DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

DIVISION OF CHEMISTRY

REPORT OF THE DOMINION CHEMIST

FRANK T. SHUTT, M.A., D.Sc., F.I.C.

FOR THE YEAR ENDING MARCH 31, 1928

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SOILS

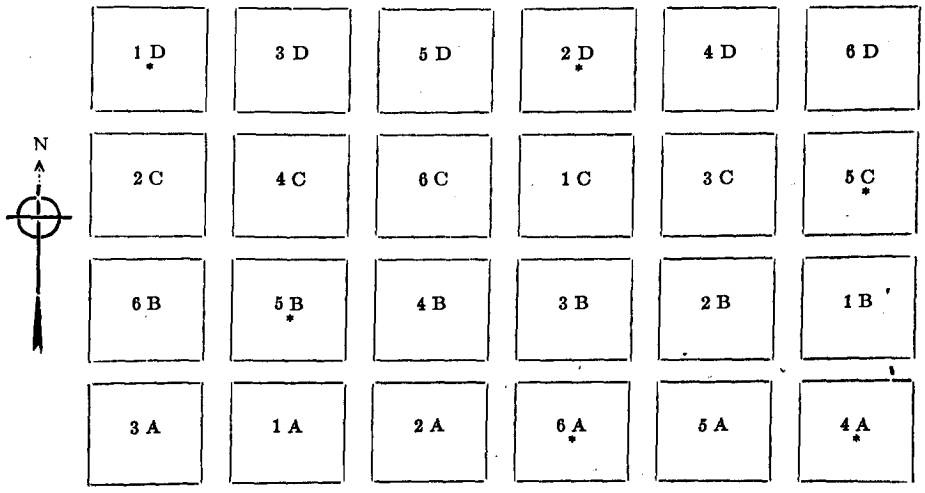
A number of investigations towards the solution of certain specific soil problems have been inaugurated during the year. These include, among the more important, the influence of irrigation on the chemical composition and texture of southern Albertan soils; the effect of plowing down sweet clover on the reaction and nitrogen content of soils at Brandon, Man.; the composition and general character of soils collected from Illustration Stations in southern Quebec; and the relation of soil acidity to the growth and fruit development of apple trees in Nova Scotia. These researches will be dealt with in detail in future publications, the work being still in progress.

In this report the results from the following investigations are presented: the chemical and physical examination of soils from the Experimental Station, Sidney, B.C., Experimental Station, Kapuskasing, Ont., and Experimental Station, Charlottetown, P.E.I., to furnish a basis for the interpretation of results of fertilizer treatments; analysis of soils from the district of Grande Prairie, Alta., and the examination of soils showing injury from mine waste deposited by the flood waters of the Massawippi river, P.Q.

BRITISH COLUMBIA

EXPERIMENTAL STATION, SIDNEY, V.I.

Six samples of soil, collected from the area devoted to experimental work with fertilizers for the potato crop at the Experimental Station, Sidney, B.C., were submitted to a complete physical and chemical analysis. The samples were taken to a depth of 6 inches from plots 4A, 6A, 5B, 5C, 1D and 2D, shown on the following plan:—



Plots 1/160 acre in acre.

Mechanical Analysis.—The results of the mechanical analysis are given in table No. 1. They show that the soil of this area varies from a gravelly-sandy loam on the west side to a clay loam on the east side.

Chemical Analysis.—The data from the chemical analysis of this series are given in table No. 2.

The percentages of nitrogen and organic matter of all six soils are very satisfactory but Nos. 88856 and 88859 are distinctly the richest of the series in regard to these constituents and indicate that the eastern side of the area would be more productive than the western half.

All six samples are fairly well supplied with phosphoric acid, particularly those collected from the east side of the area. The percentages of this element which are "available" are throughout the series quite high; they do not indicate, according to present standards, in the larger number of the plots, any immediate necessity for phosphoric acid.

The percentages of potash, both total and "available" are fair but the series as a whole cannot be considered as being very rich in this element of plant food. As might be expected the clay loams, Lab'y Nos. 88856, 88859 and 88861 are much higher in total potash than the sandy loams 88857, 88858, and 88860.

All the soils are quite well supplied with lime, although the data for the lime requirement indicate that a small dressing of ground limestone might prove beneficial for the majority of farm crops.

TABLE No. 1.—SOILS COLLECTED FROM POTATO FERTILIZER AREA—EXPERIMENTAL STATION, SIDNEY, B.C.

Mechanical Analysis—Moisture-free Basis

Lab'y. No.	Location	Gravel greater than 2 mm.	Fine gravel 2-1 mm.	Coarse sand 1-0·5 mm.	Medium sand 0·5-0·25 mm.	Fine sand 0·25-0·1 mm.	Very fine sand 0·1-0·05 mm.	Total sand	Silt 0·05-0·005 mm.	Clay 0·005-0·00 mm.	Classification
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
88856	Plot 4 A	9·85	5·55	6·95	11·49	12·60	5·90	42·49	19·95	37·56	Clay.
57	" 6 A	25·53	11·97	12·50	16·04	19·39	4·79	64·69	18·80	16·51	Gravelly sandy loam.
58	" 5 B	23·04	10·86	10·97	15·27	17·77	4·78	59·63	24·62	15·75	" "
59	" 5 C	9·19	3·21	3·81	6·65	10·73	6·34	30·74	35·69	33·57	Clay.
60	" 1 D	24·12	10·15	10·04	13·23	19·44	4·43	57·29	22·77	19·94	Gravelly sandy loam.
61	" 2 D	4·88	3·94	3·92	5·90	8·25	4·92	26·93	43·84	29·23	Clay loam.

TABLE No. 2.—SOILS: COLLECTED FROM POTATO FERTILIZER AREA, EXPERIMENTAL STATION, SIDNEY, B.C.

Chemical Analysis—On Air-dried Samples

Lab'y. No.	Location	Moisture	Loss on ignition (organic matter, etc.)	Soluble mineral matter	Insoluble mineral matter	Lime (CaO)	Magnesia (MgO)	Oxide of iron and alumina ($Fe_2O_3 + Al_2O_3$)	Nitrogen (N)	Phosphoric acid (P_2O_5)		Potash (K_2O)		Reaction	Lime requirement pounds per acre of ground limestone
										Total	Available	Total	Available		
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.		
8856	Plot 4 A	5·99	11·77	13·75	68·49	1·29	1·30	16·69	0·389	0·341	0·075	0·257	0·020	Sl. acid	3,340
57	" 6 A	3·44	8·05	8·97	79·54	1·19	0·96	9·72	0·254	0·226	0·067	0·188	0·015	"	2,440
58	" 5 B	4·26	9·28	10·16	76·30	1·36	1·04	11·57	0·310	0·201	0·059	0·147	0·012	"	1,870
59	" 5 C	6·13	12·12	14·04	67·71	1·53	1·35	16·55	0·419	0·255	0·073	0·268	0·019	V.S. acid	1,410
60	" 1 D	4·33	8·06	10·38	77·23	1·24	1·19	12·19	0·277	0·191	0·044	0·185	0·017	Sl. acid	1,990
61	" 2 D	4·54	8·79	12·11	74·56	1·55	1·46	13·34	0·275	0·195	0·039	0·246	0·018	"	1,600

ONTARIO

EXPERIMENTAL STATION, KAPUSKASING

This series of soils consists of twenty-four samples (surface and subsoil) collected from a clay area to be devoted to experimental work with fertilizers on the Experimental Station at Kapuskasing, Ont. The data should be useful in planning experimental work and in the interpretation of the results obtained. Commercial fertilizers in northern Ontario, for either general or special farm crops, have not been used to any appreciable extent, but the time undoubtedly will come when the employment of such will be found an economic practice in certain types or phases of farming. The chemical data from such an inquiry should give valuable assistance, not only toward the profitable use of fertilizers but in all methods undertaken with the view of raising the soil's productiveness.

The area in question was cleared of stumps in 1920-21, broken and seeded down with fall wheat. Three crops of hay and one of grain have been subsequently harvested, good yields being obtained.

The soil of this area may be described as a heavy clay loam. The samples were taken at depths 0″-6″ and 6″-12″ and there was no appreciable difference in physical character between the surface and subsoil, thus collected. Certain of the surface samples, however, showed traces of muck, with which many large, low-lying areas in this district are overlaid.

The chemical data from the analysis of these samples are presented in table No. 3.

TABLE No. 3.—CHEMICAL ANALYSIS OF SOILS COLLECTED AT KAPUSKASING, ONT.

Lab'y. No.	Plot No.	Depth	Moisture	On moisture-free basis							
				Loss on ignition (organic matter, etc.)	Insoluble mineral matter (sand, clay, etc.)	Lime (CaO)	Magnesia (MgO)	Oxide of iron and alumina (Fe_2O_3+ Al_2O_3)	Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)
			p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
82429	A-1	0″-6″	2·48	3·82	76·67	1·21	2·25	13·56	0·092	0·193	0·792
82430	A-1	6″-12″	3·32	11·46	62·55	7·28	3·40	15·22	0·080	0·172	0·915
82431	A-2	0″-6″	2·80	6·73	74·71	1·30	2·05	12·81	0·149	0·151	0·624
82432	A-2	6″-12″	3·23	5·12	77·54	1·27	2·10	12·87	0·091	0·152	0·720
82433	B-1	0″-6″	4·10	5·71	75·73	1·27	1·92	14·04	0·130	0·150	0·774
82434	B-1	6″-12″	4·45	7·41	69·23	3·21	3·00	17·07	0·083	0·162	1·04
82435	B-2	0″-6″	2·47	5·49	77·27	1·29	1·89	11·75	0·128	0·170	0·593
82436	B-2	6″-12″	3·20	4·99	76·37	1·25	1·79	12·81	0·081	0·168	0·669
82437	C-1	0″-6″	3·01	7·21	73·00	1·28	1·96	13·50	0·160	0·164	0·693
82438	C-1	6″-12″	3·41	7·66	70·87	3·07	2·63	15·01	0·083	0·137	0·695
82439	C-2	0″-6″	3·03	7·82	71·20	1·35	1·81	14·47	0·165	0·150	0·737
82440	C-2	6″-12″	4·84	5·56	74·04	1·32	2·55	15·89	0·078	0·150	0·993
82441	D-1	0″-6″	3·34	7·16	73·89	1·20	2·26	14·27	0·140	0·174	0·776
82442	D-1	6″-12″	4·30	6·72	76·56	1·22	2·05	13·51	0·108	0·128	0·629
82443	D-2	0″-6″	3·23	6·49	76·05	1·16	1·66	13·74	0·129	0·133	0·715
82444	D-2	6″-12″	3·73	5·08	77·31	1·16	1·57	13·94	0·085	0·120	0·746
82445	E-1	0″-6″	2·75	4·78	77·87	1·03	2·13	14·26	0·108	0·160	0·813
82446	E-1	6″-12″	5·53	7·02	69·26	2·22	2·90	17·53	0·093	0·157	1·12
82447	E-2	0″-6″	2·97	5·39	78·18	1·10	1·99	12·54	0·093	0·149	0·715
82448	E-2	6″-12″	3·23	7·11	73·03	3·24	2·39	13·42	0·076	0·141	0·728
82449	F-1	0″-6″	3·58	7·40	76·30	1·34	1·86	13·07	0·135	0·125	0·679
82450	F-1	6″-12″	3·63	6·93	76·38	1·33	1·94	12·91	0·135	0·144	0·721
82451	F-2	0″-6″	4·01	6·63	74·37	1·34	2·33	14·95	0·135	0·135	0·882
82452	F-2	6″-12″	4·23	5·36	74·96	1·28	2·44	15·24	0·075	0·143	0·936
Average of Surface Soils.....		.....		6·22	75·44	1·24	2·01	13·58	0·130	0·155	0·733
Average of Sub-soils.....		.....		6·70	73·18	2·32	2·40	14·62	0·089	0·148	0·826

Loss on Ignition.—This represents chiefly the organic matter content. However, in cases in which the soil is rich in carbonate of lime this datum will include the carbon dioxide of the carbonate driven off in the process of ignition. This is notably observable in Nos. 82430, 82434, 82438 and 82448.

The organic matter (humus) content is fair only, being distinctly below that of the best clay loams. At the larger number of the points of collection no great difference in this constituent is to be observed between the surface and subsoil.

In heavy clay loams of this character it is highly important that the organic matter content should be maintained at a high level, for ease of working and good tilth conditions generally. This may be accomplished by liberal dressing of manure (preferably fresh and strawy) and the ploughing under of green crops. To this end also the muck of the district may be profitably used, preferably after an initial composting or using as an absorbent for liquid manure in the cowbarn and piggery.

Nitrogen.—The nitrogen content in the larger number of the surface samples lies nearer the lower than the higher limit for good fertile loams. As might be expected, the surface soils (0″-6″) are richer in this element than the underlying soil.

The means already advised for the up-keep of the organic matter content, will also serve to enrich the soil in nitrogen.

Phosphoric Acid.—With very few exceptions these soils are low in phosphoric acid, the series as a whole being characterized by a content below rather than above the average for good loams.

No great difference in phosphoric acid content is to be noted between the surface and subsoil.

In view of the foregoing a profitable response might be expected from the judicious use of phosphatic fertilizers.

Potash.—The percentage of potash throughout the series may be regarded as exceptionally high. There is no indication that potassic fertilizers are needed.

Lime.—The notable characteristic of these clay loams is their high lime content. This is a very important and valuable feature, since lime (carbonate of lime) is the chief agent in bringing about a favourable tilth in and ease of working of heavy loams. It also is useful in encouraging the growth of clover and other legumes, crops valuable, as has been pointed out, for the improvement of these clays.

Since the percentage of carbonate of lime in the soils of this area increases with depth—being approximately 30 per cent at 3 to 5 feet—the means are at hand for the cheap and convenient upkeep of this element*. The high lime content of these soils constitutes probably their most valuable asset.

The comparatively high percentage of magnesia, though not assuming serious proportions, would prompt the upkeep of the lime content, since some authorities claim that excess of magnesia will prove unfavourable to maximum crop growth.

*Analyses of subsoils, collected at this Station, showing high percentages of carbonate of lime, are presented in Report, Division of Chemistry, 1924, page 5.

PRINCE EDWARD ISLAND

EXPERIMENTAL STATION, CHARLOTTETOWN

The following report contains the results from the analysis of soil samples collected from the plots devoted to experimental work with manure and fertilizers commenced in 1927, the data to be used in the interpretation of the field results. It is the intention to resample the plots later and from the data of analysis of the two series of samples to study the effect of the fertilizer treatments on soil fertility and reaction. The experiment was planned to determine the relative value of (1) manure and chemical fertilizers for the production of potatoes, and (2) nitrate of soda and sulphate of ammonia as sources of nitrogen for the potato crop.

The soil samples, 48 in number (surface and subsoil), were composites taken to a depth of 0-7″ and 7″-14″.

The chemical examination of the soils consisted of determinations of organic matter, nitrogen and lime requirement. Data for the hydrogen-ion concentration were also obtained.

The physical examination furnished seven separates from fine gravel to clay, the method of analysis employed being that of the Bureau of Soils, United States Department of Agriculture. Since the soils were very similar, physically, sixteen samples only were submitted to a mechanical analysis.

The results of analysis are tabulated in tables Nos. 4 and 5.

Chemical Analysis.—The data tabulated in table No. 4, show that the surface soil of this area is fairly uniform in respect to its percentages of organic matter and nitrogen, the averages being 6·15 and ·172, respectively. The greatest variation in nitrogen content occurs in plots 23, 28 and 29, the soils of which contain ·130, ·203 and ·202 per cent, respectively.

The data presented in the following table show that the nitrogen content of the surface soils of this series very closely approximates that found in the series of manured soils from this province previously reported on.**

NITROGEN CONTENT OF SURFACE SOILS OF PRINCE EDWARD ISLAND.

(Moisture-free basis)

—	Nitrogen	
	Soils of this Series	Soils previously reported. Manured within the past 12 years
	p.c.	p.c.
Maximum	0·203	0·203
Minimum	0·130	0·135
Average	0·172	0·167

These data indicate that the area selected for this investigational work with fertilizers may be expected to yield results which will be applicable to the soils of the province generally.

A moderate acidity is apparent throughout the series, the lime requirement for the surface members varying from 3,722 to 6,484 pounds of carbonate of lime per acre, with an average of 5,016 pounds. The lime requirement of the sub-soils (7″ to 14″) is slightly lower than that of the surface soils.

**Bulletin No. 100 Experimental Farm Series. "The Soils of Prince Edward Island."

TABLE No. 4.—CHEMICAL ANALYSIS OF SOILS COLLECTED AT CHARLOTTETOWN, P.E.I.

Lab'y. No.	Plot	Moisture		Moisture-free basis				Lime requirements pounds per acre				pH value	
				Loss on ignition (organic matter, etc.)		Nitrogen (N)		Carbonate of lime		Quicklime			
		Surface soil	Sub-soil	Surface soil	Sub-soil	Surface soil	Sub-soil	Surface soil	Sub-soil	Surface soil	Sub-soil	Surface soil	Sub-soil
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.						
87624	9	1·41	.....	6·12	.....	0·177	.....	5,524	.....	3,096	.....	5·04	.....
25	9	.....	1·18	.....	4·15	.....	0·071	.....	5,076	.....	2,844	.....	5·04
26	10	1·47	.....	6·43	.....	0·181	.....	5,012	.....	2,808	.....	5·04	.....
27	10	.....	1·52	.....	4·06	.....	0·072	.....	4,244	.....	2,376	.....	5·04
28	11	1·59	.....	5·60	.....	0·147	.....	3,722	.....	2,088	.....	5·05	.....
29	11	.....	1·12	.....	4·28	.....	0·077	.....	4,628	.....	2,592	.....	4·90
30	12	1·50	.....	5·94	.....	0·168	.....	6,228	.....	3,492	.....	4·65	.....
31	12	.....	1·57	.....	4·52	.....	0·080	.....	5,268	.....	2,952	.....	4·90
32	13	1·58	.....	6·19	.....	0·181	.....	4,244	.....	2,376	.....	5·04	.....
33	13	.....	1·21	.....	4·04	.....	0·084	.....	3,530	.....	1,980	.....	5·10
34	14	2·55	.....	5·71	.....	0·164	.....	3,722	.....	2,088	.....	5·20	.....
35	14	.....	1·67	.....	3·93	.....	0·076	.....	4,244	.....	2,376	.....	5·12
36	15	1·54	.....	5·66	.....	0·149	.....	4,500	.....	2,520	.....	5·07	.....
37	15	.....	1·95	.....	3·99	.....	0·075	.....	4,500	.....	2,520	.....	5·10
38	16	1·58	.....	6·21	.....	0·169	.....	4,756	.....	2,664	.....	5·18	.....
39	16	.....	1·94	.....	4·16	.....	0·078	.....	5,588	.....	3,132	.....	4·95
40	17	1·17	.....	6·43	.....	0·186	.....	5,524	.....	3,096	.....	4·95	.....
41	17	.....	1·08	.....	4·35	.....	0·087	.....	4,500	.....	2,520	.....	4·79
42	18	1·64	.....	6·93	.....	0·191	.....	5,012	.....	2,808	.....	5·04	.....
43	18	.....	1·33	.....	5·54	.....	0·117	.....	5,012	.....	2,808	.....	5·15
44	19	1·13	.....	6·11	.....	0·159	.....	3,722	.....	2,088	.....	5·14	.....
45	19	.....	1·61	.....	4·93	.....	0·092	.....	3,530	.....	1,980	.....	5·54
46	20	1·58	.....	6·57	.....	0·186	.....	5,524	.....	3,096	.....	4·95	.....
47	20	.....	1·19	.....	4·52	.....	0·075	.....	5,780	.....	3,240	.....	4·95
48	21	1·21	.....	6·31	.....	0·189	.....	5,268	.....	2,952	.....	4·80	.....
49	21	.....	1·00	.....	4·50	.....	0·083	.....	3,722	.....	2,088	.....	5·12
50	22	0·96	.....	5·88	.....	0·161	.....	6,484	.....	3,634	.....	4·61	.....
51	22	.....	0·92	.....	4·10	.....	0·087	.....	5,268	.....	2,952	.....	5·04
52	23	0·95	.....	4·84	.....	0·130	.....	4,756	.....	2,664	.....	5·04	.....
53	23	.....	0·75	.....	3·73	.....	0·072	.....	3,978	.....	2,232	.....	4·73
54	24	0·90	.....	5·37	.....	0·157	.....	5,268	.....	2,952	.....	4·66	.....
55	24	.....	0·86	.....	4·13	.....	0·075	.....	5,012	.....	2,808	.....	4·95
56	25	1·13	.....	6·10	.....	0·171	.....	5,268	.....	2,952	.....	4·78	.....
57	25	.....	1·19	.....	5·04	.....	0·101	.....	5,012	.....	2,808	.....	4·95
58	26	1·29	.....	6·13	.....	0·172	.....	4,756	.....	2,664	.....	4·95	.....
59	26	.....	1·23	.....	5·01	.....	0·090	.....	4,756	.....	2,664	.....	5·08
60	27	1·20	.....	6·44	.....	0·179	.....	4,756	.....	2,664	.....	5·00	.....
61	27	.....	1·06	.....	4·38	.....	0·081	.....	4,756	.....	2,664	.....	5·20
62	28	1·51	.....	7·19	.....	0·203	.....	4,756	.....	2,664	.....	5·13	.....
63	28	.....	1·61	.....	5·63	.....	0·102	.....	6,228	.....	3,492	.....	4·87
64	29	1·25	.....	6·85	.....	0·202	.....	4,756	.....	2,664	.....	5·20	.....
65	29	.....	1·16	.....	4·50	.....	0·087	.....	5,780	.....	3,240	.....	4·92
90064	6	1·35	.....	6·30	.....	0·167	.....	5,268	.....	2,952	.....	5·20	.....
65	6	.....	1·13	.....	4·58	.....	0·078	.....	4,756	.....	2,664	.....	5·29
66	7	1·14	.....	5·95	.....	0·163	.....	5,780	.....	3,240	.....	5·28	.....
67	7	.....	1·01	.....	4·38	.....	0·085	.....	5,780	.....	3,240	.....	5·12
68	8	1·23	.....	6·35	.....	0·179	.....	5,780	.....	3,240	.....	5·12	.....
69	8	.....	1·09	.....	4·33	.....	0·083	.....	6,228	.....	3,494	.....	5·07
Average.....		1·37	1·27	6·15	4·45	0·172	0·084	5,016	4,882	2,809	2,734	5·00	5·04

TABLE No. 5.—MECHANICAL ANALYSIS OF SOILS COLLECTED AT CHARLOTTETOWN, P.E.I.

(Moisture-free basis)

Lab'y. No.	Plot	Location	Gravel greater than 2 mm.	Fine gravel 2-1mm.	Coarse sand 1-0·5 mm.	Medium sand 0·5–0·25 mm.	Fine sand 0·25–0·1 mm.	Very fine sand 0·1–0·05 mm.	Total sand	Silt 0·05-0·005 mm.	Clay 0·005-0·00 mm.	Classification
			p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
90064	6	Surface	4·38	1·16	1·03	1·28	23·27	29·01	55·75	28·96	15·29	Sandy loam
			0·61*									
65	6	Subsoil	15·71	1·13	1·45	2·38	23·38	28·84	57·18	28·33	14·49	"
87624	9	Surface	3·81	0·92	0·92	2·15	26·68	27·49	58·16	28·36	13·48	"
25	9	Subsoil	12·95	0·64	0·98	2·29	27·72	29·11	60·74	25·86	13·40	"
30	12	Surface	2·80	0·71	1·32	2·39	26·21	28·31	58·94	25·61	15·45	"
31	12	Subsoil	7·81	1·19	1·77	3·24	27·60	29·88	63·68	23·85	12·47	"
36	15	Surface	7·14	1·12	0·92	2·06	25·59	28·28	57·97	27·62	14·41	"
			0·23*									
37	15	Subsoil	9·00	0·55	1·09	1·65	25·96	28·41	57·66	29·07	13·27	"
42	18	Surface	3·62	0·63	0·82	2·30	23·95	28·23	55·93	28·10	15·97	"
43	18	Subsoil	6·77	1·25	1·35	2·67	25·37	28·47	59·11	26·82	14·07	"
48	21	Surface	2·85	0·75	0·83	1·80	22·38	29·07	54·83	30·29	14·88	"
			0·33*									
49	21	Subsoil	9·84	1·35	1·55	1·83	21·65	30·22	56·60	29·50	13·90	"
54	24	Surface	1·23	0·44	0·58	1·50	21·06	30·23	53·81	30·57	15·62	"
			0·35*									
55	24	Subsoil	10·27	1·08	1·58	1·77	24·42	30·17	59·02	26·25	14·73	"
60	27	Surface	6·59	0·41	0·65	1·68	20·11	28·92	51·77	31·39	16·84	"
			0·78*									
61	27	Subsoil	8·43	0·73	1·56	2·15	22·09	29·61	56·14	30·08	13·78	"

*Cinder ash possibly accounted for by the fact that the area is in close proximity to the railway.

Mechanical Analysis.—In table No. 5 the results from a mechanical analysis of eight samples each of surface and subsoils are presented. As will be noted, all the samples examined are very similar with respect to their percentages of sand, silt and clay. They may be classed as brownish-red "fine sandy loam".

Considered from the standpoint of their physical make-up, the data indicate soils of good tilth, with ample aeration and a fair absorptive capacity for moisture. They may be expected to respond to applications of plant food.

ALBERTA

GRANDE PRAIRIE, PEACE RIVER DISTRICT

The soils discussed in this chapter were collected as typical of large areas of lands suitable for settlement in the vicinity of Grande Prairie. The information obtained from this examination should indicate the degree of fertility in the virgin soils of the district, their special characteristics and the most economic means for their upkeep.

The series consist of three samples: two surface and one subsoil. Their location and description follows:—

Lab'y. No. 62249: "Surface soil (virgin) to a depth of 6 or 7 inches, from school section SE. ¼, section 11, R. 72, tp. 6 W. of the 6th."

Description (as received): Damp, dark brown, clay loam (or silty clay loam) well supplied with humus and in excellent mechanical condition. Much root fibre present. Reaction (litmus): Very distinctly acid.

Lab'y No. 62250: "Surface Soil (virgin) to a depth of 6 or 7 inches, from SE. corner of school section 11, R. 72, tp. 6 W. of the 6th."

Description (as received): Damp, dark brown clay loam (or silty clay loam) well supplied with humus and in excellent mechanical condition. Much root fibre present. Reaction (litmus): distinctly acid.

Lab'y No. 62251: "Subsoil at depth of 7 or 8 inches, taken below surface sample 62250, from SE. corner of school section 11, R. 72, tp. 6 W. of the 6th."

Description (as received): In lumps which become very hard and refractory on air-drying. Composed essentially of clay with silt and sand (mostly very fine) in about equal proportions.

TABLE No, 6.—MECHANICAL ANALYSIS (SOILS COLLECTED AT GRANDE PRAIRIE)

(Moisture-free basis)

Lab'y. No.	Fine gravel 2-1 mm.	Coarse gravel 1-0·5 mm.	Medium sand 0·5-0·25 mm.	Fine sand 0·25-0·1 mm.	Very fine sand ·1-·05 mm.	Total sand	Silt 0·05-0·005 mm.	Clay 0·005-·00 mm.	Classification
	p.c.	p.c.	p.c.	p.c..	p.c.	p.c.	p.c.	p.c.	
62249	0·64	1·58	2·14	6·59	24·05	35·00	44·86	20·14	Clay loam
62250	0·34	0·91	2·18	6·87	25·38	35·68	44·42	19·90	"
62251	0·51	1·60	3·64	7·51	10·33	23·59	29·10	47·31	Clay.

According to accepted classifications the surface soils Nos. 62249 and 62250—which are very similar—would be classed as "clay loam," but since they contain approximately 45 per cent of silt, they might be described as "silty clay loams." The subsoil No. 62251 containing almost 50 per cent of clay, would be classed as "clay".

The excellent physical condition or tilth of the surface loams, permitting an easy working of the soils, favouring a ready root extension and affording a fair absorptive capacity for moisture, may be noted.

TABLE No. 7.—CHEMICAL ANALYSIS (SOILS COLLECTED AT GRANDE PRAIRIE)

(Air-dried basis)

—	Lab'y. No. 62249 (Surface Soil)	Lab'y. No. 62250 (Surface Soil)	Lab'y. No. 62251 (Sub-soil)
	p.c.	p.c.	p.c.
Moisture	5·02	4·05	2·89
*Loss on ignition (organic matter, etc.)	11·96	9·53	6·15
**Mineral matter soluble in HCl (Sp. Gr. 1·115)	8·72	8·26	15·00
Mineral matter insoluble in acid	74·30	78·16	75·96
	100·00	100·00	100·00
*Containing nitrogen	0·54	0·44	0·19
**Containing—			
Phosphoric acid (P_2O_5)	0·26	0·23	0·17
Potash (K_2O)	0·36	0·31	0·54
Lime (CaO)	0·43	0·31	0·40
Magnesia (MgO)	1·14	1·60	1·65
Oxide of iron and alumina ($Fe_2O_3 + Al_2O_3$)	7·04	6·46	12·40
Soluble in 1 per cent citric acid (available)—			
Phosphoric acid (P_2O_5)	0·044	0·029	0·023
Potash (K_2O)	0·032	0·036	0·044
Lime (CaO)	0·272	0·224	0·366
Lime Requirement—			
Pounds per acre of ground limestone	10,600	7,060	.....
or pounds per acre of quick lime	5,980	3,960	.....

Nitrogen and Organic Matter.—Both surface soils are well supplied in these important constituents, the percentage being decidedly above the average for Canadian loams and comparing favourably in this respect with the richest prairie soils examined in these laboratories.

For a subsoil, No. 62251 (collected at a depth of 7 to 8 inches) is characterized by a fairly high content in these elements—a feature of considerable value looking to the future productiveness of the area.

Phosphoric Acid.—The range for phosphoric acid in Canadian loams, according to our findings, is from ·15 to ·25 per cent though some exceptionally good soils exceed somewhat this latter figure. By this standard the present soils would be adjudged as above the average.

The percentage of the "total" phosphoric acid present in "available" form is very satisfactory.

Potash.—The potash content is that of fairly good soils; it is somewhat above that of the poorer soils but not so high as that of the best clay loams. In "availability", however, the potash in these soils is above the average.

Lime.—The lime content of these soils is decidedly low. This is reflected by the marked acidity of the loams and confirmed by the high "lime requirement" data. The long continued cultivation of these soils will certainly demand lime applications, if optimum results are to be expected.

Magnesia.—The magnesia content is high when compared with that of the lime—a condition, by many agricultural authorities considered undesirable. However, the lime-magnesia ratio of these soils does not approximate that in soils the productiveness of which is known to be depressed by excess of magnesian compounds. While this feature may not at the outset be of any great significance it supports and emphasizes the deductions drawn from the data for lime requirement.

Summarizing, it may be said that the examination of the two samples representative of the surface soils affords satisfactory evidence of the excellent character of the area involved. Both from the standpoint of plant food and physical condition, the soil would be adjudged of a superior type and one giving promise of producing good yields under favourable seasonal conditions.

The soil is characterized by a low lime content and an acid reaction. This more or less unfavourable feature is somewhat emphasized by the moderately high percentage of magnesia. Too great stress, however, should not be placed on this latter feature as there are many soils possessing a similar or higher lime-magnesia ratio which have proved productive over a long period.

The surface soil is of a fair depth, mellow and underlaid by a strong clay subsoil.

QUEBEC

SPECIAL INVESTIGATION OF SOILS FROM FARMS SHOWING INJURY FROM MINE WASTE (MILL TAILINGS) ON MASSAWIPPI RIVER, P.Q.

The attention of the division was drawn early in the season of 1927 to alleged injury of farm lands in the vicinity of Lennoxville from the deposition of mine waste or tailings brought down in the spring by the flood waters of the Massawippi river. Samples of soil collected by the County Agriculturist were submitted to analysis and found to be very strongly acid and more or less heavily impregnated with sulphide of iron (iron pyrites). To obtain further information and data in this matter a member of this staff made a survey of the flooded district and collected for further examination a series of soil samples from affected and unaffected areas. His report showed that the tailings of the mill (Eustic Mining Co.) amounting to about 5 tons per hour are discharged directly into the river, giving the water a dark murky appearance for some distance. At this point the tailings had made a bank reaching approximately half way across the river. Signs of damage were observed below the point of discharge of the mill waste on both sides of the river—but more particularly on the east side—pasture lands, hay, corn, grain—on a number of farms. On some of the affected areas the loss was not total—some sparse vegetation remained—on others the injury was more serious, the land being quite bare and barren.

In this survey twelve samples, surface and subsoil—were collected from affected areas and two samples representative of the mine tailings were also taken. The chemical work on these samples included the following determinations: total sulphur, sulphur as sulphide, sulphur present in water-soluble compounds, hydrogen-ion concentration and lime requirement. The data from this work together with particulars as to occurrence, action on vegetation, etc., are presented in table No. 8.

TABLE NO. 8.—SULPHUR COMPOUNDS IN SOIL FROM FARMS SHOWING INJURY FROM MINE WASTE (MILL TAILINGS) ON MASSAWIPPI RIVER, QUE.

Lab'y. No.	Depth of collection	Origin of soil, etc.	Total sulphur	Sulphur as sulphides	Water soluble sulphur	Hydrogen-ion concentration pH
			p.c.	p.c.	p.c.	
90134	0-6"	G. Beaubien, vegetation newly killed (1927)	0·286	0·153	0·133	3·06
35	6-12"	G. Beaubien, vegetation newly killed (1927)	0·110	0·036	0·074	3·90
36	0-6"	G. Beaubien, Couch grass alive (other grasses dead	0·103	0·047	0·056	3·52
37	6-12"	" "	0·055	0·025	0·030	4·05
38	0-6"	G. Beaubien, Red Top and couch grass alive, other grasses dead	0·055	0·029	0·026	4·60
39	6-12"	" "	0·028	0·010	0·018	5·22
40	0-6"	G. Beaubien, Timothy alive and a little clover	0·084	0·022	0·062	4·30
41	6-12"	" "	0·071	0·036	0·035	4·26
42	0-6"	H. Stratford. Pasture newly killed (1927)	0·736	0·077	0·659	1·65
43	6-12"	" "	0·250	0·007	0·243	2·94
44	0-6"	H. Stratford. High area unaffected	0·028	0·010	0·018	5·34
45	6-12"	H. Stratford. High area unaffected.	0·023	0·002	0·021	5·41
46	.....	H. Stratford. Deposit scraped off surface soil	6·386	5·751	0·635	2·66
49	.....	Tailings from mill, dry	20·09	.....	.....	.....

Lime Requirements

Lab'y. No.	Depth of collection	Origin of soil, etc.	Carbonate of lime, lb. per acre	Hydrated lime, lb. per acre	Quick lime, lb. per acre
90134	0-6"	G. Beaubien, vegetation newly killed (1927)	14,700	10,880	8,230
36	0-6"	G. Beaubien, couch grass alive (other grasses dead)	9,630	7,140	5,400
38	0-6"	G. Beaubien, Red top and couch grass alive, other grasses dead	6,420	4,760	3,600
40	0-6"	G. Beaubien, Timothy alive and a little clover	7,760	5,740	4,350
42	0-8"	H. Stratford, pasture newly killed (1927)	31,650	23,420	17,980
44	0-8"	H. Stafford, high area unaffected	3,660	2,710	2,050

A review of these data reveals the extreme acidity of the flooded soils. This is established by the high water-soluble sulphur content (sulphuric acid), the pH values, and the very high lime requirement figures. Under such excessive acidity vegetation is entirely destroyed and the land rendered barren.

The analysis of sample No. 90146, "Deposit scraped off surface soil" and of No. 90149, the tailings collected at the mill, show that this mine waste contains large percentages of iron pyrites. It is the weathering and oxidation of this compound deposited on the flooded areas which gives rise to this excessive soil acidity.

The application of heavy dressings of lime or ground limestone are suggested as the chief remedial measure. This with drainage and possibly deep ploughing would appear to be the only practicable means towards the reclamation of these injured areas but whether such reclamation could be economically accomplished is a matter of some doubt. If undertaken, the trial at the outset should be on a small area so that ineffective or useless expenditure might be avoided.

INVESTIGATIONAL WORK WITH FERTILIZERS

FERTILIZERS FOR THE POTATO CROP

SIDNEY, B.C.

Experimental work with fertilizers for the potato crop was continued at this Station in 1927 in an endeavour to learn (1) which element or elements of plant food may be supplied to advantage and (2) to ascertain if there is any virtue in applying the fertilizer a few weeks previous to planting as compared with making the application at planting time. Past work with fertilizers indicates that the moisture content of the soil is an important factor in the results obtained from the use of these materials at this Station where the rainfall is apt to be very light during the growing season. The more or less negative results which have been obtained here generally, from the application of fertilizers may be due in a large measure to insufficient soil moisture for their proper functioning.

The plan of the experiment was a comparatively simple one, comprising six treatments including a check. On plot 1, nitrate of soda, superphosphate and muriate of potash were used to make a complete mixture having the formula 4-8-8 (approximately) and applied at the rate of 1,500 pounds per acre. On plot 2, sulphate of ammonia was used in place of nitrate of soda to furnish the nitrogen. On plots 3, 4 and 5 the nitrogenous, potassic and phosphatic fertilizer was eliminated in turn from the complete mixture. Plot 6, the check, received no treatment. The plan was carried out in quadruplicate, two ranges of plots having the fertilizer applied at planting time and two ranges four weeks previous.

The results obtained were more or less inconsistent, probably due, in a large measure, to variations in the character and fertility of the soil of the area used. An examination of samples of soil collected from certain plots of the area showed that the soil varied from a gravelly-sandy loam on the west half to a clay loam on the east half. Further, the analytical data showed that the area as a whole was not uniform in respect to its plant food content.*

On the gravelly loam section the yields from the treated plots showed no marked increase over that from the check plot.

These results may be accounted for, in part at least, by the failure of the soil to hold moisture, the precipitation during the growing season being very sparse—only 2·73 inches during the months of May, June, July and August.

On the clay loam section the fertilized plots gave from 16 to 34 per cent average increases in yield over the check plots. The data indicate that best returns may be expected from a complete fertilizer. The lowest increase in yield was obtained when potash was omitted from the mixture. The plots on which phosphoric acid was omitted from the fertilizer gave yields approximately equal to those which received a complete mixture. There was no marked response from nitrogen, whether applied as nitrate of soda or sulphate

*The reader is referred to page 5 of this report for the plant food content of the soils of this area.

of ammonia. This perhaps may be accounted for in part by the dryness of the season. It is also worthy of note that the soil was fairly rich in this element.

In respect to the time of application, the results show that, under this year's seasonal conditions, the fertilizer applied four weeks previous to planting did not prove more beneficial than when applied at planting time.

The results of this experiment show that for the most effective response from fertilizers, seasonal conditions must be favourable.

EPHOS BASIC PHOSPHATE

SIDNEY AND AGASSIZ, B.C.

Ephos basic phosphate is ground Egyptian rock phosphate containing, approximately, 60 per cent tricalcic phosphate (27·5 per cent P_2O_5) and has a fineness of 80 per cent through 100 mesh.

Experiments with Ephos Basic Phosphate were conducted at Sidney and Agassiz, B.C. during the past season. Previous results with this ground rock phosphate were reported from experimental work in the Maritime Provinces in the report of the division for the year ending March 31, 1927, the data showing that it had proved a very satisfactory source of phosphoric acid for the turnip crop but of small value for mangels.

The investigation in both 1926 and 1927 permitted of a comparison between Ephos, superphosphate and basic slag, each material being applied in amounts to furnish 80 pounds of phosphoric acid per acre, and in combination with a nitrogenous and potassic fertilizer.

At Sidney, potatoes and mangels were used to measure the effect of the three phosphatic materials employed. The data show that there was no marked response of these crops to applications of phosphoric acid; all three forms of this element of plant food gave about equal returns.

At Agassiz, the crop was mangels. All the treated plots gave large increases over the check plots, but the data indicate that the major part of this increase was due to the application of nitrogen and potash. While the slight response to applications of phosphoric acid in this experiment prohibits any strict comparison of the three phosphatic fertilizers employed, it may be noted that the plot receiving Ephos basic phosphate gave the highest yield.

CALCITIC AND MAGNESIAN LIMESTONE

OTTAWA, ONT.; NAPPAN AND KENTVILLE, N.S.

Experiments were commenced in 1924 at the branch Station, Kentville, N.S., in 1925 at the branch Farm Nappan, N.S. and in 1924 at the Central Farm, Ottawa, Ont. to determine the relative effect of calcitic ground limestone and magnesian ground limestone (dolomite) on crop yields. The chief object of the experiment was to learn if continued applications of the ground magnesian limestone had a depressing effect on subsequent crop yields.

CENTRAL EXPERIMENTAL FARM, OTTAWA

This experiment was conducted on a light silty clay loam soil which showed a slight acidity. The area had received an application of manure at the rate of 20 tons per acre in 1922 and was in a good state of fertility. The ground limestone was applied in the spring of 1924 at the rate of 4 tons per acre. The rotation—a four year course—consisted of potatoes, oats, clover hay, timothy hay. The crop yields obtained during the four years 1924-1927 are given in table No. 9.

TABLE No. 9.—GROUND LIMESTONE EXPERIMENT, OTTAWA, ONT.

Ground limestone per acre—applied in 1924	Yields per acre: average of duplicate plots				
	1924	1925—Oats		1926 Clover hay (2 cuttings,	1927 Timothy hay
	Potatoes	Grain	Straw		
	bush.	bush.	lb.	lb.	lb.
Calcitic limestone—4 tons	252·5	60·3	2,391	5,895	5,562
Magnesian limestone—4 tons	264·0	60·5	2,336	6,240	5,940
Check—no limestone	279·0	61·3	2,355	6,240	5,319

As will be noted from the data in table No. 9, excellent yields were obtained throughout the four year period. The returns from all the crops were above the average for the district and the differences in yields of the various plots are well within the limits of experimental error.

The yields of the check plot show that there was no response to lime; evidently the soil of the area is not deficient in this element.

The results of this investigation to date furnish no evidence that magnesian limestone has an injurious effect on crop production.

EXPERIMENTAL FARM, NAPPAN, N.S.

The two classes of limestone were compared at this Farm at two rates—two and six tons per acre, applied in the spring of 1925. The soil is a medium clay loam of average fertility. The crop yields of a three-year rotation of turnips, grain, clover hay are given in table No. 10.

TABLE No. 10.—GROUND LIMESTONE EXPERIMENT—NAPPAN, N.S.

Ground limestone per acre—applied in 1925	Yield per acre—Average of quadruplicate plots			
	1925 Turnips	1926—Oats		1297 Clover hay
		Grain	Straw	
	bush.	bush.	lb.	lb.
Calcitic limestone—2 tons	749·3	40·8	2,420	4,240
" " —6 "	842·7	41·2	3,420	5,060
Magnesian limestone—2 tons	773·3	43·2	2,620	4,200
" " —6 "	824·0	45·5	2,540	4,120
Checks—no limestone	744·0	37·9	2,260	3,900

Calcitic limestone at the rate of 2 tons per acre resulted in slight increases in the grain and hay crops. Increasing the rate to 6 tons per acre gave an increase in the turnip yield and a further slight increase in the oats and clover hay.

The increases from the magnesian limestone were of the same order of magnitude as those from the calcitic limestone.

EXPERIMENTAL STATION, KENTVILLE, N.S.

The area devoted to this experiment was dressed with 16 tons of manure, 150 pounds of nitrate of soda and 300 pounds of superphosphate per acre in the spring of 1924, in preparation for the turnip crop of a four-year rotation—hoed crop, grain, clover hay, timothy hay. The soil is a gravelly loam, showing moderate acidity. The rates of application of ground limestone and the crop yields obtained during four years 1924-27 are given in table No. 11.

TABLE No. 11.—GROUND LIMESTOME EXPERIMENT—KENTVILLE, N.S.

Ground limestone per acre applied in 1924	Yields per acre: average of quadruplicate plots				
	1924 Turnips	1925—Oats		1926 Clover hay (two cuttings)	1927 Timothy hay
		Grain	Straw		
	bush.	bush.	lb.	lb.	lb.
Calcitic limestone—2 tons	602·9	61·4	3,800	6,360	2,900
" " —4 "	582·4	59·2	3,500	6,800	3,140
" " —6 "	568·6	61·6	3,720	6,600	3,380
" " —8 "	595·2	66·8	4,080	6,440	2,960
Check—no limestone	570·8	64·3	3,640	7,220	2,740
Magnesian limestone—2 tons	500·4	58·8	3,800	6,660	3,520
" " —4 "	554·8	64·9	3,760	6,740	3,840
" " —6 "	567·6	63·0	4,180	7,180	3,840
" " —8 "	528·0	62·1	3,800	6,660	3,680
Check—no limestone	551·6	52·7	3,280	7,080	3,440

These results are in accord with those obtained at Ottawa and Nappan, showing that the increases in yield resulting from the application of the ground limestone are small. Further, they afford no evidence of any depression in crop yields as resulting from the use of magnesian ground limestone.

SOURCES OF NITROGEN FOR GRAIN CROPS

The object of this experiment was to determine the relative value of the several nitrogenous fertilizers now found on the market, for the grain crop. The fertilizers are nitrate of soda, sulphate of ammonia, cyanamide, urea and nitrate of lime. The experiment was conducted at Kentville, N.S. and Fredericton, N.B.

KENTVILLE, N.S.

The area involved was dressed with muriate of potash at the rate of 100 pounds per acre and three ranges of plots laid off, treated, respectively, with Belgian slag, Sydney slag and superphosphate to furnish 80 pounds of phosphoric acid per acre. The application of nitrogen was at the rate of 23 pounds per acre. The fertilizer materials were applied at planting time. The work was conducted in triplicate.

The crop was Alaska oats and the following figures give the yields as obtained by averaging the data of the three ranges dressed respectively, with Belgian slag, Sydney slag and superphosphate.

Source of Nitrogen	Bushels per acre
Nitrate of soda	18·5
Sulphate of ammonia	20·0
Cyanamide	22·1
Urea	20·7
Nitrate of lime	18·9
Check (no nitrogen)	12·0

That there was a marked increase in yield due to the application of nitrogen is evident but the differences due to the several sources of nitrogen may be considered as within the limits of experimental error. From the data of this experiment no definite statement can be made respecting the relative values of these several nitrogenous fertilizers.

FREDERICTON, N.B.

The land selected for this experiment was dressed with 500 pounds of superphosphate and 120 pounds of muriate of potash per acre a few days previous to planting. The nitrogenous fertilizers were applied as a top dressing when the grain—Victory Oats—appeared above ground. The yields—averages of quadruplicate plots—are as follows:

Source of Nitrogen	Bushels per acre
Nitrate of soda	60·0
Sulphate of ammonia	57·6
Cyanamide	60·0
Urea	61·1
Nitrate of lime	60·6
Check (no nitrogen)	55·3

Again, as at Kentville, N.S., the differences in yield from dressings of the several nitrogenous fertilizers are not such as to permit any conclusive statement respecting the relative effectiveness of these forms of nitrogen.

FERTILIZERS, LIME AND GROUND LIMESTONE

STE. ANNE DE LA POCATIÈRE, P.Q.

This investigation was commenced at the Experimental Station, Ste. Anne de la Pocatière, P.Q., in 1924, the object being to ascertain to what extent the productiveness of the heavy clay soils of the district can be improved by the application of lime and fertilizers. The fertilizers were applied for the hoed crop of a four-year rotation of turnips, barley, clover hay and timothy hay. The plots were one-fortieth of an acre and laid out in duplicate in 1924 (Area "A") and the work was repeated in 1925 (Area "B"), 1926 (Area "C") and 1927 (Area "D"). The materials applied, their rates of application and the crop yields obtained during the four-year period 1924-27 are tabulated in table No. 12.

TABLE NO. 12.—FERTILIZERS, LIME AND GROUND LIMESTONE STE. ANNE DE LA POCATIÈRE, P.Q.

Crop yields (average of duplicate plots) in 1927 and average yields since 1924

Plot No.	Fertilizer applied per acre	Yields per acre						
		Turnips		Barley		Clover hay		Timothy hay
		1927	Average of 4 years	1927	Average of 3 years	1927	Average of 2 years	1927
		tons	tons	bush.	bush.	lb.	lb.	lb.
1	Ground limestone, 4,000 lb.	16·25	16·27	51·7	44·58	4,630	4,145	5,480
2	Burnt lime, 2,240 lb.	16·50	16·40	44·2	36·60	3,840	3,630	5,400
3	Basic slag (16% P_2O_5) 750 lb.	16·25	16·68	42·1	34·73	4,880	4,460	5,520
4	Check (no fertilizer)	17·25	17·39	46·3	39·73	4,710	4,445	5,240
5	Superphosphate, 750 lb.	17·75	19·73	45·8	38·75	4,730	4,395	6,120
6	Barnyard manure, 20 tons	19·75	21·64	55·8	47·65	5,390	4,635	5,900
7	Barnyard manure, 20 tons Ground limestone, 4,000 lb.	20·25	21·90	53·3	46·67	5,450	5,115	6,140
8	Barnyard manure, 10 tons Nitrate of soda, 100 lb. Sulphate of ammonia, 75 lb. Superphosphate, 400 lb. Muriate of potash, 100 lb.	19·75	20·68	44·2	37·23	5,000	4,580	5,820
9	Nitrate of soda, 100 lb. Sulphate of ammonia, 75 lb. Superphosphate, 400 lb. Muriate of potash, 100 lb.	18·25	20·16	45·8	38·46	4,780	4,800	5,500
10	Nitrate of soda, 100 lb. Sulphate of ammonia, 75 lb. Superphosphate, 400 lb.	17·75	17·94	46·7	37·01	4,530	4,285	5,340
11	Check (no fertilizer)	14·00	14·53	51·7	39·02	4,210	3,845	4,880
12	Nitrate of soda, 100 lb. Sulphate of ammonia, 75 lb. Muriate of potash, 100 lb.	17·75	17·06	55·8	43·01	4,290	4,035	5,180
13	Superphosphate, 400 lb. Muriate of potash, 100 lb.	19·75	18·03	54·2	43·75	4,000	3,950	5,500

The results of this work to date are more or less irregular. The response to fertilizers has not been marked but manure has had a beneficial influence, especially for turnips and grain. Analysis has indicated that this is a strong soil, fairly rich in plant food and the probability is that the effect of the manure is more particularly towards the improvement of its tilth. In heavy, strong, soils manure would be specially valuable in promoting better aeration and nitrification, increasing water-holding capacity and making the soil suitable for a freer root extension.

BASIC SLAG FOR THE IMPROVEMENT OF PASTURES

FREDERICTON, N.B.

An experiment to compare the gains which sheep will make on slagged and unslagged pasture was commenced in 1923. On May 14, 1923, a one and one-half acre plot was given an application of Bessemer slag (16 per cent P_2O_5) at the rate of 750 pounds per acre. An adjoining plot of the same size was used as the unfertilized area. Both plots were pastured with sheep from May 30 to August 14 in 1923. In 1924 the size of the plots was reduced to 1 acre and pastured with sheep from May 30 to August 19. In 1925 the plots were not pastured but were cut as hay. In 1926 the slag treatment was repeated and the plots pastured in 1926 and 1927. There was no treatment with slag in 1927. The data for the period 1923-27 are as follows:

—	With slag	Without slag
Year 1923 (on 1½ acre plots)—		
Gain in live weight of sheep	214·5 lb.*	192·5 lb.**
Weight of hay left	500·0 "	550·0 "
Year 1924 (on 1 acre plots)—		
Gain in live weight of sheep	122·0 lb. X	122·5 lb. XX
Weight of hay left by sheep	255·0 "	295·0 "
Year 1925 (1 acre plots)—		
Weight of hay (part of slagged area was badly lodged, and could not be cut as closely as the unslagged area).	2,500 lb.	2,450 lb.
Year 1926 (1 acre plots)—		
Gain in live weight of sheep	196·5 lb.[s]	157·5 lb.[s]
Weight of hay left, not recorded but better on slagged plots.		
Year 1927 (1 acre plots)—		
Gain in live weight of sheep	106·5 lb.[q]	94·0 lb.[q]
Weight of hay left, not recorded, but was better on slagged plots.		

* 5 ewes and 9 lambs
** 4 " 7 "
X 7 " 7 "
XX 6 " 6 "
S 3 " 5 "
q 3 " 3 "

From the foregoing results the following summary in respect to gains in live weight may be given:—

GAIN IN INCREASE OF LIVE WEIGHT (SHEEP) FROM APPLICATION OF BASIC SLAG

1923, 1½ acres	22 lb.
1924, 1 acre	no gain
1925, (hay)	
1926, 1 acre	39 lb.
1927, 1 acre	12·5 lb.

The small gain in increase of live weight in 1927, as compared with that of 1926 was probably owing to there not being a sufficient number of animals to keep the grass closely cropped, the season being more favourable than that of 1926. The following note from the Superintendent's report may be quoted in this connection: "It was found that 3 ewes and 5 lambs which were kept on each plot in 1926 were rather too many to allow valuable pure-bred lambs to develop properly. Therefore, in 1927 each plot was pastured with 3 ewes and 3 lambs. In 1927, a much better pasture year than 1926, the grass on both plots was excellent and it is probable that the plots would have maintained as many sheep as were pastured in 1926 without any injury to the lambs."

A further experiment, planned to obtain data with respect to the improvement of pastures by the use of basic slag, determining the effect by means of crop yields, was begun at this Station in 1923. The land selected for this work adjoined the area of the preceding experiment and had been seeded down in 1918. Since that year it had been in permanent pasture. The soil is a clay loam of average fertility, and of moderate acidity. Plots, one-hundredth acre in size were laid off and slag applied in 1923 and 1926 at the commencement of growth. The grass was cut three to four times during the season with either a lawn mower or scythe. A summary of the results is given in table No. 13.

TABLE No. 13.—BASIC SLAG FOR THE IMPROVEMENT OF GRASS LANDS

Treatment pounds per acre in 1923 and 1926	Average green weight per acre 1923-7		Average increase per acre over check	
	tons	lb.	tons	lb.
Basic slag (Belgian 16% P_2O_5)				
1000 lb.	3	5		1,711
750 "	2	1,530		1,236
500 "	2	995		701
250 "	2	867		573
Check	2	294		

Moss and weeds encroached seriously on all these plots with the result that the growth of the finer grasses was greatly reduced. This accounts in a large measure for the comparatively low yields obtained. The data, however, clearly show that the slag had been instrumental in increasing the yield of grass—increases in yield following increased application of slag.

KENTVILLE, N.S.

The area selected had been in pasture four years and had been closely grazed. It was apparently fairly uniform, the growth being principally brown-top with some timothy. One-half acre was treated with Sydney slag, 14 per cent and an equal area with Bessemer slag, 16 per cent phosphoric acid. The slag was applied early in April, 1925, at the rate of 1,000 pounds per acre. The whole area was grazed in 1925. There was a noticeable increase in the number of small clover plants on the areas treated with slag. In 1926 the crop from the plots was harvested as hay and the green weight obtained. Throughout the season the amount of clover on the treated plots was decidedly greater than on the check plots, on which the herbage was very largely brown-top with some timothy. At the time of harvest, which was late, the clover had ripened considerably, and the other grasses had dried out, so that the cured weight would be approximately 50 per cent of the green weight. The green weights from the plots were as follows:—

Plot	—	Green weight per acre	
		tons	lb.
1	Check, not fertilized	1	1,520
2	Sydney slag	2	640
3	Belgian slag	2	1,180
4	Check, not fertilized	2	320
	Average of two slagged plots	2	920
	" " check plots	1	1,920

Subtracting the average of the two check plots from that of the two slagged plots, it will be found that the slag increased the yield, green weight, 1,000 pounds per acre—an increase of 25 per cent.

DEMONSTRATIONAL WORK WITH FERTILIZERS ON PASTURE LANDS AT THE ILLUSTRATION STATIONS, N.S.

Demonstrations were commenced in 1924 on ten Illustration Stations with Belgian and Sydney slags on pasture areas, the rate of application being 1,000 pounds per acre.

Averaging the data from the ten Stations for the three year period, 1925-27, it will be found that the basic slag dressings approximately doubled the yield, as measured by cutting for hay.

Details of the work appear in the report of the Chief Supervisor of Illustration Stations, for 1927.

LIMESTONE ROCK AND GROUND LIMESTONE

Judging from the correspondence of the division the use of lime and lime compounds is steadily on the increase, more particularly on the long cultivated soils of Ontario, Quebec and the Maritime Provinces. Many of the inquiries on this subject are accompanied by samples of soil for examination as to their lime-requirement. Although "liming" is no substitute for manures or fertilizers and cannot be employed effectively in the place of drainage and the proper working of the soil, a profitable use of lime or ground limestone is possible on many areas. Experience is furnishing proof of this, especially in eastern Canada, and the larger employment of these materials—and more particularly of ground limestone—may be expected.*

LIMESTONE

The following table (No. 14) presents the analytical data obtained from the examination of limestones submitted during the year.

TABLE No. 14.—ANALYSES OF LIMESTONES, 1927-28

Lab'y. No.	Locality of Occurrence	Mineral matter insoluble in acid	Oxide of iron and alumina (Fe_2O_3+ Al_2O_3)	Carbonate of lime ($CaCO_3$)	Carbonate of magnesia ($MgCO_3$)	Report
	Ontario	p.c.	p.c.	p.c.	p.c.	
9746	Port Dover	15·66	2·28	72·43	6·58	Sulphate of lime 4·86: of fairly good quality (2nd grade).
	Quebec					
88986	Godmanchester Tp.	16·42	1·98	46·50	35·03	Dolomitic limestone, of good quality. (2nd grade).
88987	Huntingdon Co.	8·42	0·92	52·50	38·86	
88988	" "	14·62	1·56	47·50	36·28	
88989	" "	8·94	1·82	51·00	38·25	
	Nova Scotia					
88789	Glendyer, Inverness, C.B.	1·40	0·46	54·25	43·24	Dolomitic limestone of the highest grade.

*Bulletin No. 86, New Series. "Lime in Agriculture" fully explains the function of lime as a soil amendment and its use in practical farming. A copy may be obtained on application.

GROUND LIMESTONE

This material should be purchased on statement or guarantee as to composition and degree of fineness.

If there is no guarantee as to fineness, an inspection or a trial with sieves must suffice. The more coarsely the limestone has been ground the slower will be its action in the soil—and the longer will it remain an active agent in ameliorating the soil. Generally speaking, the coarser-ground material is the cheaper, as grinding, and especially to a fine powder, is a rather costly operation. If a quick action is desired, a material, 60 to 75 per cent of which passes a sieve 80 meshes to the linear inch, will be found fairly satisfactory. If an immediate action is not of first importance, a coarser ground limestone, say, 50 to 75 per cent passing a 60-mesh sieve, can be successfully used. In any case, all should pass a 10-mesh sieve.

The usual application is from one to three tons per acre, according to the character and the acidity of the soil and the degree of fineness of the material. Unlike quick and slaked lime excess of ground limestone can do little or no harm.

Three samples of crushed or ground limestone were submitted by correspondents: the data as to composition and degree of fineness are given in the following table (No. 15):—

TABLE NO. 15.—ANALYSES OF CRUSHED OR GROUND LIMESTONES, 1927-28

Lab'y. No.	Manufacturer or source	Chemical analysis				Mechanical analysis				Report
		Mineral matter insoluble in acid	Oxide of iron and alumina (Fe_2O_3+ Al_2O_3)	Carbonate of lime ($CaCO_3$)	Carbonate of magnesia ($MgCO_3$)	Passing 10-mesh sieve	Passing 20-mesh sieve	Passing 60-mesh sieve	Passing 80-mesh sieve	
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
	Ontario									
89694	Arnprior.....	16·40	1·84	52·75	29·86	79·0	57·6	32·4	27·4	Quarry screenings, dolomitic, of fair quality (2nd grade); rather coarse for immediate action.
	Quebec									
92820	Shigawake, Bonaventure	3·36	0·26	94·25	.....	99·2	87·6	41·6	29·6	Calcitic limestone of highest grade; "moderately fine"
	British Columbia									
93034	Comox, Courtenay.	0·94	0·58	98·25	.....	91·6	68·8	49·2	44·4	Calcitic limestone of highest grade; "moderately fine", contains desirable proportion of "fines."

MARL

For some years past there has been an increasing use of marl as a soil amendment—for the correction of acidity (sourness), for increasing the soil's lime supply and the improvement of tilth, this latter, more particularly, of heavy clay loams. As deposits of marl are to be found in the larger number of the provinces of Canada, the attention of farmers and agricultural organizations in areas or districts in which "sour" soils occur may again be directed to this naturally occurring source of lime. It compares most favourably with ground limestone in effectiveness, ease of application and cost. Not infrequently deposits are found on the very farms the arable soils of which stand in need of lime and in such cases it constitutes the cheapest lime amendment obtainable.

All marl deposits are not of equal value, some are almost pure carbonate of lime while others contain more or less clay, sand, muck, etc. It is therefore well to obtain an analysis of a representative sample before exploiting the deposit.

During the year samples from thirty-two deposits have been analyzed—eight in Ontario, nine in Quebec, two in New Brunswick and thirteen in British Columbia. Their composition with a brief statement as to quality, is given in the accompanying table (No. 16).

A large number of these samples are of excellent quality, indicating deposits which might be advantageously worked even when there is a fairly long haulage. Those reported as of fair quality only, can be profitably used locally if the cost of digging and hauling is not too great.

As a rule no special machinery is required to exploit these deposits. It may be necessary, however, to remove a superincumbent layer of peat or muck. The marl on digging should be piled and allowed to air-dry—to save in cost of hauling and to permit an easier and more even distribution on the land. The air-dried marl requires very little labour in the preliminary crushing treatment—which will generally be found desirable for a satisfactory application to the land. It may be applied at any convenient season of the year to the ploughed land and harrowed in. From 3 to 5 tons per acre of the air-dried marl constitutes a fair dressing.

TABLE No. 16.—ANALYSES OF MARLS (AIR-DRIED) 1927-28

Lab'y. No.	Locality of occurrence	Mineral matter insoluble in acid	Oxide of iron and alumina (Fe_2O_3+ Al_2O_3)	Carbonate of lime ($CaCO_3$)	Carbonate of magnesia, ($MgCO_3$)	Moisture, organic matter, etc. (Undetermined)	Report
		p.c.	p.c.	p.c.	p.c.	p.c.	
	Ontario						
88731	Seaforth	38·86	2·36	44·25	14·36	0·17	Of fair quality only; contains less than 60 per cent carbonates.
89636	Bowmanville	59·97	3·28	35·13	.....	1·62	Of poor quality; a calcareous silt.
89806	Brunner	42·18	2·90	41·38	13·88	.....	Of rather poor quality; contains less than 60 per cent carbonates.
90150	Lucan	48·60	3·62	32·63	13·26	1·89	Of rather poor quality; a calcareous clay.
90151	Lucan	48·71	4·82	30·75	13·57	2·15	Of rather poor quality; a calcareous clay.
90203	London	46·64	6·26	33·38	11·50	2·22	Of rather poor quality; a calcareous clay.
90204	"	45·62	6·50	31·88	14·30	1·70	Of rather poor quality; a calcareous clay.
93055	Perkinsfield	0·84	0·32	94·50	.....	4·34	Of excellent quality; very high grade.
	Quebec						
89909	Moulin Marin	1·60	0·40	88·25	1·75	8·00	Of excellent quality.
90502	Quebec	1·68	0·54	92·25	2·27	3·26	" "
90556	New Carlisle	1·42	0·58	93·50	.....	4·50	" "
90842	Ville St. Pierre	0·26	1·82	83·75	1·44	10·13	2·60% of gypsum; of excellent quality.
90992	Phillipsburg	2·24	0·68	90·25	.....	6·83	Of excellent quality.
91372	St. Alphonse de Caplan	1·24	0·54	93·50	1·35	3·37	" "
91373	" " "	0·96	0·58	93·50	1·05	3·91	" "
91563	St. Simon, Bonaventure	16·84	3·46	69·00	2·25	8·45	Of very fair quality.
92159	Ville St. Michel, Laval	1·50	1·68	84·25	.....	12·57	Of very good quality.
	New Brunswick						
88778	Centreville	0·70	0·36	94·25	1·66	3·03	Of excellent quality.
92919	Balmoral, Restigouche	0·70	0·30	89·75	.....	9·25	" "
	British Columbia						
88792	Lardo	5·96	1·24	59·75	.....	33·05	Of fairly good quality.
89085	Kimberley	2·68	1·06	91·25	2·34	2·67	Of excellent quality.
89413	Birch Island, N. Thompson River.	8·30	1·32	81·25	.....	9·13	Of good quality.
89517	Quesnel	4·02	0·90	14·72	1·06	.....	30·44 % gypsum, with approximately 15 per cent carbonates.
89638	Chapman Camp	17·60	1·14	76·50	3·62	1·14	Of fairly good quality.
89802	East Kootenay	16·20	1·98	62·25	18·29	1·28	" "
89803	" "	16·50	0·96	75·00	3·86	3·68	" "
90026	Kaslo	36·18	6·44	48·50	1·71	7·17	Of fair quality only.
90396	Baynes Lake	1·10	0·42	92·00	1·79	4·69	Of excellent quality.
90843	Peachland	.....	0·72	97·75	.....	1·53	" "
93022	Bull River	60·18	5·90	25·50	6·15	2·27	Of poor quality.
93023	"	74·96	5·10	13·90	6·90	0·04	" "
93024	"	0·94	0·58	89·00	.....	9·48	Of excellent quality.

PEATS, MUCKS AND SIMILAR DEPOSITS

Peats, mucks and muds are naturally occurring materials which frequently possess a distinct manurial value and thereby prove useful for the improvement of soils. They are not, however, to be regarded as " fertilizers " but rather as soil amendments furnishing humus-forming material or carbonate of lime, as the case may be, with small percentages of nitrogen.

Peat and muck are formed by the accumulation of plant remains in the beds of former lakes and ponds, and consist for the most part of organic matter mixed with varying amounts of clay and sand. When freshly dug they contain approximately 70 to 80 per cent of water which will be reduced on air-drying to from 10 to 20 per cent. The percentages of clay, sand or other inert rock matter in peat and muck are usually small, frequently less than 2 per cent, but some samples and more particularly in the case of mucks, may contain as high as 30 to 40 per cent.

Muck may be distinguished from peat mostly by its greater or further degree of decomposition and to some extent by its larger mineral matter content. Peat usually has a distinctly fibrous structure.

The organic matter of mucks and peats contains a small though appreciable percentage of nitrogen—usually between 1·0 and 2·0 per cent in the air-dried material. This nitrogen is largely inert and will not become available for plant use until the organic matter of the peat or muck has reached a further or more advanced stage of decomposition. For best results therefore from the use of these materials it is desirable that they be first composted with a small quantity of manure or used as an absorbent for liquid manure in the farm buildings or yards. Following this treatment with manure, fermentation will take place quite rapidly and the nitrogen will become largely available to the plant. It is this use of peat and muck which may be strongly recommended for the improvement of both sandy and clay loams which are deficient in organic matter and nitrogen.

Muds are deposits formed by tides or found in the beds of lakes and mouths of rivers. Consisting largely of ground up rock matter, clay and sand, together with shells and organic debris, their composition is naturally very variable and dependent more or less on their method of formation.

Certain muds contain notable amounts of nitrogen and organic matter but the majority of the deposits seldom approach the richness of peat and muck in these constituents. Their chief agricultural value lies in the influence they exert on the physical condition of the soil. Some muds as for example, " Mussel mud " and " oyster mud " are characterized by a high lime content. These will be found valuable for the correction of soil acidity and as a source of lime for soils in need of that element.

The data from the analysis of samples of peat, muck, muds, etc., recently reported on by this division are tabulated in table No. 17.

TABLE No. 17.—ANALYSES OF MUCKS, PEATS AND SIMILAR DEPOSITS

Lab'y. No.	Nature and locality of occurrence	Moisture	Organic matter (Loss on ignition)	Nitrogen	Mineral matter soluble in acid	Mineral matter insoluble in acid (clay, sand, etc.)	Remarks
	Ontario	p.c.	p.c.	p.c.	p.c.	p.c.	
79917	Peat, Farrans' Point.....	15·69	78·97	2·13	4·50	0·84	Surface peat, dark brown, fibrous, when air-dried would prove excellent for a litter or for composting.
79916	" "	11·38	54·35	2·60	7·21	27·06	Mixture of muck and clay taken 2 feet beneath No. 79917.
84220	Muck, Laurel.....	16·12	74·66	0·85	2·12	7·10	Fairly well decomposed, brown, good material for use as a litter or for composting.
85700	" Beaton.....	29·05	29·40	1·19	11·47	10·08	A well decomposed dark brown muck, for use as a soil dressing it would be improved by composting.
85800	" Toronto.....	37·02	52·79	1·30	8·93	1·26	Would prove suitable for litter purposes or for composting.
87544	" Barrie Tp., Frontenac Co.....	12·45	69·93	1·97	9·71	7·91	Of excellent quality for soil dressing but would be improved by composting.
88833	" Bright.....	10·86	56·51	1·68	11·70	20·93	Well decomposed, might be used as a soil, or for dressing soils low in humus and nitrogen.
88854	" Ottawa.....	12·80	42·31	1·11	13·45	31·44	Cultivated muck, well decomposed.
88855	" "	16·81	65·22	1·60	12·63	5·34	Uncultivated muck, semi-decomposed, would be suitable for litter or for composting purposes.
89263	" Forest.....	19·26	37·12	1·28	13·53	30·09	A black muck soil somewhat harsh and refractory.
89790	" Midland.....	10·62	80·46	0·77	1·81	7·11	Peaty muck, hard and refractory when air-dried.
	Quebec						
87598	Muck, St. Hebert, Chambly Co.....	13·10	70·22	1·97	6·48	10·20	Good quality, well decomposed, would be improved by composting.
92952	Muck, Montreal.....	10·87	79·87	3·09	8·03	1·23	An excellent muck for use as a litter or for composting.
92997	River mud, Shigawake...	1·55	7·45	0·165	20·44	70·56	Of very little fertilising value.
	Nova Scotia						
88535	Muck, N.E. Margaree...	10·66	82·11	1·97	7·01	0·22	Good quality, well decomposed, suitable for applications to soils poor in organic matter, or for composting.
91242	" Hillsdale Road...	14·62	70·51	1·67	10·96	3·91	Good quality for use as an absorbent or for composting.
89910	Mud, Nappan.....	7·99	31·59	0·81	60·42	.....	Suitable for application to soils poor in humus and nitrogen.
89918	" "	12·21	29·32	0·82	58·47	.....	" "
89919	" "	10·22	26·86	0·79	62·92	.....	" "
	New Brunswick						
84715	Muck, Shediac Bridge...	22·64	49·73	1·78	21·82	5·81	May be used as an absorbent litter or for composting.
85888	" Grand Bay.....	8·67	32·05	1·03	5·05	54·23	Of fair quality but could be used to advantage if first composted.
85923	Mussel Mud, Miramichi River.....	2·43	5·99	0·135	.....	57·46	A useful amendment for soils poor in lime; contains 25 per cent carbonate of lime.
80428	River mud, Port Elgin...	3·39		.....	43·15	53·46	Contains 40·5 per cent carbonate of lime, an excellent amendment for soils poor in lime.
	British Columbia						
80747	Muck, Kelowna.....	19·47	71·55	1·26	8·49	0·49	Fairly well decomposed; suitable for application to the soil and for composting.
83927	" Terrace.....	8·36	86·19	1·32	3·83	1·57	Of a peaty nature, could be used as a litter and for composting.
83928	" "	7·98	87·16	1·27	3·23	1·63	" "
83929	" "	8·76	81·47	1·90	4·82	4·95	" "
82686	Peat, Langley Prairie....	9·78	59·99	2·29	7·98	22·25	A woody peat; reclamation of area of a doubtful undertaking.

MISCELLANEOUS FERTILIZER MATERIALS

ASHES

In table No. 18 the composition of a number of samples of ashes of various kinds is presented, and in the following notes information is given as to their origin and their respective value for fertilizing purposes.

Lab'y No. 85453: Leached ashes from old potash plant in Glengarry county; pile contains probably 100 or more tons.

These ashes are useless as a potash fertilizer, but might be used as a corrective for acid soils since they contain 66·25 per cent of carbonate of lime. A small percentage of phosphoric acid gives them a slight additional value.

Lab'y No. 88030: Ashes from mill shavings and sawdust: Rimouski, Quebec. These are of excellent quality, with an exceptionallv large percentage of phosphoric acid for wood ashes.

Lab'y No. 92279: From the very small percentage of potash present, this sample, forwarded from Macdonald College, Que., has evidently been severely leached. These ashes might prove useful for their lime content, on soils in need of this element.

Lab'y No. 85840: Ashes from the incinerator plant of the city of Regina, Sask.

The analysis indicates that this refuse is incompletely burnt. It is rich in organic matter (recorded as "loss on ignition"), containing 1·99 per cent of nitrogen. This by-product has a notable plant food content and should prove a useful soil amendment.

Lab'y No. 89062: These ashes are from the plant of the Canada Electric Company at Maccan, N.S., burning pulverized coal.

The analytical data clearly show that the fertilizing value of this product is very small, indeed insufficient to pay the cost of cartage and application.

Lab'y No. 85507: These ashes, forwarded from the Experimental Station, Fredericton, N.B., are from potato haulm as burnt in piles in the field at the conclusion of the potato harvest.

The data show that in this sample there is a large admixture of soil (sand, etc.); the results therefore do not represent the true ash of potato tops. The chief value of these ashes, as received, lies in their carbonate of lime content (10·25 per cent), though this is enhanced by a notable percentage of phosphoric acid. Potash is present in traces only.

Lab'y No. 88338: Tobacco stem ashes submitted by l'Association des Planteurs de Tabac de la Vallée, St. Asaire, Yamaska, P.Q.

These ashes, containing 18·44 per cent of potash and 1·57 per cent of phosphoric acid, possess a high fertilizing value; they are essentially a potassic fertilizer.

Lab'y No. 88031: These ashes are from Hagersville, Ont., and are the result of burning the refuse from clover and grass seed cleanings, which consisted of various kinds of weed seeds, chaff, stems, etc.

Though containing a rather high percentage (26·30 per cent) of inert matter—sand, etc.—these ashes possess a very considerable fertilizing value—decidedly higher than that of good unleached wood ashes.

Lab'y No. 88069: This sample is ash from leaves, chiefly those of the oak. The data are of interest as resulting from the burning of the fallen autumn leaves of city shade trees.

These ashes possess but small amounts of potash and phosphoric acid. Composting rather than burning the leaves would seem the better plan, since it would conserve their organic matter (humus-forming material) and nitrogen.

TABLE No. 18.—ASHES, 1927-1928

Lab'y. No.	Source	Moisture	Loss on ignition	Insoluble residue	Oxide of iron and alumina	Lime	Magnesia	Phosphoric acid	Potash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
85453	Leached ashes, Alexandria Ont.	18·78	.....	7·39	.....	37·10	.....	1·70	trace
88030	Wood ashes, Rimouski, Que.	.....	.....	18·97	.....	.....	.....	6·09	6·12
92279	Wood ashes, Ste. Anne de Bellevue, Que.	.....	.....	8·46	.....	40·46	.....	1·69	0·72
85840	Incinerator ashes, Regina, Sask.	8·98	40·16	29·91	.....	.....	.....	1·15	nil
89062	Coal ashes, Maccan, N.S.	4·38	11·76	49·79	26·08	3·81	0·59	0·46	nil
85507	Potato haulm ashes, St. John, N.B.	.....	3·79	73·06	9·78	5·74	0·89	1·28	0·20
88338	Tobacco stem ashes, Yamaska, Que.	.....	.....	25·83	.....	.....	.....	1·57	18·44
88031	"Seed screenings" ashes, Hagersville, Ont.	.....	.....	26·30	.....	.....	.....	7·36	6·80
88069	Ashes of leaves, Toronto, Ont.	.....	.....	66·17	.....	.....	.....	1·13	0·77

LIME REFUSE

Lab'y No. 85736: Hydrated lime sludge, from Canadian National shops at Moncton, N.B., forwarded by the provincial Department of Agriculture for information as to its value as a lime amendment.

ANALYSIS

Water	44·67
Slaked lime (calcium hydroxide)	50·51
Oxide of iron and alumina	1·76
Mineral matter insoluble in acid	0·88
Undetermined	2·18
	100·00

Based on its lime content this by-product would have a value of about one half that of hydrated lime as found on the market. It should prove a useful amendment for all classes of loams in need of lime. Air-dried it would readily crush down to a form easily distributed on the land.

Lab'y No. 88333: Lime waste from the calcium carbide plant at Shawinigan Falls, Que., submitted by the Department of Colonization and Development, C.P.R., Montreal.

ANALYSIS

Total calcium oxide (CaO), present chiefly as hydrated and carbonate	67·48
Hydrated calcium sulphate	1·06
Calcium sulphide	0·30
Oxide of iron and alumina	2·62
Mineral matter insoluble in acid	0·64

This product, a fine, dry, white powder, consists of about 66 per cent slaked (hydrated) lime and approximately 28 per cent of carbonate of lime, with which there are associated small amounts of sulphate and sulphide of lime, and oxide of iron and alumina.

This would prove an excellent amendment for all soils which would be improved, chemically or physically, by liming.

Lab'y No. 92973: This is a sample of "waste lime" from the Paper and Pulp Mill at Bathurst, N.B.

ANALYSIS

Water	32·38
Calcium oxide (lime)	34·64
Sulphur, as sulphate	0·15
Sulphur, as sulphide	0·12
Oxide of iron and alumina	4·08
Mineral matter insoluble in acid	0·42
Undetermined (carbon dioxide, etc.)	28·21
	100·00

This sample, as received, was a dark, slate coloured pasty mass.

This waste lime consists mainly of carbonate of lime, with a little slaked lime and traces of other substances. The small amount of sulphur compounds present is not likely to prove injurious to vegetation, but as a safeguard the material may be spread on the land and allowed to remain exposed a few days before harrowing in.

Lab'y No. 88021: This sample of scallop shells was submitted by the Inspector of the Department of Marine and Fisheries at Halifax, N.S.

ANALYSIS

Carbonate of lime	97·75
Carbonate of magnesia	0·30
Undetermined (adhering sand, etc.)	1·95
	100·00

These shells are essentially carbonate of lime; finely crushed they would serve admirably as an amendment for sour soils and soils in general which may be deficient in lime.

For poultry, as a grit and source of lime, it would seem very probable that a suitable product could be prepared from these shells; the preparation, however, would entail screening, as in the crushing a considerable proportion of the material appears to be reduced to a fine powder—which might be undesirable in a poultry grit.

GYPSUM

Lab'y No. 84503: This sample of gypsum "weathered" and "rock", from the district of West Kootenay, B.C., was forwarded by the Supervisor of Agricultural Education at Kelowna, B.C.

ANALYSIS

—	Weathered	Rock
Sulphate of lime (gypsum)	85·88	100·00
Carbonate of lime	2·82	.....
Oxide of iron and alumina	trace	.....
Mineral matter insoluble in acid	7·98	.....
Undetermined (organic matter, etc.)	3·32	.....
	100·00	100·00

The "rock" specimen is a very pure gypsum. The "weathered" material (a light brown powder) is gypsum mixed with a small amount of sand, and is in a very satisfactory mechanical condition for application to the land. The agricultural use of gypsum (land plaster) has been chiefly for the encouragement of the legumes—clover, alfalfa, etc.

Lab'y No. 88441: A sample of gypsum from Lower Mill Stream, Kings County, N.B.

ANALYSIS

Sulphate of lime (gypsum)	96·75
Carbonate of lime	1·68
Mineral matter insoluble in acid	1·38
Undetermined	0·19
	100·00

This is a gypsum of excellent quality.

ROCK PHOSPHATE

Lab'y No. 86696: Ground rock phosphate, from the Chemical Products Ltd., Trenton, Ont. A fine powder, which effervesces considerably on addition of acid.

ANALYSIS	Per cent
Phosphoric acid	32·93
Phosphoric acid equivalent to calcium phosphate	71·93
Water-soluble phosphoric acid	trace
Carbonate of lime	13·61
Mineral matter insoluble in acid	7·39

This sample compares very well with ground rock phosphates of average quality, both as to composition and fineness.

Lab'y No. 89267: Nauru rock phosphate, from deposits recently opened up on Nauru Island in the Pacific. This product has appeared on the fertilizer market in British Columbia.

ANALYSIS	Per cent
Phosphoric acid, total	32·01
Phosphoric acid, soluble by Wagner method	6·19
Phosphoric acid, soluble by Robertson method	19·45
Phosphoric acid, soluble by C.E.F. method	20·16
Fineness, passing 100-mesh sieve	65·0

Experimental work with this product has been started by this Division at several of the branch Stations; the analytical data indicates that it possesses a phosphatic efficiency fully equal to that of the rock phosphates of the Southern States, ground equally fine.

SEWAGE SLUDGE

Lab'y Nos. 85949-85987: These two samples are from the Bowmanville sewage disposal system (septic tank): No. 85949 was collected direct from the tank, No. 85987 represented the sludge or deposit after several months' exposure.

ANALYSIS
(Air-dried material)

—	No. 85949	No. 85987
Moisture	6,97	5·44
Loss on ignition (organic matter, etc.)	46·21	28·85
Mineral matter soluble in acid*	16·32	19·73
Mineral matter insoluble in acid	30·50	45·98
	100·00	100·00
Nitrogen	2·73	1·24
*Containing —Phosphoric acid	1·45	1·42
—Carbonate of lime	11·40	17·10
—Potash (water soluble)	0·28	0·23
Reaction	alkaline	alkaline

This sludge evidently possesses a considerable fertilizing value. The samples, however, differ markedly in this respect—that fresh from the tank being much the richer, especially in nitrogen.

Lab'y No. 90062: This is a sample of sludge (air-dried) from a septic tank system at Brampton, Ont.

ANALYSIS

(Air-dried material)

Moisture	6·47
Loss on ignition (organic matter, etc.)	46·73
Mineral matter soluble in acid*	17·13
Mineral matter insoluble in acid	29·67
	100·00
Nitrogen	3·11
*Containing—Phosphoric acid	2·48
" Carbonate of lime	7·50
" Potash	trace
Reaction	alkaline

The percentages of nitrogen and phosphoric acid are notable and should give this material a distinct fertilizing value.

GROUND FELSPAR

Lab'y No. 94785: A sample of finely ground felspar quarried from deposits in the vicinity of Bob and Crow Lakes, Frontenac county, Ont.

ANALYSIS

Potash (K_2O) soluble in HCl (Sp. Gr. 1·115)	0·28	per cent
" " in 1 per cent citric acid	0·19	"
" " in water	0·04	"
Fineness, passing 100 mesh	99·3	

The data for potash—as soluble in water, 1 per cent citric acid and dilute hydrochloric acid—are in fair accord with those previously obtained from the examination of ground felspar; they indicate that the amount of potash which might be considered available as plant food, is extremely small. As a direct source of potash in agriculture, i.e., as a potash fertilizer, the value of this product would be negligible.

PHOSPHATIC WASTE

Lab'y No. 89090: This waste or refuse material in the form of a fine black powder is from the steel plant at Ormstown, Que., and is stated to be chiefly "bone charcoal and barium carbonate". It was forwarded for information as to possible fertilizing value.

ANALYSIS

Phosphoric acid (present as calcium phosphate)	30·04
Barium carbonate	11·58
Mineral matter insoluble in acid	2·96

This waste material is evidently rich in phosphoric acid, which should give it a distinct fertilizing value. It may be pointed out that field trials would be necessary to determine the relative availability of this phosphoric acid as well as to ascertain if the barium compounds present exerted any harmful effect on vegetation.

SHEEP MANURE

Lab'y No. 87072: Dried pulverized sheep manure,, prepared by Cyrus Witts, Norwich, Ontario, and sold as "Sheep's Head Brand".

ANALYSIS

Moisture	7·44
Loss on ignition (organic matter, etc.)	30·52
Mineral matter soluble in acid	14·75
" " insoluble in acid	47·29
	100·00

Fertilizing constituents:—

Fertilizing constituents—	
Nitrogen	1·42
Phosphoric acid	0·52
Potash	2·75

In both nitrogen and phosphoric acid the percentages are lower than those which we have found in brands of dried shredded manures on the Canadian market. In potash this sample is phenomenally rich, which may possibly be accounted for by the manure (dung and litter) having absorbed and held the greater part of the liquid—the urine being characterized by a high potash content.

Lab'y Nos. 86994-5-6: This sample of sheep manure is from an accumulation, roughly 20 to 30 tons, in a covered sheep shed on a farm near Kemptville, Ont. The deposit varied from 6 inches to 2 feet in thickness. Three samples were collected, from the top, middle and bottom of the deposit, respectively.

ANALYSIS

—	Moisture	Loss on ignition (organic matter)	Mineral matter soluble in acid	Mineral matter insoluble in acid	Nitrogen	Phosphoric acid	Potash
	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
Top—fresh	56·73	33·47	4·93	4·89	1·12	0·48	0·62
air-dried	12·83	67·41	0·92	9·84	2·25	0·97	1·28
Middle—fresh	79·29	17·02	1·70	1·99	0·46	0·17	0·21
air-dried	9·50	74·38	7·43	8·69	2·02	0·77	0·94
Bottom—fresh	80·89	13·91	2·40	2·80	0·51	0·23	0·18
air-dried	9·81	65·66	11·32	13·21	2·39	1·10	0·85

These analyses would indicate that in respect to plant food content, one ton of this sheep manure is equivalent, approximately, to from four to five tons of fresh mixed barnyard manure of good average quality.

RABBIT MANURE

Lab'y No. 90298: This is a sample of charred rabbit manure from Victoria, B.C. The correspondent states that it is "rabbit manure with straw bedding burnt in a muffle furnace".

ANALYSIS

	Per cent
Nitrogen	1·05
Phosphoric acid	2·37
Potash, soluble in water	8·64

The above data show this material to be very rich in potash, but relatively low in phosphoric acid. It has a fertilizing value also for its nitrogen, which is much higher than might have been expected; charring the manure has undoubtedly dissipated a part of its nitrogen.

SPENT HOPS AND YEAST

Lab'y Nos. 83616 & 88852: This brewery waste or by-product from the Dawes Lachine Ale, Limited, Montreal, under trial as to its manurial value by the Division of Field Husbandry is a wet, dark yellowish green mass, smelling strongly of hops, consisting essentially of the scaly bracts or leaf blades of the hop strobile which constitutes the hops of commerce.

ANALYSIS

—	Lab'y. No. 83616 1926	No. 88852 1927
Water	76·60	81·91
Organic matter	21·39	15·98
Mineral matter or ash	2·01	2·11
	100·00	100·00
Fertilizing constituents—		
Nitrogen	1·11	1·30
Phosphoric acid	0·84	0·46
Potash	0·09	trace

The following table permits a comparison of this waste product with barnyard (mixed cow and horse) manure from the standpoint of plant food content:—

—	Barnyard manure lb. per ton	Spent hops and yeast lb. per ton
Nitrogen	10–12	22·2
Phosphoric acid	6–8	16·8
Potash	9–12	1·8

The results of practical field trials indicate that this waste product has a high manurial value; it is evident that under favourable soil conditions its plant food content is freely liberated in forms available to growing crops.

COFFEE CHAFF

Lab'y. No. 91138: This is a waste or by-product from coffee roasting plants, the sample submitted to analysis being forwarded from St. John, N.B.

ANALYSIS

Moisture	4·75
Protein	13·19
Fat or oil	14·09
Carbohydrates	39·67
Fibre	23·92
Ash	4·38
	100·00
Fertilizing constituents—	
Nitrogen	2·11
Phosphoric acid	0·36
Potash	1·85

Although the analysis shows notable percentages of protein and fat our correspondent found that the product was not very palatable, generally ten to twenty per cent is as much as can be used with other feeds.

Laboratory experiments conducted with a view of determining the availability of the nitrogen of this product as an element for plant nutrition, gave results which indicated that decomposition in the soil takes place very slowly. For this reason its value as a fertilizer would be very small. It might, however, find a use as a conditioner or filler in the preparation of mixed fertilizers.

INDIAN BONE MEAL

Lab'y Nos. 84195-98: Four samples of Indian Bone Meal were submitted by the Agricultural Products Representative for Canada, London, England, with the view of determining if these meals could be advantageously placed on the Canadian fertilizer market.

ANALYSIS

—	No. 1 Coarse meal	No. 2 Small pieces of bone	No. 3 Medium size pieces of bone	No. 4 Large size pieces of bone
	p.c.	p.c.	p.c.	p.c.
Nitrogen	3·74	3·90	3·91	4·39
Phosphoric acid	23·32	25·26	25·22	24·46

In respect to nitrogen and phosphoric acid these bone meals compare very favourably with those on the Canadian market. If intended for direct application further grinding would be necessary.

WOOL WASTE

Lab'y. No. 92115: This waste product is the refuse from the wool scouring machine, the sample being forwarded from Highland Creek, Ont. It may be described as wool with a certain admixture of straw, oat hulls and lime.

ANALYSIS	Per cent
Moisture	5·98
Lime (partially carbonated)	23·10
Nitrogen	4·21
Phosphoric acid	1·00
Potash, water soluble	0·30
Oil or fat	7·75
Sand, etc	7·42

The above data show that this material contains little fertilizing value except nitrogen, though from its high lime content it might be considered of some value as an amendment for sour soils and soils generally in need of lime.

Unfortunately, from the standpoint of fertilizer value, wool is very resistant to decay; its nitrogen would only be very slowly rendered available and hence little immediate response could be expected from its application.

ROTTED PEA STRAW (VINES)

Lab'y No. 83951: This sample, submitted by the Windsor Canning Company, Limited, St. Johns, P.Q., consisted of rotted pea vine in various stages of decay; it was accompanied by an inquiry as to its fertilizing value.

ANALYSIS

Water	87·15
Organic matter	10·32
Mineral matter, soluble in acid	1·57
Mineral matter insoluble in acid	0·96
	100·00
Fertilizing constituents—	
Nitrogen	0·30
Phosphoric acid	0·23
Potash	0·02

As a manure it would serve a useful purpose in furnishing humus-forming (organic) material, nitrogen and phosphoric acid. Its potash content is negligible. It contains, approximately, three-fourths as much nitrogen and about the same phosphoric acid as barnyard manure of average quality.

SUGAR BEETS FOR FACTORY PURPOSES

The investigational work with sugar beets begun in 1902 has two main objects: (1) to ascertain the suitability of various districts in the Dominion, in respect to soil and season, for the growing of beets for sugar extraction, and (2) to determine the relative value for factory purposes of the several special strains or varieties of sugar beets bred for high sugar content, chiefly in France, Russia and Germany. In addition to the above, the comparative value of beets from foreign and Canadian grown seed has been studied.

The results from this investigation are found to be of increasing interest and value. Enquiries are being constantly received from Boards of Trade, Chambers of Commerce and other interested organizations with respect to the suitability of certain districts for the culture of the sugar beet, for there appears to be a newly-awakened interest in the possibilities of the extension of the beet sugar industry in Canada. The accumulated data from this sugar beet work of the past twenty-five years permit the furnishing of reliable information, more particularly as to the richness and purity of beets grown at a large number of widely distant points in the Dominion.

The following varieties of sugar beet seed were used in this investigation during the past season: Dippe, Horning, Schreiber and Home-grown, obtained from the Dominion Sugar Co., Chatham, Ont., the first three being imported from Germany; Ivanosk, Ivanosk (Sugar type), Ivanosk I, Ivanosk II, Ivanosk IV, Ivanosk V, Ivanosk R.M., Ivanosk SIII, Bielotzerkov, Bielotzerkov I, Bielotzerkov II, Vladovsk, Vierchniatcka, obtained from the Amtorg Trading Co., 165 Broadway, New York.

In 1927 the beets were grown on twenty-five Farms, Stations and Substations of the Experimental Farm System as follows: Prince Edward Island, Charlottetown; Nova Scotia, Kentville and Nappan; New Brunswick, Fredericton; Quebec, Lennoxville, Cap Rouge, Ste. Anne de la Pocatière and La Ferme; Ontario, Ottawa, Harrow, and Kapuskasing; Manitoba, Brandon and Morden; Saskatchewan, Rosthern, Scott, Indian Head and Swift Current; Alberta, Fort Vermilion, Lacombe, Lethbridge and Beaverlodge; British Columbia, Agassiz, Sidney, Summerland and Invermere.

The analysis of beets from experimental plots on certain of the Illustration Stations of Prince Edward Island and from farmers' plots grown under the direction of the Prince Albert, Sask., Board of Trade, has also been undertaken.

The results of analysis as to sugar and purity and the weight per root of the beets grown on the foregoing Dominion Experimental Farms in 1927 are presented in table No. 19. Notes furnished by the several superintendents on the soil and season conditions obtaining at the several Farms and Stations, together with comments on the quality of beets adduced from the analytical data are as follows:—

Charlottetown, P.E.I.—Soil: sandy loam, 6-10 inches, overlying a gravelly brick clay. Manured in the fall of 1925 with ten tons of manure and in the spring of 1927 with ten tons. Previous crop: cereal plots. Sown June 10, pulled October 24. Spring very late; summer showery and warm, with autumn showery and cool.

The series, as a whole, is of good quality—in respect to both sugar and purity. The roots were of good average size, fairly free from forkiness and sound. Beets grown at this Station have, as a rule, been of excellent quality.

Kentville, N.S.—Soil: sandy loam, 12 to 16 inches, overlying a gravelly subsoil. No manuring the previous season. Spring of 1927 manured at the rate of 15 tons per acre and sulphate of ammonia, 75 pounds; nitrate of soda, 75 pounds; acid phosphate, 350 pounds; muriate of potash, 100 pounds, mixed and applied at the rate of 600 pounds per acre. Beets sown April 26, pulled

October 31. Spring, rainfall for May was 1·61 inches above normal. Temperature was normal. In June rainfall was 1·79 inches below normal; temperature 3 degrees below normal. Summer, the rainfall for July and August was 14·97 inches, or 9·08 inches above the average of fourteen years. The temperature during July and August was practically normal. September, precipitation was slightly below normal. Temperature slightly above normal. Rainfall for October was a little above the average, while temperature was practically normal.

The results are very satisfactory, both as to sugar content and purity.

Nappan, N.S.—Crop a failure, owing to the extreme lateness of the planting season and the exceedingly wet weather which characterized the summer months.

Fredericton, N.B.—Soil: clay loam, 2-3 feet deep, rather dense compact land which does not bake, overlying a subsoil of gravelly hard pan with boulders. Manured the previous year as follows: two plots of each variety on clover sod, no manure 1926; two plots of each variety on corn land manured with 15 tons barnyard manure, also 800 pounds 4-8-6. The spring of 1927, 15 tons barnyard manure with 800 pounds 2-8-3. The crop of the previous season: two plots each variety clover, two plots each variety corn. Sown May 24, pulled October 3.

—	Mean temperature	Rainfall
	°	in.
April	39·93	1·58
May	48·78	3·67
June	57·06	3·73
July	66·75	3·92
August	61·50	5·36
September	56·30	3·19

These beets were far superior to those of the preceding season; the data for sugar content and purity indicate a crop which would be quite satisfactory for sugar extraction.

Lennoxville, Que.—Soil: 7 inches of sandy soil, overlying a subsoil of gravel and sand. No manuring the previous season; spring of 1927 barnyard manure was applied at the rate of 21 tons per acre. Crop of previous year: grain. Sown May 3, pulled October 20.

—	Mean temperature	Rainfall
	°	in.
May	49·13	4·36
June	67·95	3·77
July	66·11	2·15
August	61·85	4·05
September	56·35	1·84

The results of the examination are very satisfactory indicating a rich beet of good weight and purity.

Cap Rouge, Que.—Soil: naturally drained sandy loam from 15 to 20 inches deep, over shale subsoil. No manuring the previous season. Twenty tons rotted manure per acre applied in autumn 1926. The crop of the previous season had been timothy hay. Sown May 27, pulled October 14. The character of the season compared with the average of the last fifteen years was as follows: May

was colder, wetter and duller, June was colder and dryer. July was much wetter and duller. August was dryer and brighter, September was colder, dryer and brighter.

The exceptionally higher percentages of sugar found must be attributed in a very large measure to the very small size of the root and the fact that as received the beets were somewhat wilted.

Ste. Anne de la Pocatière, Que.—Soil: eight inches of hard clay overlying blue clay. Manured 20 tons to the acre the previous year, none the present year. Previous crop, peas. Sown May 20, pulled October 31. Spring was about normal and the seeding was done in very good condition. The land was well prepared and moist. The summer was fair and the growth of roots was very good. The rain and sunshine were well distributed for each month. Autumn weather was very favourable for roots.

Examination showed that in point of sugar content, purity and size (weight) these beets were first class.

La Ferme, Que.—Soil: sandy loam of about 9 inches over hard clay. Manured 15 tons per acre the seasons of 1926 and 1927. Previous crop, potatoes. Sown June 11 and pulled September 8. The average temperature of the month of June was 53·89° with a rainfall of 3·6 inches. The summer (July and August) had an averaged temperature of 58·7° and a rainfall of 7·3 inches. Autumn (September and October) an average of 45·4° and a rainfall of 6·5 inches.

The percentage of sugar and coefficient of purity are only fair—but possibly higher than might have been expected from such a northern latitude.

The roots were very small, resulting in too low a tonnage per acre for profitable culture.

Ottawa, Ont.—Soil: medium to light sandy loam. Subsoil: sand. The precipitation for the spring months of March, April and May was 7·56 inches; for June, July and August it was 11·57. September had a precipitation of 1·62. The mean temperature of July was 67·20°, of August, 63·00°, and of September, 59·20°.

The season was not a favourable one for root culture. Although the beets were of good size, the results as to sugar content and purity were only fair.

Harrow, Ont.—Soil: a clay loam to clay and gravelly 6-8 inches, in poor physical condition. Subsoil: gravelly-clay. Manured the previous season (1926) with manure at the rate of 12 tons per acre. Fertilized spring of 1927 with commercial fertilizer (2:10:6) 200 pounds per acre. Alfalfa had been grown the previous season. Sown May 1, pulled October 14. The spring had been very cool, precipitation about normal. Summer cool, a little dry in early summer followed by normal precipitation. Fine during September and dry, October fairly cool and plenty of rain.

The data show the beets to be of excellent quality both as to sugar content and purity.

Kapuskasing, Ont.—Soil: fairly heavy clay about 7 inches to 8 inches in depth over heavy clay, stratified and somewhat impervious to water. No manuring in 1926; sixteen tons of manure per acre in 1927. The previous crop had been hay. Sown July 6, pulled October 8. Precipitation for the spring months of March, April and May was 4·54; for June, July and August it was 8·34; for September it was 5·32 inches. The mean temperature of July was 62·60°; August, 56·40°; and September, 53·30°.

While the percentage of sugar was decidedly low, these results may be considered fair for this northern district. The roots were well formed but decidedly small. The results of the past two seasons are not favourable to the commercial growing of the sugar beet.

Brandon, Man.—Soil: a heavy clay loam, overlying a clayey subsoil. No manuring, previous or present season. Crop of previous season had been wheat. Sown May 12, harvested September 27. Spring very wet, summer frequent rains, autumn fairly dry.

The results are a little higher than those of 1926, more particularly in respect to coefficient of purity, but as in the past they are by no means satisfactory from the standpoint of sugar content. It is only occasionally that beets of high quality—though yields are always excellent—have been grown at the Brandon Experimental Farm; seasonal conditions there, it would appear, are not as a rule conducive to a proper ripening of the beet.

Morden, Man.—Soil: dark fine loam to a depth of 8 inches over a dark stiff clay. No manuring; the land was in summer-fallow the previous year. Sown June 1, pulled October 4.

—	Mean temperature	Precipitation
	°	in.
April	29·70	1·53
May	45·40	6·01
J ne	60·88	3·18
July	65·41	1·91
August	62·14	2·08
September	56·00	1·41

These beets were, as received, all sound and of good shape and size. Unfortunately, they show a very low sugar content, due largely, no doubt, to low temperatures and lack of sunshine during the autumn season. Though the yields were good the inferior quality of the beets would render them unsatisfactory for sugar extraction.

Rosthern, Sask.—Soil: sandy loam 6 inches deep overlying clay to 18 inches and below that depth sand. No manuring. Crop of previous year: corn. Sown May 17, pulled October 7. Spring abundant rain and moderate heat. Summer abundant rain with average heat and sunshine. Autumn unusually wet and cloudy. Tops of roots frozen September 26.

The beets were decidedly small but they were of good shape and sound. A few had the appearance of being touched with frost.

The sugar content is decidedly low—as is also the coefficient of purity—due most probably to continued cool and wet weather during the late summer and autumn months. The beets must be considered too poor for factory purposes.

Scott, Sask.—Soil: dark brown fine sandy loam between 6 and 7 inches, overlying greyish sandy loam. Manure applied at the rate of 12 tons per acre in fall of 1925. Ploughed under in June, 1926. No manure in the season of 1927. Summer-fallowed in 1926. Sown June 4, pulled October 7. Spring fairly cool with plenty of moisture. Summer, moderately warm. Very little windy weather. Sufficient moisture at all times for the needs of the crop. Autumn: Moisture abundant, precipitation above the average. Considerable damp cloudy weather.

The roots were all sound but somewhat irregular as to shape; nearly all except the small ones were broken, which would reduce the average weight per root.

The results both as to sugar content and purity are decidedly poor; they are among the lowest in the series. Evidently the autumn was too cold and wet to allow the beets to satisfactorily ripen. The records of this investigation have shown that with but few exceptions beets from this Station have been of poor or at best medium quality.

Indian Head, Sask.—Soil: heavy clay loam, over a subsoil of heavy clay. No manuring. Summer-fallowed in 1926. Sown June 4, pulled October 8. Spring: temperature cool, precipitation heavy. Summer: temperature moderate, precipitation heavy, except for month of June. Autumn: temperature moderate, precipitation heavy.

Although the beets were all sound and of a good shape and size the quality is decidedly poor. The data for both sugar and purity are distinctly low. The beets would not be of the quality required for sugar extraction.

Swift Current, Sask.—Soil: a sandy loam 6 inches, overlying clay. No manuring. Crop of 1926, wheat. Sown May 31, pulled October 10. May, cool and wet; little seeding done. June fair—occasionally light showers. July had seven days above 80°F., thirteen light showers and one heavy rain. August 1.61 inches of rain on the 14th in addition to five showers. Three degrees of frost on the 8th. September, .69 inches rain on the 12th, .41 on the 14th in addition to eight showers. Hottest day of year—September 6, 90°F. October on the whole was continually damp, delaying threshing.

These results are fair, both as to sugar content and purity, standing about midway between the poorest and the richest of the series. The beets were decidedly small, which, of course, means a low tonnage per acre.

Fort Vermilion, Alta.—Soil: a dark loam 4 feet in depth overlying a clay subsoil. Twenty wagon loads of manure, per acre applied in the spring of 1926. Summer-fallowed in 1926. Sown May 18, pulled September 21. Spring cool, precipitation light. Summer temperature very high, precipitation a moderate amount. Autumn, medium temperature, precipitation very light.

The data for sugar content are high—much higher than in the past—due no doubt in a large measure to the long open fall. The beets were small and this together with the fact that they were not very juicy, would account for the high sugar content.

Beaverlodge, Alta.—Soil: a black brown silty loam overlying a chocolate clay. No manuring in 1926, top dressed in 1927 with well rotted manure. Summer-fallowed in 1926. Sown May 21, pulled October 15. Spring moist, also summer except in one period in late July. Autumn fairly moist.

The roots as received were quite sound but the larger ones had hollow crowns. They were somewhat irregular as to shape and rather "rooty"; of a decidedly "woody" texture. The sugar content and purity are very low. The results do not indicate a beet suitable for factory purposes.

Lacombe, Alta.—Soil: a black loam in excellent tilth over subsoil of clay loam. Manured in 1926 at the rate of 15 tons barnyard manure per acre. No manure in 1927. Oats for green feed had been the crop of the previous year. Sown May 20, pulled September 27. May and June were excellent growing months with an abundance of moisture and no extremely low temperatures, June had 3.42 inches precipitation, July 5.36, August 1.76 and September 2.35 inches.

No killing frosts or even minor frosts were recorded during the growing season until September 15 when temperature dropped to 24.0°. Hence season was unusually free from frost and had an abundance of precipitation available for growth.

These data, both as to sugar and purity, are decidedly low; evidently seasonal conditions have not been conducive to a normal ripening of the beet—probably the temperature was too low, accompanied by an excessive rainfall. Beets grown at this Station have usually been of poor quality.

Lethbridge, Alta.—(Irrigated) Soil: sandy clay with considerable humus, overlying sandy clay. Manured the previous season by sheep on pasture. No manuring in 1927. Sweet clover pastured by sheep the year before. Sown April

22, pulled October 24. Weather: Spring much cooler and wetter than usual and less windy. Summer considerably cooler than usual with more rain in the early part than usual, and much fewer hot dry winds. Autumn much warmer than usual, with not more than five degrees of frost, recorded at date of harvesting. Rain during Autumn months has been about equal to that received in ordinary seasons. (Non-irrigated) Soil: a sandy clay, with small amount of humus, overlying a sandy clay. No manuring; summer-fallowed in 1926. Sown May 16, pulled October 24.

The roots from the dry land area were rather soft and not very juicy; though small they were fairly uniform as to size and shape; no forking. Their sugar content and purity are exceptionally high.

The beets from the irrigated land were larger and juicier than from the dry land plot; uniform as to shape. In respect to sugar and purity they are about average for this Station. The tonnage was very satisfactory and the quality would place them among the best in the series for factory purposes.

Agassiz, B.C.—Soil: sandy loam to a depth of 6-8 inches, overlying sandy gravelly subsoil. No manuring in 1926. Barnyard manure and commercial fertilizer at the rate of 500 pounds per acre applied in 1927. Hemp had been the previous crop. Sown May 19, pulled October 18. Spring a maximum temperature of 73°, minimum of 28°, and precipitation of 6·3 inches. Summer had a maximum of 97°, minimum 45°, and precipitation of 5·03 inches. Autumn a maximum of 88°, minimum of 36°, and precipitation of 15·62 inches.

These results are decidedly lower—both as to sugar content and purity—than has been usual for beets from this Experimental Farm. Presumably, these poor results may be attributed to the wet autumn, which prevented the beets from ripening.

Sidney, B.C.—Soil: clay loam overlying clay. No manuring. Clover was the crop of 1926. Sown May 2, pulled December 24. Spring cold and backward with a precipitation of 4·23 inches for March, April and May. Summer dull with more rain than usual, precipitation 1·65 inches for June, July and August. Autumn very wet, precipitation 15·30 inches for September, October and November.

The data for both sugar and purity are very fair; the very wet autumn, presumably prevented a thorough ripening of the beet. The beets were of good shape, and, on arrival, in excellent condition.

Invermere, B.C.—Crop a failure due to poor soil conditions.

Summerland, B.C.—Soil: gravelly loam 1 foot in depth, overlying gravel. Ten tons of manure per acre applied in 1927, none in 1926. Land in grass in 1926. Sown May 23, pulled October 15. Spring cooler than usual, frosts at the end of April, precipitation below the average. Summer cooler than usual with some very hot spells; precipitation, June and July below average, August very much above average. Autumn cool but no frost until October 31. Precipitation, September and October very much above average. Irrigation applied May 9, 12, 16 and 31, also August 1 and 3.

The roots were large, well formed, no forking; the yields were very satisfactory.

These beets were excellent in respect to both sugar content and purity, and of good weight.

TABLE No. 19.—SUGAR BEETS GROWN ON THE DOMINION EXPERIMENTAL FARMS, 1927

Variety	Locality where grown	Percentage of sugar in juice	Coefficient of purity	Average weight of one root		Yield per acre	
			p.c.	lb.	oz.	tons	lb.
Dippe	Charlottetown, P.E.I	17·99	90·64	1	11	12	394
	Kentville, N.S	19·23	90·28	1	4	17	56
	Fredericton, N.B	18·23	89·76	1	5	10	1,384
	Lennoxville, Que	18·32	89·60	1	11	17	300
	Cap Rouge, Que	23·20	88·92	..	12	9	1,313
	Ste. Anne de la Pocatière, Que	20·67	90·55	1	7	20	820
	La Ferme, Que	17·11	86·16	..	7	2	1,575
	Ottawa, Ont	17·37	86·74	1	14		
	Kapuskasing, Ont	16·74	86·16	..	10	6	1,380
	Harrow, Ont	19·95	89·54	1	8		
	Brandon, Man	14·45	81·32	2	3	16	804
	Morden, Man	13·97	80·30	1	8	10	1,000
	Rosthern, Sask	13·85	77·26	..	14	8	600
	Scott, Sask	12·70	72·02	1	6	4	850
	Indian Head, Sask	12·17	78·50	1	2	6	1,080
	Swift Current, Sask	17·37	81·81	..	12	12	1,560
	Fort Vermilion, Alta	19·95	85·45	1	2	16	1,600
	Beaverlodge, Alta	12·89	75·08	2	7	5	200
	Lacombe, Alta	16·10	82·15	..	10	9	174
	Lethbridge, Alta. (Irrigated)	17·76	83·56	2	2	17	160
	Lethbridge, Alta. (Non-irrigated)	20·99	87·46	1	3	9	1,180
	Agassiz, B.C	15·54	84·53	..	12	7	935
	Summerland, B.C	19·69	88·00	2	7	13	1,000
	Sidney, B.C	16·81	84·72	1	9	9	480
Home Grown	Charlottetown, P.E.I	17·82	88·80	1	7	13	1,225
	Kentville, N.S	18·66	91·01	..	13	15	1,152
	Fredericton, N.B	18·18	88·65	1	12	12	107
	Lennoxville, Que	18·20	91·26	1	11	17	300
	Cap Rouge, Que	22·35	91·18	..	10	9	1,022
	Ste. Anne de la Pocatière, Que	20·01	89·60	1	4	20	820
	La Ferme, Que	16·25	86·92	..	7	3	1,434
	Ottawa, Ont	16·99	84·83	2	3		
	Kapuskasing, Ont	15·74	86·34	..	8	5	1,190
	Harrow, Ont	17·39	88·28	1	6		
	Brandon, Man	14·17	82·46	2	3	14	1,946
	Morden, Man	14·95	82·38	1	2	10	1,000
	Rosthern, Sask	14·92	75·37	..	12	10	960
	Scott, Sask	13·37	75·51	1	0	4	100
	Indian Head, Sask	13·43	82·22	..	14	7	168
	Swift Current, Sask	18·48	85·43	..	14	11	1,400
	Fort Vermilion, Alta	19·54	86·00	..	7	17	440
	Beaverlodge, Alta	14·16	76·00	1	13	3	500
	Lacombe, Alta	14·94	78·60	..	11	8	1,650
	Lethbridge, Alta. (Irrigated)	17·60	83·41	2	0	15	795
	Lethbridge, Alta. (Non-irrigated)	19·45	86·24	1	4	10	300
	Agassiz, B.C	15·75	86·28	1	0	9	1,115
	Summerland, B.C	19·73	89·84	2	14	13	1,000
	Sidney, B.C	17·37	88·61	2	8	10	1,560
Horning	Charlottetown, P.E.I	17·68	88·88	1	5	13	1,225
	Kentville, N.S	18·52	90·42	1	5	17	56
	Fredericton, N.B	16·87	87·84	1	5	11	394
	Lennoxville, Que	18·18	89·82	1	18	18	700
	Cap Rouge, Que	23·53	89·78	..	12	10	701
	Ste. Anne de la Pocatière, Que	19·72	90·35	1	5	20	1,778
	La Ferme, Que	16·73	88·37	..	3	1	1,252
	Ottawa, Ont	16·95	86·17	2	0		
	Kapuskasing, Ont	16·84	87·54	..	10	7	40
	Harrow, Ont	20·04	86·78	1	5		
	Brandon, Man	14·69	82·49	1	14	16	568
	Morden, Man	12·81	79·10	1	12	13	800
	Rosthern, Sask	14·78	76·98	..	13	6	1,740
	Scott, Sask	12·75	72·16	1	4	6	1,800
	Indian Head, Sask	12·59	79·02	1	0	7	680
	Swift Current, Sask	18·61	84·10	..	14	12	1,080
	Fort Vermilion, Alta	20·25	86·54	1	0	18	960
	Beaverlodge, Alta	13·43	73·77	1	13	2	700
	Lacombe, Alta	14·35	78·00	..	12	9	564
	Lethbridge, Alta. (Irrigated)	17·56	83·39	2	12	14	1,860
	Lethbridge, Alta. (Non-irrigated)	20·78	87·88	..	15		
	Agassiz, B.C	14·61	83·66	..	15	10	1,432
	Summerland, B.C	20·28	89·84	2	4	15	
	Sidney, B.C	17·02	85·94	1	7	9	1,580

TABLE No. 19.—SUGAR BEETS GROWN ON THE DOMINION EXPERIMENTAL FARMS, 1927—*Concluded*

Variety	Locality where grown	Percentage of sugar in juice	Co-efficient of purity	Average weight of one root		Yield per acre	
			p.c.	lb.	oz.	tons	lb.
Schreiber	Charlottetown, P.E.I.	18·17	89·51	1	11	11	216
	Kentville, N.S.	18·23	88·45	1	3	20	1,976
	Fredericton, N.B.	18·18	89·95	1	5	11	1,262
	Lennoxville, Que.	19·25	91·45	1	14	17	
	Cap Rouge, Que.	22·12	90·28	..	14	11	1,055
	Ste. Anne de la Pocatière, Que.	19·66	88·96	1	7	20	1,778
	La Ferme, Que.	16·51	85·61	..	9	3	1,898
	Ottawa, Ont.	17·02	85·39	2	4		
	Kapuskasing, Ont.	16·78	88·31	..	13	4	580
	Harrow, Ont.	18·59	87·74	1	5		
	Brandon, Man.	14·73	80·21	2	3	14	1,139
	Morden, Man.	13·06	80·48	1	9	16	400
	Rosthern, Sask.	13·92	77·56	..	14	8	1,320
	Scott, Sask.	12·86	73·52	1	4	4	1,320
	Indian Head, Sask.	11·98	78·21	1	3	6	280
	Swift Current, Sask.	17·79	82·26	1	1	10	1,780
	Fort Vermilion, Alta.	19·23	86·08	1	0	15	1,920
	Beaverlodge, Alta.	14·31	76·67	1	13	2	600
	Lacombe, Alta.	15·13	78·81	..	11	8	614
	Lethbridge, Alta. (Irrigated)	18·51	85·78	2	2	16	40
	Lethbridge, Alta. (Non-irrigated)	20·77	87·46	1	3	9	880
	Agassiz, B.C.	15·88	85·51	..	15	8	802
	Summerland, B.C.	22·27	89·54	2	5	13	800
	Sidney, B.C.	17·70	85·94	..	15	8	1,820
Ivanosk	Charlottetown, P.E.I.	17·64	89·34	1	4	13	572
" (Sugar type)	" "	18·13	90·31	1	6	13	1,660
" IV	Kentville, N.S.	18·97	92·53	1	5	13	126
	Ste. Anne de la Pocatière, Que.	20·22	90·97	1	5	21	966
	Brandon, Man.	15·07	83·54	1	11	15	858
Ivanosk I	Rosthern, Sask.	13·00	74·30	..	12	11	860
Ivanosk V	Kentville, N.S.	19·14	95·19	1	0	15	360
	Ste. Anne de la Pocatière, Que.	20·03	89·32	1	6	21	768
	Brandon, Man.	14·47	81·47	1	13	14	635
Ivanosk II	Rosthern, Sask.	12·86	74·91	..	14	10	1,140
Bielotzerkov	Charlottetown, P.E.I.	17·17	88·46	1	8	12	394
	Kentville, N.S.	18·42	94·30	1	0	15	624
	Brandon, Man.	13·58	80·85	2	5	14	1,038
Bielotzerkov I	Rosthern, Sask.	12·71	74·15	1	1	8	1,320
" II	" "	12·85	74·25	1	1	10	1,680
Vladovsk	Charlottetown, P.E.I.	17·16	88·55	1	6	12	1,918
	Kentville, N.S.	19·11	93·17	1	4	13	1,456
	Ste. Anne de la Pocatière, Que.	20·49	91·26	1	8	20	689
	Brandon, Man.	13·85	79·58	2	5	15	1,055
Vierchniatcka	Charlottetown, P.E.I.	17·47	90·47	1	4	11	1,305
	Kentville, N.S.	19·25	91·62	1	0	13	1,456
	Brandon, Man.	16·01	84·08	1	7	13	1,526
	Rosthern, Sask.	13·96	76·30	1	1	9	1,780
Ivanosk R.M.	Ste. Anne de la Pocatière, Que.	19·81	92·00	1	7	21	1,857
" S. III.	" "	19·82	89·84	1	5	21	1,758
Bellingham	Agassiz, B.C.	14·57	85·88	..	15	9	1,263

NOTE.—The "yield per acre" data furnished by the several superintendents, have been calculated from small plots and consequently are to be regarded as merely indicative.

Averages of "sugar in juice" and "coefficient of purity" of the four varieties—Dippe, Home Grown, Horning and Schreiber & Sons—as grown on the twenty-five Farms and Stations in this investigation in 1927 are presented in table No. 20.

TABLE No. 20.—SUGAR BEETS: SUGAR IN JUICE AND COEFFICIENT OF PURITY: AVERAGES FROM THE SEVERAL VARIETIES GROWN ON 25 EXPERIMENTAL FARMS AND STATIONS THROUGHOUT THE DOMINION, 1927

Variety	Sugar in juice	Co-efficient of purity
	p.c.	p.c.
Dippe	17·21	84·60
Home grown	17·06	85·21
Horning	17·06	84·53
Schreiber & Sons	17·19	85·11

These averages, for both sugar and purity, are distinctly higher than for the previous season. They indicate that the varieties sown are of high factory quality. It is worthy of note that the beets from the home grown seed are fully equal in sugar content and purity to those from the imported seed. It is perhaps significant that the beets from all four sources of seed were practically of equal quality.

The results in the following table (No. 21) present the average percentage of sugar in juice from beets grown from 1919 to 1927 inclusive at the several Farms and Stations of the Experimental Farm System. They permit a comparison of the quality of the beets as grown at a large number of points in the Dominion and indicate the variation which may take place from year to year at these points, due largely to changing seasonal conditions.

TABLE NO. 21.—AVERAGE PERCENTAGE OF SUGAR IN JUICE IN SUGAR BEETS GROWN ON DOMINION EXPERIMENTAL FARMS 1919–1927

Locality	1919	1920	1921	1922	1923	1924	1925	1926	1927
Charlottetown, P.E.I.	18·33	16·44	16·40	.....	18·67	19·23	19·30	17·80	17·91
Kentville, N.S.	19·25	18·36	18·06	18·72	20·43	24·71	18·08	20·33	18·66
Nappan, N.S.	17·83	18·01	18·08	18·45	17·61	16·98	19·49	18·41	.....
Fredericton, N.B.	20·94	18·34	18·09	16·61	15·60	21·42	19·19	15·48	17·86
Lennoxville, Que.	15·91	14·55	16·01	15·12	15·99	17·51	17·29	17·15	18·49
Cap Rouge, Que.	16·88	16·69	17·04	21·27	18·61	.....	20·17	19·11	22·80
Ste. Anne de la Pocatière, Que.	18·89	13·24	17·31	17·69	15·30	19·72	19·80	18·18	20·01
La Ferme, Que.	16·05	.....	.....	.....	.....	.....	.....	.....	16·65
Ottawa, Ont.	17·79	15·04	15·61	16·44	16·16	16·36	15·57	16·92	17·08
Kapuskasing, Ont.	.....	.....	.....	.....	.....	.....	.....	15·73	16·52
Harrow, Ont.	.....	.....	.....	.....	.....	.....	.....	.....	18·99
Brandon, Man.	.....	15·24	16·82	14·14	12·19	13·36	.....	13·16	14·51
Morden, Man.	.....	.....	.....	.....	.....	.....	.....	9·44	14·17
Rosthern, Sask.	.....	14·15	13·56	17·27	13·13	14·19	14·27	17·95	14·37
Scott, Sask.	14·39	15·74	15·79	17·25	19·21	15·71	14·18	12·58	12·92
Indian Head, Sask.	15·68	20·24	.....	19·70	20·12	17·10	16·52	15·73	12·54
Swift Current, Sask.	.....	.....	.....	.....	.....	.....	.....	16·05	18·06
Fort Vermilion, Alta.	17·35	.....	14·47	16·00	14·32	13·01	16·11	12·28	19·74
Beaverlodge, Alta.	.....	.....	15·77	.....	19·16	.....	.....	13·45	13·70
Lacombe, Alta.	.....	12·86	13·84	15·77	.....	.....	12·25	9·26	15·13
Lethbridge, Alta. (Irrigated.	14·31	18·34	17·99	17·04	17·21	18·85	17·28	15·34	17·86
Lethbridge, Alta. (non-irrigated).	.....	19·35	16·63	17·57	15·92	.....	15·04	15·23	20·50
Agassiz, B.C.	17·02	16·46	15·78	16·67	17·62	16·75	.....	14·94	15·44
Sidney, B.C.	17·98	14·29	.....	.....	16·67	14·90	18·74	16·38	17·22
Invermere, B.C.	14·72	19·26	15·78	17·56	20·02	17·44	21·96	15·84	.....
Summerland, B.C.	.....	16·85	20·03	17·36	16·92	20·08	21·33	14·96	20·49

CO-OPERATIVE WORK WITH SUGAR BEETS

PRINCE EDWARD ISLAND, 1927

Field tests with sugar beets were carried out on nine of the Illustration Stations of Prince Edward Island during the past season, the work being under the direction of the Superintendent, Experimental Station, Charlottetown. Two varieties of seed, Home Grown and Dippe, were used and were from the same stock as that used on the Experimental Farms and Stations. The results are presented in table No. 22.

TABLE No. 22.—SUGAR BEETS—CO-OPERATIVE WORK, 1927. PRINCE EDWARD ISLAND

Lab'y. No.	Locality	Variety	Sugar in juice	Coefficient of purity	Average weight of one root
			p.c.	p.c.	lb. oz.
91489	Richmond	Home Grown	16·63	87·38	.. 3
90	"	Dippe	17·44	89·41	.. 4
91	West Devon	Home Grown	19·64	89·00	.. 5
92	"	Dippe	19·07	89·64	.. 4
93	Rose Valley	Home Grown	18·19	83·49	.. 6
94	"	Dippe	18·31	87·66	.. 7
95	Rustico	Home Grown	19·10	91·11	.. 8
96	"	Dippe	18·09	88·41	.. 9
97	St. Peters	Home Grown	16·54	87·04	.. 15
98	"	Dippe	16·07	85·96	.. 12
99	Red Point	Home Grown	17·92	87·72	.. 4
500	"	Dippe	18·07	90·63	.. 6
01	Montague	Home Grown	19·95	87·64	.. 5
02	"	Dippe	18·73	89·69	.. 4
03	Iona	Home Grown	17·28	89·04	.. 5
04	"	Dippe	19·70	91·91	.. 8
05	Wood Islands	Home Grown	18·60	92·64	.. 5
06	"	Dippe	18·30	89·80	.. 5

The soil generally was sandy loam overlying a gravelly brick clay. Manure was applied in the spring at about 15 tons per acre and on a number of the Stations the soil was dressed with fertilizer. The date of sowing varied from June 1 to June 22, that of harvesting from October 11 to October 19. The spring was late and at the majority of the Stations was cold and wet and the autumn was late.

The series as a whole is very satisfactory in respect to both sugar content and purity. However, the beets were very small and in consequence the tonnage per acre would be altogether too low for the profitable growing of beets for sugar extraction.

PRINCE ALBERT DISTRICT, SASKATCHEWAN, 1927

In 1925 and 1926 the analysis of a number of samples of sugar beets grown by farmers was made for the Board of Trade of Prince Albert, Sask., to test out the Prince Albert District in respect to its suitability for sugar beet growing. The results of this work were published in the annual reports of this division for the years ending March 31, 1926 and 1927. The data indicated that this district is too far north for the growth of a rich, pure root. The roots were of a good size and the yield fairly satisfactory but the sugar content and purity were too low for profitable sugar extraction. It would appear that the season is too short to allow a proper ripening of the beet.

This co-operative work was continued during the season of 1927 and fifteen samples of sugar beets were submitted in the autumn for analysis. The field work was supervised by Mr. Georges Michaud of the Provincial Department of Agriculture. The variety of seed used, the locality in which the beets were grown and the data of analysis of this series are presented in table No. 23.

TABLE No. 23.—CO-OPERATIVE WORK, 1927, PRINCE ALBERT, SASK.

Lab'y No.	Name	Locality	Variety	Sugar in juice	Co-efficient of purity	Average weight of one root
				p.c.	p.c.	lb. oz.
91579	P.A.J.	Prince Albert	Schlanstedt	14·61	80·69	1 7
580	E.H.D.	Albertville	Fredericksen	13·21	77·87	1 4
581	A.D.C.	Lily Plain	"	14·93	82·54	1 12
582	J.C.D.	Royal	Buszczynskie	16·44	83·95	1 8
583	S.B.	Lily Plain	"	17·03	83·87	.. 9
584	F.J.G.	Davis	"	15·67	84·86	.. 9
585	J.P.B.	Henriburg	Rabbethge & Giesecke	15·91	78·86	.. 15
586	O.E.	Spruce Home	" "	15·92	84·80	1 0
587	C.C.Y.	Paddockwood	" "	16·44	86·48	1 8
588	T.B.	Royal	" "	16·63	84·09	2 6
589	J.A.	Clouston	" "	17·18	84·68	1 8
590			Dippe	18·20	86·32	1 8
591			A. Torevsz	17·34	85·86	1 13
592			Fredericksen	18·26	88·65	2 3
593			Buszczynskie	15·89	84·65	1 0

It will be observed that these results are very variable; some of the beets are very fairly good while others are decidedly poor. The differences are not due to "variety" but evidently to cultural and seasonal conditions. In some cases it would seem that the roots were frosted but the low sugar content, in general, may probably be ascribed to the wet season and the inability of the roots to normally ripen. Apparently, the season—or rather the latter part of it—was not favourable to sugar production, by reason of it being too wet and too cold.

WHEAT AND FLOUR

MARQUIS, GARNET AND REWARD WHEATS GROWN ON EXPERIMENTAL FARMS AND STATIONS, 1926

This series comprises samples of these three varieties as grown in 1926 at a number of the Experimental Farms and Stations in the Prairie Provinces under the direction of the Cereal Division.

The main objects of this work were to ascertain, (1) varietal differences, chiefly in protein content, under the same environmental conditions, and (2) the influence of different environmental conditions on the character of the grain of the same variety. Results in this inquiry for the crops of 1924 and 1925 have been published in the annual report of this division for the year ending March 31, 1926.

In table No. 24 in addition to data for weight of kernel, protein and ash, particulars are presented for locality of growth and crop culture of previous season. The data have been arranged in groups for each locality, to facilitate comparison of the varieties.

TABLE No. 24.—MARQUIS, GARNET AND REWARD WHEATS FROM EXPERIMENTAL FARMS AND STATIONS: CROP OF 1926

Lab'y No.	Locality	Particulars as to previous soil treatment	Variety	Weight of 1,000 kernels	Moisture	Protein (N.x5·7)		Ash (Water-free basis)
						13·5% moisture basis	Water-free basis	
				gms.	p.c.	p.c.	p.c.	p.c.
	Manitoba							
89132	Experimental Farm, Brandon	Alfalfa sod land	Marquis	29·79	10·43	15·74	18·20	1·69
89129	" " "	" "	Garnet	26·91	10·37	15·70	18·14	1·59
89135	" " "	" "	Reward	35·30	11·44	16·15	18·68	1·66
89139	" Station, Morden	Field	Marquis	25·51	10·74	10·35	11·98	2·06
89138	" " "	"	Garnet	25·05	10·79	9·94	11·49	1·81
89140	" " "	"	Reward	38·17	10·67	14·82	17·15	1·99
	Saskatchewan							
89146	Experimental Farm, Indian Head	Summer-fallow	Marquis	30·24	10·03	12·83	14·84	1·60
89143	" " "	"	Garnet	26·72	10·54	12·94	14·96	1·41
89151	" " "	"	Reward	32·70	11·76	13·55	15·66	1·65
89158	" Station, Swift Current	"	Marquis	27·02	10·13	16·48	19·05	1·69
89155	" " "	"	Garnet	23·28	10·62	16·29	18·82	1·56
89159	" " "	"	Reward	28·59	9·93	17·72	20·49	1·57
89167	" Rosthern	Corn land	Marquis	24·92	9·59	14·93	17·26	1·29
89164	" " "	"	Garnet	21·15	10·41	14·01	16·19	1·24
89169	" " "	"	Reward	29·25	11·17	15·60	18·03	1·30
89175	" Scott	Summer-fallow	Marquis	29·98	9·54	16·29	18·84	1·39
89173	" " "	"	Garnet	24·68	9·78	17·21	19·90	1·71
89169	" " "	"	Reward	30·27	9·94	18·79	21·72	1·48
	Alberta							
89184	Experimental Station Lethbridge	" (dry land)	Marquis	28·96	10·51	15·01	17·36	1·51
89181	" " "	" "	Garnet	28·96	10·60	15·03	17·38	1·91
89186	" " "	" "	Reward	27·79	10·56	16·50	19·07	1·60
89191	" " "	After corn and summer-fallow (irrigated).	Marquis	36·24	9·93	13·54	15·65	1·57
89190	" " "	" "	Garnet	28·00	10·86	11·49	13·28	1·89
89194	" " "	" "	Reward	31·82	10·40	12·82	14·82	1·86
89198	" " Lacombe	Summer-fallow	Marquis	32·46	10·53	13·61	15·74	1·61
89195	" " "	"	Garnet	31·31	10·99	12·46	14·40	1·37
89199	" " "	"	Marquis	30·30	10·11	13·27	15·35	1·58
89197	" " "	"	Garnet	29·38	10·97	14·22	16·44	1·84
89201	" " "	"	Reward	35·41	10·54	16·78	19·34	1·59
89196	" " "	After animal pasture	Garnet	31·18	10·93	12·89	14·90	1·45
89207	" " Beaverlodge	Summer-fallow	Marquis	31·31	10·03	14·29	16·51	1·49
89204	" " "	"	Garnet	27·32	10·61	12·03	13·91	1·26
89209	" " "	"	Reward	34·05	8·99	14·79	17·10	1·30

Although further data are desirable before reaching definite conclusions respecting the relative merits of these varieties and the influence of environmental conditions upon them, the present results indicate that in respect to protein Reward stands highest with Marquis and Garnet decidedly lower. Between Marquis and Garnet the difference is slight but is in favour of Marquis. These inferences are well brought out by the following table presenting the maxima, minima and averages of the series.

PROTEIN CONTENT ON DRY MATTER BASIS

—	Marquis	Garnet	Reward
	p.c.	p.c.	p.c.
Maximum	19·05	19·90	21·72
Minimum	11·98	11·49	14·82
Average	16·50	16·04	18·22

MARQUIS AND GARNET WHEATS

This series consisting of fourteen samples was examined at the instance of the Cereal Division, the object of the inquiry being to obtain protein data of these two prominent wheat varieties as grown at a number of points in the Prairie Provinces. It further includes one sample (Garnet) grown on the Experimental Station, St. Anne de la Pocatière, P.Q. Table No. 25 presents data for weight of kernel, protein and ash.

TABLE NO. 25.—MARQUIS AND GARNET WHEATS FROM POINTS IN QUEBEC, MANITOBA, SASKATCHEWAN AND ALBERTA CROP OF 1926

Lab'y No.	Locality	Variety	Weight of 1,000 kernels	Moisture	Protein (N. x 5·7)		Ash water-free basis
					13·5% moisture basis	Water-free basis	
			gms.	p.c.	p.c.	p.c.	p.c.
89229	Dauphin, Man.	Marquis	36·68	11·14	10·76	12·44	2·06
89228	"	Garnet	33·07	11·29	10·78	12·48	1·76
89231	Beatty, Sask.	Marquis	31·72	11·15	13·42	15·52	1·34
89230	"	Garnet	28·77	11·69	13·05	15·09	1·65
89242	Shoal Lake, Man.	Marquis	32·02	10·40	14·39	16·63	1·57
89220	Experimental Farm, Brandon, Man.	"	32·44	10·02	12·69	14·67	1·63
89222	Beausejour, Man.	"	28·48	10·74	11·42	13·21	1·71
89224	Glenboro, Man.	"	28·09	10·52	11·63	13·45	2·02
89232	Birtle, Man.	"	33·98	11·06	13·15	15·20	1·76
89234	"	"	30·69	11·46	11·93	13·79	1·47
89236	Dafoe, Sask.	"	31·88	10·31	14·42	16·66	1·41
89240	Foam Lake, Sask.	"	30·82	11·08	13·54	16·02	1·35
89217	Ste. Anne de la Pocatière, P.Q.	Garnet	28·08	9·89	11·27	13·02	1·77
89226	Buffalo Lake, Alta.	"	27·00	11·39	13·64	15·77	1·57

The low protein content of the wheats grown at Dauphin, Man., may be noted. This is in agreement with results previously obtained in these laboratories; samples forwarded from this district have usually been characterized by a fairly large proportion of piebald (starchy) kernels. No appreciable difference between the two wheats, in this respect, is to be observed.

The samples of Marquis and Garnet grown at Beatty, Sask., are among the best in the series in respect to protein content, Marquis being slightly the better. Where these two varieties have been grown in the same locality, side by side, Marquis in the larger number of instances has shown the higher percentage of this constituent.

Garnet as grown at Ste. Anne de la Pocatière, P.Q., has a comparatively low percentage of protein, which, from seasonal conditions usually prevailing in this district, is not unexpected.

MARQUIS AND KHARKOV WHEATS

This series comprises three samples of Marquis and two of Kharkov grown at the Provincial School of Agriculture, Claresholm, Alta. It was forwarded to the Cereal Division for examination as to the comparative milling value of these two wheats.

TABLE No. 26.—MARQUIS AND KHARKOV WHEATS FROM PROVINCIAL SCHOOL OF AGRICULTURE, CLARESHOLM, ALBERTA

Lab'y No.	Milling No.	Variety	Crop year	Weight of 1,000 kernels	Moisture	Protein (N.x5·7)	Ash	Soil treatment
				gms.	p.c.	p.c.	p.c.	
89275	26·91	Kharkov...	1924	36·61	11·65	12·94	1·41	Summer-fallow, following inter-tilled corn and summer-fallow.
89276	26·92	" ...	1925	35·09	11·52	13·27	1·38	Summer-fallow, following oats.
89278	26·94	" ...	1926	36·22	11·21	16·05	1·63	Summer-fallow, following fallow, following pasture.
89277	26·93	Marquis....	1925	33·89	11·22	15·50	1·38	Summer-fallow, following pasture.
89279	26·95	"	1926	31·75	11·26	13·58	1·25	Summer-fallow, following white sweet clover grown for hay.

The protein content of the Kharkov samples shows a "spread" of 3·11 per cent. Whether the high percentage, 16·05, in the wheat from the soil fallowed for two succeeding seasons results from an exceptional production of nitrates is debateable, but the figures for this series certainly suggest the desirability of a carefully planned inquiry to ascertain the influence of previous soil culture and cropping on the quality of the grain.

The spread in the protein content of the Marquis samples approximates 2·0 per cent. Here the higher protein grain is from the land "summer-fallowed following pasture," but the evidence is insufficient to permit the conclusion that the differences here noted are to be attributed solely to previous soil cultural methods.

WHEATS FOR EXPORT SHIPMENTS

This series of eight samples drawn from shipments to England was examined as to protein content at the instance of the Cereal Division. These wheats were under investigation as to varietal composition. They are of the crop of 1926, and were shipped to Great Britain in April and May, 1927, and samples returned to Canada for examination.

TABLE No. 27.—ANALYSIS OF WHEATS—SAMPLES FROM SHIPMENTS FROM CANADA TO ENGLAND: FROM SERIES INVESTIGATED FOR VARIETAL COMPOSITION, CROP OF 1926

Lab'y No.	Ident. No.	Grade	Weight of 1,000 kernels	Moisture	Water-free basis	
					Protein (N. x 5·7)	Ash
			gms.	p.c.	p.c.	p.c.
93042	277	No. 1 Northern	28·99	11·92	14·89	2·63
43	275	No. 1 "	29·54	11·86	14·81	1·71
44	276	No. 1 "	29·59	11·73	14·90	1·72
45	287	No. 1 "	27·42	10·67	16·31	1·64
46	288	No. 2 "	28·25	11·30	15·23	1·65
47	289	No. 3 "	28·09	10·65	15·04	1·68
48	.....	No. 1 "	28·51	11·41	15·81	1·59
49	.....	No. 2 "	27·79	10·45	16·14	1·63

Of the eight shipments five were graded No. 1 Northern, two No. 2 Northern, and one No. 3 Northern. A summary of the protein content (water-free basis) is as follows:—

PROTEIN OF GRADES (WATER-FREE BASIS)

—	Number of samples	Maximum	Minimum	Average
No. 1 Northern	5	16·31	14·81	15·34
No. 2 "	2	16·14	15·23	15·68
No. 3 "	1	.....	.....	15·04

If it is admitted that the official grading is a true measure of the milling quality of the wheat, there is in this series further evidence that the nitrogen (protein) data could not be used solely as the determining factor in grading wheat.

The varietal composition of these wheats, determined by the botanical examination of the plants as grown from the seed, was undertaken by the Dominion Cerealist.

MARQUIS WHEAT

DATE OF CUTTING EXPERIMENT, EXPERIMENTAL FARM, BRANDON, CROP OF 1926

This investigation conducted on the Experimental Farm, Brandon, Man., was undertaken to obtain data in respect to changes in protein content and weight of kernel, occurring over a twelve-day interval during the latter stages of ripening.

The series comprise six samples collected at two-day intervals between July 29 and August 9.

According to these results there would appear to be a more or less steady increase in both weight of kernel and protein content during the period of collection. This trend is in fair accord with the results of previous work in this inquiry, which has shown that there is a gradual increase in protein content during the earlier but not the earliest days of ripening followed by a final period of some days in which there is no appreciable increase in protein.

This important question will receive further study but it may be expected that results will, in some degree, vary with the season and inherited characteristics of the variety under examination.

TABLE No. 28.—MARQUIS WHEAT GROWN AT EXPERIMENTAL FARM, BRANDON, MAN., CROP 1926

Laby' No.	Cutting	Date of cutting	Weight of 1,000 kernels	Moisture	Protein (N x 5·7)		Ash (water-free basis)
					13·5% moisture basis	Water-free basis	
			gms.	p.c.	p.c.	p.c.	p.c.
89244	1st	29–7–26	19·58	9·96	13·69	15·82	1·69
89245	2nd	31–7–26	24·07	9·97	14·48	16·74	1·62
89246	3rd	2–8–26	27·62	9·87	15·36	17·75	1·66
89247	4th	4–8–26	29·48	9·99	15·81	18·28	1·73
89248	5th	6–8–26	29·05	10·41	15·45	17·85	1·66
89249	6th	9–8–26	30·60	9·73	15·93	18·43	1·71

MARQUIS AND GARNET: WHEAT AND FLOUR

These wheats, graded No. 2 Northern, grown on the Experimental Station, Scott, Sask., in 1927, were milled under the directions of the Cereal Division at Wakefield, Que., and consignments of 600 pounds of each flour sent to Liverpool, England, for baking trials on a commercial scale.

ANALYSIS OF WHEATS

Lab'y No.	Variety	Weight of 1,000 kernels	Moisture	Water-free basis	
				Protein (N. x 5·7)	Ash
		grms.	p.c.	p.c.	p.c.
92998	Marquis	29·54	9·99	14·65	1·54
93000	Garnet	27·68	9·96	14·28	1·47

The protein content of these wheats is fair; it is not among the lowest nor is it among the highest. The examination of the standard grades shows that the crop generally of 1927 was somewhat low in protein. The wheats used in this inquiry evidently represent fairly the grade No. 2 Northern for that season.

In comparing these two varieties the characteristics usually observed are again in evidence, viz., a slightly higher weight of kernel and percentage of protein in Marquis.

The data for the corresponding flours are as follows:—

ANALYSIS OF FLOURS

Lab' No.y	Variety	Moisture	Water-free basis		Gluten		
			Protein (N. x 5·7)	Ash	Wet	Dry	Ratio wet/dry
		p.c.	p.c.	p.c.	p.c.	p.c.	
92999	Marquis.....	14·67	14·34	0·49	33·94	12·19	2·78
93001	Garnet.....	15·36	13·60	0·54	33·30	11·45	2·90

As in the case of the wheats from which these flours were milled the protein content of the Marquis is slightly the higher.

With respect to *character* of gluten that of neither flour quite reaches that standard of excellence which has been designated as " firm, elastic and resilient ". There is very little difference between the two glutens in their physical properties.

The Garnet flour has a distinctly yellow tint and its moist gluten retains this tint.

Flours from these two wheats were subjected, under direction of the Cereal Division, to bleaching treatments with Agene and Novaldelox B., bleaching reagents, in several concentrations, as stated in the table of analysis (No. 29). In addition to the usual determinations, data for diastatic value and hydrogen-ion concentration are given.

TABLE NO. 29—MARQUIS AND GARNET FLOURS

Subjected to Various Bleaching Treatments, Crop of 1927

Lab'y No.	Milling No.	Variety	Treatment	Moist-ure	On water-free		Dia-static value	pH	Gluten		
					Protein (Nx5·7)	Ash			Wet gluten	Dry gluten	Ratio Wet — Dry
				p.c.	p.c.	p.c.			p.c.	p.c.	
93091	27·95	Marquis....	Untreated.....	10·49	13·61	0·51	224	6·20	36·39	12·72	2·8
92	27·97	"	1 gm. Agene per bbl.	10·75	13·56	0·50	228	6·27	36·16	13·16	2·7
93	27·99	"	1·5 gm. " "	11·37	13·46	0·52	220	6·25	36·72	13·25	2·7
94	27·101	"	2 gm. " "	11·17	13·52	0·53	230	6·29	37·78	13·22	2·8
96	27·103	"	0·6 oz. Novadelox B per bbl.	14·86	13·71	0·53	206	6·20	32·86	12·06	2·7
93087	27·94	Garnet.....	Untreated.....	10·76	12·97	0·52	348	6·30	33·96	12·06	2·8
88	27·96	"	1 gm. of Agene per bbl.	10·99	12·81	0·51	346	6·30	33·41	11·82	2·8
89	27·98	"	1·5 " "	10·75	12·77	0·52	348	6·30	33·47	11·80	2·8
90	27·100	"	2 " "	10·98	13·06	0·54	328	6·20	33·09	11·71	2·8
95	27·102	"	0·6 oz. Novadelox B per bbl.	15·74	12·97	0·53	296	6·30	28·87	10·55	2·7

As in the previous series, Marquis has somewhat the higher percentage of protein.

Bleaching apparently exerted no influence on the protein content of either flour.

No effect from the bleaching agent Agene on either the amount or character of the gluten is to be observed. On the samples, both Marquis and Garnet,

treated with Novaldelox B, the percentages of wet and dry gluten are slightly lower than corresponding data for the remaining members of the series. These lower percentages are partly accounted for by the higher moisture content of the flours so treated, but calculated to the same moisture basis as the other flours the gluten results are still somewhat lower.

As in the series already discussed in this Chapter (Lab'y Nos. 92999 and 93001) the gluten of neither flour was of the best quality.

There was no significant difference between the glutens of the two flours but both were characterized by a slight " toughness ".

The diastatic enzymes present are now recognized as one of the important factors in determining the bread-making value of a flour.

In this series, as in the series of Marquis and Garnet flours reported in the Annual Report Division of Chemistry, 1927, pp. 36-40, Garnet has the higher diastatic value. This higher maltose producing power may result in a crust of more pleasing appearance and there is some evidence that it otherwise favourably affects the value of a bread flour.

The hydrogen-ion (pH) data—which give a measure of active acidity—are very slightly higher for the Garnet flour; however, in this property both closely approach the normal for freshly milled flour. The exact value of the hydrogen-ion concentration datum as a diagnostic factor is as yet undetermined but there is some evidence to show that high acidity (say, pH = 5·0) is associated with maximum loaf volume.

WHOLE WHEAT FLOUR

Lab'y No. 89789: This sample is stated to be whole wheat flour from which a certain proportion of the first patents had been removed. It was milled by the Peterborough Cereal Co., Ltd., Peterborough, Ont.

ANALYSIS

Moisture	11·91
Protein	14·42
Fat	1·63
Carbohydrates	67·81
Fibre	2·39
Ash	1·84
	100·00

These data are in accord with those of "whole wheat flour", differing from those of " patents " in possessing higher percentages of protein, fibre and ash.

Lab'y No. 89992: This whole wheat flour " Mellow Cream ", is the product of the Carp Roller Mills, Carp, Ont.

ANALYSIS

Moisture	13·00
Protein	13·18
Fat	1·71
Carbohydrates	68·13
Fibre	2·18
Ash	1·80
	100·00

This sample, though slightly lower in protein than average whole wheat flour, possesses all the characteristics of this type of flour, viz., higher fibre and ash than white flour. It is not quite so coarse as some brands on the market, a feature which may or may not enhance its value, according to the point of view.

CLOSE GRAZING EXPERIMENT

THE PROTEIN CONTENT OF GRASS, CHIEFLY MEADOW FOX-TAIL (*ALOPECURUS PRATENSIS*) AS INFLUENCED BY FREQUENCY OF CUTTING

It has been known for many years that agricultural grasses become less nutritious as they approach maturity and ripen their seed. The grass plant in its earlier weeks of growth makes a heavier draft on soil nitrogen than later in the season, with the result that its tissues are particularly rich in protein. As the grass continues to grow the protein, now formed in lessening quantities, is distributed throughout a greater bulk of the plant and thus its percentage in the dry matter is reduced. From a study of the analytical data on record of grasses examined at several stages of growth it may be summarized that as a grass matures the protein, ash, fat and water decrease while the carbohydrates (nitrogen-free extract) and fibre increase. Further, in addition to the larger percentages in their dry matter of protein and mineral constituents, the leaves and shoots of very young grass are more succulent, palatable and digestible than the leaves of the older plant. These facts have been used in giving advice as to the best period at which to cut for hay, i.e., the stage of growth at which the grass will yield the largest amount of digestible matter per acre. This will vary somewhat with different species but the weight of scientific evidence is in favour of cutting at or shortly after the flowering period. It will thus be seen that chemistry has contributed valuable information in relation to the best time or period for the harvesting of grass for hay.

In recent years much investigatory work has been carried out in England, Wales and Germany on the life-history of grasses, particularly in respect to the composition and digestibility. This work has confirmed and greatly extended the earlier results. The application of the facts thus brought out suggested a new scheme—popularly known as close grazing—for the profitable management of pasture lands. It has been most conclusively shown that in the adoption of this plan of pasturing and manuring, the feeding value of pastures may be greatly increased.

The work here recorded presents data as to the protein and dry matter content of grass of one, two and three weeks' growth, contrasting these results with similar data from the same grass cut for hay. The weights of the several cuttings permit the calculation of the total yields of the nutrients for the season per acre. It may therefore be considered a contribution towards the chemistry and economics of the newly proposed close-grazing scheme of pasturing.

PLAN OF EXPERIMENT, WITH ATTENDANT INFLUENCING FACTORS

The field selected for this investigation had been cut for hay for a number of years. For at least thirty years it had not been ploughed, pastured or manured.

The soil was a deep, moderately heavy clay loam with an abundance of humus. The nitrogen content of the surface soil (to a depth of six inches) was ·258 per cent (water free basis) and the subsoil from six to twelve inches was ·08 per cent. The surface soil has a pH value of 6·39 and a lime requirement of 2,000 pounds carbonate of lime, per acre (Jones method). The strong vigorous growth of grass gave evidence of a high degree of fertility.

A botanical survey of the area early in May, 1927, revealed a remarkably even "stand" of grass. The dominant grasses were Meadow foxtail (*Alopecurus pratensis*) and timothy (*Phleum pratense*), with the former greatly preponderating. Kentucky blue grass (*Poa pratensis*) was present but in almost negligible amounts. Legumes were not visible. A very few plants of tall buttercup (*Ranunculus acris*) and dandelion (*Taraxacum officinale*) were noticed.

Meadow fox-tail is an early perennial grass of good quality, requiring a rich soil, moist climate and three or four years to come to perfection. Though not among the heaviest hay grasses, it is valuable for pastures on account of earliness, rapidity of growth after cutting and rich aftermath.

Four adjacent plots (A, B, C, D) each 12 feet by 24 feet were laid out on this area. The frequency of cutting adopted was as follows: "A", weekly; "B", fortnightly; "C", every third week, and "D", at stage for hay (seed formed) with one aftermath. "A", "B" and "C" were cut with a lawn mower, leaving a close-cut sward. Every cutting was immediately weighed, sampled and total moisture determined. The remainder of the sample was air-dried, ground and analysed.

The first cuttings unfortunately contained a certain amount of dead grass, a residue from the growth of the previous season. This somewhat affected both the weight and quality of these initial cuttings, adding to the weight and detracting from the quality. In the case of plot A, it was thought advisable to omit from consideration the data of the first two cuttings.

Notes were taken at each cutting of the colour and length of grass and on changes in botanical composition.

The precipitation was recorded weekly throughout the experiment. Between May 19 and September 29, the period of experiment, the precipitation amounted to 14·79 inches. The rainfall for June, July and August, the chief growing months, was 11·32 inches—a precipitation at least 2 inches heavier than the ten-year average for this period at Ottawa.

Furthermore, as the data in table 33 (giving weekly precipitations) show, this was a season characterized by a remarkably well distributed rain-fall, no week being without a shower. This feature made the season one particularly favourable to the rapid springing up of fresh growth after cutting.

FREQUENCY OF CUTTING AS AFFECTING PERCENTAGES OF MOISTURE, PROTEIN AND FIBRE

Moisture

The data in table 30 show a steadily declining percentage of moisture in the grass with the lengthening of the periods between cuttings. The higher dry matter content in the older grass is possibly accompanied by a slight falling off in palatability and digestibility.

TABLE No. 30.—MOISTURE CONTENT OF GRASSES AS CUT

—	Plot A 15 cuttings	Plot B 9 cuttings	Plot C 6 cuttings	Plot D 2 cuttings
	p.c.	p.c.	p.c.	p.c.
Maximum	77·39	75·28	73·87	67·87
Minimum	66·76	68·20	68·52	63·47
Average	73·52	72·38	71·66	65·67

Protein

The percentages of protein (dry matter basis) of the several cuttings of the four plots are presented in table 31.

TABLE No. 31.—CRUDE PROTEIN (DRY MATTER BASIS)

Date of cutting	Plot A	Plot B	Plot C	Plot D
1927	p.c.	p.c.	p.c.	p.c.
May 19	12·47†	.....	.....	.....
" 27	14·41†	10·70†	.....	.....
June 2	19·04	.....	10·49†	.....
" 9	21·47	15·73	.....	.....
" 16	21·80	.....	.....	.....
" 23	21·00	16·74	15·33	.....
" 30	20·97	.....	.....	.....
July 8	19·36	19·98	.....	9·00
" 14	21·36	.....	16·36	.....
" 21	22·57	20·18	.....	.....
" 28	22·19	.....	.....	.....
Aug. 4	22·24	20·60	18·40	.....
" 11	*	.....	.....	.....
" 18	21·78	18·63	.....	.....
" 25	*	.....	17·25	.....
Sept. 1	21·50	19·68	.....	.....
" 7	*	.....	.....	.....
" 15	18·69	17·30	18·52	.....
" 22	.....	.....	.....	.....
" 29	.....	.....	.....	11·32

*Growth too short to allow of cutting.
†Omitted from consideration due to presence of old and dead grass.

The first cuttings from all the plots contained a certain amount of dead grass from the previous year. This fact undoubtedly has lowered the percentages of protein of the first samples from the plots.

Plot A.—The percentages of protein of the ten weekly cuttings, June 2 to August 4 inclusive, range from 19·04 to 22·57 with an average percentage of 21·20.

Subsequent to August 4 growth slowed down and it was found necessary to leave the plot two weeks between cuttings. The three cuttings on August 18, September 1 and 15, therefore, represent fortnightly growths. The data for their protein percentages are 21·78, 21·50 and 18·69 averaging 20·66. These figures, it will be observed are somewhat lower than those for the weekly cuttings, June 2 to August 4, due in large part to the increasing proportion of dandelion, as noted in the botanical observations of this plot from August 4 on. To lend support to this conclusion the analysis of a sample of dandelion (leaves, with no flower stalks) collected August 20, is presented.

COMPOSITION OF DANDELION

—	Fresh material	Dry matter
Water	83·17	.....
Crude protein	2·88	17·12
" fat	0·88	5·18
Carbohydrates	8·09	48·04
Fibre	2·15	12·79
Ash	2·83	16·87
	100·00	100·00

The protein content of dandelion, it will be seen, is distinctly lower than that of cuttings essentially composed of young grass.

Plot B.—Omitting, as in the discussion of plot A consideration of the data of the first cutting (May 27), for the reason already advanced, the range of protein for these fortnightly cuttings, June 9 to September 15 inclusive, is from 15·73 to 20·60 per cent, the average being 18·60 per cent.

Plot C.—Again disregarding the first cutting, the protein content of the several collections from this plot cut every third week, June 23 to September 15, inclusive, furnishes the following figures: minimum 15·33, maximum 18·52 and average 17·17 per cent.

Plot D.—This plot was first cut July 8 when the grass was at a stage of growth considered best for hay: the seeds of the meadow foxtail were fully formed but not ripe and the timothy was in flower. A second cutting—the aftermath—was made on September 29. This represented twelve weeks' growth, the grass showing a small number of stalks in bloom and the red clover a few plants with ripe seeds.

The percentage of protein of the July cutting was 9·00 per cent. This probably would have been slightly higher but for the presence of the small amount of dead grass of the previous season's growth.

The " aftermath", as might be expected, showed a higher protein content, viz. 11·32 per cent.

The foregoing data clearly prove that frequency of cutting markedly influences the protein content: the shorter the period of growth the higher the percentage of protein. The following figures, summarized from this work, show at a glance the decrease in protein associated with or following the decrease in frequency of cutting.

Frequency of cutting	Protein (dry matter basis)
	p.c.
Cut every week (ten cuttings)	21·20
Cut every two weeks (eight cuttings)	18·60
Cut every three weeks (five cuttings)	17·17
Cut for hay, with aftermath	10·16

Fibre

The percentage of fibre and its digestibility markedly influence the nutritive value of grass; as a grass matures and ripens its seed it becomes less valuable by reason of the increasing amount and lower digestibility of its fibre. The present work indicates that frequency of cutting affects the fibre content; the longer the period of growth the higher the percentage of fibre and vice versa. It is evident that frequent cutting results in the production of a grass which in respect to nutritive value has the characteristics of young grass—high protein and low fibre. The fibre results for this series are as follows:

TABLE NO. 32.—CRUDE FIBRE (DRY MATTER BASIS)

Date of cutting	Plot A	Plot B	Plot C	Plot D
1927	p.c.	p.c.	p.c.	p.c.
May 19	25·28	.....	.....	.....
" 27	25·39	26·74	.....	.....
June 2	24·00	.....	26·65	.....
" 9	21·57	25·24	.....	.....
" 16	20·16	.....	.....	.....
" 23	20·53	22·46	27·13	.....
" 30	22·36	.....	.....	.....
July 8	20·87	23·15	.....	32·90
" 14	19·12	.....	23·74	.....
" 21	19·87	21·81	.....	.....
" 28	18·48	.....	.....	.....
Aug. 4	18·88	20·96	23·56	.....
" 11	*	.....	.....	.....
" 18	16·56	17·47	.....	.....
" 25	*	.....	18·22	.....
Sept. 1	16·56	17·39	.....	.....
" 8	*	.....	.....	.....
" 15	15·17	15·52	17·64	.....
" 22	*	.....	.....	.....
" 29	.....	.....	.....	24·40

*Growth too short to allow of cutting.

The trend in respect to the general relationship of period of growth to fibre content may be gathered from a casual inspection of the foregoing table, the specific relationship as observed from this work is more clearly brought out by the following summary:—

Frequency of cutting	Fibre (dry matter basis)
	p.c.
Cut every week (ten cuttings)*	19·38
Cut every two weeks (eight cuttings)	20·50
Cut every three weeks (five cuttings)	22·06
Cut for hay, with aftermath	28·65

* This datum, 19.38, is the average from the cuttings June 2 to August 4; if the results from the last three cuttings of the plot, which were fortnightly, are included, the average percentage of fibre becomes 18.80. This low figure is due to the development of dandelion from August 4 on; reference to the analysis of this plant will show a percentage of 12.79 for fibre.

FREQUENCY OF CUTTING AS AFFECTING AMOUNTS OF DRY MATTER AND PROTEIN, PER ACRE

The data so far considered have shown that shortening the period of growth increases the nutritive value of a grass; does the same procedure result in the production of a greater weight of nutrients per acre? Every cutting of the plots was weighed and in consequence this experiment permits a reply to this enquiry.

Dry Matter

In table 33 data are presented for the weight per acre of the fresh grass and dry matter from the several plots. The table also gives the weekly rainfall throughout the experiment, the recorded data being for the precipitation of the week preceding the date of cutting.

TABLE No. 33.—WEIGHT OF GRASS (AS CUT) AND DRY MATTER, PER ACRE.

Date of cutting	Precipitation	Plot A. Cut weekly		Plot B. Cut every two weeks		Plot C. Cut every three weeks		Plot D. Cut for hay, with aftermath	
		Weight in pounds per acre		Weight in pounds per acre		Weight in pounds per acre		Weight in pounds per acre	
		Grass as cut	Dry matter	Grass as cut	Dry matter	Grass as cut	Dry matter	Grass as cut	Dry matter
1927									
May 19	.....	5,898·7	1,919·0	.....	.....	.....	.....	.....	.....
" 27	1·51	624·0	180·0	6,493·0	1,965·0	.....	.....	.....	.....
June 2	0·55	208·0	46·7	.....	.....	7,450·0	2,281·0	.....	.....
" 9	1·25	359·2	81·7	794·3	227·0	.....	.....	.....	.....
" 16	1·32	226·9	52·9	.....	.....	.....	.....	.....	.....
" 23	0·35	226·9	53·7	992·4	234·5	2,458·0	641·5	.....	.....
" 30	1·20	180·0	45·4	.....	.....	.....	.....	.....	.....
July 8	1·37	302·6	83·2	832·2	214·8	.....	.....	10,890·0	3·499·0
" 14	0·27	189·1	46·9	.....	.....	1,598·0	420·6	.....	.....
" 21	0·67	170·1	45·3	473·5	131·6	.....	.....	.....	.....
" 28	2·45	226·5	72·6	.....	.....	.....	.....	.....	.....
Aug. 4	0·24	170·2	45·4	907·5	224·0	2,401·1	627·7	.....	.....
" 11	0·37	*	*	.....	.....	.....	.....	.....	.....
" 18	0·62	321·4	86·2	501·0	142·2	.....	.....	.....	.....
" 25	0·23	*	*	.....	.....	501·5	160·3	.....	.....
Sept. 1	0·98	340·3	96·8	463·2	125·6	.....	.....	.....	.....
" 7	0·11	*	*	.....	.....	.....	.....	.....	.....
" 15	0·70	189·1	62·0	255·2	78·7	586·1	172·5	.....	.....
" 22	0·32	*	*	.....	.....	.....	.....	.....	.....
" 29	0·28	*	.....	*	.....	.....	.....	4,631·0	1,812·0

*Growth too short to allow of cutting.

The data for rainfall are rather unusual in that they show that there was not one week between May 19 and September 29 without rain. The liberal and well distributed rainfall which characterized this season was undoubtedly a most important factor towards maintaining a steady growth of grass and would we may conclude, be particularly favourable to the returns from plots A, B and C.

Though certain of the cuttings indicate a more or less definite relation between growth and rainfall, it is evident from the data that other factors, e.g. temperature and sunshine have also had a potent effect on growth.

It is of interest to note that the growth (weight of grass produced) on a unit area does not vary directly with the length of the growing period. It will be observed that the sum of two successive weekly cuttings does not equal—indeed is always less than—the weight of grass from a fortnightly cutting—the plots being adjacent and the samples grown simultaneously. Over the six weeks' interval June 30 to August 4, inclusive, the following data from the grass of plots A, B and C, calculated to weights per acre were obtained.

—	Number of cuttings	Grass as cut	Dry matter
		lb.	lb.
Plot A, cut weekly	6	1,239	339
Plot B, cut fortnightly	3	2,213	570
Plot C, cut every third week	2	3,999	1,048

This cumulative effect may possibly be explained on the hypothesis that as the leaf surface develops the plant's physiological activity or power to grow increases geometrically rather than arithmetically.

Considering the total yields of the plots for the season, plot "D" cut for hay, with aftermath, gave the heaviest weight both of grass as cut and dry matter. Under the conditions of this experiment, with a period of frequency

of cutting ranging from one week to three weeks the total yields increase as the intervals between cuttings lengthen. This is well brought out in the following summary:—

SEASONAL YIELDS PER ACRE: GRASS AS CUT AND DRY MATTER

Plot	Grass as cut	Dry matter
	lb.	lb.
"A," (Cut weekly)	9,633	2,918
"B," (Cut fortnightly)	11,712	3,344
"C," (Cut every third week)	15,004	4,304
"D," (Cut for hay, with aftermath)	15,503	5,311

Protein

The amounts of protein, per acre, in the several cuttings are given in table 34.

TABLE No. 34.—WEIGHT OF PROTEIN, PER ACRE

Date of cutting	Plot A. Cut weekly	Plot B. Cut every two weeks	Plot C. Cut every three weeks	Plot D. Cut for hay, with aftermath
	lb.	lb.	lb.	lb.
May 19	239·2	.....	.....	.....
" 27	25·8	210·3	.....	.....
June 2	8·9	.....	239·2	.....
" 9	17·5	35·7	.....	.....
" 16	11·5	.....	.....	.....
" 23	11·3	39·3	98·3	.....
" 30	9·5	.....	.....	.....
July 8	17·8	42·9	.....	314·6
" 14	10·0	.....	68·8	.....
" 21	10·2	26·7	.....	.....
" 28	16·1	.....	.....	.....
Aug. 4	10·1	46·2	115·5	.....
" 11	*	.....	.....	.....
" 18	18·8	24·7	.....	.....
" 25	*	.....	16·8	.....
Sept. 1	20·8	13·6	.....	.....
" 7	*	.....	.....	.....
" 15	11·7	26·5	31·9	.....
" 22	*	.....	.....	.....
" 29	*	*	.....	205·1

*Growth too short to allow of cutting.

It was pointed out when discussing dry matter yields that plots B and C produced heavier yields than A—the yields, being for the same period of growth. The same is true for protein, as is shown in the following summary for the period June 30-August 4.

—	Number of cuttings	Protein per acre
Plot A, cut weekly	6	74
Plot B, cut fortnightly	3	116
Plot C, cut every third week	2	184

The season's weights of protein, as resulting from the several plots are of particular interest. The figures are as follows:—

SEASONAL YIELDS PER ACRE: PROTEIN

Plot	Protein
	lb.
A. Cut weekly	439
B. Cut fortnightly	466
C. Cut every third week	571
D. Cut for hay with aftermath	520

It is significant that plot C, cut every third week, furnished the largest amount of protein, per acre.

Second in order is D, cut as hay, with aftermath. It owes its position, in a large measure, to its very heavy aftermath enriched by a comparatively high protein content.

Plot A, cut weekly, in respect to protein yield ranks last in the series, notwithstanding that its protein concentration was the highest. This position is due to its low yields of grass, and these in turn may possibly be attributed to a disturbance of the proportion of leaf to root necessary to the normal development of the plant following a too frequent cutting. It would seem only natural to conclude that the too frequent removal of foliage would result in a depression of the general vigor and vitality of the plant. It is in the acceptance and development of this hypothesis that the high ranking of "C" probably finds an explanation.

A period of three weeks is not necessarily the one which will give every year the highest protein yield; this period must vary with seasonal conditions. Grasses differ in their habit of the rate of producing aftergrowth which constitutes another factor in determining the most advantageous interval between cuttings.

The whole area was dressed last autumn (1927) with a fertilizer mixture, as follows:—

	Pounds per acre
Ammonium sulphate	50
Superphosphate	350
Muriate of potash	100

It is the intention to continue this investigation, making several applications of available nitrogen throughout the season and commencing the cuttings at an earlier date than was possible in 1927.

Digestible Protein

It may be safely assumed that grass as cut for hay possesses a lower coefficient of digestibility than very young grass; the evidence for this assumption is ample and satisfactory. There are not, however, on record any coefficients which can be strictly applied to the several cuttings of Meadow Foxtail as analyzed in this inquiry. It is impossible therefore to calculate precisely the amounts of digestible protein produced in the season by the several plots. It is probably justifiable, however, as between C and D, to conclude that plot C (cut every third week), with its higher total of protein—protein undoubtedly more digestible than that of plot D, cut for hay—has yielded the greater amount of digestible protein.

FORAGE CROPS

GRASSES AND CLOVERS—COMPOSITION AND YIELDS

FROM EXPERIMENTAL STATION, KENTVILLE, N.S., CROP 1927

Lab'y Nos. 90263-271: This series of nine samples sent for analysis as to relative feed value from the Experimental Station, Kentville, N.S., were accompanied by the following particulars:—

"The plots were seeded in June, 1926; the samples for analysis were collected August 4, 1927. Nos. 46. 47, 50, 52, 53 and 54 were seeded to determine their value for pasture. In respect to No. 46 the alsike checked the growth of the Kentucky blue grass and suppressed the wild white clover, so that the crop harvested was practically all alsike clover No. 47, similar to No. 46 but without alsike gave a good growth of Kentucky blue grass and wild white clover."

Tables Nos. 35 and 36 present data for the composition of the forages, their yield and weight of nutrients per acre.

It will at once be seen that the clovers and the mixtures in which clovers predominate, are the richest in protein. Of the legumes under experiment the English wild white clover, on the dry matter basis, possesses the highest percentage of this valuable nutrient. The two grasses under examination, Kentucky blue grass and red top, differ but slightly from each other in their nutritive value. On the dry matter basis, weight for weight, these grasses possess, roughly, but one-third of the protein content of the legumes.

Considering yield data, No. 46 which is practically all alsike clover, gave the largest yield per acre, in green material, dry matter and protein. It is, however, to be noted that plot 54, also of alsike, yielded only half, approximately, the weight of green crop produced by plot 46 and in consequence its weight per acre of dry matter and protein are not outstandingly high. Although the dry matter of the English wild white clover was the richest in protein and lowest in fibre in the series, this variety falls behind the other clovers in amount of dry matter per acre, with the exception of the alsike plot No. 54.

The two grasses do not fall much below the average from the legume plots in dry matter per acre but furnish scarcely a third as much protein. Red top, of the two, gave the highest yield of green material, but in dry matter was surpassed by the Kentucky blue grass. In protein per acre these grasses were almost identical.

TABLE No. 35.—COMPOSITION OF GRASSES AND CLOVERS FROM EXPERIMENTAL STATION, KENTVILLE, N.S., CROP OF 1927.

Lab'y No.	Ident. No.	Variety	Stage of growth when cut	As received						Water-free				
				Moisture	Protein	Fat	Carbohydrates	Fibre	Ash	Protein	Fat	Carbohydrates	Fibre	Ash
				p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
90263	45	Late Red Swedish Clover	Partly in bloom	70·0	2·8	1·0	10·8	6·8	1·6	12·30	4·25	46·82	29·58	7·05
90264	46	Kentucky Blue Grass and English Wild White Clover and Alsike	Alsike past bloom	79·3	2·4	0·5	9·5	6·8	1·5	11·78	2·50	45·52	32·84	7·36
90265	47	Kentucky blue grass and English wild white clover	Kentucky blue not headed, white clover past bloom	77·0	2·6	0·6	10·5	7·6	1·6	11·52	2·61	45·84	33·07	6·96
90266	50	Kentucky blue grass	Seed ripe	61·2	1·5	1·0	17·8	14·2	4·3	3·81	2·53	46·13	36·67	10·86
90267	52	English wild white clover	Just past full bloom	84·9	2·5	0·3	6·8	3·9	1·6	16·41	2·13	44·84	26·08	10·54
90268	53	Red top	Headed and coming into bloom	76·83	0·9	0·4	10·4	8·9	2·6	3·94	1·84	44·53	38·45	11·24
90269	54	Alsike	Just past full bloom	86·12	1·8	0·2	5·9	4·6	1·4	13·35	1·66	41·91	32·92	10·16
90270	56	Medium late red clover, Swedish	Not quite full bloom	80·0	2·4	0·3	8·9	6·8	1·6	12·09	1·71	44·31	34·02	7·87
90271	67	Alfalfa, Ontario, variegated	Full bloom	72·13	2·5	0·3	11·0	12·2	1·9	9·05	1·22	39·42	43·39	6·92

TABLE No. 36.—COMPOSITION OF GRASSES AND CLOVERS FROM EXPERIMENTAL STATION, KENTVILLE, N.S., CROP OF 1927.

Lab'y No.	Indent. No.	Variety	Stage of growth when cut	Yield green crop per acre	Weight of dry matter per acre	Weight of nutrients per acre				
						Protein	Fat	Carbohydrates	Fibre	Ash
				tons	lb.	lb.	lb.	lb.	lb.	lb.
90263	45	Late red Swedish clover	Partly in bloom	5·0	2,300	280·0	100·0	1,080·0	680·0	160·0
90264	46	Kentucky blue grass and English wild white clover and alsike	Alsike past bloom	11·7	4,844	570·0	121·0	2,205·0	1,592·0	360·0
90265	47	Kentucky blue grass and English wild white clover	Kentucky blue not headed, white clover past bloom	6·4	2,919	336·0	76·0	1,339·0	965·0	203·0
90266	50	Kentucky blue grass	Seed ripe	1·81	2,333	89·0	59·0	1,076·0	856·0	253·0
90267	52	English wild white clover	Just past full bloom	6·3	1,900	313·0	40·0	852·0	495·0	200·0
90268	53	Red top	Headed and coming into bloom	4·7	2,181	86·0	40·0	972·0	438·0	245·0
90269	54	Alsike	Just past full bloom	6·08	1,690	226·0	28·0	708·0	556·0	172·0
90270	56	Medium late red clover, Swedish	Not quite full bloom	6·4	2,560	309·0	44·0	1,134·0	871·0	202·0
90271	67	Alfalfa, Ontario, variegated	Full bloom	5·8	3,248	294·0	40·0	1,280·0	1,409·0	225·0

DYKE HAYS

This critical examination of hays from the dyked lands of Nova Scotia and New Brunswick, about the head of the Bay of Fundy, was undertaken to learn their nutritive value as compared with that of upland cut hays, preparatory to the drawing up of a series of grades which might be advantageously employed in the marketing of the hays.

Six samples of dyke cut hay, collected and shipped by a special committee of leading hay growers and dealers with headquarters at Sackville, N.B., were received on April 2, 1928, in good condition. These were of the crop of 1927 and were dry and free from mould and dust.

These dyke (marsh) hays were listed as follows:—

No. 1. Heavy grass, mixed.
No. 2. Light grass, mixed.
No. 3. Couch and fine grasses.
No. 4. Timothy and clover.
No. 5. Couch and timothy.
No. 6. Strong couch and fine grasses.

BOTANICAL EXAMINATION

The first step in the examination of these hays was the determination of their botanical composition. i.e., the varieties of grass, legumes and other herbage and the proportions in which these are severally present. The results of this examination are given in table 37. It will be observed that Nos. 1 and 2, designated "heavy" and "light" marsh hays respectively differ only in the former containing a higher percentage of timothy and a lower percentage of couch. They are both characterized by about 45 per cent of red top.

No. 3 designated as "couch and fine grasses" may be said to consist of 60 per cent red top and 33 per cent timothy, with 4 per cent of alsike clover. Its percentage of couch is almost negligible.

No. 4, labelled "timothy and clover", is seen to be composed of approximately 15 per cent of each of the following grasses: timothy, red top and couch, with 45 per cent of alsike clover and a little more than 5 per cent of Canadian blue grass.

No. 5, designated "Couch and Timothy" is composed of practically equal parts of timothy and couch. There is a slight sprinkling of red top and legumes.

No. 6 is practically pure couch grass. Other grasses and legumes are present in traces only.

CHEMICAL ANALYSIS

The results of the chemical analysis are presented in table 38 the data giving the composition of the hays "as received", on a 12·5 per cent moisture basis, and on the "water free" or "dry matter" basis.

Comparing samples Nos 1 and 2, "heavy" and "light" marsh hays respectively, it will be seen that No. 1, possesses the higher protein content, due, it must be concluded to its larger proportion of timothy; the lower percentage of protein in No. 2 is evidently due to the replacement of a part (10 per cent) of the timothy by couch grass. Both hays as already stated, contain about the same proportion of red top.

The figures for No. 3 afford no evidence as to the nutritive value of couch grass since the proportion of this grass present is negligible, but they indicate that a hay made up, roughly, of one third timothy and two thirds red top is one of very fair quality.

Hay No. 4 is characterized, as already noted, by a large proportion—almost 50 per cent—of legumes (chiefly alsike clover) and this is reflected in the analysis; this sample has much the highest protein content of the series.

A comparison of Nos. 5 and 6 is of interest—the former being practically couch and timothy, half and half, and the latter essentially pure couch grass. The data show No. 6 to be decidedly the poorest in the series in respect to protein; the substitution of half the couch grass by timothy (No. 5) has very materially raised the nutritive value of the hay, as shown in the higher percentage of protein and a lower fibre content.

This enquiry will be continued and expanded to include upland hays and hays from early and late cuttings.

TABLE No. 37.—BOTANICAL COMPOSITION OF DYKE HAYS
From Cumberland Co., N.S., Albert and Westmoreland Co., N.B., Crop 1927

Lab'y No.	Ident. No.	Locality	Percentage of species by weight						Individual species of weeds found among the samples
			Timothy (Phleum pratense)	Red top (Agrostis sp.)	Couch (Agropyrum repens)	Slough Grass (Spartina Michauxiana)	Legumes (Trifolium pratense T. hybridum Vicia sp.)	Canadian Blue Grass (Poa compressa)	
93056	No. 1	Cumberland Co., N.S. (Chas. T. Logan)	18·79	43·59	29·45	0·26	0·69 (Vetch)	.....	Rattle-box, mouse-eared chickweed, yarrow, rush, daisy and hawkweed.
93057	No. 2	" " "	11·92	45·26	39·70	.....	3·12	.....	Yarrow, perennial sow thistle, oxeye daisy, spurrey.
93058	No. 3	Albert Co., N.B. (Wm. Dickson).....	32·86	58·94	2·80	1·85	3·55 (alsike)	.....	Perennial sow thistle, rattle-box, yarrow, rush, bit of moss.
93059	No. 4	Westmoreland Co., N.B. (W. B. Fawcett).	16·86	14·86	14·61	.....	45·94 (alsike)	6·37	Oxeye daisy, yarrow, hawkweed, mouse eared chickweed, horsetail, Canada thistle.
93060	No. 5	" " "	51·83	1·83	43·72	.....	2·62	.....	Yarrow, perennial sow thistle, oxeye daisy, spurrey.
93061	No. 6	Westmoreland Co., N.B. (C. C. Campbell).	.....	0·74	99·16	.....	0·10	.....	

TABLE No. 38.—CHEMICAL COMPOSITION OF DYKE HAYS—*Crop of 1927*

Lab'y. No.	Sample No.	Locality	Particulars as given by Committee	As received						Water-free					Moisture-basis of 12·5 per cent					
				Moisture	Protein	Fat	Carbohydrates	Fibre	Ash	Protein	Fat	Carbohydrates	Fibre	Ash	Moisture	Protein	Fat	Carbohydrates	Fibre	Ash
				p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
93056	1	C. T. Logan, Amherst, Cumberland Co., N.S.....	"Heavy marsh hay"	6·57	8·14	2·90	46·77	27·38	8·24	8·71	3·10	50·05	29·32	8·82	12·50	7·62	2·71	43·80	25·66	7·71
93057	2	" ..	"Light marsh hay"	5·84	5·75	2·38	49·55	29·29	7·19	6·11	2·53	52·61	31·11	7·64	12·50	5·34	2·21	46·06	27·21	6·68
93058	3	Wm. Dickson, Sackville, Albert Co., N.B.....	"Couch and fine grasses".....	5·93	7·50	2·32	47·15	29·85	7·25	7·97	2·46	50·13	31·74	7·70	12·50	6·97	2·16	43·87	27·76	6·74
93059	4	Wm. B. Fawcett, Saskville, Westmoreland.....	"Timothy and Clover".....	7·12	9·50	2·34	44·10	28·47	8·47	10·23	2·52	47·47	30·66	9·12	12·50	8·95	2·20	41·55	26·82	7·98
93060	5	" "	"Couch and timothy".....	5·89	5·64	2·02	47·50	31·04	7·91	5·98	2·15	50·48	32·98	8·41	12·50	5·24	1·88	44·16	28·87	7·35
93061	6	C. C. Campbell, Sackville, Westmoreland.....	"90 per cent couch"	6·04	4·69	1·60	48·38	31·84	7·45	4·99	1·71	51·49	33·88	7·93	12·50	4·37	1·49	45·05	29·65	6·94

WESTERN PRAIRIE FORAGE PLANTS

At the request of the Division of Forage Plants analysis has been made of a number of grasses, sages, thistles, etc. collected at a number of points in Alberta and British Columbia, but chiefly from the Federal Ranch at Manyberries, Alta. The dates of collection extend from June to November and consequently the specimens submitted represent the plants at several stages of growth. As received, for analysis, the samples were thoroughly air-dried—many of them, owing to lateness in the season when collected, had been subjected to "weathering" for some weeks after coming to maturity.

The accompanying table (39) presents, in addition to the analytical data, the following particulars; scientific and common names of the plants, locality, date of collection and stage of growth.

Commenting briefly on the analytical results, the following more important features may be noted:—

1. In such cases in which a grass has been collected and analysed at three stages of growth—flowering, late milk or dough and "cured" *i.e.* not collected until, say, November—it will be seen that the protein content decidedly declines with advance in the stage of growth—as for instance between flowering and late milk—and falls off very markedly from the ripening stage until "cured" and weathered, at the date of collection, November 1. This is illustrated by the following examples taken from the table of data:

PROTEIN CONTENT OF GRASSES AT THREE STAGES OF GROWTH (DRY MATTER BASIS)

Stage of growth	Needle Grass	Blue Grama Grass	June Grass	Dwarf Meadow Grass	Blue Joint
	p.c.	p.c.	p.c.	p.c.	p.c.
Flowering	8·12	7·59	5·99	5·84	7·62
Late milk or dough	5·61	5·65	4·89	5·36	6·49
Cured	2·00	2·14	1·37	0·99	3·54

It is well known that as a grass develops from "spearing" to "seeds fully ripe" the protein content decreases, but the marked decline which has taken place in this series between "late milk" (dough) and "cured" would appear to be far greater than that which would result solely from the ripening of the plant. This may possibly be due in part to severe weathering conditions in the late autumn but more probably in a larger degreee to loss of leaf. It may be remarked that many of the later collected samples consisted largely, in some cases entirely, of stem.

2. The analysis of the Russian thistle (No. 92559) shows some remarkable results. First, there is a phenomenally high protein content, indicating an herbage of considerable feeding value; secondly, there is a low percentage of fibre and a high ash. Quoting from "Feeds and Feeding" (Henry and Morrison) respecting this plant (page 251) "The introduced Russian thistle, now growing over great areas of the plains east of the Rockies, is used to come extent as pasture and hay. The mature plant is woody and loaded with alkali. It should be cut when in bloom and quickly stacked. It may also be ensiled."

3. The various sages examined (Nos. 92563-67), while showing differences in composition (in part due to different stages of growth) all possess fair percentages of protein, especially in the younger plants. In this respect they are superior to many of the grasses. According to American authorities many species of sage brush are forage plants of considerable value, especially for sheep. One author states "whole bands of sheep will leave all other forage and feed on sage brush for a day or two at a time; after that they may not touch it for days or even weeks."

TABLE NO. 39.—PRAIRIE PLANTS—COLLECTED BY DR. CLARK, FORAGE

Lab'y.	Name	Locality	Date of collection	Stage of growth
92533	Stipa Comata (Needle grass)	Manyberries, Federal Ranch, Alta	June 27	Flowering
34	Stipa Comata (Needle grass)	" "	July 27	Late Milk
35	Stipa Comata (Needle grass)	" "	Nov. 1	Cured
36	Stipa viridual (Short awned needle grass.	" "	July 26	Dough
37	Calamovilfa longifolia (Sand grass)	Maple Creek, Sask	" 30	Flowering
38	Bouteloua gracilis (Blue Grama Grass)	Manyberries, Federal Ranch, Alta	" 28	"
39	Bouteloua gracilis (Blue Grama Grass)	" "	Aug. 12	Dough
40	Bouteloua gracilis (Blue Grass Grama)	" "	Nov. 1	Cured
41	Poa Reflexa, (Tall Meadow Grass)	Lindsay Flats	July 26	Dough
42	Koeleria gracilis, (June Grass)	Manyberries, Federal Ranch, Alta	June 27	Flowering
43	Koeleria gracilis, (June Grass)	" "	July 18	Dough
44	Koeleria gracilis (June Grass)	" "	Nov. 1	Cured
45	Poa laevigata, (Dwarf Meadow Grass) (Upland Poa)	" "	June 26	Flowering
46	Poa laevigata, (Dwarf Meadow Grass) (Upland Poa)	" "	July 15	Late Dough
47	Poa laevigata, (Dwarf Meadow Grass) (Upland Poa)	" "	Nov. 1	Cured
48	Agropyron Smithii, (Blue Joint)	" "	July 26	Flowering
49	Agropyron Smithii, (Blue Joint)	" "	" 26	Dough
50	Agropyron Smithii, (Blue Joint)	" "	Nov. 1	Cured
51	Beckmannia erucaeformis (Slough Grass)	" "	July 27	Dough
52	Deschampsia atropurpurea (Swamp Grass)	" "	" 27	Dough
53	Poa triflora (Feather Grass)	Walsh Flats, Alberta	Aug. 1	"
54	Sporobolus cryptandrous (Drop seed Grass)	Bindloss, Alberta	" 23	Cured
55	Agropyron spicatum (Blue-bunch wheat grass)	Summerland, B.C	Aug. 10	"
56	Agropyron spicatum (Blue-bunch wheat grass)	Nicola Valley, B.C	Sept. 25	"
57	Carex sp. (Wire grass)	Manyberries, Federal Ranch, Alta	Aug. 10	Flowering
58	Carex filifolia (Thread-leaved sedge)	" "	" 10	Cured
59	Salsola pestifer (Russian Thistle)	" "	" 12	Early flowering
60	Artemisia frigida, (Prairie Sage)	" "	Aug. 10	Flowering
61	Artemisia frigida, (Prairie Sage)	" "	Sept. 25	Late flowering
62	Artemisia frigida, (Prairie Sage)	" "	Nov. 1	Cured
63	Artemisia gnaphaloides, (Sage Brush)	" "	Aug. 10	Flowering
64	Artemisia gnaphaloides, (Sage Brush)	" "	Nov. 1	Cured
65	Atriplex Nuttalia, (Salt Sage)	" "	Aug. 10	Flowering
66	Eurotia lanata, (Sweet Sage)	" "	" 10	Late flowering
67	Artemisia frigida, (Prairie Sage)	Summerland, B.C	" 10	Flowering

As received						Water-free				
Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash	Protein	Fat	Carbo-hydrates	Fibre	Ash
p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
12·75	7·08	2·80	29·66	42·48	5·23	8·12	3·21	33·97	48·70	6·00
9·62	5·08	2·10	45·86	32·96	4·38	5·61	2·63	50·71	36·40	4·65
8·59	1·83	1·84	45·37	36·43	5·94	2·00	2·02	49·63	39·84	6·51
9·79	8·30	1·61	41·03	32·10	7·17	9·20	1·78	45·53	35·54	7·95
8·32	7·21	1·73	43·95	34·18	5·11	7·86	1·89	47·40	37·28	5·57
8·46	7·03	1·70	45·38	30·20	8·23	7·59	1·84	48·04	32·63	8·89
8·19	5·19	1·94	50·27	28·95	5·47	5·65	2·12	54·74	31·53	5·96
9·05	1·98	1·54	46·21	30·71	10·51	2·14	1·69	50·83	33·79	11·55
9·49	1·97	2·13	45·24	36·78	4·39	2·13	2·35	49·99	40·68	4·85
12·67	5·23	2·73	43·01	31·02	5·36	5·99	3·13	49·63	36·01	6·14
8·90	4·45	3·34	43·68	32·44	7·19	4·89	3·67	47·95	35·60	7·89
8·24	1·26	0·95	41·95	33·17	14·43	1·37	1·04	46·24	35·61	15·72
10·22	5·24	2·66	42·68	32·94	6·26	5·84	2·96	47·54	36·69	6·97
10·36	4·80	2·88	46·05	31·78	5·13	5·36	3·21	50·25	35·46	5·72
9·28	0·90	1·54	43·79	38·55	5·94	0·99	1·70	48·75	42·50	6·55
12·46	6·67	2·26	40·15	32·25	6·21	7·62	2·58	45·86	36·84	7·10
10·10	5·83	1·85	45·05	31·22	5·95	6·49	2·06	50·10	34·73	6·62
12·29	3·10	2·58	39·94	29·05	13·04	3·54	2·94	45·53	33·12	14·87
11·14	3·02	3·17	45·82	28·86	7·99	3·40	3·57	51·57	32·47	8·99
10·86	4·65	1·61	39·25	35·32	8·31	5·22	1·81	44·03	39·62	9·32
11·15	4·88	1·28	46·14	30·35	6·20	5·44	1·44	51·96	34·18	6·98
9·31	5·01	2·01	47·25	30·67	5·75	5·52	2·22	52·10	33·82	6·34
8·11	2·07	2·89	42·45	37·92	6·56	2·25	3·15	46·29	41·17	7·14
9·31	5·43	2·99	38·38	32·69	10·70	6·02	3·32	42·55	36·24	11·87
10·44	9·90	1·68	43·23	27·41	8·34	10·93	1·89	47·72	30·25	9·21
10·05	5·60	3·90	46·86	23·98	9·61	6·23	4·34	52·03	26·71	10·69
9·47	18·30	1·67	31·72	18·61	20·23	20·22	1·85	34·99	20·59	22·36
10·41	7·03	3·99	40·80	33·77	4·00	7·78	4·41	45·57	37·81	4·43
11·83	10·03	5·87	38·84	26·57	6·86	11·37	6·64	44·08	30·13	7·78
10·47	4·31	2·75	41·24	37·97	3·26	4·81	3·07	46·08	42·40	3·64
10·64	10·86	6·12	39·44	26·82	6·16	12·15	6·85	44·48	29·69	6·89
10·42	7·53	3·80	42·42	31·73	4·10	8·40	4·24	47·37	35·42	4·57
14·06	12·19	1·85	36·46	19·25	16·19	14·18	2·15	42·43	22·40	18·84
5·10	13·51	2·06	36·80	29·87	12·66	14·23	2·17	38·74	31·51	13·35
10·70	5·61	6·02	44·94	27·69	5·04	6·28	6·74	50·32	31·02	5·64

WHEAT STRAW—MARQUIS AND KITCHENER

Lab'y No. 91749-50: It was reported to this division that "horses at large on ranches on the Elrose branch of the Canadian National Railways would eat the straw from fields of Kitchener wheat and leave that from Marquis alone." The Superintendent of the Experimental Farm, Indian Head, Sask., secured samples of these straws from the district in question and forwarded them for analysis.

ANALYSIS OF STRAW

—	Marquis	Kitchener
	p.c.	p.c.
Moisture	7·63	6·93
Protein	5·49	5·01
Fat (Ether extract)	1·41	1·26
Carbohydrates	36·74	37·06
Fibre	39·24	40·61
Ash	9·49	9·13
	100·00	100·00

These results throw little or no light on the problem. From the standpoint of protein content, Marquis should be the more nutritious, granting that both straws are equally digestible. Of course, this might not in any degree affect palatability. In point of maturity, we judge there can be little difference betwen the straws, as the fibre percentages are very close.

In addition to the ordinary fodder analysis, a water extract of the straws was made to learn if the results indicated a superiority in one of the straws. The data are as follows:—

—	Marquis	Kitchener
Water soluble extract	9·85	10·11
Water-soluble protein (nitrogenous material N.x 6·25)	2·17	1·81

Whether the larger soluble carbohydrate content of Kitchener would account for its greater palatability is open to question.

ALFALFA

Lab'y Nos. 89931-2: The alfalfa (*a*) leaf and (*b*) stem here reported, were from a crop grown on the Experimental Farm, Brandon, Man., 1927 and cut immediately before coming into bloom.

ANALYSIS OF PRE-BLOOM ALFALFA—LEAF AND STEM

Constituents	Leaf		Stem	
	Green material	Dry matter	Green material	Dry matter
Water	78·92	.....	78·95	.....
Protein	6·16	28·99	1·75	8·30
Fat (ether extract)	0·61	2·95	0·29	1·39
Carbohydrates	9·35	44·39	8·40	39·94
Fibre	2·56	12·18	8·54	40·55
Ash	2·40	11·49	2·07	9·82
	100·00	100·00	100·00	100·00

The above data are of interest in permitting a comparison as to the nutritive value of the leaf and stem, from a crop cut for hay at a very early stage of growth, *i.e.* before coming into bloom.

1. Leaf and stem at this stage of growth appear to possess the same dry matter content.

2. The dry matter of the leaf differs from that of the stem (1) in being much richer—approximately 3½ times—in protein, (2) in containing a higher percentage of carbohydrates, roughly 5 per cent, (3) in a much lower fibre content—the difference is almost 30 per cent. and (4) in a decidedly higher mineral (ash) content.

These results very emphatically show the superior quality of leaf, even at this early stage of growth; later, the difference in feeding value between leaf and stem would, we expect, be still greater.

COUCH GRASS HAY *(AGROPYRUM REPENS)*

Lab'y. No. 92735: This sample of couch hay, cut from marsh lands at Nappan, N.S. was forwarded to obtain information respecting the nutritive value of late-cut couch hay. The particulars are as follows: "Cut August 26, 1927, the grass being dead-ripe, the sample forwarded being essentially (over 90 per cent) couch." As received, the hay was finely cut, of a good colour (though evidently ripe) and free from dust and mould.

ANALYSIS

Moisture	7·92
Protein*	6·37
Fat (ether extract)	1·71
Carbohydrates	46·01
Fibre	31·02
Ash	6·97
	100·00
*Albuminoids	4·94
Non-albuminoids	1·43

This apparently exceptionally low protein content can only be accounted for by the advanced stage of maturity which the grass had reached when cut. An analysis made in 1893 of couch grass grown at Ottawa and cut when "in flower" showed, on a basis of 8 per cent moisture, 15·40 per cent of protein. Couch, like other grasses, varies greatly in its nutritive value according to its stage of growth; the younger it is the more nutritious, as judged by protein content. Couch is a grass relished by cattle, and if cut not later than "in flower" would in all probability produce a rich hay.

The question as to the value of maritime grown hay for its iodine content in animal nutrition has been raised. Apparently there are no data on record for the iodine content of Canadian grasses, but it is significant that this marsh grown couch hay possessed a decidedly higher iodine content than that commonly found in grasses.

SILAGE

The series now reported comprises eight samples, submitted from Experimental Farms or Stations located at Ottawa and Kapuskasing, Ont., Brandon, Man., and Nappan, N.S. They are of the crop of 1926 and of 1927 and represent corn, sunflower, oat, peas and vetch and sweet clover silages as used in feeding trials under the direction of the Animal Husbandry Division. The data are presented in table 40.

CORN

CENTRAL EXPERIMENTAL FARM, OTTAWA

Lab'y Nos. 88455 and 88794: Sample No. 88455, of the crop of 1926, was taken from near the bottom of the tile silo at the Central Experimental Farm on March 14, 1927. It contains 21·05 per cent dry matter, which is somewhat below the average figure for silage from corn in the "glazing" condition—a condition or stage of development which has been favoured for the larger number of varieties, to yield the largest amount of nutrients per acre with the highest quality of silage. The percentage of fibre is higher than that of the best corn silage—an undesirable feature since this is the least digestible of all the nutrients. The "ash" also is decidedly above the average. Previous analysis of samples from the bottom of deep silos have shown somewhat similar characteristics in respect to ash content.

The sample of corn silage, No. 88794, also of the crop of 1926, was taken from near the top of the cement block silo at the Central Experiment Farm, Ottawa, on April 12, 1927. This silage was used in continuing the feeding experiment of the Animal Husbandry Division begun some weeks earlier with silage No. 88455.

This silage contained 17·80 per cent of dry matter, which brings its feeding value decidedly lower than that of No. 88455. The analysis generally is not representative of first quality corn silage, though considering the comparatively low dry matter content the protein is very satisfactory—as is also the case with No. 88455.

SUNFLOWER: OAT, PEA AND VETCH

EXPERIMENTAL STATION, KAPUSKASING, ONT.

Lab'y Nos. 91859 and 92166: The sunflower silage No. 98159, from the Station at Kapuskasing used in a cattlefeeding experiment in comparison with silage from oat, pea and vetch, is evidently from an immature crop, the dry matter content being decidedly lower than that of a crop cut, say, one-tenth to one-half in bloom. The high ash content is characteristic of the sunflower crop.

The sample of oat, pea and vetch silage No. 92166, employed in the same feeding trial with the foregoing silage, contains 7·0 per cent more dry matter than that of the sunflower. The data indicate a silage of good average quality for this crop which has usually furnished a silage superior in feeding value to that from either corn or sunflower as grown at this northern point.

SWEET CLOVER: CORN

EXPERIMENTAL FARM, BRANDON, MAN.

Lab'y Nos. 92698 and 92699: These two silages—used in a feeding trial at the Experimental Farm, Brandon, Man., to determine their relative value for milk production, were accompanied by the following notes:—

"Sweet clover silage (No. 92698) cut July 25 when about three-fourths in bloom and ensiled 1½ days after cutting. Water was added to the last loads as put in the silo, since they had been allowed to wilt over the week end. The sample submitted was from about half way down the silo. The crop yield was about 10½ tons green material per acre."

"The corn silage (No. 92699) was ensiled September 14, one day after cutting. The crop was partly in the "late milk" stage and partly more advanced, in that known as "glazed". No water was added in filling the silo. The yield was 7 tons, 317 pounds green weight per acre."

The sweet clover silage is characterized by an exceptionally high dry matter content, practically 28 per cent, which gives it a feeding value considerably above that usually found in this type of silage. The dry matter composition

however reveals a lower protein and a higher fibre content than present in sweet clover silage from an earlier cut crop, which from a nutritive point of view detracts but does not entirely offset the favourable feature of a high dry matter content.

Similarly, the dry matter content, 27·40 per cent; of the corn silage is above the average, which may be stated approximately as 23·0 per cent. The data calculated to the water-free basis, indicate a dry matter with a protein content somewhat above the average. The low percentage of fibre also points to a leafy crop. These features show this to be a silage of more than average quality.

SUNFLOWER: OAT, PEA AND VETCH

EXPERIMENTAL FARM, NAPPAN, N.S.

Lab'y Nos. 92733-4: These silages were from the crop of 1927 at this point and, as in the cases already discussed, were used in feeding trials under the direction of the Animal Husbandry Division.

The low protein and high fibre of this sunflower silage place it below the average; the results generally are not indicative of silage of the best quality from this forage.

The sample of oat, pea and vetch silage though rather low in dry matter has an excellent protein content. The data of this silage compare very favourably with the average data from a series of 16 samples of oat, pea and vetch silage from crops grown on the Central Experimental Farm, Ottawa, and analyzed in these laboratories.

TABLE No. 40.—SILAGE: CORN, SUNFLOWER, OAT, PEA AND VETCH AND SWEET CLOVER

Lab'y No.	Particulars	As received							Water-free					
									Protein					
		Moisture	Protein	Fat	Carbohydrates	Fibre	Ash	Acidity	Albuminoid	Non-Albuminoid	Fat	Carbohydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
88455	Corn, Division Animal Husbandry, C.E.F., Ottawa	78·95	2·00	0·69	9·82	7·00	1·54	3·28	9·48		3·28	46·66	33·26	7·32
88794	Corn: Division Animal Husbandry, C.E.F., Ottawa	82·20	1·88	0·72	8·19	6·06	0·95	2·38	10·54		4·02	45·94	34·18	5·32
91859	Sunflower: Experimental Station, Kapuskasing, Ont	81·40	2·18	0·54	8·14	5·42	2·32	0·84	8·38	3·36	2·87	43·75	29·15	12·49
92166	Oat, Pea, Vetch: Experimental Station, Kapuskasing, Ont	74·40	2·26	1·23	11·87	8·63	1·61	1·93	5·80	3·02	4·81	46·35	33·71	6·31
92698	Sweet Clover: Experimental Farm, Brandon, Man	71·90	3·75	0·85	10·76	11·04	1·70	1·65	7·88	5·45	3·01	38·34	39·26	6·05
92699	Corn: Experimental Farm, Brandon, Man.	72·60	2·65	0·67	16·53	5·81	1·74	2·53	5·31	4·35	2·46	60·33	21·19	6·36
92733	Sunflower: Experimental Farm, Nappan, N.S	80·80	1·51	0·73	7·45	7·35	2·16	1·60	6·16	1·71	3·82	38·77	38·27	11·27
92734	Oat, Pea, Vetch: Experimental Farm, Nappan, N.S	77·40	2·85	1·12	8·88	7·49	2·26	1·17	6·48	6·12	4·95	39·30	33·13	10·02

FEEDING STUFFS

This chapter presents the analysis of the feeding stuffs examined during the year. For convenience of reference the samples have been classified as to type or class and the data arranged in tabular form, table No. 41. A summary report as to quality, purity, etc., is furnished in the following notes.

BRAN

Lab'y No. 92616: This sample of bran is from winter, Ontario-grown, wheat. In fat and fibre it very satisfactorily meets the requirements of the standard, but does not reach the standard in respect to protein. This is characteristic of winter wheat bran, which as a rule may be distinguished by its "flouriness", a quality which commends it to many farmers, especially for use with young stock. The sample is genuine and of good quality.

SHORTS

Lab'y No 89112: This is an excellent sample, free from foreign matter and meeting the requirements of the standard very satisfactorily.*

Lab'y No. 89340: This sample was submitted by a farmer who doubted its genuineness. The name of the milling firm could not be obtained. The data indicate shorts of excellent quality, fully meeting the requirements of the standard for this class of feed.

Lab'y No. 91827: This sample may perhaps be considered as meeting the requirements of the Feeding Stuffs Act; it is somewhat low in protein and slightly high in fibre. It could not be classed with the finest quality shorts on the Canadian market.*

MIDDLINGS

Lab'y No. 89111: This sample of middlings is of excellent quality, free from foreign matter and fully meeting the requirements of the Act in respect to protein and fat.*

Lab'y No. 91826: Genuine, high quality middlings meeting fully the requirements of the Act.*

Lab'y No. 92178: Labelled "Extra White Premier Middlings." It meets the requirements of the Act very satisfactorily in respect to fat and fibre but is somewhat low in protein.

Lab'y No 92911: This sample fully meets the requirements of the Act in respect to protein and fat, but exceeds the standard for fibre by 2 per cent.

Lab'y No 92936: Middlings of fairly good quality; though somewhat low in protein and a trifle high in fibre, it may be considered as meeting the requirements of the Act.

OAT PRODUCTS

Lab'y No. 89113: From western-grown oats; of good quality.*

Lab'y No. 89640: Used in co-operative self-feeding experiment with swine. This sample is not of first class quality—it is about one per cent low in protein and about half a per cent too high in fibre, compared with first quality oat chop.

Lab'y No. 89914: Used in feeding trials at the Experimental Station, Lacombe, Alta. This sample was in the form of a finely ground meal; its analysis showed that it was exceptionally low in fibre for an oat chop; in protein and fat the data indicate oats of good average quality.

*Employed in feeding experiments by the Animal Husbandry Division.

BARLEY PRODUCTS

Lab'y No. 89109: A sample of ground barley, from grain grown on the Central Farm and used in a swine feeding experiment by the Animal Husbandry Division. An excellent barley, better than average quality.

Lab'y No. 89639: Submitted from Experimental Station, Scott, Sask. and used in co-operative self-feeding (swine) experiments. A good sample of barley, with a somewhat low fibre content.

Lab'y No. 89915: A sample of No. 4 C.W. barley finely ground; used in swine feeding experiments at Experimental Station, Lacombe, Alta. The data indicate a grain of good average quality.

DISTILLERS' DRIED GRAINS

Lab'y No. 88903: Distillers' Grains from corn, sold with a guarantee of protein, minimum, 30·0 per cent; fat, minimum, 7·0 per cent; fibre, maximum, 14·0 per cent. Though somewhat below its guarantee in protein, it is decidedly superior in respect to fat and fibre.

Lab'y No. 89076: Submitted from Experimental Station, Fredericton, N.B. The analysis indicates that it is probably from a mixture of cereals with a small proportion of corn; of good average quality.

Lab'y No. 89086-87: Two samples of rye grains taken from the same shipment; conform to the generally accepted standards for this feeding stuff.

Lab'y Nos. 92743-92935: Two samples from the same shipment; the differences are perhaps not greater than might be expected. Somewhat low in respect to protein, for rye grains, but of good average quality in the matter of fat and fibre.

Lab'y No. 92912: "Grains" of fair average quality, apparently from a mixture of cereals containing a small proportion of corn.

POULTRY FEEDS

Lab'y No. 89074-75: These samples represent two shipments of "Monarch Chick Mash." The differences in composition are not of any great magnitude, and probably arise from an incomplete mixing of the components. This feed is characterized by a satisfactory protein content and a low percentage of fibre. The following guarantee is given of this product; protein, minimum 15·0 per cent, fat minimum 5·0 per cent, fibre, maximum 4·0 per cent.

Lab'y No. 89646: This sample would be classed with poultry mashes of high protein content; the percentage of fibre is not too high for meals of this type.

Lab'y No. 91595: A "poultry mash" made for the Institut Agricole d'Oka, La Trappe, P.Q., from special formula. It is a high protein product, with a moderate fibre content. The very high "Ash" is due to the presence of bone meal, added carbonate of lime and powdered oyster shell.

Lab'y No. 91863: The components of this poultry mash are stated to be oat chop, ground wheat, middlings, shorts, barley meal, corn chop, blood meal, alfalfa meal, fish meal, oil cake, buttermilk and ground limestone.

It carries a guarantee of protein, minimum 20 per cent, fat, minimum 3·5 per cent, fibre maximum 7·0 per cent.

Except that it is somewhat low in fat, it meets its guarantee very well.

TANKAGE AND MEAT SCRAP

Lab'y No. 89114: In the form of a dark brown powder showing fragments of bone. It meets it guarantee of protein 45 per cent and fat 6 per cent, fairly satisfactorily. It contains 20·75 per cent bone phosphate. Apparently sound and wholesome. Sample from shipments used by the Animal Husbandry Division.

Lab'y No. 89641: A dry coarse dark brown powder, showing fragments of bone. It contains 30·78 per cent of bone phosphate. It is free from sand or other extraneous matter and apparently is sweet and wholesome. Its percentage of bone would, under the provisional classification, place it with "meat and bone" products. This sample was from a shipment used in preparing a ration, in co-operative swine self-feeding experiments at the Experimental Station at Scott, Sask.

Lab'y No. 91248: This sample of tankage is of the same brand as No. 89114 and similarly meets its guarantee. It contains 21·51 per cent bone phosphate.

Lab'y No. 91425: A dark brown, coarsely ground powder, with many fairly large particles of bone. It contained 23·40 per cent bone phosphate. Stated to contain 45 per cent protein; analysis shows only 33·68 per cent. Apparently sound and wholesome but of low grade. Possibly the fat content is too high for good keeping qualities.

Lab'y No. 92128: A coarsely ground "beef scrap" with 19·78 per cent bone phosphate. A high grade product; the only sample in the present series with 60 per cent protein.

Lab'y No. 92946: A coarsely ground product, with particles of bone freely distributed throughout the sample, the analysis showing 28·29 per cent bone phosphate. It scarcely meets its guarantee of 45 per cent protein.

FISH PRODUCTS

Lab'y No. 88717: A finely ground, almost powdered sample, of a yellowish brown colour, with a number of very small fragments of bone throughout the mass. Dry, with characteristic odour of fish meal. Apparently sound and wholesome. Analysis shows it to contain 18·87 per cent bone phosphate.

Its guarantee states protein, 70·75 per cent; fat, 2·3 per cent; phosphate, 16·24 per cent; salt, 1·2 per cent. While an excellent quality of fish meal, sample does not quite meet its guarantee in protein.

Lab'y No. 89101: This meal it is stated is made from heads, tails, bone and broken fish.

A fine, dry, brown meal, showing particles of bone. Apparently sound and wholesome. It contains 14·55 per cent bone phosphate and 4·54 per cent common salt.

Lab'y No. 89788: This sample, from the same source as No. 89101, but of later manufacture. It is very similar in appearance to No. 89101, but differs in composition from that sample chiefly in its much higher oil content. It is, also, about 3 per cent lower in protein and in bone phosphate (11·33 per cent). Eight per cent of salt, further, makes it a less desirable product than No. 89101.

Lab'y No. 90296: Also from the factory at Blacks Harbour, N.B. but unlike the two preceding samples, it was made from whole herring. A brownish, finely granular meal. It differs chiefly from the meal made from "heads, tails, bones, etc." in having a much higher oil content (14·58 per cent) and a lower percentage of bone phosphate (6·67 per cent). Its percentage of common salt is 4·90.

Lab'y No. 90768: A light coloured meal of a fibrous nature. Contains 5·29 per cent bone phosphate and 2·30 per cent common salt. Its percentage of protein (69·25) places it among the higher grades of fish meal.

Lab'y Nos. 91078 and 91099: Two samples, submitted by the Animal Husbandry and Poultry Division, respectively, of the Faster Fat fish meal (see No. 88717). The guarantee reads protein 70 per cent fat 2 per cent, phosphates 16 per cent salt 1·0 per cent. Both samples meet the guarantee in all respects very satisfactorily. This is evidently a fish meal of first quality.

Lab'y No. 91249: A finely ground, yellowish brown meal. In addition to 60·93 per cent of protein and 8·78 per cent fat it contains 19·86 per cent bone phosphate.

Lab'y No. 91377: This sample was submitted from the Experimental Station, at Scott, Sask. It is imported from San Salvador, Central America.

It may be described as a coarsely ground, light brown meal with many large pieces of bone, scales, eyes, etc. throughout the mass. Apparently sound.

It carries a guarantee of protein 65 per cent, fat 12 per cent, which it fully meets. It contains 12·37 per cent bone phosphate.

Lab'y No. 91378: This fish meal was made at Ceepeecee Centre Island, V.I., B.C.

A coarsely ground, light brown meal, showing particles of bone, scales, etc. It contains 12·01 per cent of bone phosphate and is free from salt.

It is evidently a well made fish meal of excellent quality.

Lab'y No. 91704: Made at Blacks Harbour, N.B., from the waste of Sardine plant and stated to be mainly herring waste.

A very fine, dark brown meal. This meal is characterized by a low protein and high fat content. It contains 8·78 per cent bone phosphate. Its percentage of salt, 12·77 is decidedly higher than the limit generally recognized as desirable in fish meals.

MISCELLANEOUS

Lab'y No. 89039: This is a feed, which is apparently largely from oats, either of inferior quality or containing added oat hulls. It has too high a percentage of fibre and of ash for a good quality oat chop; it is a poor feed.

Lab'y No. 89375: This sample was found to consist of oat scalpings 65 per cent ground corn 25 per cent and oat feed 10 per cent.

This meal apparently would be, approximately, equal in nutritive value to that made from good quality oats.

Lab'y No. 89519: Dried buttermilk submitted by the Institut d'Oka, La Trappe, P.Q. but the name of the manufacturer is not stated.

A coarse, flakey yellowish powder. The percentage of protein and of fat indicate only a fair quality product—the percentage of salt (4·49) probably added as a preservative, is much higher than is desirable.

Lab'y No. 89596: A sample of dried buttermilk submitted by the Poultry Division, Central Experimental Farm.

A rather coarse, light yellow flakey powder. The protein, 33·41 per cent, and fat, 12·36 per cent, would indicate a genuine product of good quality.

Lab'y No. 89629: Soyabean cake meal: a buff coloured meal, with a pleasant, sweetish odour. This concentrate is characterized by a high protein content and a notable percentage of fat; these features with its low fibre content combine to place soyabean cake meal among the most valuable of the concentrates. The present sample would appear to be somewhat better than the average as deduced from American analyses.

Lab'y No. 89991 and 91250: Dried buttermilk or buttermilk powder. A fine yellowish powder with the odor of sour milk. The analyses of these two samples—taken several months apart—indicate that the manufacturing process employed yields a fairly uniform product. The percentages of protein and fat are quite satisfactory and the low salt content (1·73 and 1·82) per cent is a desirable feature.

Lab'y No. 90023: Cod liver oil mash. This is stated to be a composite of corn and other cereals, finely ground. A high protein concentrate, with low oil and fibre content and therefore would be suitable as a component of mashes for laying stock.

Lab'y No. 90779: This provender was made by grinding oats and barley with a small admixture of peas. Its protein content (12·99 per cent) shows it to be decidedly superior to the chop or provender made from the usual mixed grain (oat and barley) crop. A comparatively low fibre content enhances its value.

Lab'y No. 92032: Provendine or Phosphated Food Tonic, submitted by the Animal Husbandry Division and described as a feed for swine; name of manufacturer not given, nor is there any guarantee accompanying the product. This preparation appears to be a mixture of corn meal, phosphate of lime (10·30 per cent) and carbonate of lime (9·96 per cent). The protein content, 8·40 per cent, practically removes it from the class of concentrates. It may be regarded as a supplier of the mineral requirements—lime and phosphoric acid.

Lab'y No. 92719: A sample of weed seeds from the thresher, accompanied by a request for information as to its feed value, if suitably ground.

The analysis shows high percentages of protein and fat, with a low fibre content. Nevertheless, a separation of the various seeds of which it consists indicates that it would prove an undersirable and possibly a dangerous feed. The separation gave the following results:—

	Per cent
Oats and wild oats	4·4
Flax	3·4
Weed seeds not designated injurious by regulation	26·4
Weed seeds designated injurious by regulation (mainly wild mustard)	63·8
Chaff	2·0

In all probability this material would be refused by stock, unless pressed by hunger, for it is undoubtedly unpalatable by reason of its large proportion of wild mustard seed.

Lab'y No. 92951: A sample of apple pulp, after the juice has been extracted for cider. A moist, reddish brown mass consisting of pulp, seeds, stem, carpels, cores, etc.; slightly fermented and slightly acid, with fairly pleasant odour. The accompanying enquiry was as to its nutritive value compared with mangels.

Although the dry matter content of this apple pulp exceeds that of mangels it cannot be considered of equal nutritive value to that class of field roots, since it consists chiefly of skins, seeds and cores, which are largely indigestible and for the most part would pass through the animal unattacked. An American authority places the food value of fresh apple pulp at 40 per cent of that of corn silage.

Lab'y No. 93031: A sample designated as mixed chop. A finely ground meal, apparently sound and wholesome. The analysis indicates a feed with distinctly lower nutritive value than would be obtained from oats of good grade. It is a feed of poor quality.

Lab'y No. 89511: Corn gluten feed with a guarantee of protein 25 per cent, fat 2 per cent and fibre 8 per cent, which it satisfactorily meets. Submitted by the Animal Husbandry Division, Central Experimental Farm.

Lab'y No. 89110: Linseed oil cake meal, submitted by the Animal Husbandry Division, Central Experimental Farm. A fair quality of oil cake meal in respect to protein, with a notable percentage of oil. Representative of good average grade.

Lab'y No. 92736: Turnips (Bangholm) submitted from Experimental Farm, Nappan, N.S., and used in feeding tests. The analysis shows it to be decidedly superior in dry matter content to the larger number of turnip varieties examined in these laboratories. It would rank with the best on our records.

Lab'y No. 89916: Frosted Wheat—No. 6 Feed. This sample, used in experimental swine feeding trials at the Experimental Station, Lacombe, Alta., is stated to be wheat that was fairly well ripened before being overtaken by frost. The protein content supports this statement. With oats and barley chop this wheat, well ground, should give a mixture excellent alike for dairy cattle and swine.

Lab'y No. 92183: Frosted Wheat and Barley. This sample was submitted for analysis and report as to feeding value by the Department of Animal Husbandry, University of Saskatchewan, Saskatoon. The letter accompanying the sample states that the wheat and barley were grown together and that the wheat was frosted before the date of harvesting. A quantity of this grain was offered for sale at Regina as a desirable feed for dairy cattle.

Its examination revealed the following composition:—

Barley	52·7
Wheat	47·1
Chaff, etc	0·2
	100·00

It may be described as a mixture of frosted and shrivelled wheat and small, rather poor barley. It is practically free from dust and other foreign matter.

The analytical data are in fair accord with those calculated from a mixture of wheat and barley in equal proportions.

As a cereal component of the ration this feed would rank fairly high in protein. Used judiciously it could be advantageously employed in the ration for dairy cattle. The presence of barley would undoubtedly reduce the glutinous character of a meal solely from wheat—an undersirable feature in a feeding stuff. The meal from the mixed grain should prove a more acceptable, palatable and nutritious feed than that from either cereal alone.

Lab'y No. 88456: Mangels, submitted by the Animal Husbandry Division, Central Experimental Farm, Ottawa and used in a feeding experiment with cattle, in comparison with corn silage.

The dry matter content of these mangels, 10·17 per cent, is somewhat below the average found in these laboratories over a twenty year period, viz., 11·08 per cent. The several nutrients making up the dry matter are in the proportions usually found in this type of farm roots.*

* The comparative value of farm roots and corn silage is discussed in Bulletin No. 94 (New Series), Growing and Feeding Farm Roots.

TABLE No. 41.—ANALYSIS OF FEEDING STUFFS

Lab'y No.	Particulars	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
	Bran						
92616	Tilson's N.H. Quaker Oats Co., Peterborough, Ont.	7·37	12·28	4·51	58·22	10·35	7·27
	Shorts						
89112	Maple Leaf Mlg. Co.	12·54	17·20	5·98	53·22	7·04	4·02
89340	A. S., Warren, Ont.	10·81	16·59	5·20	57·24	6·24	3·92
91827	St. Lawrence Fl. Mills, Montreal, P.Q.	12·51	15·53	5·23	54·39	8·25	4·09
	Middlings						
89111	Maple Leaf Milling Co.	11·37	16·61	4·69	59·26	4·75	3·32
91826	St. Lawrence Flour Mills, Montreal, Que.	12·75	16·50	4·25	58·89	4·46	3·15
92178	St. Lawrence Flour Mills, Montreal, Que.	13·69	15·47	3·78	60·18	3·90	2·98
92911	Pembroke Milling Co.	11·53	16·66	5·59	55·51	6·58	4·13
92936	"O. Dairy" Ogivile Flour Mills, Fort William, Ont.	10·75	16·06	5·36	58·82	4·93	4·08
	Oat Products						
89113	Oat Chop, C.E.F. from Western Oats.	11·72	12·22	4·80	57·19	10·96	3·11
89640	Oat Chop, from Experimental Station, Scott, Sask.	12·30	10·89	3·83	58·26	11·38	3·34
89914	Oat Chop, from "No. 4 Feed" Oats, Lacombe, Alta.	12·22	11·72	4·35	61·43	7·66	2·62
	Barley Products						
89109	Barley Chop, from barley grown on C.E.F.	12·81	12·22	1·92	65·63	4·68	2·74
89639	Barley Chop, from Experimental Station, Scott, Sask.	13·69	12·06	1·67	66·94	3·55	2·09
89915	Barley Chop, from Experimental Station, Lacombe, Alta.	13·59	10·90	1·40	67·98	3·64	2·49
	Distillery Products						
88903	Distillers' Dry Grains (Corn) Can. Industrial Alchool Co., Montreal, Que.	4·71	28·73	12·41	39·70	12·80	1·65
89076	Distillers' Dry Grains, Gooderham & Worts, Toronto, Ont.	7·77	22·09	8·37	45·99	13·76	2·02
89086	Distillers' Dry Grains, Melcher's Gin and Spirits Distillery Ltd., Berthierville, Que.	7·55	20·18	10·00	46·04	14·20	2·03
89087	Distillers' Dry Grains, Melcher's Gin and Spirits Distillery Ltd., Berthierville, Que.	7·77	19·72	8·78	46·89	14·64	2·22
92743	Distillers' Dry Grains, Can. Industrial Alcohol Co., Montreal, Que.	6·55	18·46	6·76	53·71	12·16	2·36
92912	Distillers' Dry Grains, Melcher's Gin and Spirits Distillery, Ltd., Berthierville, Que.	5·70	23·20	10·80	43·09	14·83	2·38
92935	Distillers' Dry Grains, Canadian Industrial Alcohol Co., Montreal, Que.	6·42	19·28	8·04	53·03	11·06	2·17
	Poultry Feeds						
89074	Monarch Chick Mash, Maple Leaf Mlg. Co.	10·12	13·89	2·55	64·13	2·92	5·39
89075	Monarch Chick Mash, Maple Leaf Mlg. Co.	10·52	15·19	3·14	62·11	2·87	6·17
89646	Dry Egg Mash, E.G.B., Stratford, Ont.	11·88	19·13	5·38	52·20	5·80	5·61
91595	Poultry Feed, M.A. Lavigne, St. Eustache, Grande Frenière, Que.	8·44	16·62	5·27	49·95	4·56	15·16
91863	Mash, R.H.D., Blair, Ont.	11·55	21·16	2·18	51·32	6·58	7·21
	Tankages and Meat Scraps						
89114	Tankage, City Renderers Ltd., Montreal, Que.	7·46	44·90	10·77	.....	.....	27·26
89641	Digester Tankage, Swifts Canadian Co.	8·25	43·42	11·17	.....	.....	33·86
91248	Tankage, City Renderers Ltd., Montreal, Que.	6·80	45·13	12·65	.....	.....	25·78
91425	Beef scrap, Arscott & Co., St. John, N.B.	5·03	33·68	16·28	.....	.....	40·67
92128	Beef scrap, National Fertilizers, Toronto, Ont.	7·29	60·49	9·93	.....	.....	22·74
92946	Poultry Meat Scrap, "Royal Windsor," Colonial Fertilizer Co., Windsor, N.S.	5·48	43·09	14·22	.....	.....	34·14
	Fish Products						
88717	Faster-fat Fish Meal, Faster-fat Co., Ltd., Halifax, N.S.	7·86	64·98	3·05	.....	.....	24·02
89101	Fish Meal, Connors Bros., Ltd., Blacks Harbor, N.B.	8·92	60·44	7·50	.....	.....	20·38
89788	Fish Meal, Connors Bros., Ltd., Blacks Harbor, N.B.	9·31	57·60	11·12	.....	.....	20·00
90296	Fish Meal, Connors Bros., Ltd., Blacks Harbor, N.S.	11·28	61·87	14·58	.....	.....	12·63
90768	Fish Meal, Underwood Packing Co., Jonesport, Me., U.S.A.	7·67	69·25	13·76	.....	.....	8·01
91078	Faster-fat, Fish Meal, Faster Fat Co., Ltd., Halifax, N.S.	7·44	74·00	1·90	.....	.....	17·40

TABLE No. 41.—ANALYSIS OF FEEDING STUFFS—*Concluded*

Lab'y No.	Particulars	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
	Fish Products—Concluded	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
91099	Faster-fat, Fish Meal, Faster Fat Co., Ltd., Halifax, N.S.	7·83	76·37	1·90	.....	.....	15·83
91249	Fish Meal, City Renders Ltd., Montreal, Que.	6·83	60·93	8·78	.....	.....	22·89
91377	Radio fish meal, Ingenic "El Angel" Guillermo Melandez San Salvador, S.A.	6·93	67·56	14·17	.....	.....	12·45
91378	Fish Meal, Canadian Packing Corp., Ceepeecee, B.C.	8·45	67·59	3·17	.....	.....	13·25
91704	Fish Meal, Connor's Bros., Ltd., Blacks Harbor, N.B.	3·79	48·81	17·50	.....	.....	25·64
	Miscellaneous						
89039	Feed, A. L., St. Barnard, Que.	11·72	9·60	4·46	51·64	15·34	7·23
89375	Feed, R. R., Actonvale, Que.	7·30	10·77	4·40	63·73	10·80	3·00
89519	Dried Buttermilk, J.A. d'Oka, La Trappe, Que.	8·75	30·01	8·95	.....	.....	11·99
89596	Dried Buttermilk, Dried Buttermilk Co., Montreal, Que.	10·46	33·41	12·36	.....	.....	9·70
89629	Soya Bean cake meal, American Milling Co.	7·13	46·91	8·36	27·03	4·74	5·83
89991	Buttermilk Powder, Ottawa Dairy Limited, Ottawa	5·95	31·18	6·85	.....	.....	9·22
91250	Buttermilk Powder, Ottawa Dairy Limited, Ottawa	5·03	32·99	5·03	.....	.....	8·50
90023	Cod Liver Oil Mash, Vancouver Mlg. Co., Victoria, B.C.	10·42	17·50	3·65	55·45	4·50	8·48
90779	Provender, A.A.H., Kemptville, Ont.	11·93	12·99	4·09	58·63	9·11	3·25
92032	Provendine, or Phosphated Food Tonic	8·66	8·40	3·00	.....	.....	25·23
92719	Weed Seeds, E.G.T., Durham, Ont.	7·53	19·91	24·52	31·42	9·46	7·16
92951	Apple Pulp, W.A.C. Kelowna, B.C.	72·94	1·88	.....	15·44	5·73	0·92
93031	Mixed Chop, Burns Bros. Mlg. Co., Meaford, Ont.	9·69	9·47	2·40	65·70	9·20	3·54
89511	Corn Gluten Feed, Canada Starch Co., Montreal, Que.	8·75	27·70	2·96	48·09	7·21	5·29
89110	Linseed Oil Meal, Sherwin-Williams Co., Montreal	7·71	31·65	9·77	36·74	8·02	6·11
92736	Turnips (Bangholm) Experimental Farm, Nappan, N.S.	86·21	1·32	0·57	9·79	1·27	0·84
89916	Frosted Wheat No. 6, Experimental Sta., Lacombe, Alta.	12·27	12·22	1·68	69·47	2·46	1·90
92183	Frosted Wheat and Barley, Dept. Animal Husbandry, Saskatoon, Sask.	8·66	13·14	2·33	69·41	4·28	2·18
88456	Mangels, Animal Husbandry Division, C.E.F., Ottawa	89·83	1·18	0·13	6·78	0·87	1·21

INSECTICIDES AND FUNGICIDES

The prosecution of the work on insecticides and fungicides was carried on partly in the laboratories of the division and partly in co-operation with members of the Entomological Branch at Annapolis Royal, N.S. The main problems jointly under examination were the determinations of nicotine in residues on leaves, in commercial nicotine dusts and in specially prepared laboratory preparations; the solubility of copper in " honey-dew ", a secretion from the apple sucker insects; the adherence of arsenic on forest growths and a continuation of the work previously undertaken, viz., the analysis of mosquito and spray oils and the persistency of arsenic on apple foliage and fruit when poisonous dusts and sprays were applied at different periods throughout the growing season.

As nicotine, either in the form of dust or spray, was found to be very efficacious in the control and extermination of bud moth, an examination was made of a number of samples of nicotine sulphate previous to incorporating in dusts, an examination of the prepared dusts to ascertain if the method of mixing was such that the prepared dusts would be up to strength, and of the nicotine residues on foliage immediately after applying and at varying periods thereafter. A more detailed account of this investigation has been presented under a separate publication.

Field observations had shown that where growers applied copper dusts to trees infested with apple sucker, injury invariably resulted; the degree of injury

depending on the severity of the insects present. The injury was always intensified in proximity to the small globule of "honey-dew" secreted by the insect. A collection of "honey-dew" was undertaken and mixed with monohydrate copper sulphate—the copper ingredient of the dust. In addition, sugar solutions such as cane sugar, raw sugar and molasses solutions were also prepared. In all cases the copper was reduced and eventually would cause copper "burning".

In order to combat the spruce bud worm lead arsenate dusts and several brands of calcium arsenate were applied to plots in selected areas in Cape Breton. The poison was spread at different rates per acre from a specially designed aeroplane. Samples of the dusted needles were collected the day after dusting and at various periods thereafter and analysed for arsenic. Dead and dying larvæ taken from the trees and from the ground beneath were also analysed to find out if they had died from ingesting the poisonous dusts. These results are given in detail in a separate report. Chemical and physical examinations of many of the materials used in the field work were undertaken, a number of which are discussed briefly in the following chapter.

ARSENATE OF LIME

The two samples of arsenate of lime analysed satisfactorily met their guarantee and liberated only a trace of soluble arsenic when subjected to carbon dioxide aspiration, thus indicating that they were stable compounds.

ANALYSIS OF ARSENATE OF LIME, 1927–28

Lab'y No.	Source of sample (manufacturer)	Vendor or submitter	Arsenic as metallic As		Moisture
			Total	Water-soluble	
			p.c.	p.c.	p.c.
89645	Canada Paint Co., Montreal	Entomological Laboratory, Vineland, Ont.	25·93	0·03	1·28
90216	.....	Seed Branch, Ottawa.....	27·58	0·05	0·76

ARSENATE OF LEAD

Only one sample of arsenate of lead was examined and it was of excellent quality. This sample was one of a number analysed for the Seed Branch with a view toward fixing standards for the new Insecticide Act, "The Agricultural Pests' Control Act".

Lab'y No.	Submitter	Arsenic as metallic As		Lead oxide	Moisture
		Total	Water-soluble		
		p.c.	p.c.	p.c.	p.c.
90215	Seed Branch, Ottawa.....	21·52	0·51	63·81	0·28

PARIS GREEN

The samples analysed were well made and free from adulteration; the particulars are given in the following table:—

ANALYSIS OF PARIS GREENS, 1927–28

Laby' No.	Source of sample	Vendor or submitter	Arsenic as metallic As		Cupric oxide	Moisture
			Total	Water-soluble		
			p.c.	p.c.	p.c.	p.c.
90372	McArthur Irwin & Co., Montreal.	Co-operative Fédérée de Quebec, Montreal.	43·69	1·20	24·73	0·20
90374	" "	" "	43·66	1·17	24·83	0·28
90373	Canada Paint Co., Montreal		41·67	0·98	24·93	0·27

To determine the amount of arsenic rendered soluble when Paris greens were digested for twenty-four hours with previously boiled distilled water kept at a constant temperature of 32° C. (Method I), with previously boiled distilled water at room temperature, 23-25° C. (Method II), and with distilled water, not previously boiled, at room temperature, 23-25° C. (Method III), a number of samples of "Greens" were collected and analysed for water-soluble arsenic. The results of these analyses are given in the following table (42):—

TABLE NO. 42.—ANALYSIS OF PARIS GREENS FOR WATER-SOLUBLE ARSENIC; RESULTS EXPRESSED AS METALLIC ARSENIC (As)

Lab'y No.	Source of sample	Method I	Method II	Method III	Moisture
		p.c.	p.c.	p.c.	p.c.
91806	The Canada Paint Co., Montreal	1·87	1·35	1·42	0·52
91807	" " "	1·29	0·96	1·08	0·37
91847	Webb & Sons, Ltd., Stourbridge, England	0·77	0·50	0·67	1·05
91848	Blundell Spence & Co., Ltd., Hull, England	1·26	0·85	1·02	0·82
91849	Lewis Berger & Sons, Ltd., London, England	1·51	0·85	1·02	0·34
91850	McArthur Irwin & Co., Toronto, Ont	1·10	0·72	0·99	1·30
91851	Webb & Sons, Ltd., Stourbridge, England	0·80	0·72	0·72	1·06
91852	The Gliddon Co., Cleveland, Ont	1·74	1·31	1·46	0·70
91853	Lewis Berger & Sons, Ltd., London, England	1·30	0·82	0·91	0·43
91854	The Canada Paint Co., Ltd., Montreal	2·19	1·35	1·53	0·58
91855	" " "	2·01	1·26	1·38	0·61
91856	Blundell Spence & Co., Ltd., Hull, England	1·25	0·89	1·13	0·80
92155	John Cowan Chemical Co., Montreal	2·03	1·27	1·48	1·25
92156	" " "	1·45	1·11	1·28	1·15

COPPER DUSTS

Lab'y No. 92918: Potato Dust, "Air-floated Medina Dust", manufactured by the New York Insecticide Co., Medina, N.Y., and submitted by Jos A. Morin, Arsenault Siding, N.S.

As received it was a fine, bluish coloured dust.

ANALYSIS

	Per cent
Total arsenic (as metallic As)	4·99
Water-soluble arsenic (as metallic As)	0·10
Copper (as metallic Cu)	8·36

Lab'y No. 90220: Bordeaux Dust, submitted by the Seed Branch, Ottawa.

	Per cent
Total arsenic (as metallic As)	5·04
Water-soluble arsenic (as metallic As)	0·06
Copper (as metallic Cu)	6·22
Moisture (at 100°C.)	4·24

SULPHUR PREPARATIONS

Lab'y Nos. 89264-90218: Two samples of lime sulphur concentrate were received for analysis. Sample No. 89264 was submitted with the information that when used it had caused foliage burning. A qualitative analysis showed the sample to be well made and free from any foreign added salts.

ANALYSIS OF LIME SULPHUR CONCENTRATE, 1927–28

Lab'y No.	Manufacturer	Vendor	Total sulphur	Sulphide sulphur	Degrees Beaumé
			p.c.	p.c.	(at 20°C.)
89264	Niagara Brand Spray Co., Burlington.	Entomological Laboratory, Vineland Station, Ont.	24·22	21·99	32·3°
90218	.....	Seed Branch, Ottawa.....	24·03	23·11	31·7°

SULPHUR DUST

Lab'y No. 90221: Dusting sulphur, submitted by The Seed Branch, Ottawa. The sample was pure sulphur.

ANALYSIS

	p.c.
Sulphur (free).....	99·45
Moisture.....	0·15

SULPHUR-LEAD ARSENATE

Lab'y Nos. 90214-90223: Sulphur-lead arsenate dusts, submitted by The Seed Branch, Ottawa.

—	Lab'y No. 90214	Lab'y No. 90223
	p.c.	p.c.
Sulphur (free).....	79·48	89·40
Total arsenic (as metallic As).....	2·35	2·18
Water-soluble arsenic (as metallic As).....	0·35	0·49
Lead oxide.....	6·80	6·14
*Copper (as metallic Cu).....	0·29	

*Probably present as an impurity from the mixer.

NICOTINE PREPARATIONS

Lab'y Nos. 90364-65: Nicotine sulphate solutions, manufactured respectively by The Nicotine Production Corporation, Clarksville, Tenn., and The Tobacco By-products and Chemical Corp., Louisville, Ky., and submitted by G. E. Chase, Port Williams, N.S. The samples were up to guarantee.

ANALYSIS

	Lab'y No. 90364	Lab'y No. 90365
	p.c.	p.c.
Nicotine.....	40·64	40·71

Lab'y No. 90222: Nicotine dust, submitted by G. D. Grattan, Ottawa. This dust was composed of lime and nicotine sulphate and guaranteed to contain 2 per cent nicotine. Analysis showed the dust to be up to guarantee.

ANALYSIS

Nicotine.....	2·15 per cent

ROACH POWDER

Lab'y No. 89047: Cockroach powder, manufactured by the J. G. Wilson Corp. Laboratories, Fort Waynne, Indiana, and submitted by A. M. Woodburn, Ottawa. It was stated to be the best exterminator and inoculator of ants, roaches and water bugs.

The material was a fine white powder consisting of sodium fluoride as the active substance and starch, sodium as chloride and carbonate, iron and silica as the inert materials

Bacteriological examination indicated that none of the organisms found in the preparation had pathogenic properties.

OILS

Lab'y Nos. 92668-69: Tar acid oil and hydrocarbon oil, submitted by Wm. A. Ross, Entomological Lab'y, Vineland, Ont., and the product of the Barrett Co., New York city.

The oils were to be used in the preparation of dormant sprays for the control of various insects.

—	Lab'y No. 92668 25% tar acid oil	Lab'y No. 92669 Hydrocarbon oil
Specific gravity at 20°	1·015	0·996
Flash point	148°F. (64°C.)	125°F. (52°C.)
Volatility (at room temp. 72°F.)	3·92 p.c.	4·16 p.c.
Water	1·95 "	0·10 "
Tar acids	29·0 "	3·0 "
Viscosity (McMichael, Centipoises)	476	308
Distillation—		
Light oils and water (up to 200°C.)	25 p.c.	27 p.c.
Medium oils (200–270° C.)	68 "	66 "
Heavy oils (above 270°C.)	4 "	4·5 p.c.
Residue (tarry matter)	3 "	2·5 "

OILS FOR MOSQUITO CONTROL

Lab'y Nos. 89048 and 89423: Submitted by the Dominion Entomologist and the product of The Imperial Oil Co., Ottawa. The oils were to be used for the purpose of controlling mosquito emergence in the Ottawa area.

ANALYSIS

—	Lab'y No. 89048 105° mosquito oil	Lab'y No. 89423 furnace fuel oil
Specific gravity (at 20°C.)	0·853	0·854
Flash point	36°C.	89°C.
Reaction	acid	acid
Volatility (4 hours at room temperature)	3·97 p.c.	0·54 p.c.
Distillation range—		
Initial boiling point	110°C.	210°C.
Light oils (up to 200°C.)	8 p.c.	– p.c.
Medium oils (200°C to 300°C.)	80 "	80 "
Heavy oils (above 300°C.)	12 "	20 "

In a comparison of the above two oils, the higher percentage of light oils contained by Lab'y No. 89048 would cause this oil to spread more readily when sprayed on water; on the other hand, the film formed would not be of as long duration as that from Lab'y No. 89423, which contained a higher percentage of heavy oils. Since it has been proved that lighter oils are more toxic to mosquito

larvæ than the heavier oils, the type of oil used would be governed by whether speedy toxic action was desired or whether the duration of the oil film was of greater importance.

OILS AS SPREADING AGENTS

Lab'y Nos. 89049-50: Tar acid oil and crude cresylic acid submitted by the Dominion Entomologist and the product of the Barrett Co., New York city.

In an endeavour to use waste crank case oil as a larvicide for mosquitoes, it was found that the oil would not spread when sprayed on water but collected in droplets. To overcome this difficulty, a small percentage, up to one per cent, of a more volatile oil such as crude cresylic acid or tar acid oil when added readily causes the oil to spread and form a continuous film.

Samples of crude cresylic acid and tar acid oil were submitted for analysis, the results of which are shown as follows:—

—	Lab'y No. 89049 crude cresylic acid	Lab'y No. 89050 tar acid oil
Specific gravity at 20°C	1·028	1·0123
Flash point	88°C.	65°C.
Reaction	acid	alkaline
Volatility at room temperature 68°F	0·81 p.c.	6·22 p.c.
Initial boiling point	187°C.	104°C.
End point	224°C.	281°C.
Distillation range—		
Below 200°C	5 p.c.	40·5 p.c.
From 200 to 205°C	30 "	200 to 300°C.
205 to 210°C	35 "	57·0 p.c.
210 to 215°C	15 "	Residue, soft 2·0
215 to 225°C	15 "	pitch.

WELL WATERS FROM FARM HOMESTEADS

Omitting the analytical data and the detailed reports furnished to the senders of water samples, the waters examined during the year may be classified as follows:—

	Per cent
Pure and wholesome	24·4
Suspicious and probably dangerous	32·2
Seriously polluted	30·4
Saline	13·0

These results are not very encouraging; the percentage returned as "pure and wholesome" should be higher. It would seem necessary from time to time to call attention to the value of pure water on the farm and the danger that lurks in a polluted supply.

It should be more widely recognized that an ample supply of pure water is one of the farm's most valuable assets—a necessary factor for the good health of the family and the thrift of the live stock. With this in mind the location of the well is a matter of the first importance; it is a great mistake to risk pollution for the sake of convenience. The well should be at least 50 yards from all possible sources of contamination. Secondly, the well should be lined to a depth of, say, 10 feet with concrete or puddled clay of a thickness, say, 6 inches. This lining should project some 6 to 12 inches above the mouth of the well to prevent the inflow of surface water. The top of the well should be water-tight.

The examination—chemical and bacteriological—of farmers' water supplies is made free of charge, provided samples are collected and shipped in accordance with directions obtainable from the division on application and that express charges on the sample are prepaid. This statement is made to clear up a misapprehension on the minds of some farmers as to what is necessary in order to

take advantage of this service. A large number of samples are received which are quite inadequate as to quantity for a satisfactory analysis; others are sent in dirty containers or in bottles with used corks. All these must be discarded; any examination of them would be useless or misleading. No satisfactory analyses or report can be made unless the sample is properly taken and information furnished as to the well and its surroundings.

SOFT PORK INVESTIGATION

In co-operation with the Division of Animal Husbandry this investigation has been continued during the past year. Thirty-nine samples—twenty-two from the Experimental Station at Lethbridge, Alberta, and seventeen from the Experimental Station at Scott, Sask., were examined for the percentage of unsaturated fats present in the purified fats. The results of analysis confirm our previous conclusions that immaturity and lack of thrift are the two chief causes of softness of fatty tissue in pork.

APPLE WRAPS

In co-operation with the Division of Horticulture the inquiry has been continued to ascertain the influence of various paper wraps on apples in storage. Several samples of plain and oiled papers were examined in these laboratories and the results of analysis are given in table No. 43.

TABLE NO. 43.—RESULTS OF ANALYSIS OF APPLE WRAPS FROM THE EXPERIMENTAL STATION, SUMMERLAND, B.C.

Lab'y No.	Identification No.	Description	Moisture	Petrolic ether extract	Butyro-refractometer reading at 25°C.	Refractive index
			p.c.	p.c.		
92137	1	Amalic	4·48	14·88	58·1	1·464
38	2	Koto	4·80	19·76	72·3	1·473
39	3	Koto Heavy	5·44	24·91	72·5	1·473
40	4	Protexit	5·44	0·29	.....	.....
41	5	Oronite	5·78	15·26	75·4	1·475
42	6	Oronite Heavy	4·65	41·03	74·6	1·475
43	7	Pacific	5·41	0·19	.....	.....

ANALYTICAL AND EXAMINATIONAL WORK ON SAMPLES SUBMITTED BY THE HEALTH OF ANIMALS' BRANCH, DEPARTMENT OF AGRICULTURE

During the year 2,230 samples were examined and reported on. This report gives a brief summary of the analytical results obtained for each class of product.

Classified list of samples examined during the year 1927-28:—

Condensed and evaporated milks	699
Milk and cream powders	275
Evaporated apples	196
Colours and inks	9
Salts and preservatives	20
Spices and condiments	179
Denaturing oils	33
Lards, lard compounds, edible oils and fats	61
Canned and preserved fruits and vegetables	209
Tomato products	72
Sausages, potted and preserved meats and fish pastes	345
Pickled pork and bacon and pickling solutions	40
Miscellaneous	92
	2,230

CONDENSED AND EVAPORATED MILKS

Six hundred and ninety-nine samples were examined under this heading.

The average, maximum and minimum net weights of eighty-five samples of condensed milks were 14·07, 15·13, and 13·05 ounces, respectively.

The average, maximum and minimum percentages of fat of ninety-one samples of condensed milk were 8·54, 10·15, and 7·66 respectively.

Six samples, or 7 per cent, contained less than 8 per cent of fat, the minimum allowed by the regulations for this class of milk product.

No samples of condensed milk were found to have "sugar down", that is, a deposit of milk sugar at the bottom of the can.

Six hundred and five samples of evaporated milk were examined. A summary of results is given in table No. 44.

TABLE NO. 44.—SUMMARY OF RESULTS AND ANALYSES OF EVAPORATED MILK

Net weight			Total solids			Fat		
Number of samples	Net weight	Per cent number under weight	Number of samples	Total solids	Per cent number below standard (25·5%)	Number of samples	Fat	Per cent number below standard (7·8%)
	oz.			p.c.			p.c.	
180	Ave. 6·18	7	150	Ave. 26·03	Nil	150	Ave. 7·89	10
	Max. 6·33			Max. 26·55			Max. 8·12	
	Min. 5·85			Min. 25·74			Min. 7·77	
425	Ave. 16·33	8	455	Ave. 31·82		455	Ave. 9·14	
	Max. 16·94			Max. 32·15			Max. 9·38	
	Min. 14·76			Min. 31·39			Min. 8·98	

Two samples were completely solidified in the cans.

SKIM-MILK, WHOLE MILK AND CREAM POWDERS

Two hundred and seventy-five samples were examined under this heading. A summary of results is given in table No. 45.

TABLE NO. 45.—SUMMARY OF RESULTS OF ANALYSIS OF MILK AND CREAM POWDERS

Moisture			Ash		Fat		
Number of samples	Moisture	Per cent number above standard (5%)	Number of samples	Ash	Number of samples	Fat	Per cent number below standard (26%)
	p.c.			p.c.		p.c.	
	Skimmed Milk Powder						
193	Ave. 3·28	9	193	Ave. 8·05			
	Max. 8·07			Max. 8·35			
	Min. 1·47			Min. 7·52			
	Whole Milk Powder						
69	Ave. 1·88	1	69	Ave. 5·77	69	Ave. 27·46	2
	Max. 6·11			Max. 6·47		Max. 28·69	
	Min. 0·90			Min. 5·17		Min. 24·12	
	Cream Powder						
8	Ave. 0·90	Nil	8	Ave. 2·33	8	Ave. 70·24	
	Max. 1·90			Max. 2·50		Max. 71·25	
	Min. 0·53			Min. 2·12		Min. 67·76	

One sample of "lactogen" whole milk powder contained 25·33 per cent fat and 3·62 per cent ash.

One sample of "protein" milk contained 34·95 per cent protein and 25·48 per cent fat.

All samples of milk powders were found to be free from borates and carbonates.

EVAPORATED APPLES

One hundred and ninety-six samples were examined for water content. Table No. 46 gives a comparison of results of analysis for the past six years.

TABLE No. 46.—WATER CONTENT OF EVAPORATED APPLES

Year	Number of samples	Water per cent			Number of samples containing water in excess of standard (25 p.c.)	Per cent number containing water in excess of standard
		Average	Maximum	Minimum		
1922–23	604	21·4	33·3	2·8	101	17
1923–24	300	22·1	31·1	6·2	53	18
1924–25	412	21·8	31·3	4·8	56	14
1925–26	561	21·7	34·4	3·9	72	13
1926–27	204	22·2	27·7	4·2	28	14
1927–28	196	21·9	29·8	13·2	27	14

COLOURS AND INKS

Seven samples of food colours were examined. All were permitted coal tar colours.

Two samples contained very small amounts of arsenic.

Two samples of stamping ink were examined and found to be free from arsenic.

SALTS AND PRESERVATIVES

Twenty samples were examined. All were free from harmful ingredients.

SPICES AND CONDIMENTS

One hundred and seventy-nine samples were examined. Six samples were found to be adulterated.

DENATURING OILS

Thirty-three samples were examined. A summary of results is given in table No. 47.

TABLE No. 47.—NUMBER AND PERCENTAGE NUMBER OF DENATURING OILS, WHICH SATISFY THE VARIOUS STANDARD TESTS

Tests	Standards required	Satisfy requirements	
		Number	Per cent number
All		8	24
Flash point	Not below 75°C. (167°F.)	31	94
Boiling point	Not below 205°C. (401°F.)	18	54
Specific gravity	Not below 0·819	33	100
Taste	Easily recognized when present in the proportions of 1 part oil to 1,000 parts fat	14	42

LARD, LARD COMPOUNDS AND EDIBLE OILS AND FATS

Sixty-one samples were examined. One sample only—a lard—appeared to be adulterated.

CANNED AND PRESERVED FRUITS AND VEGETABLES

Two hundred and nine samples were examined under this heading. These included seventy-four samples of jams prepared in Canada, fifty-one samples of imported jams, fourteen samples of canned fruits and fruit plups, and seventy samples of glace, drained and maraschino cherries.

Twenty-nine samples of Canadian jams contained preservatives, of which twenty-two contained benzoates and seven contained salicylates.

Nineteen samples of Canadian jams contained coal tar colour. Four of these were found to contain a non-permissible colour, Magenta (S. & J. 448).

Two samples of Canadian pure jams were found to contain glucose.

All samples of imported jams were free from glucose and preservatives. Five samples of imported jams contained permitted coal tar colours.

Ten samples of sugarless jams, imported from England, were examined. All were found to be free from added sugar and saccharine and contained glycerine as a sweetening agent. The maximum percentage of glycerine was found in a sample of orange marmalade and was 69 per cent.

One sample of black fig marmalade, which was described as suitable for diabetics, was found to be made up with maltose and dextrose.

The average, maximum and minimum percentages of glucose in forty-four samples of glace cherries were 42·0, 76·0 and 13·2, respectively. No samples of this product contained more than traces of sulphites. Eighteen samples of maraschino cherries were examined. Four samples contained benzoates, one only containing more than the maxium (1 part in 1,000) allowed by the regulations. All were free from non-permissible coal tar colours.

TOMATO PRODUCTS

Seventy-two samples were examined under this heading. These included tomato pastes, ketchups, soups, chili sauces, and peeled tomatoes.

The average, maximum and minimum percentages of total solids in forty-three samples of tomato pastes were 36·7, 46·5, and 7·5 respectively.

All samples were free from coal tar colours and preservatives.

Twenty-four samples of tomato ketchups were examined, Fourteen contained ponceau 3 R. (S. & J. 56), a permitted coal tar colour.

Fourteen samples contained benzoates, of which three contained more than the maximum (1 part per 1,000) allowed by the regulations. One sample was found to contain as much as 7 parts per 1,000.

SAUSAGES POTTED AND PRESERVED MEATS AND FISH PASTES

Three hundred and forty-five samples were examined. Forty-two samples of sausages were examined for water, protein and starch content.

Summaries of results are given in table Nos. 48 and 49.

TABLE No. 48.—SUMMARY OF RESULTS OF ANALYSIS OF SAUSAGES FOR WATER, PROTEIN, AND STARCH CONTENT

Forty-two samples	Water	Protein	Water protein ratio	Starch
	p.c.	p.c.		p.c.
Average	57·8	12·3	4·8	3·3
Maximum	67·5	17·8	6·1	8·3
Minimum	44·3	9·3	3·4	Free

TABLE No. 49.—NUMBER AND PERCENTAGE NUMBER OF SAUSAGES CONTAINING WATER AND STARCH IN EXCESS OF AMOUNTS ALLOWED BY THE REGULATIONS, AND SUMMARY OF WATER-PROTEIN RATIOS

Forty-two samples	Samples containing more than 60 per cent water	Samples containing more than 5 per cent starch	Samples having water-protein ratios				
			Above 5	Above 4·5	Above 4	Above 3·6	Below 3·6
Number	15	7	15	30	37	38	2
Per cent number	37	17	37	75	92	95	5

A comparison with the results for last year, when fifty samples were examined, shows a large increase in the per cent number of samples having water-protein ratios above 3·6, 4, 4·5, and 5. In our opinion the ratio for genuine sausages should not exceed 4, and values in excess of this indicate adulteration with water. Our results for this year show a decline in the quality of this type of manufactured meat product.

The casings of two samples of weiners were found to be coloured with a coal tar colour—bismarck brown (S. & J. 197).

Two hundred and ninety-three samples of fish and meat pastes were examined. Nineteen samples were artificially coloured, seventeen with a coal tar colour, rhodamine (S. & J. 504), and two with cochineal.

One sample only was found to contain preservative—borates.

The average, maximum and minimum percentages of cereal starch found in eighty-three samples of fish and meat pastes were 4.0, 7.1 and nil, respectively. Of these, twenty-six contained more than 5 per cent.

PICKLED PORK AND BACON AND PICKLING SOLUTIONS

Twenty-two samples of cured pork and bacon were examined for nitrite content. Eight samples, 36 per cent, contained more than 200 parts per million calculated as sodium nitrite.

The maximum amount found in any one sample was 1,090 parts per million.

Eleven samples of pickling solutions were examined for nitrite content. Three samples contained more than 200 parts per million calculated as sodium nitrite. The maximum amount found in any one sample was 1,500 parts per million.

MISCELLANEOUS

Ninety-two samples were examined under this heading, including sugars, flours, pickles, soups, chutney, gelatine, edible paste, rat poison, mincemeats, dehairing material, fullers' earth, filtering agents, etc.

CHEMICAL SERVICE FOR FARMERS

The volume of work in this field of the division's activities continues to increase. Inaugurated in the earliest days of the division's history, the response from farmers to the invitation to submit their problems was at first slow. As the value of the assistance we can render became better and more widely recognized, more and more farmers took advantage of the privilege extended to them. In recent years the work involved has grown apace and the answering of correspondents on matters relating to the chemistry of soil, manures, fertilizers, cattle feeds, etc., etc. may now be regarded as among the larger and more important features of the division's work.

SAMPLES RECEIVED FOR ANALYSIS

During the year ending March 31, 1928, 4,338 samples were received for examination or analysis.

These samples are roughly classified in the following table (No. 50); the scheme of presentation adopted indicates the nature and scope of the laboratory work and the source or distribution of the samples by provinces.

TABLE No. 50.—SAMPLES RECEIVED FOR EXAMINATION AND REPORT FOR TWELVE MONTHS ENDING MARCH 31, 1927

—	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	Total
Soils	35	4	2	8	142	139	14	22	9	375
Manures and fertilizers	14	2	.....	.....	25	20	11	10	2	84
Forage plants, fodders and feeding stuffs.—	15	12	72	38	559	78	62	55	1	892
Waters	6	.....	5	12	80	25	10	7	2	147
Samples from Meat and Canned Foods Division	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,240
Miscellaneous, including dairy products, insecticides	31	69	76	15	224	123	9	16	37	600
										4,338

These samples include those collected in connection with experimental work or investigations inaugurated by the division, those sent in by farmers and related to their soil, crop and live stock problems submitted by correspondence, and those forwarded by the Health of Animals Branch, Department of Agriculture and other branches and departments of the Government service.

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