades.

The exterior black and white marking of the animals, as noted in Bulletin XVII., was in its location and area a matter of striking similiarity with the pure breed—something unchallenged from any other source. In like manner the general framing stands unquestioned in its likeness, the heavy bone and large paunch particularly. Had food been all along bulky, or green, or sloppy, allowance would be made for what a beefy type must discard as an unnecessary middle piece; but as very much of all the upkeep was hard grain and dry fodder, the special class, and not the management, must account for it. Both animals were very marked in this respect, and it certainly agrees with their history and deep milking qualities. The older steer had a very prominent heavy or coarse bone and frame, and the frame of the other is also peculiarly angular and irregular when compared with the usual model of a beefer. We are not drawing fine lines in these statements, and no experienced judgment was required to draw attention to the want of quality in the general form of the animals. Not only so, but the quality otherwise, with depth, mellowness and uniform covering of flesh, were prominently absent. These, with hard handling, a thick skin and legginess, make up the specimens of beef in question.

In direct opposition, however, to these characteristics, which are usually not taken as representative of the best type for the most profitable production of flesh, we are met with the first statement made in this report: How shall we reconcile the *early heavy weights* with the *want of form and quality?*

The older steer, having been killed, gave 62½ per cent. of butcher's meat. If possible, we shall also get the block record of the younger one, which, if about equal to the other, will give them a high place in this important particular. Necessarily, the actual food value—*i.e.*, flesh *versus* bone, with fat and lean—would be required to ascertain the consumer's valuation.

Altogether, Ontario should wait and exercise impartiality until the cattle of Holland have time to show what they can do.

7.—The Better Cultivation of Wool.

Among the many developments in Agriculture of late years there does not seem to have been any practical facts as to what may be accomplished in the improvement of wool. The Ontario Experimental Farm made some testing in 1883 and 1885 in clipping lambs once and shearlings twice a year. These, we know, have been adopted in some cases, but as yet very few are aware of how much can be done, reasonably, in several lines to produce more wool per head, better wool, and more suitable wool for various manufactures.

As Canada has not yet obtained a place among nations even as a second rate producer of wool and mutton, and as we are just beginning to see how much we could do very easily, there is the better reason to ask that our farmers should enter upon the business with all the light of modern experience and requirements.

We are not without experience in most countries as to the marked effect of climate, soil and herbage upon the various properties of wool, and at the same time it is safe to assert that few men make these influences a study before investment in a particular breed of sheep. Neither do we find justification by sound argument for the practice of washing, of clipping *once* a year, nor of rarely taking wool from lambs. What has been so easy to get and so cheap to produce has necessarily obtained corresponding attention from farmers as well as manufacturers; indeed, the surprise is that the manufacturers of woollen goods have not demanded from wool growers such a character of material as is required for particular markets, rather than having had to make the articles according to the nature of the material got with so little skill. It is a remarkable fact that absolutely no change has taken place, save perhaps in Saxony and France, in the *method of cultivating and harvesting wool.*

It will be said, no doubt, that with the many breeds and nearly as many varieties of wool the manufacturers can get very much of texture, and of length, and other properties, as must meet all, or nearly all, public wants. There is much truth in this statement, but the argument is just the best to use in favour of the position I am claiming for better cultivation and the improvement of the crop by methods of harvesting.

Take several practical examples from the experience of this station.

We have put to pasture this season all our imported rams and ewes of Lincoln, Cotswold, Leicester, Oxford, Shrops, Hamps, South Down, Merino and Cheviot, as well as homebred shearlings and lambs, both rams and ewes, together with first cross wether lambs of all these with the common or grade ewes of the country. Every animal, lambs excepted, was shorn close during the end of April and beginning of May, so that practically no wool has gone to grass with us this season. The airy, cool sheds all winter, with access to outside courts at all hours, kept the sheep comparatively free from sweating with their heavy coats, and hence after clipping very few had to be jacketed, and not one has had inflammation or milk trouble in nursing, nor has there been more than the usual head colds even during an unusually late and cold spring up to date. By changing from pen to pen according to time of shearing and temperature we have had marked benefits by better doing in flesh, growth and general bloom.

The common practice is to leave clipping until June, or after spring seeding, when wool is less in quantity, dirtier, harsher, more ragged, and not so sound for manufacturing purposes. Allow me to give the strong advice: "*Never let your wool go to grass.*"

The few lines allowed in this public document do not admit of telling all the accompaniments of the change of practice recommended, among the most important of which would be that poor feeding and early spring clipping implies many deaths, an inferior crop, and nearly everything in correspondence. Much of the wool of a large flock after a long housing and dry feeding necessary in this country, deteriorates before April; some of it leaves the skin, dries, and consequently the whole fleece prematures and loses value. When removed two to four weeks before going out, there is such a stubble of new growth as sufficiently fends from sunshine and chilly mornings, supplemented as it should always be by the application in any case of a good "dip" in midsummer.

And now comes what to me stands as a great mistake in management and the value of a crop of wool anywhere, namely, harvesting only once a year, and never clipping the lambs. We have already indicated the good resulting from early clipping, and that sheep are decidedly more comfortable from it, and it is also our experience that clipping again in July is both beneficial to the animal and profitable to the owner. The extra well-doing after April has produced upon good pasture a superior second crop, shorter and finer in texture relatively to kind. This is the stage claiming the better sample for certain fabrics, where also the longer, coarser varieties would and do actually give such a change as fetches a greater price per pound. Why do not flock-masters take this crop? There is not the shadow of cruelty about it, though it certainly means tree or shed shade and another turn of the dipping tub. Long before the chilly nights of September or the actual frost of winter comes—not forgetting it is not frost but wet that does most harm to sheep—the second growth is long and close, and ere next April, under good management, is equal in weight to what it would have been had clipping been done only once.

Altogether then we gather up the following comparison of the two systems as applicable to Ontario and the market to-day for unwashed wool, on an average of the breeds named:

Usual clip of 7 lb. in June, at 15c		$1 05
1st clip of 7 lb. in April, at 15c	$1 05	
2nd clip in July, 3¼ lb. at 16c	0 52	
Clip of lamb one per head of all the flock, 3 lb. at 17c.	0 51	
		2 08
Difference per head		$1 03

The extra cost of shearing and dipping amounts to eight cents per head.

I have recently advised with two extensive woollen manufacturers, and submitted samples of unwashed wool from all our breeds, upon which they set the following at the highest possible present market prices per pound:

FROM CLIP APRIL AND MAY, 1888.

Breeds.	Cts.	Lbs.
Lincoln	11	13⅓
Ontario grade	13	11⅓
Cotswold	13	11⅓
Leicester	13	11⅓
Oxford	15	10
Cheviot	16	9
Shrops	16	9
Hamps	16	9
South Down	18	8
Merino	21	7

Taking the Merino as a standard and at an average weight of seven pounds per fleece in Ontario, I give in the second column the number of pounds per fleece *required* from the other breeds to make an equal value. It is significant of nature's impartiality that but one of the number, viz., the grade, fails to stand the comparison, as with that exception, which is three pounds too much, the actual average weight per fleece of all the breeds with us is very close upon the figures given.

II.—FIELD EXPERIMENTS.

During the spring of 1887 a large number of varieties of cereals were imported from Germany, England and Scotland, with the object of obtaining some kinds that might do well under Canadian climate. They were all tested on the plots of this Experimental Station a[illegible] a number of packages of most of the varieties were distributed over Ontario for testi[illegible] The returns were generally light during the first season, owing probably to the change of climate and the exceptionally dry summer. We have at present to report upon the results of the second year's trial of the above-mentioned cereals, as well as upon the first season's experience with a number of Australian varieties.

Owing to the cold spring and the great lack of rain during the earlier part of the summer vegetation was backward. Later in the season, however, conditions were more favorable, and at the time that crops suffered most during the previous year there was an occasional shower which brought very satisfactory results, the yield of grain this fall surpassing that of a number of years previous.

In our last report we concluded a four year's rotation with a number of special fertilizers. We have now to note the effects of salt on different kinds of soil. We have also carried on experiments with various fertilizers, on different grains, in conjunction with the Experimental Union. Besides aiding that association in its experimental work the college has been the centre from which the grains and fertilizers have been sent, at the expense of the Union, to its members and to prominent farmers through Ontario. We might here state that in the recent fire the bulk of the experimental grains raised at this station and intended for distribution next spring, were destroyed; but, luckily, full notes had been taken and preserved, and luckily also, two samples of all the grains were kept, and to supplement this we hope to obtain larger quantities of the best varieties from the farmers to whom we had sent out nearly all the imported varieties, and thus be enabled to continue testing and distributing as formerly.

I.—SECOND YEAR TESTING OF IMPORTED CEREALS.

Variety.	Grain.	Sown.	out.	General Appearance.	Ground	Weight of Produce.
[illegible] imported 1887.						

I.—Second Year Testing of Imported Cereals.

Place that grains were imported from, 1887.	Variety.	Grain.	Sown.	Brairded.	Headed out.	Matured.	General Appearance. Straw.	General Appearance. Grain.	Size of ground cropped.	Weight of Produce. 1887. Straw	1887. Grain	1888. Straw	1888. Grain
									Acres	lbs.	lbs.	lbs.	lbs.
Scotland	Chevalier	Barley	April 25	May 4	July 10	Aug. 10	Bright and good quality..	Plump and bright.....	1-10	340.	158.	372.	244.
Scotland	Common	"	" 25	" 4	" 4	" 1	Medium length, average quality.	Average in brightness and plumpness.	"	259.	137.	319.	217.5
Germany	Probsteier	"	" 25	" 4	" 11	" 10	Medium length, a very little rusted.	Fair in size and plumpness.	"	312.5	203.5	268.	177.
England ...	Peerless White.	"	" 25	" 4	" 6	" 10	Medium in all respects ...	Medium in all respects ..	"	218.5	65.5	317.5	[illegible]6.5
England	Empress	"	" 25	" 7	" 7	" 7	Medium length, clean and good.	Plump and fair sample...	"	245.	67.	336.5	194.5
England	Golden Melon ..	"	" 25	" 4	" 13	" 10	Medium length, a very little rusted.	Short and plump.....	"	228.5	83.5	302.	199.5
Scotland	Stirlingshire....	"	" 25	" 4	" 7	" 10	Bright and good quality..	Fair in plumpness and brightness.	"	150.	82.4	269.	176.
Scotland	Potato	Oats ..	" 26	" 10	" 18	.....	Medium length, touched with rust.	Small but plump.....	1-20	142.	26.	306.5	91.
England	Black Tartarian	"	" 26	" 10	" 16	" 8	Medium length, nearly free from rust.	Fair quality	"	....	17.8	147.5	85.5
Scotland	Hopetown.....	"	" 26	" 10	" 18	.....	Medium length, touched with rust.	Small plump grain.....	"	159.	35.	182.	76.
England	Racehorse	"	" 26	" 10	" 9	" 1	Clean but rather weak ...	Quality good as to size, plumpness and weight.	"	154.5	18.5	132.5	102.
Scotland	Tam Findlay...	"	" 26	" 10	" 16	.....	Medium length, clean and stiff.	Inferior in uniformity and plumpness.	"	180.	22.	204.7	80 3
Scotland	Sandy	"	" 26	" 10	" 17	.....	Medium length, clean and stiff.	Below average in uniformity and plumpness.	"	187.5	29.5	195.5	73.5
Scotland	Blainslie	"	" 27	" 10	" 26	Aug. 19	Medium length and bright	Inferior in uniformity and plumpness.	"	128.5	13.5	232.	58.
Germany	Probsteier	"	" 27	" 9	" 16	July 30	Touched with rust, otherwise good.	Fair in uniformity and plumpness.	"	....	49.	208.	119.5
Scotland	Hamilton	"	" 27	" 9	" 19	Aug. 9	Rather short, considerable rusted.	Small but plump.....	"	149.5	27.5	198.5	87.5
Germany	Zeelander	Rye...	" 27	" 2	" 2	.....	Medium length and good	Good quality	1-10	133.	45.	223.7	119.3
Germany	Sachsischer....	"	" 27	" 2	" 2	.....	quality. Quite long and clean.....	Good quality	"	150.5	41.5	309.	186.

Notes on the Results of the Second Year's Testing of Imported Cereals.

In the College Report for 1887 details were given concerning experiments carried on during the previous summer with a large number of varieties of oats, barleys, and pease, imported from European countries. We have repeated the tests this season, and the yield in every case, except one, was greater than that obtained from the first year's crop.

Barleys.—We had under experiment seven varieties of barley; three from Scotland, three from England, and one from Germany. They were grown in the old experimental field, and on the same range in which barley tests were conducted in 1887. The quantity of seed sown on each plot of 1-10 acre was 9.5 lbs. The ground was in good condition, the grain was sown broadcast and harrowed in.

By looking at last year's report we find that the Probsteier Gerste took the lead at this station, and the Chevalier came out first among the samples sent over the Province. The above table shows the Chevalier to again take the lead while the Probsteier is the only variety whose yield is smaller than that of last year. The second place this season is claimed by the common two-rowed barley of Scotland, and the third by the Golden Melon of England.

The following table shows the results, arranged according to yield per acre :—

Variety.	Imported from.	Yield (bush. per acre).
Chevalier	Scotland	50.8
Common	"	45.3
Golden Melon	England	41.6
Peerless White	"	40.9
Empress	"	40.5
Probsteier	Germany	36.9
Sterlingshire	Scotland	36.7

Oats.—Nine varieties of oats have been tested for the second season. Although the seed was rather light owing to the very dry summer of 1887, still the oats did very well. They were sown in the new experimental field on which cereals were grown last year. The seed, as in the case of the barley, was sown broadcast and harrowed in. The quantity of seed was $3\frac{3}{4}$ lbs. on each 1-20 acre plot.

The Probsteier Hafer claims the same place this year that it held last, namely, that of being first. The yield of grain this summer from this variety is 17 per cent. more than that from the next best. This is a variety of much promise, and after another year's testing we hope to distribute small lots to farmers over Ontario. The Race-horse which did poorly before, probably owing to late sowing, as was stated last year, has done well this season. The chief objection to this variety is in its having rather weak straw, with a tendency to lodge. The Potato oats did well both years and is one of the best varieties. The Black Tartarian and the Hamilton take an intermediate position, while the Tam Findlay, Hopetown, Sandy and Blainslie came pretty low, the last two of which may probably be dropped out of the trial next season.

A table similar to that of the barley will illustrate the relative yield per acre :—

Variety.	Imported from.	Yield (bush. per acre).
Probsteier	Germany	70.3
Race-horse	England	60.0
Potato	Scotland	53.5
Hamilton	"	51.5
Black Tartarian	England	50.3
Tam Findlay	Scotland	47.2
Hopetown	"	44.7
Sandy	"	43.2
Blainslie	"	34.1

II. First Year Testing of Imported Cereals.

Country from which grain was imported.	Variety.	Grain.	Sown.	Brairded.	Headed out.	Matured.	General Appearance.		Size of ground cropped.	Weight of	
							Straw.	Grain.		Straw.	Grain.
									acres.	lbs.	lbs.
Australia	Cape	Barley	Apr. 25	May 4	July 4	July 30	Medium in length, good quality.	Fair sample	1-10	213	106
"	Scotch	"	" 25	" 4	" 4	" 30	Short but good quality	Good as to plumpness	1-10	232	152
"	Chevalier	"	" 25	" 4	" 16	Aug. 19	Long and rather coarse	Medium in plumpness and quality.	1-10	421	130
Germany	Winter Gerste	"	Sept. 5	.....	" 2	July 19	Medium length, bright and good.	Good sample in brightness and plumpness.	1-20	125	103
Australia	White	Oats	Apr. 27	" 10	" 11	Aug. 3	Average length, somewhat rusted.	Small, plump and good quality.	1-20	114.5	72.5
"	Triumph	"	" 27	" 9	" 19	" 19	Very long and nearly free from rust.	Medium in all respects	1-20	197	83.
New Brunswick.	St. John	"	" 27	" 10	" 8	July 30	Clean and good quality	Medium size, plump and heavy.	1-20	206½	90.5
C.E.S., Ottawa.	Ladogo	Spring wheat.	" 27	" 7	" 4	Aug. 6	Good length, nearly free from rust.	A little shrunken, medium sized grain.	1-40	68.2	23.3
Australia	Purple Straw	"	" 27	" 9	" 8	" 6	Average length very badly rusted.	Very inferior sample	1-20	.....	20
"	White Essex	"	" 27	" 9	" 9	" 6	Long and considerably rusted	Very inferior sample	1-20	.....	14
"	Purple Tuscan	"	" 27	" 10	" 12	" 8	Good length, very badly rusted.	Large grain, but considerably shrunken.	1-20	125	16
"	White Tuscan	"	" 27	" 9	" 11	" 8	Good length, very badly rusted.	Large grain, but considerably shrunken.	1-20	130.2	19.8
"	African Bearded	"	" 27	" 9	" 7	" 6	Pretty long, nearly free from rust.	A little shrunken, medium sized grain.	1-20	113	37
"	Indian	"	" 27	" 10	" 4	July 27	Very short, but stiff and of good quality.	Good sample, large and plump.	1-20	50	34
"	Improved Baart	"	" 27	" 9	" 4	Aug. 3	Average length, a very little rusted.	Good sample, large and plump.	1-20	99.2	37.8
"	Soft White	"	" 27	" 10	" 4	July 27	Very short and nearly free from rust.	Good sample, large and plump.	1-20	62	40
"	Ward's Prolific	"	" 27	" 9	" 11	Aug. 7	Long and considerably rusted.	Average size, considerably rusted.	1-20	75.5	27

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Notes on Testing Australian Cereals.

This is the first time we have had the opportunity of reporting the results of Australian cereals grown in Canadian climate. The seed was sown at the usual time of Canadian spring seeding. The time of ripening was also about the same as that of our common varieties, although some were a little earlier and some a little later. There were three varieties of barley, two of oats, and nine of spring wheat.

Barley.—Owing to the small quantities obtained we seeded thinner than we did the other barleys, putting only six pounds to the plot, or at the rate of sixty pounds per acre. These grains were sown also in Range I. of the old experimental field. Each plot consisted of one-tenth acre. The seed was sown broadcast as before, and harrowed in.

The Scotch is a six-rowed variety with rather short, stout straw, and yielded at the rate of 31.7 bushels per acre. This may do much better another season. The Cape barley was below the average in point of yield of grain and quantity of straw. The grain was not as plump as might have been expected from a two-rowed variety. The largest growth of straw was from the Chevalier, another two-rowed grain. This was nearly three weeks later than the others in reaching maturity, and produced very coarse and succulent straw.

A sample of fall barley was received from Germany in 1887, and sown in the following autumn. It germinated very well, and grew nicely until winter. In the spring it was discovered that part had been frozen out, but what remained grew rapidly, and a very good sample of six-rowed barley was produced. The straw was medium in height, stout and clean, and produced 42.9 bushels of grain to the acre.

Oats.—Only two varieties of oats were obtained from Australia, viz., the White and the Triumph. The former produced a medium-length straw of fair quality, with a yield of nearly 43 bushels of grain to the acre, the sample being superior to the oats sown. The latter was much longer in maturing, and the straw considerably heavier and coarser. There was 14.4 per cent. more grain obtained from this than from the White oats.

The St. John oats was a variety grown in New Brunswick, and given to Prof. Brown to test among others. The crop was good, the straw being heavy, clean, and standing well. The grain was plump and heavy, and, on weighing, shown to yield 53.2 bushels per acre.

Spring Wheats.—Among the nine varieties of spring wheats none produced very promising yields, but when it is considered that this is a poor section for spring wheat, and when we again consider the average yield per acre over the Province, we conclude that some of the varieties did fair for the first season under Canadian conditions. The Indian and the Soft White were very similar in every respect, producing very short straw, but grain of good quality. These two varieties were one week earlier in maturing than the next earliest variety, and eleven days earlier than some. The Improved Baart was very highly recommended by the Australian Experimental Station, and took a place among the best with us. The only other variety which we will mention is the African Bearded, which gave a fair yield, but the sample was somewhat inferior to those previously mentioned. The best four varieties produced the following yield per acre:—

Soft White..................................	13.3	bushels.
Improved Baart..............................	12.6	"
African Bearded.............................	12.3	"
Indian......................................	11.3	"

III. Application of Salt with Barley on Four Kinds of Soil.

The results from salt application have varied to such an extent that no definite conclusions appear to have been obtained as to its most economical use. It has been found by co-operative experiments with different fertilizers by members of the Experimental Union over Ontario and at this station, that in some cases salt acts very beneficially in increasing the yield of crops, while in other instances no perceptible good results occur. An interesting experiment was conducted during the last season, in which the effect of salt might be observed upon four varieties of soil under somewhat similar conditions.

In 1883 a plot was formed in the experimental field, consisting of loam, marl, clay, and muck. The whole plot was one-tenth acre in size, being eight rods long by two rods in width. It was divided into four parts, each two rods square. That at one end was naturally muck land, but was well underdrained. The two centre divisions were excavated to the depth of two feet, and one filled in by rather heavy clay and the other by marl intermixed with loam, while the remaining division was left a natural clay loam. A crop of fodder corn was grown upon the land last summer, and the treatment had been the same on all the soils since their preparation. In the spring of 1888 each soil division was separated into two equal parts, between which a board was sunk to the depth of six inches. Common six-rowed barley was sown on each part at the rate of 96 lbs. per acre. Salt was afterwards sown on one of the parts of each soil division at the rate of 400 lbs. per acre.

The experiment may be illustrated by the following diagram :—

SALT.	SALT.	SALT.	SALT.
LOAM.	MARL.	CLAY.	MUCK.
NO SALT.	NO SALT.	NO SALT.	NO SALT.

Paths twenty inches wide separated the different soils, and also one of the same width extended through the centre of the plot between the salted and the unsalted portions.

The following is a tabulated form of both grain and straw produced from the various parts :—

Variety of Soil.	Salt or No Salt.	Weight of		
		Grain. lbs.	Straw. lbs.	Total. lbs.
Loam	Salt	21¼	23¾	45
	No salt	21	21½	42½
Marl	Salt	11¼	36¼	47½
	No salt	10½	31½	42
Clay	Salt	16¾	15¼	32
	No salt	12¼	17¾	30
Muck	Salt	11¼	15¼	26½
	No salt	7	20	27

From this we learn that the soil, with salt applied, took the lead in every case in yield of grain, but in that of loam and marl the results were nearly the same. A greater difference is noticed from the influence of salt on clay, there being 86.7 % more grain from the part on which salt was applied than from the part without the application of salt. The greatest difference of all is with the muck, as salt on this soil produced over 60 % more grain than was obtained from the other part. Storer states in his valuable work on agricultural chemistry, that salt on mucky soil has a beneficial effect in forming carbonate of soda, and on clay soil, when not applied too freely, by dissolving its constituents.

The grain stood up well over all the plots, and that from salt was a little the brightest.

IV.—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 carry on systematic experimental work; to hear papers and addresses delivered by competent parties, and to meet at least once annually for these purposes.

The experimental work carried on by members of the Union and other interested agriculturists over Ontario is increasing year by year. The line of work taken up at present is testing the relative value of the most easily procured Canadian fertilizers.

The following are the instructions sent to each member who expressed a desire to conduct experiments during the past season, after which a very concise summary of the results of the Union tests of 1886 and 1887 will be given in tabulated form.

Ontario Agricultural and Experimental Union.

O. A. C., Guelph, March, 1888.

Dear Sir,—The last annual meeting of the Experimental Union appointed a committee to inaugurate and carry out a plan of experiments for the coming season. We have decided upon testing the effects of salt, superphosphate, ground apatite, wood ashes, farmyard manure, and no manure upon wheat, barley and oats.

Instructions for Experiments with Fertilizers.

1st.—Select a piece of ground of same nature throughout, under same conditions, and representative, as far as possible, of the land of the neighborhood. Avoid naturally wet spots, and keep clear of trees, fences and buildings. Give cultivation to experimental plots similar to that of your larger fields. If you can choose your plots in such a position as to allow them to remain for experiment another year, so much the better.

2nd. Mark off six plots of one-fortieth of an acre each, having clean path of two feet wide between the plots. Two rods square is a convenient shape.

3rd. Submit all plots to same treatment and sow one-sixth of grain sent on each. Aim at seeding one inch deep.

4th. Apply the salt sent to plot No. I., the superphosphate to No. II., the ground apatite to No. III., wood ashes to No. IV., farmyard manure to No. V., and no manure to No. VI. The fertilizers to be sown at time of seeding.

5th. Keep plots at all times clear from trespassing by poultry, etc.

6th. Each experimenter is allowed to use his own judgment in reference to the quantity of barnyard manure applied.

7th. It is requested that No. v. plot be sown with 10 lbs. fresh wood ashes, used same as the other fertilizers, as no Kainit can be obtained in Canada.

We have sent by express to those experimenting, expressage prepaid, one of the following lots of grain for six plots :—18 lbs. White Russian wheat ; 18 lbs. Red Fife wheat ; 11¼ lbs. Egyptian oats ; 11¼ lbs. White Cluster oats, or 12¾ lbs common six-rowed barley. Also 10 lbs. salt for plot No. I., 10 lbs. superphosphate for plot No. II., and 10 lbs. apatite for plot. No. III. The produce from the plots becomes the property of the experimenter.

Make out reports of experimental plots and meteorological observations as full and careful as you can and forward to Mr. C. A. Zavitz, O. A. C., Guelph, not later than 1st November.

NOTE.—To those who carried on somewhat similar experiments last season, on five plots, and two years ago on four plots, we send additional grain to be sown on the same plots. The object is to test the influence of the fertilizers over two and three seasons. Report in the same manner as for the new plots.

OPTIONAL EXPERIMENTS.

If you can furnish us any accurate information as to the results obtained by any others in your neighbourhood with the same fertilizers, we shall be glad to receive it. As for your own work, the success of the experiment and your own reputation demand carefulness, accuracy, and a little sacrifice.

In addition to, or entirely independent of the above general experiments, we are looking for some individual work. We wish every experimenter to send in an accurate statement in regard to some one or more of the following experiments :—

(1) Testing some imported cereals.
(2) Testing if chess sown will mature to seed.
(3) Testing whether plowing under farmyard manure or leaving as top-dressing is the best.
(4) Testing a mixture of grass seeds for use as a permanent pasture.
(5) Any experiment you are in a position to carry out, but which is not mentioned in the above.

Reports of all satisfactory experiments will be printed in the annual report of the Union.

METEOROLOGICAL OBSERVATIONS.

Rain gauges can be obtained free on application to the College, provided the observer will fill out a report and send it monthly to the Observatory at Toronto.

Make observations as regards rain and sunshine as follows :—

(*a*) *Rainfall.*—Have gauge well exposed, away from wind currents, near buildings, etc., and mouth of gauge a foot above the ground. At close of rain pour the amount into the graduated tube, divide the number of inches by ten, and call results inches of rain.

(*b*) *Clouds.*—Mark from 1 to 10, according to the amount of cloud in the sky. In making a summary, below 4 is clear ; above 6, cloudy. Make as many observations as convenient during the day, say 7 a.m. and 2 p.m. The mean is obtained by dividing the sum of the observations by the number of observations taken.

(*c*) *Heat.*—If possible, ascertain the readings of the thermometer for that district, if observations are made within ten miles of place of experiment.

If further instructions are desired in regard to these meteorological observations please correspond with Prof. Panton, O. A. C., Guelph.

RESULTS OF GRAIN TESTS ON PLOTS FERTILIZED IN 1887.
Yield of Straw and Grain in lbs. per plot of 1/40 acre.

	SALT.		SUPERPHOSPHATE.		APATITE.		FARM-YARD MANURE.		NO MANURE.	
	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.
Oats, 12 [illegible]										

Results of Grain Tests on Plots Fertilized in 1887.

Yield of Straw and Grain in lbs. per plot of 1/40 acre.

——	Salt.		Superphosphate.		Apatite.		Farm-yard Manure.		No Manure.	
	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.
Oats—13 tests	1 71.11	4 36.03	2 70.15	2 36.84	3 67.9	3 36.21	4 65.3	1 37.	5 62.55	5 34.9
Wheat—6 tests	3 56.25	4 22.51	4 54.85	2 25.51	2 57.25	3 23.181	1 65.125	1 27.9	5 50.5	5 20.5
Barley—8 tests	3 57.28	1 35.81	2 57.29	3 32.38	5 54.50	5 30.97	1 57.96	2 34.97	4 55.0	4 31.0
Average	1 64.27	3 33.71	2 63.51	1 35.22	4 62.02	4 31.79	3 63.14	2 34.62	5 58.03	5 31.32

Results on Grain Plots which were Fertilized in 1886.

Yield of Straw and Grain in lbs. per plot of 1/40 acre.

——	Salt.		Superphosphate.		Gypsum.		No Manure.	
	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.
Oats—3 tests	4 62.7	4 30.1	3 63.3	2 36.4	2 65.8	3 35.4	1 76.3	1 38.1
Wheat—1 test	4 68.	1 26.	2 90.5	2 18.5	1 96.00	4 16.00	3 86.00	3 18.00
Average	4 63.57	4 29.41	3 67.83	2 33.41	2 70.83	3 32.16	1 77.91	1 34.75

Number of Times each Fertilizer was First.

——	Salt.		Superphosphate.		Apatite.		Farm-yard Manure.		No Manure.	
	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.
Oats	1 6	5	2	2	1	1	4	2	2	2
Barley	2	4	3	2	.....	.....	3	2	.....	.....
Wheat	1	1	.....	2	2	.....	2	3	.....	1
Total	1 9	1 10	3 5	3 6	4 3	5 1	1 9	2 7	5 2	4 3

Note.—The figures in small type indicate the result of each experiment as compared with all the others. Thus, in the tests of the first table, salt on oats gave first place in straw and fourth in grain, while on wheat it gave third place in straw and fourth in grain.

In the year 1886 there were twelve members of the Union conducting experiments with fertilizers in about as many counties over Ontario. The number in 1887 increased to sixty, and this year it reached nearly one hundred.

About 300 packages of fertilizers and 600 packages of grains were sent from this institution last spring for experimental purposes at the expense of the union.

Surely no person can doubt that valuable work is being accomplished in the hands of those who, owing to their educational advantages, ought to be the most capable for such work.

In conclusion I wish to say that, in reviewing the work of the Experimental Department for the past year, a good deal of satisfaction is felt, and we trust the results may be of practical value to all interested. The importance of experimentation is becoming more evident all the while, and a deeper interest is being manifested by Ontario farmers as they are led to see that the results are of direct benefit to themselves.

Respectfully submitted,

C. A. ZAVITZ.

PART VII.

REPORT OF THE PHYSICIAN.

GUELPH, December 31st, 1888.

To the President of the Agricultural College:

SIR,—I have the honour to present to you my thirteenth Annual Report.

I am glad to be able to report that notwithstanding the fact that we have had some contagious disease in the city and neighbourhood, we have not had a single case in the College.

The cases I have been called to treat are such as are not within a general practice.

Our chief anxiety this year was caused by two accidents; the first case was caused by a blow upon the eyes, and the second, by a young man being precipitated a distance of about twenty-five feet, alighting on the threshing floor, breaking ribs and causing other serious injuries, but both cases recovered in due time. The building is in a good sanitary condition.

Before closing this report, allow me to urge the necessity of providing a proper sick-room into which the young men may be removed when they are ill. I speak strongly on this point as we have so often felt the need of such a room.

I have the honour to be, Sir,

Your obedient servant,

E. W. McGUIRE.