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, 1926

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CHEMICAL SERVICE TO FARMERS

Reference may first be made to that branch of the division's work which deals directly with the farmer. From the earliest days in the history of the Experimental Farm System this Division has endeavoured to assist the man on the land in his difficulties and problems by furnishing information and making suggestions of a helpful character. Correspondence from farmers is invited and the invitation has been accepted. In many instances the inquiry calls for a certain amount of analytical work, which, as circumstances permit, is undertaken. There are few phases of farm work which do not, at one time or another, call for chemical information or analysis for their rational operation and the inquiries sent in relate to a host of subjects among which the following are the most prominent: soils, manures, fertilizers, fodders and feeding stuffs, insecticides and fungicides and water supplies.

It is gratifying to note that in recent years there has been an ever increasing response on the part of farmers to this proffered assistance and that there is now a large number of correspondents in every province of the Dominion receiving assistance from this service. This work does not furnish much material for the annual report but there is ample evidence to show that it is proving a valuable factor towards more rational and profitable methods in Canadian agriculture.

Under this caption may be mentioned the analysis of samples undertaken for the district agricultural representatives of the several provinces. There is now a very considerable volume of work coming in from this source; it is felt that in responding to these requests the Experimental Farm system is establishing a further agency for the extension of its service among the farming community.

SAMPLES RECEIVED FOR ANALYSIS

The register of the division shows that the samples received during the past year numbered 5,073. This number includes the samples sent in by farmers, and district representatives, those collected in connection with the several investigations carried on by the Division and those submitted by the Veterinary Director-General (Health of Animals' Branch) in the administration of the Meat and Canned Foods Act.

The following table presents a rough classification of the samples and indicates the number received from the several provinces:—

TABLE 1.—SAMPLE, RECEIVED FOR EXAMINATION AND REPORT FOR TWELVE MONTHS ENDING MARCH 31, 1926

—	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	Total
Soils	36	224	41	41	108	180	6	3	8	647
Manures and fertilizers	19	.....	.....	1	28	31	1	4	1	85
Forage plants, fodders and feeding stuffs	28	23	41	7	796	64	66	1	.....	1,026
Waters	5	4	11	1	74	41	5	1	2	144
Samples from Meat and Canned Foods Division	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,429
Miscellaneous, including dairy products, insecticides and fungicides	56	50	41	5	366	59	23	64	78	742
										5,073

SOILS

PRINCE EDWARD ISLAND

In the report of this division for the year ending March 31, 1925, an account is given of a series of soils collected in the vicinity of Charlottetown. This work—which includes the complete chemical and physical examination of the soils—was undertaken at the instance of the provincial Department of Agriculture. This report awakened considerable interest and evidently proved of some value in the direction of soil management. It was therefore decided to make a further and more comprehensive survey of the soils of the province and to that end samples of surface soils, with their respective sub-soils, have been collected from the several Illustration Stations distributed throughout the island. These are now in course of analysis. On the completion of the work it is expected to issue the report in bulletin form.

SOILS OF PRINCE EDWARD ISLAND IN RELATION TO BROWN TOP (RHODE ISLAND BENT) SEED PRODUCTION

This work was undertaken at the request of the Seed Commissioner, who was conducting field trials on Prince Edward Island in seed production of the grass known as brown top—now largely used for the making of fine turf for golf-courses bowling-greens, tennis-courts and fine lawns. In recent years rapid progress has been made in the Maritime Provinces, and especially in Prince Edward Island, in the production of this seed and as a result a new and profitable industry has been established. It was thought that a more intimate knowledge of the soils upon which this seed was grown might suggest economic treatments in respect to the application of fertilizers, leading to the seed production.

Six samples of surface soils were collected from selected areas in the eastern part of the province.

Lab'y No. 80927

No. 1, East Baltic, P.E.I. Sample collected to a depth of 6 inches from land "under good growth of brown top" and which had not been manured. The soil is a red, friable, sandy loam.

Lab'y No. 80928

No. 2, East Baltic, P.E.I. Sample collected to a depth of 6 inches "from lower ground 50 feet distant from Soil No. 1, with practically no growth—a few scattered plants." No manure has been applied—as far as known. The soil is a red, friable, sandy loam.

Lab'y No. 80929

No. 3, East Baltic, P.E.I. Sample collected to a depth of 5 inches from land in which there is "goose-grass growth," no manure. The soil may be described as a pale red light clay loam, somewhat harsh in texture.

Lab'y No. 80930

No. 4, East Baltic, P.E.I. Sample collected to a depth of 5 inches; "from same field as No. 3 and with strong growth of brown top;" no manure. The soil is a grey, fairly friable, medium clay loam.

Lab'y No. 80931

No. 5, Georgetown, P.E.I. Collected to a depth of 6 inches; no manure applied. The soil is a pale reddish grey loam, fairly friable.

Lab'y No. 80932

No. 6, North River, P.E.I. Collected to a depth of 6 inches, land had been manured and fertilized. The soil is a friable, reddish loam.

ANALYSIS OF AIR-DRIED SOILS

Laboratory Number Soil Number	80927 No. 1	80928 No. 2	80929 No. 3	80930 No. 4	80931 No. 5	80932 No. 6
Moisture	1·74	2·22	1·70	1·00	0·81	1·92
Loss on ignition (organic matter, etc.)	5·36	4·05	4·72	4·15	3·77	6·48
Mineral matter soluble in acid	3·61	6·04	3·05	1·83	2·54	4·96
Mineral matter insoluble in acid	89·29	87·69	90·53	93·02	92·88	86·64
	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen	0·150	0·085	0·090	0·095	0·110	0·185
Reaction: all soils are strongly acid.						
Lime Requirement—						
Pounds of ground limestone, per acre	3,664	5,524	6,860	5,524	3,466	3,210
or						
Pounds of burnt lime, per acre	2,052	3,096	3,960	3,096	1,944	1,800

With the exception of Nos. 1 and 6 these soils are rather poor in organic matter and its concomitant, nitrogen; these two samples—1 and 6—may be considered, in respect to these constituents, as comparable to average fertile soils as found in Eastern Canada. The whole series has a strongly acid reaction.

Comparing Nos. 1 and 2, which are from the same area but which apparently differ as to suitability for the growth of brown top, the most notable difference lies in their percentages of nitrogen, and to a lesser degree in organic matter content. The fertilizer experiments conducted by the Seed Branch in co-operation with the Division of Chemistry, indicated, from the yields of seed obtained, the value of nitrogen, as applied in sulphate of ammonia and nitrate

of soda. Sulphate of ammonia applied at the rate of 200 pounds per acre proved to be the most economical treatment for increasing seed production.

Nos. 3 and 4, both from the same field, are evidently very similar in character and composition; in this case chemical analysis has not made clear the reason why brown top produces a strong growth on No. 4 and not on No. 3. The results of the various fertilizer applications on this land show that nitrogen gave the largest yield of seed. The response from sulphate of ammonia was slightly higher than that from nitrate of soda.

In the absence of detailed information in respect to the growth of brown top on soils Nos. 5 and 6, the data indicated that a good growth might be expected from No. 6. The probabilities are that applications of available nitrogenous fertilizers would increase the yield of seed on both soils.

The application of ground limestone, slaked lime etc., did not increase the growth of brown top and from this it may be assumed that an acid condition of the soil is not detrimental to this crop.

QUEBEC

EXPERIMENTAL STATION, CAP ROUGE

At the request of the Dominion Horticulturist an examination of the soil from the apple orchard at the Experimental Station, Cap Rouge, was undertaken, the object being to ascertain what deficiencies in plant food, if any, might exist and, further, to suggest, from the results an economic fertilizer treatment, looking to an increase in fruit production. The samples were collected in August, 1925.

Each of the soils was collected to a depth of 6 inches and represented an area of about 3 acres which had not, so far as could be ascertained received any barnyard manure or fertilizer. The surface soil is on an average six inches deep and is underlaid by shale.

In their physical characteristics the two samples are much alike. Both are light brownish-grey clay loams containing many shale particles. They consist essentially of silt and clay, with much fine and a little coarse sand. In the air-dried condition they are granular to lumpy and somewhat refractory.

ANALYSIS OF THE AIR-DRIED SOIL

—	Sample "A" No. 81222	Sample "B" No. 81223
Moisture	3·83	3·51
*Loss on ignition (organic matter, etc.)	7·90	7·32
**Mineral matter soluble in acid	17·42	18·31
Mineral matter insoluble in acid	70·85	70·86
	100·00	100·00
*Containing nitrogen	0·285	0·250
**Containing—		
Phosphoric acid (P_2O_5)	0·259	0·429
Potash (K_2O)	0·955	1·088
Lime (CaO)	0·266	0·308
Magnesia (MgO)	0·693	0·346
Oxide of iron and alumina (Fe_2O_3+Al_2O_3)	14·080	15·070
Lime Requirement—		
Pounds per acre of ground limestone	3,210	2,990
or		
Pounds per acre of quicklime	1,800	1,670

Nitrogen and Organic Matter.—The nitrogen and organic matter content of both soils is well above the average for Canadian loams. While the above data do not indicate any special need of nitrogenous fertilizer, a small dressing of

nitrate of soda in early spring when nitrification may be slow would probably be found beneficial. Occasional small applications of barnyard manure or the turning under of cover crops would no doubt be of value in maintaining a satisfactory condition of tilth. It is important that the organic content of these soils be well maintained.

Phosphoric Acid.—Both soils are exceptionally well supplied with phosphoric acid—particularly sample B. Apparently, there is no need of phosphatic fertilizers for the orchard crop, provided that a fair proportion of their phosphoric acid content is available for crop growth. It is, however, not at all unlikely that basic slag might improve the soil physically—and to some degree, chemically.

Potash.—The high potash content of these soils is noteworthy—it is at least double that of the best soils in Eastern Canada. This makes it highly doubtful if potassic fertilizers would give a profitable response, except perhaps for certain leafy crops which require a quick and readily available supply of that element.

Lime.—The data show that both soils are deficient in lime. Our experience goes to show, that clay loams containing less than 0.5 per cent of lime will as a rule have their productiveness increased by a dressing of lime in one or other of its agricultural forms. In the case of the two soils under consideration an application of 2 tons of ground limestone per acre or 1 ton of quick lime per acre would prove of great value not only in correcting the acidity but in improving the soil physically and bringing about more favourable conditions for nitrification processes in the soil.

It will be observed in both samples that the percentage of magnesia exceeds that of lime. This preponderance of magnesia indicates as a rule a more or less unsatisfactory condition in respect to fertility; the application of lime (as corbonate or quicklime) is valuable in correcting this condition.

Drainage.—The drainage should be adequate; attention should be given to this factor, which is of special importance for soils of this type or character.

In connection with the basic slag experiments conducted on the Experimental Station, Cap Rouge, it was thought desirable to submit the soils of the area involved to a chemical and physical examination, the data to assist in arranging the plan of the experiment and in the interpretation of the field results:

Four representative samples of the surface soil to a depth of 5 inches were collected in the autumn of 1925.

TABLE 2.—MECHANICAL ANALYSIS OF SURFACE SOILS, CAP ROUGE, QUE.

Lab'y No.	Moisture	Loss on Ignition (organic matter)	Large Rock Fragments	Coarse Gravel left on 2 mm.	Analysis of Material passing 2 mm. sieve—on moisture-free basis							
					Total Sand	Fine Gravel 2–1 mm.	Coarse Sand 1–·5 mm.	Medium Sand ·5–·25 mm.	Fine Sand ·25–·1 mm.	Very fine Sand ·1–·05 mm.	Silt ·05–·005 mm.	Clay ·005–·00 mm.
	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
81862	2·05	9·52	11·10	20·84	43·32	8·77	10·77	6·76	8·62	7·40	33·11	24·57
81863	2·06	10·07	6·81	17·30	32·92	6·62	9·16	4·85	5·43	6·86	37·54	29·54
81864	2·09	9·62	10·02	23·09	43·41	10·44	12·89	6·82	6·80	6·47	31·60	24·98
81865	2·02	9·35	7·11	20·63	41·74	8·70	12·71	6·72	7·00	6·62	32·81	25·45

The soils may be classified as clay or silty clay loams. They are of a light yellowish brown colour and possess a very large proportion of shale fragments —over 50 per cent of the sample did not pass a 0.5 mm. sieve. The fine material is chiefly silt and clay, the remainder consisting approximately of coarse and fine sand in the ratio of 1:2.

In the air-dried condition they are granular to lumpy and for this type of soil are fairly friable.

TABLE 3.—CHEMICAL ANALYSIS OF SURFACE SOILS—CAP ROUGE, QUE.

—	Laboratory No. 81862 Soil No. 1	Laboratory No. 81863 Soil No. 2	Laboratory No. 81864 Soil No. 3	Laboratory No. 81865 Soil No. 4
Moisture	3·64	3·57	3·53	3·15
*Loss on ignition (organic matter, etc.)	10·09	10·49	10·72	10·33
**Mineral matter soluble in acid	18·38	18·47	18·77	18·58
Mineral water insoluble in acid	67·89	67·47	66·98	67·94
	100·00	100·00	100·00	100·00
*Containing nitrogen	0·325	0·350	0·345	0·340
**Containing—				
Phosphoric acid (P_2O_5)	0·192	0·229	0·227	0·195
Lime (CaO)	0·238	0·252	0·210	0·182
Magnesia (MgO)	1·957	2·187	1·989	2·201
Soluble in 1 per cent Citric Acid (available)—				
Phosphoric acid (P_2O_5)	0·075	.....	0·067	.....
Lime (CaO)	0·048	.....	0·006	.....
Magnesia (MgO)	0·032	.....	0·023	.....
Lime Requirement—				
Pounds per acre of ground limestone	9,190	9,190	9,885	9,885
Pounds per acre of quicklime	5,150	5,150	5,545	5,545

The percentages of nitrogen and organic matter of all four soils are very satisfactory; indeed they are decidedly higher than generally found in average fertile soils in Eastern Canada.

The total phosphoric acid content is very fair; the proportion considered as available is exceptionally high.

The lime content of these soils is very low, the data being supported by those which indicate a "lime-requirement" of more than four tons per acre of ground limestone.

The exceptionally high percentage of magnesia, especially when contrasted with the low lime content, is worthy of note. It is generally admitted that with a lime-magnesia ratio such as exists in these soils, approximately 1:10, conditions are not favourable to maximum growth. Although the percentage of "available" or soluble magnesia is not high, soil conditions for the majority of crops would undoubtedly be improved by heavy dressings of ground limestone.

The four soils of the series are very similar, both as to character and composition; the area in question therefore appears to be quite uniform.

Occasional applications of barnyard manure, or a turned under green crop (preferably a legume) should be sufficient to maintain a satisfactory condition of tilth, though the desirability of better drainage is indicated.

From conclusions drawn from experiments made on similar soils, it is reasonable to suppose that applications of lime and phosphoric acid, as furnished by ground limestone, basic slag or finely ground rock phosphate, would give a profitable return.

ALBERTA

EXPERIMENTAL STATION, LETHBRIDGE

In connection with the work carried on at the Experimental Station, Lethbridge on the plots devoted to irrigation investigations, it was thought desirable to obtain information respecting the physical character of the soil to a depth of 6 feet. The experimental work seeks to ascertain (*a*) the stages of growth at which water may be best applied (*b*) the number of irrigations required in a season and (*c*) the optimum amount of water to be applied per irrigation.

Six series of soils were collected and submitted to mechanical analysis. Each series consisted of six samples taken from one location, the samples being representative of successive feet to a depth of 6 feet (table 4).

TABLE 4.—MECHANICAL ANALYSIS OF SOILS COLLECTED IN CONNECTION WITH IRRIGATION EXPERIMENTS AT LETHBRIDGE, ALTA.

Series	Laboratory No.	Depth	Moisture	Loss on Ignition (organic matter)	Gravel greater than 2 mm.	Fine Gravel 2–1 mm.	Coarse Sand 1–·5 mm.	Medium Sand ·5–·25 mm.	Fine Sand ·25–·1 mm.	Very fine Sand ·1–·05 1 mm.	Silt ·05–·005 mm.	Clay ·005–00 mm.	Variety
		ft.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
"A"	82084	1st	2·26	6·53	0·08	0·15	0·27	2·09	20·49	38·80	21·18	17·02	Sandy loam
	85	2nd	1·96	10·74	nil	0·09	0·28	1·76	35·69	28·87	14·60	18·71	"
	86	3rd	1·74	9·65	"	nil	0·14	1·41	16·03	49·26	15·46	17·70	"
	87	4th	1·65	8·75	"	0·09	0·22	2·31	26·16	39·92	15·84	15·46	"
	88	5th	1·57	8·48	"	0·04	0·12	1·31	31·20	35·21	16·40	15·72	"
	89	6th	1·65	8·60	0·01	0·06	0·09	1·10	34·31	31·14	16·25	17·05	"
"B"	82090	1st	1·94	11·13	nil	0·05	0·20	1·34	27·66	32·02	19·42	19·31	"
	91	2nd	1·48	11·03	"	0·02	0·11	0·78	28·38	37·28	14·74	18·69	"
	92	3rd	1·43	9·65	"	nil	0·08	1·20	35·36	29·41	13·34	20·61	"
	93	4th	1·36	8·48	"	0·08	0·15	1·33	36·88	32·20	13·52	15·84	"
	94	5th	1·45	8·29	"	nil	0·09	1·01	35·94	33·33	12·00	17·63	"
	95	6th	1·48	8·27	"	nil	0·10	0·79	30·57	38·60	12 10	17·84	"
"C"	82096	1st	2·29	5·60	0·02	0·06	0·22	1·28	23·77	29·72	26·60	18·35	"
	97	2nd	1·84	12·15	nil	nil	0·11	0·97	24·05	35·92	19·64	19·31	"
	98	3rd	1·54	10·03	"	"	0·01	0·41	22·40	41·54	18·83	16·81	"
	99	4th	1·42	9·36	"	"	0·03	0·45	23·59	40·98	18·83	16·12	"
	82100	5th	1·52	8·91	"	"	0·07	0·95	26·17	36·72	18·70	17·39	"
	01	6th	1·61	8·35	"	"	0·11	1·65	34·00	29·26	15·64	19·34	"
"D"	82102	1st	2·13	8·38	0·03	0·05	0·26	1·39	23·48	24·94	22·78	17·10	"
	03	2nd	1·77	11·81	"	nil	0·13	0·69	20·46	37·61	21·38	19·73	"
	04	3rd	1·47	9·47	"	"	0·07	0·87	30·08	36·58	14·83	17·57	"
	05	4th	1·46	8·76	"	"	0·07	0·75	30·14	37·50	13·40	18·14	"
	06	5th	1·45	8·62	0·20	0·08	0·22	1·14	39·06	24·73	13·24	21·53	"
	07	6th	2·36	5·83	1·06	0·91	1·40	4·12	18·07	19·46	28·28	27·76	Clay loam
"E"	82108	1st	2·60	5·78	nil	0·03	0·21	1·06	17·35	40·94	22·85	17·56	Sandy loam
	10	2nd	1·74	12·42	0·05	0·02	0·06	0·75	18·68	40·58	19·02	20·89	"
	11	3rd	1·66	10·48	nil	nil	0·03	0·61	20·80	41·53	16·88	20·10	"
	09	4th	1·67	9·12	"	"	0·07	0·56	24·44	40·33	14·88	19·72	"
	12	5th	1·48	8·56	"	"	0·04	0·54	31·74	36·38	10·64	20·66	"
	13	6th	1·59	8·27	"	"	0·13	0·86	36·11	30·66	10·32	21·92	"
"F"	82114	1st	2·11	5·00	nil	0·03	0·14	1·02	20·46	38·22	22·40	17·73	Sandy loam
	15	2nd	2·20	4·03	"	0·01	0·13	0·83	17·63	40·39	22·81	18·20	"
	16	3rd	1·73	10·81	"	0·01	0·08	0·57	12·63	34·90	27·47	24·32	Clay loam (nearly sandy loam).
	17	4th	1·47	11·06	"	nil	0·03	0·44	17·31	39·34	18·16	24·72	Sandy loam
	18	5th	1·36	9·55	"	"	0·05	0·53	22·53	39·81	15·90	21·18	"
	19	6th	1·45	9·02	"	"	0·03	0·61	20·75	41·14	16·75	20·72	"

The results are extremely interesting in revealing a remarkable similarity throughout the series as to the proportions of soil "separates"—clay, sand, etc.—to a considerable depth. Stated otherwise, this means there is no sharp line of demarkation between surface and subsoil. This is characteristic generally of the soils in semi-arid districts and denotes a condition well adapted to farming operations under irrigation. These data are worthy of permanent record as they will be of value in future work on irrigation problems.

BRITISH COLUMBIA

EXPERIMENTAL STATION, WINDERMERE, EAST KOOTENAY

The acquisition of land for the establishment of an Experimental Station at Windermere, Columbia valley, in East Kootenay, made it desirable to collect and submit to laboratory examination representative samples of soil from the area in question formerly known as Big House Ranch. The object of this investigation was not only to determine, in so far as may be possible by chemical analysis, the present fertility of the soil, but to obtain data which might assist in the planning of manurial and fertilizer experiments. Since the land of this area may be considered as fairly typical of much throughout the Columbia river valley the results of these experiments would no doubt be more or less generally applicable in the district.

The series of soils was collected in July, 1925, four samples of surface and sub-soil being taken at such points as were considered representative of the farm.

Location "A".—About 300 feet from north fence and about 300 feet from edge of oat field. Surrounding area showed an incrustation of bluish grey salts on surface.

Lab'y. No. 80867

Surface soil to depth of 7 inches, light chocolate brown silty loam, mostly silt and very fine sand with a very little clay. In air-dried condition it is loose and powdery (flour-like).

Lab'y. No. 80868

Sub-soil, depth 7 inches to 12 inches—yellowish-brown silty loam, differing from the surface soil by being of a lighter colour and containing somewhat more gravel and clay. Below 12 inches the soil contains a very large amount of coarse gravel and stones.

Location "B".—About 300 feet from west fence and in line with north end of barn.

Lab'y. 80869

Surface soil to a depth 5½ inches; light chocolate-brown silty loam, mostly silt and very fine sand; loose and powdery when air-dried.

Lab'y. No. 80870

Sub-soil, depth 5½ to 10 inches—yellowish-brown silty loam containing a fair amount of clay. Below 10 inches the soil is stoney and gravelly.

Location "C".—About 125 feet from the south line fence (highway) and in line with the west side of dairy barn.

Lab'y. No. 80871

Surface soil to a depth of 7 inches, light chocolate-brown, silty loam containing a slightly higher percentage of silt than the other surface soils of the series; loose and powdery.

Lab'y. No. 80872

Sub-soil, depth 7 to 12 inches—yellowish- brown silty loam containing much very fine sand. It extends to a depth of 22 inches and then changes to a gravelly and stoney loam.

Location "D".—About 100 feet west of the line between the original property of John Jones and Walter Jones, and in centre of the cleared area.

Lab'y. No. 80873

Surface soil to a depth of 5½ inches; light chocolate-brown silty loam, loose and powdery.

Lab'y No. 80874

Subsoil, depth 5½ to 12 inches but extending to a depth of 16 inches when it changes to a gravelly and stoney loam. It is a yellowish-brown silty loam much like the surface soil but differing in colour.

Information with respect to the previous manuring and cropping of these areas was not available but the farm as a whole was thought to be more or less "run down."

PHYSICAL ANALYSIS

The method of analysis employed was that of the Bureau of Soils, United States Department of Agriculture, and furnished seven separates from fine gravel to clay. The results are given in the accompanying table (Table 5).

In respect to physical characteristics—colour, texture, etc.—the four surface soils of this series are very similar. According to the United States Bureau of Soils classification which requires 50 per cent and over of silt to bring a soil into a "silt-loam" class, all these surface soils with the exception of No. 80871 would be considered as "loams". However, according to the scheme drawn up from sources both European and American and adopted by this division some years ago, they would be classed as "silt-loams". They have been so designated in the table. The main feature of interest is that these soils consist essentially of sand (fine and very fine) and silt present practically in equal proportions.

The amounts or proportions of sand, silt, clay, etc., of the sub-soils are very similar to those of the surface, a characteristic commonly noted in semi-arid areas. Frequently, the surface soil passes almost imperceptibly into the sub-soil.

CHEMICAL ANALYSIS

The results of a complete chemical analysis of the surface soils are presented in the accompanying table: they comprise the "total" constituents as obtained from digestion with 1.115 sp. gr. hydrochloric acid (A.O.A.C. methods) and "available" phosphoric acid and potash from digestion with 1 per cent citric acid solution (Dyer method). Nitrogen determinations were made by the Kjeldahl process (Table 6).

Only one sub-soil (No. 80872) was included in this part of the work; it was considered fairly representative of the sub-soils of the series.

TABLE 5.—COLUMBIA VALLEY SOILS, B.C.—COLLECTED FROM THE NEW EXPERIMENTAL STATION, LAKE WINDERMERE, B.C.

(Mechanical Analysis: Moisture-free Basis)

Lab'y No.	Location	Moisture	Loss on ignition	Gravel greater than 2 mm.	Fine gravel 2–1 mm.	Coarse sand 1–·5 mm.	Medium sand ·5–·25 mm.	Fine sand ·25–·1 mm.	Very fine sand ·1–·05 mm.	Total sand	Silt ·05–·005 mm.	Clay ·005–·00 mm.	Classification
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
80867 (A)	Surface soil.....	1·90	14·37	1·09	1·43	1·30	1·23	4·65	38·12	46·73	48·08	5·19	Silt loam.
80868 (A)	Subsoil.....	0·98	21·50	8·82	3·71	2·33	2·03	4·69	28·82	41·58	44·04	14·38	Silt loam.
80869 (B)	Surface soil.....	1·38	15·20	0·93	1·26	1·21	1·31	5·23	39·41	48·42	44·60	6·98	Silt loam, nearly sandy loam.
80870 (B)	Subsoil.....	0·83	15·90	1·94	0·87	0·94	0·87	3·93	36·23	42·84	40·87	16·29	Silt loam.
80871 (C)	Surface soil.....	1·88	14·83	0·94	1·16	0·95	1·03	4·57	30·58	38·29	55·82	5·89	Silt loam.
80872 (C)	Subsoil.....	0·51	17·90	0·58	1·34	0·97	0·66	1·93	43·68	48·58	44·76	6·66	Silt loam, nearly sandy loam.
80873 (D)	Surface soil.....	2·54	12·71	0·42	1·03	0·83	1·27	4·70	37·83	45·66	49·33	5·01	Silt loam.
80874 (D)	Subsoil.....	1·67	21·60	0·88	1·50	2·00	2·40	5·27	36·08	47·25	48·52	4·23	Silt loam.

TABLE 6.—Columbia Valley Soils, B.C.—Collected from the New Experimental Station, Lake Windermere, B.C.

Chemical Analysis—On Air-dried Sample

Lab'y. No.	Location and depth	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
										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.	
	Surface Soils—													
80867	A. 0–7	2·88	7·62	19·87	69·63	5·28	0·48	8·15	0·330	0·205	0·015	0·281	0·016	Alkaline
80869	B. 0–5½	2·13	6·06	24·75	67·06	7·63	0·58	7·98	0·275	0·211	0·014	0·236	0·017	"
80871	C. 0–7	2·24	6·38	24·83	66·55	7·66	0·27	8·57	0·260	0·237	0·012	0·255	0·020	"
80873	D. 0–5½	2·91	7·84	16·76	72·49	3·86	0·28	8·51	0·330	0·208	0·023	0·230	0·029	"
	Sub-soil—													
80872	C. 7–12	0·83	2·52	40·38	56·27	15·78	1·49	9·01	0·070	0·186	0·002	0·208	0·020	"

Loss on Ignition.—This is largely organic matter; owing to the high carbonate of lime content present it possibly includes a small percentage of carbonic acid from destruction of this carbonate.

The organic matter (humus) content is fair for soils of a semi-arid district. The desirability of the up-keep of humus by manuring or green crops turned under is suggested by these data. Additions of organic matter by such methods would serve to increase the moisture-holding capacity of the soil and to maintain a satisfactory condition of tilth.

Nitrogen.—It was thought that these soils were more or less run out or exhausted by poor farming methods but the percentages of nitrogen obtained do not lend support to this impression. They compare very favourably with those of productive soils both in semi-arid and humid districts.

Phosphoric Acid.—The percentages of this element are fair but not equal to those of our best soils. In soils of average fertility the phosphoric acid usually lies between 0.15 and 0.25; very good loams contain from 0.25 to 0.3 per cent. The average for the four surface soils of this series is .215 per cent.

In respect to "available" phosphoric acid, as determined by the Dyer method three of the four surface soils are distinctly low, the data indicating that phosphatic fertilizers would give a profitable return. The fourth sample (No. 80873) appears to be sufficiently well supplied with this element in an available condition for present crop requirements.

Potash.—Though all the soils of this series may be considered as coming within the limits tentatively set for good soils, viz., 0.25 to 0.5 per cent, they are not rich in potash. The probabilities are that applications of potassic fertilizers for certain crops, e.g., farm roots, would be profitable.

The data for the "available" potash would indicate that a good proportion of the total is more or less assimilable by crops.

Lime.—All these soils are marked by a high carbonate of lime content—a characteristic feature of soils of the semi-arid districts.

Alkali.—Careful examination has shown freedom from all injurious alkali; there is no reason to fear "rise of alkali" on this land under irrigation.

Drainage.—Gravelly and stoney soil underlies the surface soil at depths varying from 10 inches to 22 inches and ensures adequate drainage—a desirable feature for farming under irrigation.

INVESTIGATIONAL WORK WITH FERTILIZERS

In addition to the experiments with fertilizers already established and in progress on the branch Farms and Stations, a number of new investigations were commenced in the spring of 1925. These include the following: Experiments with Ephos Basic Phosphate conducted at Charlottetown, P.E.I., Nappan and Kentville, N.S., and Cap Rouge, P.Q.; nitrate of soda as a top-dressing on second year hay at Fredericton, N.B.; and an experiment at Summerland, B.C., to compare the value of barnyard manure and green manuring, alone and in conjunction with commercial fertilizers, as a means of maintaining the fertility of the soils of the Okanagan valley, B.C.

EXPERIMENTS WITH EPHOS

Ephos basic phosphate is ground rock phosphate, manufactured from deposits of this mineral which occur quite extensively in Egypt. It is claimed by the vendors that "Ephos" contains 60 per cent tribasic phosphate of lime and has a fineness of 80 per cent through 100 mesh. They guarantee it "to act

as quickly as superphosphate, and to be as effective as superphosphate or basic slag when equal quantities of phosphoric acid are used."

A sample of "Ephos" was submitted to analysis and the following results were obtained:

ANALYSIS OF EPHOS (Lab'y. No. 77258)

	Per cent
Total phosphoric acid* (P_2O_5)	28.75
Phosphoric acid, soluble in 2 per cent citric acid 5 gms. 500 cc. ½ hour.	10.76
Phosphoric acid, soluble in 2 per cent citric acid 1 gm. 500 cc. ½ hour.	27.66
Phosphoric acid, soluble in 1 per cent citric acid, 1 gm. 500 cc. 5 hours.	25.67

*Equivalent to 62.81 per cent tricalcic phosphate.
Fineness—97.6 per cent through 100 mesh.

As there are efforts being made to establish a market in Canada for Ephos, it was thought desirable to obtain some information with respect to its value as a source of phosphoric acid for fertilizing purposes. An experiment was planned which permitted of comparisons between Ephos, superphosphate and basic slag, each material being applied singly and in combination with a nitrogenous and potassic fertilizer. This experiment was commenced in 1925 at the branch farms Nappan and Kentville, N.S., and Charlottetown, P.E.I. The plan outlined in table 7 was conducted on quadruplicate plots of $\frac{1}{320}$-acre area.

TABLE 7.—PLAN OF EXPERIMENT WITH EPHOS

CROP ROTATION: HOED CROP, GRAIN, CLOVER HAY, TIMOTHY HAY

Plot No.	Treatment (pounds per acre)		Plant Food Constituents supplied (pounds per acre)		
			N	P_2O_5	K_2O
1	Ephos	292	.....	80	.....
2	Superphosphate	500	.....	80	.....
3	Basic slag	500	.....	80	.....
4	Ephos	292	24	80	50
	Nitrate of soda	150			
	Muriate of potash	100			
5	Superphosphate	500	24	80	50
	Nitrate of soda	150			
	Muriate of potash	100			
6	Basic slag	500	24	80	50
	Nitrate of soda	150			
	Muriate of potash	100			
7	Nitrate of soda	150	24	.....	50
	Muriate of potash	100			

The crop yields obtained from the first year of the rotation (hoed crop) at the Stations mentioned are given in table 8.

TABLE 8.—EPHOS BASIC PHOSPHATE EXPERIMENT

CROP YIELDS AT CHARLOTTETOWN, P.E.I., NAPPAN, N.S., AND KENTVILLE, N.S.

Plot No.	Treatment (pounds per acre)	Crop Yields, per acre (Average of Quadruplicate Plots)			
		Charlottetown	Nappan	Kentville	
		Turnips	Turnips	Turnips	Mangels
		tons	tons	tons	tons
1	Ephos 292	10·28	12·00	7·72	1·68
2	Superphosphate 500	12·52	14·12	7·68	4·12
3	Bessemer slag 500	8·60	14·08	7·04	4·56
4	Ephos 292 Nitrate of soda 150 Muriate of potash 100	12·32	16·64	8·16	2·76
5	Superphosphate 500 Nitrate of soda 150 Muriate of potash 100	15·64	15·60	9·48	6·35
6	Bessemer slag 500 Nitrate of soda 150 Muriate of potash 100	8·56	16·72	9·72	6·96
7	Nitrate of soda 150 Muriate of potash 100	5·56	9·48	7·84	3·08
8	Checks	5·83	7·44	6·34	2·00

DISCUSSION OF RESULTS

Charlottetown, P.E.I.—The results at Charlottetown show that there have been large increases in the yield of turnips from applications of phosphoric acid. The plots which received nitrogen and potash only (plot 7) gave no increase in yield over the average of check plots while applications of phosphoric acid alone (on plots 1, 2 and 3) and in conjunction with nitrogen and potash on (plots 4, 5 and 6) resulted in decidedly large increases.

Comparing the three sources of phosphoric acid it will be noted that superphosphate gave the best yields both when applied alone, and in conjunction with nitrate of soda and muriate of potash; plot 5 on which it was used to furnish phosphoric acid gave the highest yield of all the plots and one which resulted in an increase of almost 10 tons per acre over the average of the checks. Ephos also gave very satisfactory results and while its effectiveness is somewhat lower than that of superphosphate it has proved superior to basic slag. The increase in yield from applications of basic slag, Ephos and superphosphate, used alone (plots 1, 2 and 3) are respectively 2.77, 4.45 and 6.69 tons per acre; used in conjunction with nitrogen and potash (plots 4, 5 and 6), the increases are 2.73, 6.49 and 9.81 tons per acre, respectively.

Nappan, N.S.—The data obtained at Nappan are similar in many respects to those recorded at Charlottetown. There has been a notable response of the turnip crop to applications of phosphoric acid, applied alone and in conjunction with nitrogen and potash. As a source of phosphoric acid Ephos used in conjunction with nitrogen and potash, has proved equal to superphosphate and basic slag.

Kentville, N.S.—At Kentville the experiment, which included mangels and turnips, was conducted on land that had grown a heavy crop of corn in

1923 and oats in 1924, and that was considered low in available plant food constituents.

Turnips: Applications of phosphoric acid alone gave small increases and all three forms of this element appear to have been equally effective. Used in conjunction with nitrogen and potash the increases are larger, with superphosphate and slag about equal and Ephos a close third.

Mangels: The yield of mangels are much below the average for this crop, apparently due to the general poverty of the soil, since seasonal conditions were reported as favourable. Superphosphate and basic slag when used alone gave very fair increases in yield and still larger increases in conjunction with nitrogen and potash. Ephos has not proved an effective fertilizer for the mangel crop, no increase in yield having resulted from its use, either alone or with nitrogen and potash.

EXPERIMENT WITH EPHOS BASIC PHOSPHATE AT CAP ROUGE, P.Q.

At Cap Rouge, P.Q. Ephos basic phosphate was compared with Bessemer slag and superphosphate the materials being applied singly for the corn crop, on quadruplicate plots of 1/320 acre. The rates of application and yields of corn are given in table 9.

TABLE 9.—EPHOS BASIC PHOSPHATE—CAP ROUGE, P.Q.

Plot No.	Materials applied (pounds per acre)		Pounds per acre of Phosphoric acid supplied	Yield of Corn (green) per acre (average of quadruplicate plots)
				tons
1	Ephos (27·5% P_2O_5)	510	140	18·68
2	Superphosphate (16% P_2O_5)	875	140	19·48
3	Bessemer slag (17% P_2O_5)	825	140	19·20
4	Check			18·00

The response of the corn crop at Cap Rouge to applications of phosphoric acid has, under the conditions of this experiment, been very small; the increases in yield of the treated plots over the check plot might be considered as within the limits of experimental error. Comparison of the materials used is therefore not justified.

NITRATE OF SODA AS A TOP DRESSING FOR HAY
Fredericton, N.B., 1925

The practice of top-dressing second-year hay crops with a nitrogenous fertilizer has of late years been growing in importance in the Maritime Provinces. To obtain data with respect to the best time in the spring and the most profitable rate at which to apply the fertilizer, an experiment was commenced at Fredericton, N.B., in the spring of 1925.

The land on which the experiment was located was a clay loam and had been seeded with timothy, red clover and alsike in 1923 with a nurse-crop of oats. In 1924 the hay crop, a mixture of clover and timothy, was rather light. Shortly after commencement of growth in 1925 a section of the field was laid out in plots of 1/320 acre area and nitrate of soda was applied on the date and at the rates outlined in the following table of yields. Hay has been assigned a value of $12 per ton and the cost of nitrate of soda taken as $65 per ton or $3.25 per 100 pound.

TABLE 10.--YIELDS OF SECOND-YEAR HAY TOP-DRESSED WITH NITRATE OF SODA—FREDERICTON, N.B., 1925

Plot No.	Rate and Date of Application per acre			Yield of Hay per acre Average Triplicate plots	Increase over untreated plot	Value of Increase per acre	Cost of Fertilizer per acre	Profit per acre
	May 18	June 6	June 20					
	lb.	lb.	lb.	lb.	lb.	$ cts.	$ cts.	$ cts.
1	100	.....	.....	5,276	611	3 66	3 25	0 41
2	50	50	.....	5,594	929	5 57	3 25	2 32
3	200	.....	.....	5,385	720	4 32	6 50	−2 18
4	100	100	.....	5,497	832	4 99	6 50	−1 51
5	300	.....	.....	5,741	1,076	6 45	9 75	−3 30
6	100	100	100	5,637	992	5 95	9 75	−3 80
7	Check	.....	.....	4,665	.....	.....	.....	.....

The results presented in table 10 show that under the conditions of this experiment, 50 pounds of nitrate of soda applied when growth is commencing in the spring followed by 50 pounds two to three weeks later, has given a fair return. It is of interest to compare the results of this treatment on plot 2 with that of plot 1 in which the same quantity of nitrate was applied in one dressing, plot 1 gave a profit of 41 cents whereas the profit from plot 2 was $2.32. When the nitrate was applied at a higher rate than 100 pounds per acre larger yields were obtained but the additional increase in yield was insufficient to offset the increase in cost of fertilizer. These results agree fairly well with those obtained at Kentville in 1923 and which indicated that an application of 100 pounds per acre represented the maximum rate at which nitrate of soda might be applied with profit as a top-dressing for hay lands.

BARNYARD MANURE, GREEN MANURING AND COMMERCIAL FERTILIZERS

Summerland, B.C.

The object of this experiment commenced in 1925 at Summerland, B.C., is to ascertain the value of green manuring as compared with barnyard manure when employed (1) alone and (2) in conjunction with commercial fertilizers, as a means of maintaining the fertility of the soils of the Okanagan valley.

The plan of experiment is carried out in triplicate on plots $\frac{1}{100}$ acre area and includes treatments with barnyard manure at rates of 5, 10, 15 and 20 tons per acre applied alone and in conjunction with a complete fertilizer. A two-year rotation of corn (for silage) and annual hay (oats, peas and vetches) is followed and the manure and fertilizers are applied to the corn crop. The cover crop of the green manure plots is seeded following the removal of the annual hay crop and ploughed under the next spring at the same time the manure is applied for the corn.

The soil in the district of Summerland is apparently fairly well supplied with available plant food and produces excellent crops where there is a sufficiency of moisture. There is, however, a tendency on cultivation under irrigation for them to lose their mellow character and this no doubt is due to loss of organic matter. The building up of the soil in humus would seem to be an important phase of land treatment in the successful growth of crops in this district and, more particularly so, as the supply of barnyard manure is likely to be inadequate. It is hoped that the resultant data of this experiment will prove of value in that respect.

EXPERIMENT E-21

Agassiz, B.C.

This experiment commenced at the Experimental Farm at Agassiz, B.C., in 1921, includes several features in regard to fertilizing and manuring. It involves 60 fertilized plots of $\frac{1}{40}$ acre area. The soil—a heavy sandy loam—had not been long under cultivation, the land having been cleared in 1914 and in the fall of 1920 had received a uniform application of manure at the rate of 10 tons per acre. The fertilizers were applied in the spring of 1921 for the mangel crop of a three year rotation; mangels, oats and hay.

The results obtained over the three year period 1921-23 may best be studied by considering the various features of the experiment separately.

SECTION I

In this section of the experiment, consisting of eight groups of three plots each, a number of fertilizer formulae are compared and in addition provision is made for distributing the application of the nitrogenous fertilizer throughout the crop rotation. Plot A of each group receives all the nitrogen in the first year; plot B receives one-half the nitrogen in the first and one-half in the second year; plot C receives one quarter of the nitrogen in the first year, the remaining three-quarters being divided between the second and third years. The nitrogen of the various formulae used was furnished by nitrate of soda, phosphoric acid by superphosphate, and potash by muriate of potash.

The plan of section 1 and the crop yields obtained for the three years 1921-23 are given in table 11.

TABLE 11.—CROP YIELDS, SECTION I: EXPERIMENT E 21—AGASSIZ, B.C.

Plot No.	Fertilizers applied (pounds per acre) and Year of Application					Yields per acre			
	Nitrate of Soda (15·5% N)			Superphosphate (16% P_2O_5)	Muriate of Potash (50% K_2O)	Mangels	Oats		Hay
	1921	1922	1923	1921	1921	1921	1922		1923
							Grain	Straw	
						bush.	bush.	pounds	tons
1 A	400	.....	.....	500	200	1,732·0	57·6	2,880	2·816
B	200	200	.....	500	200	1,688·0	82·4	3,680	2·940
C	100	150	150	500	200	1,653·6	84·7	3,860	2·976
2 A	200	.....	.....	500	200	1,769·6	57·1	2,780	3·224
B	100	100	.....	500	200	1,392·0	76·5	3,880	3·272
C	50	75	75	500	200	1,332·8	90·6	4,240	3·276
3 A	400	.....	.....	250	200	1,760·0	82·9	3,780	3·215
B	200	200	.....	250	200	1,536·0	105·9	7,760	2,632
C	100	150	150	250	200	1,568·0	101·2	4,640	2·592
4 A	200	.....	.....	250	200	1,560·0	78·8	3,580	2·844
B	100	100	.....	250	200	1,381·6	100·0	4,440	3,220
C	50	75	75	250	200	1,506·4	95·3	4,340	2,804
5 A	400	.....	.....	500	100	1,772·8	83·5	3,800	2·968
B	200	200	.....	500	100	1,669·6	108·8	4,620	2·736
C	100	150	150	500	100	1,508·8	114·1	5,040	3·088
6 A	200	.....	.....	500	100	1,585·6	100·6	4,420	2·864
B	100	100	.....	500	100	1,484·0	107·1	4,960	2·728
C	50	75	75	500	100	1,248·0	102·4	4,560	2·772
7 A	400	.....	.....	250	100	1,572·0	81·2	3,580	2·720
B	200	200	.....	250	100	1,152·0	98·8	3,960	2·548
C	100	150	150	250	100	1,176·0	94·1	3,860	3·012
8 A	200	.....	.....	250	100	1,438·4	83·5	3,800	2·656
B	100	100	.....	250	100	1,380·0	98·8	4,320	2·368
C	50	75	75	250	100	1,488·0	97·6	4,220	2·880
Average yields of check plots						876·5	73·7	3,367	2·395

40000—2½

The exceptionally high yields of the plots generally, throughout the rotation are noteworthy. In spite of the fact that the fertility of the soil of the area was apparently quite high—as shown by the average yields of the check plots—the response to fertilizer treatment, particularly in the case of the mangel crop is very marked.

For the purposes of comparison, the total value for the three years of the increased yield of the fertilized plots over the check plot, and the profit after deducting the cost of fertilizer have been compiled as shown in table 12. In making these calculations mangels were valued at $2.80 per ton, oats at 50 cents per bushel, oat straw at $6 per ton and clover hay at $16 per ton. The costs of the fertilizing materials used were placed as follows: nitrate of soda $70 per ton, superphosphate $28 per ton and muriate of potash $50 per ton.

TABLE 12.—VALUE OF INCREASED YIELDS—SECTION I, EXPERIMENT E-21, AGASSIZ, B.C.

Plot group	Elements furnished in pounds per acre			Equivalent formulae at rate of 1000 lb. per acre	Total Value of Increase			Profit per acre after deducting cost of fertilizer		
	Nitrogen	Phosphoric acid	Potash		A plots (all the nitrogen in 1st year)	B plots (nitrogen in 1st and 2nd year)	C plots (nitrogen in 1st, 2nd and 3rd year)	A plots	B plots	C plots
					$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
1	62	80	100	6-2-8-10	57 11	70 81	70 68	31 11	44 81	44 68
2	31	80	100	3-1-8-10	65 72	53 05	57 09	46 72	34 05	38 09
3	62	40	100	6-2-4-10	80 80	79 24	69 13	58 30	56 74	46 63
4	31	40	100	3-1-4-10	58 21	64 90	64 35	42 71	49 40	48 85
5	62	80	50	6-2-8-5	78 11	82 29	80 57	54 61	58 79	57 07
6	31	80	50	3-1-8-5	73 79	69 34	49 97	57 29	52 84	33 47
7	62	40	50	6-2-4-5	58 28	36 07	42 59	38 28	16 07	22 59
8	31	40	50	3-1-4-5	49 71	50 23	65 08	36 71	37 23	52 08

Comparison of Formulae Used.—The data are somewhat conflicting as regards any conclusions which might be attempted in respect to the most suitable formulae for the rotation under consideration. All treatments have given very profitable returns. On the A plots on which all the nitrogen was applied in the first year, the highest yields of mangels were obtained on plot 5A from an application of 62 pounds of nitrogen, 80 pounds of phosphoric acid and 50 pounds potash, per acre; plot 2 A, which received but only half as much nitrogen as plot 5 A and twice as much potash, gave practically the same yield. These yields were in turn closely followed by that of plot 3 A which received 62 pounds of nitrogen, 40 pounds phosphoric acid and 100 pounds of potash per acre. Considering the profits resulting over the three-year periods on the A plots, it is found that the treatments of plots 3 A, 5 A, and 6 A have given about the same amount of profit.

On the B and C plots, the plot receiving 62 pounds nitrogen, 80 pounds phosphoric acid and 50 pounds of potash has given the largest profit over the three year period, but almost as good returns are recorded for several of the other formulae used.

While this experiment has shown very clearly that profitable returns have been obtained from a large number of formulae it has not shown that any particular formula stands out markedly superior to the rest.

Distribution of Applications of the Nitrogenous Fertilizer in the Rotation.—Of the eight series of treatments outlined in table 12 four show the largest profit to have been derived from the application of all the nitrogen in the first year to the mangel crop. In three instances the largest profit resulted from

applying one-half the nitrogen in each of the first two years. In one series only, did the distribution of nitrogen over the three years prove most profitable. It will be noted, however, within a series that in the majority of instances no great difference in profit resulted from the three methods of applying nitrogen.

Averaging the values of the increased yields and profits therefrom, from the three methods of application of nitrogen the following results are obtained:—

—	Application	Average value of increase over checks per acre	Average profit
		$ c.	$ c.
Average of A plots	All nitrogen applied in first year	65 22	45 72
" B "	Nitrogen distributed over two years	63 28	43 74
" C "	Nitrogen distributed over three years	62 43	42 93

From these figures it will be noted that almost equal returns resulted under the three methods of application of the nitrogenous fertilizer. It may be pointed out that the largest proportion of the profits obtained was due to the very large increases in the yield of mangels, a crop which as a rule responds markedly to nitrate of soda. While the nitrate in the second year proved of benefit to the oat crop on the B and C plots, with a few exceptions it did not increase the yield of hay when applied to the C plots in the third year.

The comparatively small differences resulting from the various treatments of this experiment may have been due in part to the relatively high fertility of the soil.

SECTION II

In this section all the fertilizers are applied the first year, for the mangel crop. The first series, consisting of three groups of three plots each, permits of the comparison of three fertilizer mixtures at three rates of application.

The second series consists of two groups of three plots each which in addition to the fertilizers received 10 tons per acre of barnyard manure, and two plots which received manure without any application of fertilizers.

TABLE 13.—CROP YIELDS, SECTION II: EXPERIMENT E-21, AGASSIZ, B.C.

Plot No.	Fertilizers applied (pounds per acre)			Yields and Increases (over check plots) per acre					
				1921 Mangels		1922 Oats (Grain)		1923 Hay	
	Nitrate of soda	Superphosphate	Muriate of potash	Yields	Increases	Yields	Increases	Yields	Increases
				bush.	bush.	bush.	bush.	tons	tons
11 A	400	500	100	1,785·6	909·1	83·5	9·8	2·628	0·233
B	300	375	75	1,586·4	709·9	78·8	5·1	2·912	0·517
C	200	250	50	1,456·0	579·5	70·6	−3·1	2·680	0·285
12 A	200	500	100	1,642·4	765·9	79·4	5·7	2·900	0·505
B	150	375	75	1,540·0	663·5	84·7	11·0	2·980	0·585
C	100	250	50	1,340·0	463·5	83·5	9·8	3·076	0·681
13 A	400	250	100	1,736·0	859·5	91·2	17·5	2·904	0·509
B	300	188	75	1,552·0	675·5	76·5	2·8	3·060	0·665
C	200	125	50	1,498·4	621·9	76·5	2·8	3·124	0·729
Average yields of check plots				876·5		73·7		2·395	

In all of the groups 11, 12 and 13 of the first series of plots, the yields of mangels are in direct relation to the amounts of plant food supplied. In the case of the oats (second year) and the hay (third year) crops, the response to the fertilizer applied in the first year of the rotation is extremely irregular; in practically all instances there has been a well marked profitable return, but this response, it will be observed shows a great fluctuation.

The values of the increases in yield from the plots of these three groups over the three-year period are tabulated in table 14.

TABLE 14.—VALUE OF INCREASED YIELDS FROM PLOTS OF GROUPS 11, 12 AND 13 OF SECTION II: EXPERIMENT E-21, AGASSIZ, B.C.

Plot No.	Elements furnished in pounds per acre			Equivalent Formula and Rate per acre	Values of Increase per acre					Profit per acre for period of three years
	Nitrogen	Phosphoric acid	Potash		Mangels	Oats		Hay	Total for three years	
						Grain	Straw			
					$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
11 A	62	80	50	1,000 lb. 6-2-8-5	63 64	4 90	1 12	3 73	73 39	49 89
B	46½	60	37½	750 " 6-2-8-5	49 69	2 55	1 48	8 27	61 99	44 36
C	31	40	25	500 " 6-2-8-5	40 57	−1 55	−0 87	4 56	42 71	30 96
12 A	31	80	50	1,000 " 3-1-8-5	53 61	2 85	0 10	8 08	64 64	48 14
B	23	60	37½	750 " 3-1-8-5	46 45	5 50	1 30	9 36	62 61	50 23
C	15½	40	25	500 " 3-1-8-5	32 44	4 90	0 94	10 90	49 18	40 93
13 A	62	40	50	1,000 " 6-2-4-5	60 16	8 75	2 62	8 14	79 67	59 67
B	46½	30	37½	750 " 6-2-4-5	47 28	1 40	0 88	10 64	60 20	45 20
C	31	20	25	500 " 6-2-4-5	43 53	1 40	0 88	11 66	57 47	47 47

Of the three fertilizing mixtures employed in the series, no one formula has given markedly superior results to the other two; the data of table 14 show that all three have given very profitable returns.

With respect to rates of application, it will be noted that the total values of the increased yield for the three year period are in the order of the amount of plant food supplied in the first year, but the resulting profits after deducting the cost of fertilizer are not so regular. In groups 11 and 13 the heavy application resulted in the largest profit; in group 12, while slightly lower, the profit from the heavy was practically the same as from the medium application. In groups 11 and 12 the low rate of applications gave distinctly smaller profits than those from the medium and heavy dressings.

In the second series of section II, the influence of manure is shown in the crop yields tabulated in table 15. For comparison, group 12 of the first series which received the same quantities of fertilizers as group 14 but not manure, is included in the table.

TABLE 15.—INFLUENCE OF MANURE—SECTION II: EXPERIMENT E-21, AGASSIZ, B.C.

Plot No.	Manure tons per acre	Fertilizers Applied (pounds per acre)			Yields and Increases (over check plots) per acre					
					1921 Mangels		1922 Oats (Grain)		1923 Hay	
		Nitrate of soda	Superphosphate	Muriate of potash	Yields	Increases	Yields	Increases	Yields	Increases
					bush.	bush.	bush.	bush.	tons	tons
12 A		200	500	100	1,642·4	765·9	79·4	5·7	2·900	0·505
B		150	375	75	1,540·0	663·5	84·7	11·0	2·980	0·585
C		100	250	50	1,340·0	463·5	83·5	9·8	3·076	0·681
14 A	10	200	500	100	1,623·2	746·7	80·0	6·3	2·848	0·453
B	10	150	375	75	1,570·4	693·9	71·8	−1·9	2·680	0·285
C	10	100	250	50	1,668·8	792·3	68·2	−5·5	2·560	0·165
15 A	10	200	250	100	1,800·0	923·5	72·9	−0·8	2·792	0·397
B	10	150	188	75	1,616·0	739·5	75·9	2·2	3·136	0·741
C	10	100	125	50	1,646·4	769·9	69·4	−4·3	3·012	0·617
21 A	15				652·8	−223·7	69·4	−4·3	2·800	0·405
B	10				657·6	−218·9	67·6	−6·1	2·700	0·305
Average	of check	plots			876·5		73·7		2·395	

These results clearly show that manure proved of practically no benefit for the mangel and oats crop and of only slight benefit to the hay crop. This exceptionally poor return from manure may have been due, in part, to the effect of the latter on the mechanical condition of the soil. In reporting on the yields of mangels the superintendent wrote: "It is rather difficult to explain why plots 21 A and 21 B yielded less than the check plots except that the spring-applied manure was not thoroughly rotted and may have had a tendency to dry out the land." Further, on plots 21 A and 21-B which received 15 and 10 tons of manure respectively without fertilizers, the plant food of the manure may have been liberated too slowly in the early stages of crop growth to help the young plants to become well established before dry weather set in later in the season.

SECTION III

The main feature of this section of the experiment is a comparison of "mineral" and organic sources of nitrogen and phosphoric acid. Four groups of three plots each are used and the application of the fertilizing materials as outlined in table 16 was made for the first crop of the rotation—mangels.

In the first group (11) the nitrogen and phosphoric acid are furnished by nitrate of soda and superphosphate.

In the second group (18) part of the nitrogen and phosphoric acid are supplied by nitrate and superphosphate and part by tankage.

In the third group (19) all the nitrogen and part of the phosphoric acid are furnished by tankage, the balance of the latter element of plant food being supplied by superphosphate.

In the fourth group (20) all the nitrogen and part of the phosphoric acid are furnished by dried blood and tankage; superphosphate supplies the balance of the phosphoric acid.

TABLE 16.—MINERAL AND ORGANIC FERTILIZER MATERIALS—SECTION III: EXPERIMENT E-21, AGASSIZ, B.C.

Plot No.	Fertilizers applied in 1921 (pounds per acre)					Yields and Increases (over check plots) per acre					
						1921 Mangels		1922 Oats (Grain)		1923 Hay	
	Nitrate of soda (15·5 % N)	Dried blood (10·74 % N, 3 % P_2O_5)	Tankage (7·82 % N, 5·87 % P_2O_5)	Superphosphate (16 % P_2O_5)	Muriate of potash (50 % K_2O)	Yields	Increases	Yields	Increases	Yields	Increases
						bush.	bush.	bush.	bush.	tons	tons
11 A	400	.....	.....	500	100	1,785·6	909·1	83·5	9·8	2·628	0·233
B	300	.....	.....	375	75	1,586·4	709·9	78·8	5·1	2·912	0·517
C	200	.....	.....	250	50	1,456·0	579·5	70·6	− 3·1	2·680	0·285
18 A	200	.....	384	360	100	1,513·6	637·1	62·9	−10·8	2·616	0·221
B	150	.....	288	270	75	1,448·0	571·5	65·9	− 7·8	2·360	0·035
C	100	.....	192	180	50	1,432·0	555·5	78·8	5·1	2·976	0·581
19 A	.....	.....	768	282	100	1,432·8	556·3	78·2	4·5	3·124	0·729
B	.....	.....	576	212	75	1,349·6	473·1	76·5	2·8	2·596	0·201
C	.....	.....	384	141	50	1,453·6	577·1	78·2	4·5	3·328	0·933
20 A	.....	280	384	306	100	1,558·4	681·9	83·5	9·8	3·432	1·037
B	.....	210	288	230	75	1,243·2	366·7	72·9	−0·8	2·860	0·465
C	.....	140	192	153	50	1,200·0	323·5	75·3	1·6	3·004	0·609
Average of check plots						876·5	.....	73·7	.....	2·395	.....

When one-half the inorganic nitrogen furnished to the plots of group 11 has been replaced by the organic nitrogen of tankage in the plots of group 18, the yields of mangels (1st year) and oats (2nd year) have decreased, and the yields of hay (3rd year) remain much the same.

When all the inorganic nitrogen is replaced by the nitrogen of tankage as in group 19, there has been a further slight decrease in the yield of mangels, the yields of oats are practically the same as those from group 11 and the hay crop has materially increased.

When all the nitrogen has been furnished by the organic materials dried blood and tankage as in group 20, the yields of mangels are somewhat lower than those from the all mineral group of plots (11) but the yields of oats are equal to and the yields of hay considerably above those of the latter plots.

While the relative efficiency of mineral and organic forms of fertilizers must be influenced by several factors, chief among which are type of soil, character of season and nature of crop, the results of this investigation lend support to the practice of furnishing the major part of the nitrogen in inorganic form.

SECTION IV

In this section one group of three plots received phosphoric acid in the form of superphosphate; in a second group of three plots, phosphoric acid is furnished equally by superphosphate and basic slag; in a third group basic slag is used to supply this element of plant food. The nitrogen and potash applications of each group remained constant throughout. The crop yields are recorded in table 17.

TABLE 17.—SUPERPHOSPHATE AND BASIC SLAG AS SOURCES OF PHOSPHORIC ACID
SECTION IV, EXPERIMENT E-21, AGASSIZ

Plot No.	Fertilizers applied in 1921 (pounds per acre)				Yields and Increases (over check plot) per acre					
	Nitrate of Soda (15% N)	Superphosphate (16% P_2O_5)	Basic Slag (16% P_2O_5)	Muriate of Potash (50% K_2O)	1921 Mangels		1922 (Oats grain)		1923 (Hay)	
					Yields	Increases	Yields	Increases	Yields	Increases
					bush.	bush.	bush.	bush.	tons	tons
11 A	400	500	.....	100	1,785·6	909·1	83·5	9·8	2·628	0·233
B	300	375	.....	75	1,586·4	709·9	78·8	5·1	2·912	0·517
C	200	250	.....	50	1,456·0	579·5	70·6	− 3·1	2·680	0·285
16 A	400	250	250	100	1,665·6	789·1	60·0	−13·7	2·568	0·173
B	300	188	188	75	1,486·4	609·9	55·9	−17·8	2·048	−0·347
C	200	125	125	50	1,356·0	479·5	65·9	− 7·8	2·140	−0·255
17 A	.....	.....	500	100	1,128·0	251·5	64·7	− 9·0	2·228	0·167
B	.....	.....	375	75	1,017·6	141·1	68·2	− 5·5	2·368	0·027
C	.....	.....	250	50	982·4	105·9	65·9	− 7·8	2·584	0·189
Average of check plots					876·5	.....	73·7	.....	2·395	.....

The outstanding feature of the results tabulated in table 17 is the low yields obtained on the basic slag group of plots. In the plots on group 16, when one-half the phosphoric acid was furnished by superphosphate, there appears to have been a sufficiency of this element of plant food in an available condition to give good yields of mangels. When all the phosphoric acid is furnished by basic slag, as in group 17, distinctly lower yields were obtained.

EXPERIMENTS WITH FERTILIZERS, CONDUCTED AT THE BRANCH EXPERIMENTAL FARMS AND STATIONS

Lack of space in this report does not permit of the publication of results from year to year of all the experiments with fertilizers being carried on at the Farms and Stations of the Experimental Farms System. In the following list the titles and nature of the more important projects dealing with fertilizers are given for each Station where such work is being conducted.

CHARLOTTETOWN, P.E.I.

Project C-5.—The influence of manuring and crop rotation on potato yields—to obtain data on the growing of potatoes with "manure alone," "fertilizers alone" and "manure and fertilizers" (1) continuously and (2) in a rotation of potatoes, grain, clover hay and timothy hay.

Project C-8.—Fertilizer formulæ for potatoes—to obtain information with respect to the amount and nature of plant food most profitable for the potato crop.

Project C-26.—Basic Slag Experiment—to compare the effect of fortified slag, Bessemer slag, ground Florida rock phosphate, superphosphate and superphosphate with ground limestone, on crop yields in a three-year rotation of grain, clover hay and timothy hay.

Project C-130.—Malagash salt as a fertilizer for roots and grain—to ascertain the effect of applications of Malagash salt on the turnip, mangel and oat crops.

Project C-142.—Ephos Basic Phosphate Experiment—discussed in this report.

KENTVILLE, N.S.

Project C-12.—Experiment E-21—to obtain data with respect to the most efficient distribution of commercial fertilizers over a three-year rotation.

Project C-13.—Orchard Fertilizer Experiments.

(1) Comparison of different sources of nitrogen, phosphoric acid and potash in varying combinations.
(2) Fertilizer ingredients in varying proportions.
(3) Fertilizers applied at different dates.
(4) Nitrate of soda applied at varying rates with and without phosphoric acid and potash.
(5) Malagash Salt as an orchard fertilizer.
(6) Cyanamide as an orchard fertilizer.

Project C-15.—Experiment No. 5—to ascertain the influence of ground limestone when used in conjunction with fertilizers and to compare various sources of nitrogen and phosphoric acid.

Project C-23.—Ground limestone at different rates per acre.

Project C-26.—Basic Slag Experiment—similar to that outlined for Charlottetown, P.E.I.

Project C-40.—Basic Slag for the improvement of pasture areas.

Project C-102.—A comparison of calcitic and magnesian ground limestone as soil amendments.

Project C-104.—Gypsum and Sulphur Experiment—to determine the effect of gypsum and sulphur on the crop yields of a three year rotation of potatoes, grain and hay.

Project C-130.—Malagash salt as a fertilizer for roots and grain.

Project C-131.—Fertilizers for hemp—the influence of commercial fertilizers on the yield and quality of hemp.

Project C-142.—Ephos Basic Phosphate Experiment—discussed in this report.

Project C-144.—Nitrate of soda for the Strawberry Crop—to ascertain the benefit derived from an application of nitrate of soda to strawberries early in the spring of their fruiting year.

NAPPAN, N.S.

Project C-8.—Fertilizer formulæ for potatoes—as outlined for Charlottetown, P.E.I.

Project C-26.—Basic Slag Experiment—as outlined for Charlottetown, P.E.I.

Project C-102.—A comparison of calcitic and magnesian ground limestone as soil amendments.

Project C-130.—Malagash salt as a fertilizer for roots and grain.

Project C-142.—Ephos Basic Phosphate Experiment as discussed in this report.

FREDERICTON, N.B.

Project C-8.—Fertilizer formulæ for potatoes—as outlined for Charlottetown, P.E.I.

Project C-26.—Basic Slag Experiment—as outlined for Charlottetown, P.E.I.

Project C-25.—Nitrate of soda as a top dressing for hay lands.

Project C-96.—Basic Slag on Pastures Experiment—to compare the stock carrying properties of New Brunswick pasture lands treated with basic slag with pasture receiving no fertilizer treatment.

Project C-98.—Improvement of old pasture—to ascertain the effects of different fertilizer treatments on pasture lands.

Project C-99.—Apple Orchard Fertilizer Experiment—to determine what fertilizer treatment will give best results for a young orchard.

Project C-139, C-155.—An experiment to compare different sources of lime for agricultural purposes.

STE. ANNE DE LA POCATIÈRE, P.Q.

Project C-132.—An experiment with fertilizers, lime and ground limestone to determine the plant food requirements on the heavy clay soil of the district.

CAP ROUGE, P.Q.

Project C-26.—Basic Slag Experiment—to obtain data on the relative influence on crop growth of Bessemer Slag, Fortified Slag, Ephos Rock Phosphate, superphosphate and ground limestone.

Project C-40.—Basic slag on pastures—to ascertain the influence chemically and botanically of basic slag on the herbage of meadows and pastures.

CENTRAL FARM, OTTAWA, ONT.

Project C-26.—Basic Slag Experiment—as outlined for Charlottetown, P.E.I.

Project C-102.—A comparison of calcitic and magnesian ground limestone as soil amendments.

Project C-104.—Gypsum and Sulphur Experiment—to determine the effect of applications of gypsum and sulphur on the crop yields of a three year rotation of potatoes, grain and hay.

Project C-105.—Sources of Organic Matter Experiment—to obtain data with respect to the value of barnyard manure as compared with green manuring (by turning under clover) for vegetable crops.

SUMMERLAND, B.C.

Project C-157.—Commercial fertilizers for the cantaloupe and tomato crops.

Project C-149.—Barnyard Manure and Green Manuring Experiment—to ascertain the value of barnyard manure and green manuring (1) alone and (2) with commercial fertilizers, in a two-year rotation of corn and annual hay under irrigation.

AGASSIZ, B.C.

Project C-110, 158.—An experiment dealing with methods of application of commercial fertilizers for the mangel crop.

SIDNEY, B.C.

Project C-50.—Fertilizer for potatoes—to obtain information with respect to the application of commercial fertilizers for the potato crop under dry seasonal conditions.

Project C-109.—To obtain data with respect to the influence of applications of gypsum, sulphur and lime on crop yields.

Project C-110.—Time of application of fertilizers for the potato crop.

LIMESTONE

Limestones are variable as to composition and hence before a deposit is exploited for the purpose of producing ground limestone for agricultural purposes, it is important that the quality of the rock be determined. Limestones of the highest grade will contain over 95 per cent of carbonate of lime, the remaining 5 per cent being largely inert material, viz., quartz, slate, etc. When the percentages of inert material make up 50 per cent of the rock, the limestone is of very poor quality and unfit for agricultural purposes if better grades can be obtained within a reasonable distance. It may be found that the hauling charges of the ground material will determine in some measure the economy in grinding the lower grade rocks.

Dolomitic or magnesian limestone contains from 20 to 40 per cent of carbonate of magnesia. This limestone, if of high enough grade, will prove suitable for the production of ground limestone.

Ten samples have been submitted to the Division for analysis; the data with locality of occurrence are given in table 18.

TABLE 18.—ANALYSES OF LIMESTONES, 1925 AND 1926

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 ($MgCO_3$)	Remarks
	Ontario	p.c.	p.c.	p.c.	p.c.	
66636	Clarksburg.....	0·31	1·15	54·38	42·96	Dolomitic limestone of exceptionally good quality.
75560	Lot 3, Con. 2, Dymond, Temiskaming.	1·56	0·89	55·01	44·23	Dolomitic limestone of exceptionally good quality.
77212	Fesserton.....	3·74	1·02	94·13	1·70	A calcitic limestone of high quality.
78975	Barton Twp. Quarry (Hamilton).	0·30	0·45	52·20	46·57	A dolomitic limestone of very good quality.
	Quebec					
78787	Drummondville.....	14·08	1·35	81·50	1·49	Calcitic limestone of good quality.
	Nova Scotia					
72126	Huntington.....	20·53	5·34	42·96	30·30	Dolomitic limestone of rather low grade.
79404	Windsor.....	11·74	0·82	82·32	1·67	Calcitic limestone of fair quality.
	British Columbia					
73280	Perry Siding.....	65·52	4·08	18·34	10·91	Of too low a grade to warrant grinding for agricultural purposes.
78279	Cobble Hill, V.I.....	10·80	2·18	67·00	21·47	A dolomitic limestone of very fair quality.
81524	" "	11·26	3·41	65·00	17·86	A dolomitic limestone of very fair quality.

GROUND OR CRUSHED LIMESTONE

The value of ground limestone as a useful soil amendment for many of the soils of Eastern Canada deficient in lime has been clearly demonstrated by investigational work conducted during the past few years. As a result of this work, the crushing of limestone has become an important industry and is carried on by several firms on a fairly large scale particularly in those sections where soil conditions have created a good demand for this material. In some districts in which outcrops of good limestone rock occur, small crushing plants have been established by farmers' organizations through the help of the provincial department of agriculture.

The quality of a crushed limestone and its suitability for employment will depend on its chemical composition and its degree of fineness. A good quality limestone will contain at least 80 per cent of carbonate of lime—or of mixed carbonates of lime and magnesia, as occurring in dolomitic limestones—while those of highest grade will contain 90 per cent and over.

The degree of fineness will determine to a great extent the rate of solution of the ground limestone in the soil and hence the rapidity with which it will correct acidity and furnish lime for plant growth. The finer the limestone the more rapid will be its solution and hence its effectiveness. Generally speaking, if a quick prompt 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.

In the following table (table 19) data of the samples of ground limestone received by the division for analysis and report during the past two years have been tabulated.

TABLE 19.—ANALYSES OF CRUSHED OR GROUND LIMESTONES, 1925-1926

Lab'y No.	Manufacturer or Source	Chemical Analysis				Mechanical Analysis				Remarks
		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	
	Ontario	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	
80047	Dust from stone cutting, Ottawa	0·67	0·55	94·56	1·97	100·0	100·0	85·0	85·0	Of excellent quality and very finely ground.
83513	Billings Bridge, Ottawa	4·42	2·40	89·28	Nil	78·8	58·0	43·6	40·6	Of good quality, but coarsely ground; satisfactory if a quick response is not of first importance.
	Quebec									
81746	Quarry, St. Louis Road, Quebec	89·51	6·43	4·06		.....	.....	.....	.....	Not a limestone; of no agricultural value.
81872	Deschambault Quarry Corporation	0·82	0·76	96·50	Nil	92·8	81·4	60·8	51·8	Of excellent quality and quite well ground.
	New Brunswick									
71557	Demoiselle Creek, Albert Co	12·73	2·39	82·22	2·80	98·08	79·66	50·62	43·72	Satisfactory as to composition and fineness.
71558	Brookville, St. John Co	3·50	0·93	93·71	2·65	100·00	99·75	81·73	66·74	Of excellent quality, finely ground.
71581	Cape Station, Albert Co	10·48	2·72	83·77	2·78	97·56	78·64	45·71	37·61	Of good quality, moderately fine.
71582	" "	21·49	4·25	71·27	2·73	98·29	80·61	52·01	44·67	Of fair quality only, moderately fine.
71583	" "	24·74	4·53	67·01	2·88	98·58	97·55	96·21	95·75	Of rather poor quality, but extremely fine.
	Nova Scotia									
71249	Cumberland Lime and Fertilizer Co., Amherst	4·17	2·05	58·37	35·98	73·79	57·16	39·71	33·44	Magnesian limestones (dolomite) of excellent quality, but quite coarsely ground.
71250	Cumberland Lime and Fertilizer Co., Amherst	4·06	2·57	58·37	35·75	77·47	59·65	42·27	35·84	
71624	Eastern Lime Co., Windsor	10·35	1·79	85·33	2·23	98·49	63·64	26·65	20·67	Of good quality, but coarsely ground.
79405	Windsor	11·01	1·60	82·32	1·13	93·2	80·4	55·6	48·8	Of good quality, moderately fine

MARL

As the value of "liming" for the correction of soil acidity (sourness) becomes more widely recognized, increased attention is being directed to the marl deposits scattered here and there throughout the several provinces of the Dominion. There is yet, however, the need of a wider dissemination of information respecting the nature and value of these deposits, for in their neighbourhood there should be no necessity to purchase ground limestone. They furnish an excellent form of lime for land treatment, one requiring little preparation and one that can usually be obtained at the cost of digging.

In the accompanying table (20) the analysis is presented of thirty-four samples, sent in during the past year from widely distant points in the Dominion. A brief report respecting quality is added.*

Marl or shell marl is a naturally-occurring deposit consisting essentially of carbonate of lime mixed with varying amounts of clay, sand or other inert material.

Some marls are almost pure carbonate of lime, others are more or less impure from the presence of clay, sand or organic matter, etc., as already noted, and these, of course, are of less value agriculturally. A marl containing from 80 to 90 per cent of carbonate of lime may be considered of good average quality.

Usually, as found, marls are soft and pasty in consistency, frequently showing many small shells. On air-drying by a simple exposure they are found to be readily friable, breaking down to a coarse powder which easily permits of uniform distribution on the land. It is seldom that the air-dried material will require any preliminary crushing; it therefore constitutes a very cheap and desirable source of lime, as not infrequently marl may be had for the cost of digging and hauling.

"Indurated" marl is a hard rock-like material with a honey-combed structure. It occurs by deposition from the waters of streams and springs which are rich in carbonate of lime. Large deposits of this material occur in many of the valleys of British Columbia and are composed almost entirely of pure carbonate of lime. A certain amount of crushing is necessary before this type of marl can be used satisfactorily as a soil dressing.

Marl may be used on both heavy clay and light sandy loams and is especially valuable for the former. As a supplier of lime it corrects acidity or sourness, furnishes an element for plant nutrition and promotes nitrification and hence assists in rendering available the soil's store of inert nitrogen. Full advantage should be taken of this cheap and satisfactory source of lime, especially where the deposits occur in the neighbourhood of the farm.

Good quality marl may be known by giving a brisk effervescence on the addition of a few drops of strong vinegar or weak acid.

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* In the larger number of cases the Division has on record information respecting the size, location, etc., of the deposit, but lack of space forbids the publication of these details in this report.

TABLE 20.—ANALYSES OF MARLS (AIR-DRIED) 1924-26)

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.	p.c.
	Ontario						
71580	Nottowa	40·11	3·45	51·40	2·50	2·54	Shell marl of poor quality, but might be used locally.
74979	Perkinsfield	0·63	0·18	93·07	1·93	4·19	Of excellent quality.
75924	Lucknow	3·91	0·58	86·50	2·88	6·13	Of good quality.
77872	Alliston	26·39	0·80	69·00	1·74	2·07	Of fair quality only.
77873	"	48·70	3·33	42·50	2·87	2·60	Of poor quality, but might be used locally.
77874	"	48·15	6·92	40·00	4·38	0·55	" " "
78980	"	57·84	3·20	31·68	3·85	3·43	A low-grade marl, but suitable for local use.
79408	Amyot	69·70	1·87	17·86	7·94	2·63	A very low grade marl, valuable for local use only.
80538	Elora	46·00	5·22	36·70	10·25	1·83	A low grade marl valuable for local use only.
	Quebec						
74202	Paspebiac	9·89	1·04	58·16	1·28	29·63	Marl of fair quality.
75286	St. Alexis de Matapedia	11·10	2·24	72·40	1·97	12·29	Of good quality, but not of highest grade.
80501	Broughton East	5·58	0·20	87·00	0·92	6·30	Shell marl of excellent quality.
83242	New Carlisle	2·37	0·60	90·25	1·66	5·12	Of excellent quality.
	New Brunswick						
78786	Andover	9·99	1·22	75·75	0·50	12·54	Of good quality.
	Nova Scotia						
72127	Huntingdon	73·77	11·18	2·69	3·87	8·49	Sent as a marl, but the percentage of lime is insignificant; it cannot be classed as a marl.
	British Columbia						
71587	Ewing's Landing	24·79	2·45	67·07	4·17	1·52	Of fair quality only.
71738	East Barriere Lake	0·31	0·13	98·51	0·98	0·07	Indurated marl of excellent quality; would require crushing.
71880	Enderby	3·45	.....	67·20	1·74	27·61	Shell marl of good quality.
72188	Longworth Station	13·63	1·30	77·55	3·41	4·11	Disintegrated limestone resembling marl; of good quality.
73253	Grassy Plains, 10 miles south of Francois Lake	11·00	1·47	79·39	4·32	3·82	Of good quality.
73531	Birken	0·38	0·30	97·86	1·25	0·21	Of excellent quality.
75922	Mara	14·18	1·40	80·50	0·98	2·94	Of good quality.
76895	Canal Flats	26·74	2·34	65·50	5·52	.....	Of fair quality.
77859	Beaverley	4·63	0·62	85·75	2·94	6·06	Of good quality.
78609	Grinrod	0·73	0·14	91·00	7·56	0·57	Of excellent quality.
78865	Queens Bay	3·36	1·40	91·50	trace	3·74	Of excellent quality.
80214	Winslow	18·24	3·52	69·12	1·49	7·63	Indurated marl of fair quality.
80627	Alberni	0·42	0·44	95·22	0·76	3·16	Indurated marl of excellent quality.
82557	Salmon Arm	44·38	2·02	48·13	0·87	4·60	Of poor quality, but useful locally.
82708	Arrowhead	0·17		96·50	0·30	3·03	Indurated marl of excellent quality;
83516	Creston	1·64	0·76	93·75	.....	3·85	" " "
83681	Masset	0·33	1·25	94·75	.....	3·67	Of excellent quality.
	Yukon Territory						
82735	Hanson Lake	1·86	0·45	82·00	2·80	12·89	Of good quality.
82736	"	2·35	0·54	85·00	2·63	9·46	Of good quality.

MUCKS, PEATS AND SIMILAR DEPOSITS

The deposits of peat and muck that are to be found more or less in all parts of Canada have been formed by the gradual accumulation of partially decomposed vegetable matter—the remains of successive generations of plants chiefly aquatic—in swamps and bogs, the sites of former lakes and ponds. These have been filled up by the gradual encroachment of vegetation from their shores. This semi-decayed vegetable matter contains valuable plant food. The peat or muck of these deposits have been and are being used to quite a considerable extent in farming practices as sources of organic matter (humus) and

nitrogen and have been found valuable as dressing for both clay loams and sandy loams deficient in these valuable constituents. Many peats and mucks serve admirably in the air-dried condition as absorbent litter. Muck areas also in many cases may be reclaimed and made fairly productive soils.

DEFINITIONS OF PEAT AND MUCK

Peat may be briefly defined as partially-decayed vegetable matter, usually showing the structure of the plants from which it is formed. It is often more or less fibrous or woody, sometimes moss-like; and varies in colour from a light to dark brown when air-dried. As a rule it contains only small amounts of mineral matter (sand, silt and clay).

Muck is essentially vegetable organic matter in which decomposition or decay has reached a more advanced stage than in peat. It may or may not contain more or less clay and sand. As a rule the root fibres and plant tissues are usually well broken down, the original structures largely destroyed, and the bulk of the muck is of a black or dark brown oozy consistency when wet. Certain mucks can be readily reduced to a powder when dry, others cake on drying into more or less hard and refractory masses.

COMPOSITION OF PEAT AND MUCK

Peat and muck are composed essentially of organic matter mixed with varying amounts of mineral matter—clay, sand etc. In peats proper the percentage of clay, sand or other rock matter is usually very small, frequently less than 2 per cent in the air-dried material but may in many cases and more especially in true mucks reach 50.0 per cent or over. The vegetable matter of mucks and peats contains a notable percentage of nitrogen, usually between 1.0 to 2.0 per cent in the air-dried material. Mucks as a rule contain a higher percentage of nitrogen than peats. When freshly dug peat and muck contain approximately 70 to 80 per cent of water, which, as a rule, is reduced on air-drying to about 20 per cent.

USES AND TREATMENT OF PEAT AND MUCK AS A SOIL AMENDMENT

The agicultural value of any particular sample of peat or muck is dependent upon the percentages of nitrogen and organic matter which it contains and its state of decomposition. Since the organic matter is formed in many stages of decay, it follows that the fertilizing effect of different samples is very variable, but in none of them can we suppose the nitrogen to be in such combinations as to be immediately available to crops. Mucks, by reason of their being much further decomposed and broken down than peats are to be preferred for soil dressings.

Speaking generally, the application of peat and muck in the crude and raw condition is not to be advised for, as already pointed out, their plant food does not exist in immediately available forms. Fermentation is necessary to set it free. This may be accomplished by the following treatments:—

The material after digging (preferably in the fall) should be piled and allowed to remain exposed to the action of the air and frost throughout the winter, if possible. The air-dried and roughly powdered peat or muck may then be used as an absorbent in and about farm buildings or it may be composted with manure.

40000—3

Used as an absorbent the air-dried material makes an excellent medium for soaking up liquid manure—a fertilizing material rich in nitrogen and potash —likely to go to waste. It may be placed behind the stock in the gutter in the cow barn or any place in which liquid is apt to accumulate, absorbing from 2 to 6 times its weight of liquid. Its use keeps the buildings sweet and clean and facilitates the cleaning of the stables. The resulting manure, now largely increased in bulk and value may be taken at once to the fields or may be allowed to stand in a heap for some little time. Fermentation will proceed quite rapidly and the nitrogen contained in the organic matter of the peat and muck will be largely rendered available to plant use. Owing to its coarser and more fibrous nature peat often makes a better absorbent than muck.

Peat and muck may be composted with barnyard manure and their fertilizing value thereby greatly enhanced. Sufficient manure to set up active fermentation in the peat and muck should be used to bring about the decomposition of the latter. One method of constructing a compost heap is to spread the peat or muck on the ground to a depth of 1 or 1½ feet making the width of the heap about 8 to 10 feet and length in accordance with the size desired. Cover this with a layer of manure from 8 to 12 inches thick, and continue with alternate layers of peat or muck and manure until the heap is 4 to 5 feet high. The heap should be *kept moist* but not saturated and after standing for a few weeks should be forked over. This operation may be repeated about once a month for three or four months moistening if necessary with liquid manure or water, when the compost should be in excellent condition for application to the soil.

Peat and muck treated as above outlined make valuable dressings for both clay loams and sandy loams, and furnish an increased bulk of good manure which is greatly to be desired on farms of low fertility and on which the supply of manure is usually limited. Lime and wood ashes may be used in composting the peat or muck to destroy acidity; but these materials should not be used with manures in the heap.

MUDS

Muds are extremely variable in composition but in the majority of cases are composed essentially of sand, silt and clay in varying proportions. Some muds, particularly mussel muds are characterized by their comparatively high content of carbonate of lime and muds of this class will be found of special value as a dressing for soils deficient in lime. Usually, the percentages of nitrogen and organic matter in muds are not high and a great many of these deposits are of little value compared with mucks in supplying these constituents to the soil. Occasionally, however, they contain fair percentages of organic matter and these will prove of value in improving the mechanical condition of worn and exhausted soils.

In table 21 are presented data from the analysis of 42 samples recently examined in these laboratories. They have been arranged according to the province in which they occur. The series includes mucks, peats, lake muds, mussel muds, etc. Each of these samples has been reported upon more or less fully to the sender but for the purposes of this report, the agricultural value has been briefly stated.

TABLE 21.—ANALYSIS 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
		p.c.	p.c.	p.c.	p.c.	p.c.	
	Ontario						
60065	Black mud, Keene.....	6·49	20·02	0·81	.....	.....	Well decomposed, suitable for application to soils poor in humus and nitrogen.
60244	Lake mud, Milford Haven	3·05	11·47	0·51	.....	.....	Of small manurial value, but worthy of trial.
62367	Lake mud, Pembroke....	3·46	19·64	0·88	.....	.....	Of small but appreciable value for soils deficient in humus.
66216	Muck, Stratford.....	12·99	75·24	1·66	6·12	5·65	Valuable for use as a bedding material or for composting.
69404	Pulverized peat, Alford...	18·04	71·76	1·33	6·45	3·75	Would prove an excellent "conditioner" for fertiliser mixtures.
69573	Peat, Durham.....	7·61	89·89	.....	1·37	1·13	When air-dried would make good litter, or may be used as a fuel.
74062	Leaf mould, Toronto.....	26·13	52·98	1·35	13·43	7·46	Suitable for use as an absorbent litter or for composting.
80631	Leaf mould, Deloro.....	8·33	31·64	1·22	9·72	50·31	May be used to advantage on soils poor in humus and nitrogen.
81676	Muck, Sheguiandah.....	14·06	65·83	2·34	9·19	10·92	Good quality for use as an absorbent or for composting.
	Quebec						
60380	Pond mud, Knowlton.....	3·52	16·87	0·67	.....	.....	Of poor quality, but might be employed as an amendment to poor soils.
60670	Marsh mud, Paspebiac...	1·52	5·86	0·22	11·98	80·64	Of very little value as a soil amendment.
62407	Peat, Lac la Tortue.....	7·11	90·72	2·07	.....	.....	Valuable if composted or used as an absorbent.
62625	Peat, St. Donat.....	7·58	82·95	3·02	.....	.....	Good quality for use as a compost or absorbent.
64237	Black mud, Chelmsford..	47·13	10·96	.....	.....	0·61	Of no agricultural value; contains 37·80 p.c. manganese oxide.
79946	Mussel mud, Bonaventure East.	7·50	7·40	0·25	14·23	70·87	Of extremely small fertilizing value.
80749	Muck, Metis Beach.....	35·62	53·35	0·97	9·62	0·91	Suitable for soils poor in humus and nitrogen; for best results should be composted.
81010	River mud, Restigouche River.	0·82	5·58	0·13	10·54	83·06	Of no fertilising value.
83594	Pond mud, New Richmond Station.	5·94	77·96	2·08	3·25	12·85	Of good quality, could be used as an absorbent or for composting.
	New Brunswick						
55005	Mussel mud, Tracadie....	9·29	5·04	0·21	43·97	41·70	Of value for soils poor in lime; contains 37·0 per cent carbonate of lime.
58241	Mud, Upper Charlo.....	13·00		0·25	20·67	66·33	Of poor quality and of little o no value for land treatment.
58298	Black muck, W. Bathurst	55·49		1·25	13·69	30·82	Of fair quality for composting or use as a litter; in its present condition might improve the mechanical condition of loose soils.
59705	Black muck, Tilley Road	26·80	71·68	0·76	.....	.....	Valuable for composting or for use as an absorbent.
65318	Mud, Burton.....	13·29	82·05	1·00	2·10	2·56	Fairly well decomposed; valuable as a source of humus for poor soils.
65319	" "	5·64	42·30	0·90	3·25	48·81	Low in organic matter; of little agricultural value.
78440	Turf, St. Andrews.....	7·60	30·05	1·12	14·37	47·98	If composted might prove of some value as a soil dressing.
80918	Lake mud, Victoria Co...	8·16	40·13	1·29	2·79	48·92	Of some value for soils low in organic matter; improved by composting.
	Nova Scotia						
56369	Mud, Huntington.....	25·71		0·70	10·34	63·95	Of poor quality, but might prove of small value for the dressing of soils.
56370	" "	38·28		0·86	8·85	52·92	
56371	" "	32·00		0·74	7·38	60·62	
71410	Muck, Gardiner Mines....	8·24	31·83	1·05	18·73	41·70	Might be used on soils low in organic matter.
71411	Peat, Gardiner Mines.....	11·25	58·24	2·31	16·51	14·00	Suitable for employment as a litter or for composting.

TABLE 21.—ANALYSIS OF MUCKS, PEATS AND SIMILAR DEPOSITS—*Concluded*

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
		p.c.	p.c.	p.c.	p.c.	p.c.	
	Prince Edward Island						
59563	Mud, O'Leary.....	5·81	11·63	0·55	.....	.....	Of small fertilizing value, but may prove beneficial on exhausted soils.
59564	" "	4·53	12·15	0·56	.....	.....	
63432	Oyster mud, Charlottetown.	1·80	15·15	0·21	43·25	39·80	Would make a valuable soil amendment for soils in need of lime; contains 40·0 per cent carbonate of lime.
63917	Mussel mud, St. Peter's Bay.	2·48		0·12	70·92	26·60	A useful amendment for soils deficient in lime, contains 67 p.c. carbonate of lime.
66077.	Marsh mud, Annandale...	5·26	34·51	1·41	10·01	50·22	Of slight value for poor soils.
	Alberta						
62703	Peat, Banff.....	12·73	60·51	1·87	15·76	11·00	Turf-like and fibrous. Valuable only as an absorbent or in compost.
	British Columbia						
60329	Peat, Coombs, V.I.....	10·95	81·45	3·04	.....	.....	Fibrous; valuable for composting or for use as an absorbent.
63264	Slough mud, Wynndel....	4·98	21·03	0·74	11·42	62·57	Possibly of some value for poo soils.
71879	Muck, Enderby.....	16·43	67 01	2·49	15·20	1·36	Well decomposed and containing 11 per cent carbonate of lime.
72992	Peat, Elko.....	19·18	72·72	2·67	6·21	1·89	Fibrous; valuable for composting and use as a litter.
80539	Lake mud, Millstream...	7·46	70·21	2·58	3·03	19·30	Valuable, if composted.

MISCELLANEOUS FERTILIZER MATERIALS

ASHES

Lab'y. Nos. 77533 and 78278

Flue ashes from a cement burner in Vancouver Island, B.C. As received the samples were in the form of a light grey fairly fine powder. This material was being used as an amendment for acid loams and peat soils deficient in potash.

ANALYSIS

—	Lab'y No. 77533	Laby' No. 78278
Mineral matter insoluble in acid (including soluble silica).....	23·25	27·39
Oxide of iron and alumina.....	9·38	0·65
Lime (CaO).....	43·01	38·78
Magnesia (MgO).....	0·81	2·34
Potash (K_2O).....	0·95	1·33
Sulphur trioxide (SO_3).....	0·21	—
Carbon dioxide, etc.....	22·39	29·51
	100·00	100·00

These ashes—both samples—contain from 50 to 60 per cent of calcium carbonate and about 25 per cent of calcium silicates; they are therefore of considerable value for soils in need of lime.

The small amount of potash (varying from less than 1 per cent to slightly over 1 per cent) imparts little if any value to the material as a fertilizer.

For loams and peat soils which are acid in nature these flue ashes applied at the rate of from 2 to 4 tons per acre would undoubtedly prove beneficial in correcting acidity and furnishing lime, but whether such an application would be profitable or not would depend on the cost of the material.

Lab'y. No. 81309

Ashes from a tannery, mixed with hardwood and soft wood ashes, at Champigny, P.Q.

ANALYSIS

	Per Cent
Mineral matter insoluble in acid	71.77
Loss on ignition (Charcoal, etc.)	6.50
Carbonate of lime	12.30
Phosphoric acid	.71
Potash (soluble in water)	.50

These ashes are of very poor quality; their percentages of plant food elements—phosphoric acid and potash—are very small. Their value lies in their carbonate of lime content which would render them useful for acid soils and soils in need of lime.

LIME REFUSE AND MINING BY-PRODUCTS

Lab'y. No. 60314

Slag from smelter at Trail, B.C. This sample of slag was found on analysis to be of practically no value as a fertilizer. The only element of plant food present is phosphoric acid—and the amount is negligible, viz., 0.383 per cent. On treatment with strong acid it yielded 16.5 per cent of lime but this is not in a form valuable for correcting soil acidity.

Lab'y. No. 71628

"Lime Sludge" from pulpwood plant at La Tuque, Que. Received as a greenish coloured sludge having a disagreeable odour.

ANALYSIS

	Per cent
Water	46.67
Organic and volatile matter	1.10
Carbonate of lime ($CaCO_3$)	48.70
Hydrated lime ($Ca(OH)_2$)	0.97
Oxide of iron and alumina ($Fe_2O_3+Al_2O_3$)	0.88
Phosphoric acid (P_2O_5)	0.15
Silica (SiO_2)	0.60
Magnesia (MgO)	0.30
Sulphur as sulphate sulphur	0.16
Sulphur as sulphite sulphur	0.02
Sulphur as sulphide sulphur	0.34
Undetermined	0.11
	100.00

This product dries by exposure to a fine powder with a light greenish tinge (water –.55 per cent). If dried it would prove an admirable amendment for soils in need of lime, though owing to the fact that it contains a small but appreciable percentage of sulphur compounds not fully oxidized, it might be desirable to institute some practical field experiments to secure data in respect to possible harmfulness to growing vegetation.

Lab'y. No. 74798

Lime-kiln waste from Sheguiandah, Ont. Received in a very wet pasty condition.

ANALYSIS

	Per cent
Moisture	46.00
Mineral matter insoluble in acid	1.69
Oxide of iron and alumina	2.11
Lime (CaO)	22.18
Magnesia (MgO)	11.80
Undetermined (Carbon dioxide, etc.)	16.22
	100.00

This waste consists essentially of slaked lime mixed with a certain proportion of unburnt limestone. The original limestone—the source of this product is evidently dolomitic or magnesian. If dried it should prove a useful source of lime for acid soils and soil generally in need of that element.

TOBACCO BY-PRODUCTS

Lab'y. No. 65613

Pulverized tobacco stems from Montreal, Que., received in the form of a very fine buff-coloured powder.

ANALYSIS

	Per cent
Moisture	9.16
Loss on ignition (organic and volatile matter)	63.62
Mineral matter soluble in acid	24.56
Mineral matter insoluble in acid	2.66
	100.00
Fertilizing constituents—	
Nitrogen	1.95
Phosphoric acid	0.54
Potash, total	8.73
Potash, water soluble	8.49

This waste product has a high value as a potassic fertilizer. Its nitrogen (almost 2 per cent) further adds to its value, particularly if the "stems" are composted.

Lab'y. No. 69782

Tobacco ashes from Champigny, Quebec.

ANALYSIS

	Per cent
Potash, water soluble	13.46
Phosphoric acid	2.41

These ashes contain a comparatively large proportion of charcoal and inert matter (sand, etc.), yet nevertheless they possess a high fertilizing value. In addition to the percentages of potash and phosphoric acid recorded above, they contain about 20 per cent of carbonate of lime, enhancing the value of the ashes as a soil amendment.

MARINE MUD

Lab'y. No. 60484

Submitted as decayed sea vegetation, but on examination it proved to be more of the nature of marine mud. From a deposit near Halifax, N.S., at the Northwest Arm and stated to be some eighteen feet in thickness and covering

an area of about five acres. As received it was a very soft and oozy mud, black, essentially clay, but containing some plant structures e.g. eelgrass, pieces of roots and a number of shells (several species). On the whole, the material seemed to be fairly uniform and its organic content well decomposed.

When air-dried by exposure it formed into easily broken masses or lumps of a dark greyish colour showing the presence of weeds and shells.

The correspondent wished to know the fertilizing value of the material.

ANALYSIS

—	As received	Air-dried
Water	60·75	4·80
Organic matter (loss on ignition)	5·44	13·20
Mineral matter, soluble in acid	13·46	32·63
Mineral matter, insoluble in acid	20·35	49·37
	100·00	100·00
Carbonate of lime ($CaCO_3$)	3·67	8·90
Phosphoric acid (P_2O_5)	0·18	0·44
Potash (K_2O)	0·59	1·43
Nitrogen	0·21	0·50

This mud possesses a certain small value for its plant food content but it is to be regarded as an amendment rather than as a fertilizer. Its percentages of phosphoric acid and potash do not exceed those in good soils, though possibly these elements are present in a fairly assimilable form. In organic matter and nitrogen this mud may, in some measure, be compared with a mucky soil, i.e. these constituents are in notable though by no means large amounts.

Possibly its chief value would lie in its carbonate of lime content which would render it serviceable as an amendment for soils in need of lime.

In any use of this material it should be exposed to the air as by spreading on the land before incorporating it with the soil.

SEAWEED

Lab'y. No. 63132

Seaweed (*Fucus serratus*) commonly known as serrated wrack, from Pictou Co. N.S.

ANALYSIS

	Per cent
Moisture	14.96
Organic matter	74.10
Ash	10.94
	100.00
Nitrogen	1.13
Phosphoric acid	0.18
Potash	1.16

This is not one of the richer seaweeds but it has a distinct fertilizing value and could be used as a soil dressing if the cost of hauling is not too great.

EEL GRASS ASH

Lab'y. No. 64221

Eelgrass ash from the burning of grass wrack (*Zostera marina L.*) collected near the village of Caraquet. N.B.

ANALYSIS

	Per cent
Moisture	0.94
Charcoal	7.84
Mineral matter insoluble in acid, including sand	67.42
Lime (CaO)	7.23
Magnesia (MgO)	2.20
Phosphoric acid (P_2O_5)	0.44
Potash (K_2O)	0.93
Undetermined (carbonic acid, etc.)	13.00
	100.00

Though of some fertilizing value the percentages of phosphoric acid and potash fall much below those of unleached wood ashes or of the ash of true seaweed.

BAT GUANO

Lab'y. Nos. 60425, 60614 and 60615

Bat guano from deposits in Colombia, South America. *No. 60425* from Cartagena, as received was fairly dry, of a medium brown colour, in soft lumps and granules and containing some rock fragments.

No. 60614: from Fort Angel, as received was damp, of a deep rich brown colour, fairly uniform throughout and in a soft mellow condition.

No. 60615: from Fort Fernando, as received was in the form of very wet brownish-black plastic lumps, which, on air-drying become fairly hard and brittle.

ANALYSIS

—	No. 60425 Cartagena	No. 60614 Fort Angel	No. 60615 Fort Fernando
Moisture	13·53	32·30	44·98
Organic and volatile matter	37·91	23·63	14·18
Mineral matter soluble in acid	34·65	28·57	24·92
Mineral matter insoluble in acid	13·91	15·50	15·92
	100·00	100·00	100·00
Nitrogen, ammoniacal	1·09	0·33	0·13
" nitrate	2·58	1·45	0·70
" organic	3·36	2·04	1·29
" total	7·03	3·82	2·12
Phosphoric acid	6·93	6·33	4·60
Potash	1·33	1·07	0·41
Common salt, as calculated from chlorine determinations	1·58	0·51	2·06

These data show considerable differences in composition and fertilizing value between the several samples.

Bat guano has been found a valuable fertilizer, furnishing more particularly nitrogen and phosphoric acid in notable quantities. It has been used with benefit for garden and green-house crops.

Since this product is somewhat variable in respect to its plant food content, it should be purchased only on guaranteed analysis.

FISH SCRAP

Lab'y. Nos. 58500 and 58985

Fish scrap from Walsh Fisheries, Grand River, Gaspé, P.Q. As received, brownish white, fairly dry, powdery to coarse, containing coarse particles presumably of bone.

ANALYSIS

—	No. 58500	No. 58985
Moisture	6·35	4·29
Mineral matter insoluble in acid	0·24	1·16
Nitrogen	8·62	5·80
*Phosphoric acid	5·80	4·47
Potash	trace	trace
*Equivalent to phosphate of lime	12·67	9·76

No. 58500 is the more valuable of the two, being richer in both nitrogen and phosphoric acid.

Fish scrap of this character is a valuable fertilizer. If supplemented with potash (*e.g.* muriate of potash) it would make a complete and effective fertilizer mixture.

Lab'y. No. 75118

Fish waste, from West St. John, N.B. As received, with strong fishy smell, but not decomposed or putrid; almost pasty mixture of fish bones, heads, skins, fins, scales and entrails with a little flesh. When air dried it is easily reduced to powder.

ANALYSIS

	Per cent
Moisture	55.76
Mineral matter insoluble in acid (sand, etc.)	0.06
Nitrogen	3.95
Phosphoric acid	2.77
Fat	4.17

Though, as received, it contains notable percentages of nitrogen and phosphoric acid, drying to, say, 10 per cent of moisture is to be advised unless immediate application is possible. With its present water-content it would readily "heat" and become offensive and difficult of application. If dried as suggested it would be practically twice as rich in nitrogen and phosphoric acid and, further, it could be ground and safely stored—thus concentrating it and improving it in respect to distribution and keeping qualities.

TANKAGE

Lab'y. No. 77581

Meat and bone scrap forwarded by the Superintendent, Experimental Station, Cap Rouge, who writes that he is informed that it is manufactured from the rendering of horse and cattle carcasses, in the preparation of glue.

ANALYSIS

	Per cent
Moisture	3.34
Organic matter	41.75
Mineral matter insoluble in acid	3.05
Mineral matter soluble in acid	51.86
	100.00
Nitrogen	4.34
Phosphoric acid*	17.67

*Equivalent to 38.59 per cent bone phosphate.

In its percentages of nitrogen and phosphoric acid this product ranks about midway betwen tankage and bone meal.

BURNT SLAUGHTER-HOUSE WASTE

Lab'y. No. 75285

Offal from slaughter house at Davidson, Sask. result of burning bones and slaughter house offal with manure. As received it was a mixture of ashes and burnt bones.

ANALYSIS

	Per cent
Mineral matter insoluble in acid	18.92
Phosphoric acid*	28.54
Potash, water soluble	1.95

*Equivalent to 62.30 per cent bone phosphate.

Although the phosphoric acid for the most part is not in an immediately available condition, the material is of very considerable value as a phosphatic fertilizer. The small but appreciable percentage of potash enhances the value of this product. The nitrogen present in the orginal offal was of course dissipated in burning this waste.

DRIED BLOOD

Lab'y. No. 83751

Dried blood meal from City Renderers Ltd., Montreal, P.Q. Examined for the Horticultural Division. As received: quite finely ground, reddish brown powder in good condition.

ANALYSIS

	Per cent
Moisture	16.28
Nitrogen	10.52
Phosphoric acid	3.74

This sample is a good example of the dried blood usually sold for fertilizer purposes and which contains from 6 to 12 per cent of nitrogen and 3 to 4 per cent of phosphoric acid. Looking to good storage qualities, this blood meal contains a rather high percentage of moisture.

Of all sources of organic nitrogen, dried blood is no doubt the most valuable. It is best adapted to soils which are warm, moist, and well aerated.

GYPSUM

Gypsum is a naturally-occurring sulphate of lime; finely ground it is known as land plaster.

Gypsum may be valuable agriculturally in furnishing lime for plant growth, as it is fairly soluble in water, but since this lime is combined with sulphuric

acid and is present in a neutral condition it follows that *gypsum has no value for the treatment of sour or acid soils.* For this purpose it cannot take the place of quicklime, slaked lime, marl or ground limestone, which, as is known are essentially alkaline in character.

The two chief agricultural functions of land plaster are its property of flocculating clay and its effect or influence on the insoluble potash compounds setting free this element in forms available for plant use. The first of these functions makes it valuable for the dressing of heavy clay loams, which it improves in tilth by rendering them less plastic, more open and friable; in a word, mellower and more easily worked. The second rôle spoken of constitutes it an indirect potash fertilizer, though of course, it does not add to the sum total of the soil's potash. It is this property that makes land plaster specially beneficial as a top dressing for clover, a crop that particularly responds to potash manuring. The usual application is in the neighbourhood of 500 pounds per acre.

Four samples of this mineral were recently analysed, furnishing the following data:—

Constituent	Lab'y No. 61903	Laby' No. 62969	Lab'y No. 69768	Lab'y No. 83179
	p.c.	p.c.	p.c.	p.c.
Sulphate of lime ($CaSO_4.2H_2O$)	53·50	79·02	79·87	95·59
Carbonate of lime ($CaCO_3$)	12·89	18·17	8·93	2·68
Carbonate of magnesia ($MgCO_3$)	10·22	3·10	1·59	trace
Oxide of iron and alumina ($Fe_2O_3.Al_2O_3$)	3·15	trace	1·40	trace
Mineral matter insoluble in acid	20·40	.....	8·21	0·53

Lab'y No. 61903

Low grade gypsum from Almonte, Ont. Received in the form of a fine grey powder which effervesces on the addition of dilute acid.

This sample contains over 20 per cent of inert rock matter; nevertheless with a content of over 53 per cent of sulphate of lime and 23 per cent of mixed carbonates of lime and magnesia, it would prove a useful amendment for the improvement of heavy clay loams, and would be valuable more particularly for clover and other legume crops.

Lab'y No. 62969

This sample was from a deposit near Keremeos on the Similkameen river, B.C. Received in the form of a cream-coloured earthy powder which effervesces strongly on addition of dilute acid.

This material consists of sulphate of lime (approximately 80 per cent) with a certain amount of carbonate of lime.

Lab'y No. 69768

This specimen was from a deposit on the Basque Ranch, Ashcroft, B.C.

This gypsum is not of the highest grade but may be considered of fair quality. It would prove useful as a soil amendment.

Lab'y No. 83179

This sample from Port Mann, B.C., was received in the form of a light pinkish white powder, giving a slight effervescence on addition of dilute acid.

The data show this material to be gypsum of very high quality.

DIGESTER LIQUOR

Lab'y. No. 83854

This liquor from Eburne, B.C., resulted from the digesting of meat and bone refuse. As received it had a somewhat unpleasant odour and was in a fermenting and gassy condition. The sender wished to know its fertilizing value and the best use to which the liquor could be put.

ANALYSIS

	Per cent
Water	92.18
Organic matter*	7.55
Ash or mineral matter	0.27
	100.00
*Containing nitrogen	1.11

The fertilizing value of this liquid lies in its nitrogen content, which is notable, amounting to practically 22 pounds per ton of liquid.

It could be used directly on pasture and hay lands though before application it should be well diluted, say, with two or five times its volume of water. Possibly the best method of handling and conserving this liquor would be to mix it with barn manure provided there is sufficient straw or other absorbent to hold it. It could also be used in making compost—as with muck, peat or other waste material.

This liquid is certainly too valuable to be allowed to run to waste; judiciously used it would prove a useful nitrogenous fertilizer.

FECALIN

Lab'y. No. 77850

This "liquid fertilizer" from Messrs. Fainer and Giesskann, Montreal, was submitted to analysis at the request of the Fertilizer Division of the Seed Branch and the following data obtained:—

	Per cent by weight
Ammoniacal nitrogen	1.70
Nitrate nitrogen	2.04
Total nitrogen	3.74
Phosphoric acid (P_2O_5)	2.30
Potash (K_2O)	3.00

KIRKLAND'S WEED EXTERMINATOR

Lab'y. No. 79816

Manufactured at Qu'Appelle, Sask., and submitted by the Superintendent of the Experimental Farm, Brandon, Man. Received in the form of a dry, greyish powder with faint pinkish tinge. It is claimed by the manufacturers that this material will destroy all weeds and weed seeds in the soil within a few days after application; furthermore it is claimed that at the end of ten days the chemical is no longer detrimental to crop growth and the land can be sown to grain. The chemical, it is stated then has manurial value.

This preparation is essentially a mixture of hyposulphite (thiosulphate) of soda, sulphide of soda and air-slaked lime (containing carbonate), together with a small amount of an arsenical compound (probably arsenite of lime) and about 1 per cent of nitrogen presumably as a compound of ammonia.

Though this preparation might be expected to possess some merit as a weed destroyer, and possibly subsequently act to a certain degree as a nitrogenous fertilizer it is doubtful if it would be found sufficiently satisfactory in either rôle to be worth using.

BROKEN SEA SHELLS

Lab'y. No. 71586

Broken shells submitted from St. John's, Newfoundland.

This sample was examined by the Palaeontological Division of the Geological Survey, which reported as follows: About nine-tenths of the material consists of the barnacle *Balanus crenatus*, *Mytilus edulis* the blue shell, is fairly abundant. The gasteropod *Littorina rudis* is represented by one specimen and a few fragments only.

ANALYSIS

	Per cent
Carbonate of lime ($CaCO_3$)	88.95
Carbonate of magnesia ($MgCO_3$)	2.01
Oxide of iron and alumina ($Fe_2O_3+Al_2O_3$)	0.61
Mineral matter insoluble in acid	7.21
Undetermined	1.22
	100.00

These shells contain in the neighbourhood of 90 per cent carbonate of lime with a little carbonate of magnesia. The inert foreign matter—largely gravel—is approximately 7 per cent.

If ground to a satisfactory degree of fineness the product would be useful as an amendment for soils in need of lime.

DRIED OAK LEAVES

Lab'y. No. 78284

From Toronto, Ont. The leaves had been gathered in the fall, dried and then rubbed through a half-inch sieve.

ANALYSIS

Moisture	9.96
Organic matter*	35.20
Mineral matter soluble in acid	8.15
Mineral matter insoluble in acid (mostly sand)	46.69
	100.00
*Containing nitrogen	0.80

The data show that these leaves contain a considerable proportion of adherent soil which greatly reduces the proportion of organic matter. This material possesses a small but appreciable fertilizing value and might be advantageously used as a compost with manure.

SOILGRO AND SOILGRO BACTERIA FOOD

These preparations of the Earth-Ritch Ltd., Toronto, were examined as to plant food content at the instance of the Dominion Agricultural Bacteriologist.

Lab'y No. 79604

"Soilgro, a brown turbid liquid smelling like sewage; possibly liquid manure or manurial extract.

	Per cent
Total solids at 105° C	0.16
Total solids after ignition (ash)	0.10
Nitrogen	0.006
Phosphoric acid (P_2O_5)	0.003
Potash (K_2O)	0.015

Lab'y. No. 79603

Soilgro Bacteria Food. This material has the appearance of a sandy soil with a certain admixture of horse manure. It was moist (water—20.4 per cent) and practically odorless.

ANALYSIS OF AIR-DRIED MATERIAL

	Per cent
Moisture	1.31
Organic matter	9.78
Mineral matter soluble in acid	6.51
Mineral matter insoluble in acid	82.40
	100.00
Nitrogen	0.35
Phosphoric acid (P_2O_5)	0.307
Potash (K_2O)	0.504

SUGAR BEETS FOR FACTORY PURPOSES

The chief object of the inquiry is to determine the influence of seasonal and soil conditions on the quality of the sugar beet as grown at a number of points throughout the Dominion. Incidentally, it has been serviceable in ascertaining the differences in sugar content which may exist between strains or varieties grown under the same seasonal conditions and between beets from imported and home-grown seed respectively. The relationship between size, shape, etc. and sugar content has also been traced.

The outstanding result of this investigation, begun in 1902 and carried out so far as the growing of the experimental beets is concerned at the several Farms and Stations of the system, is that beets of excellent quality can be grown in a great many widely distant districts of the Dominion. The records of this work have been found of particular value for those seeking information respecting the possibilities of various parts of Canada for beet sugar manufacture, that is, in so far as the growing of beets suitable for sugar production is concerned.

The results now recorded are from beets grown in 1925 at 17 Farms, Stations and substations in the system, as follows: Prince Edward Island: Charlottetown; Nova Scotia: Kentville and Nappan; New Brunswick: Fredericton; Quebec: Lennoxville, Cap Rouge and Ste. Anne de la Pocatière; Ontario: Ottawa; Saskatchewan: Rosthern, Scott and Indian Head; Alberta: Fort Vermilion, Lacombe and Lethbridge; British Columbia: Sidney, Invermere and Summerland.

Eight stocks of seed were used, seven being obtained from the Dominion Sugar Co., Chatham and Wallaceburg, Ont., who for a number of years past have generously donated the seed for this inquiry. The following varieties were imported by the company: Dieppe, Dr. Bergman, Schreiber & Sons, Horning, Rabbethge & Giesecke and Henning and Harving; the seed entitled "Home Grown" was from the company's seed farm near Kitchener, Ont. This latter seed is consequently of purely Canadian origin though the stock we understand was originally imported from Russia. The variety Vilmorin's Improved was imported by us specially for this investigation from Messrs. Vilmorin, Andrieux et Cie., Paris, France.

TABLE 22.—SUGAR BEETS GROWN ON THE DOMINION EXPERIMENTAL FARMS, 1925

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.
Dieppe	Charlottetown, P.E.I.	18·62	89·93	2	..	13	640
	Kentville, N.S.	18·98	87·68	..	13	14	1,568
	Nappan, N.S.	20·53	92·81	1	1	13	1,566
	"	18·57	87·10	1	3	13	1,566
	Fredericton, N.B.	19·04	92·23	1	8	14	136
	Lennoxville, P.Q.	17·59	90·28	1	8	13	1,200
	Ste. Anne de la Pocatière, P.Q.	21·05	85·23	1	4	..	....
	Ottawa, Ont.	15·24	83·89	..	12	10	665
	"	15·70	83·99	..	13	10	665
	Rosthern, Sask.	14·18	75·84	1	..	8	104
	Scott, Sask.	14·91	80·23	..	11	14	....
	Indian Head, Sask.	17·10	93·46	1	6	7	125
	Lacombe, Alta.	12·66	71·64	..	13	12	602
	Lethbridge, Alta. (irrigated)	18·42	85·76	1	15	29	180
	Invermere, B.C.	21·91	89·69	1	1	15	1,073
	Summerland, B.C.	20·90	89·71	3	7	17	838
	Saanichton, B.C.	19·25	86·42	1	2	7	960
Dr. Bergman	Charlottetown, P.E.I.	19·29	93·76	1	14	13	1,360
	Kentville, N.S.	18·39	87·98	1	4	16	1,264
	Nappan, N.S.	19·74	89·76	1	1	14	433
	"	19·50	89·60	..	14	14	433
	Fredericton, N.B.	20·14	89·71	1	1	13	1,483
	Lennoxville, P.Q.	17·46	89·60	1	6	15	600
	Ste. Anne de la Pocatière, P.Q.	19·88	84·37	1	8	12	1,410
	Ottawa, Ont.	15·42	86·54	..	12	11	6
	"	16·72	90·40	..	4	11	6
	Rosthern, Sask.	14·56	78·86	1	..	8	1,226
	Scott, Sask.	14·74	72·19	..	9	13	1,000
	Indian Head, Sask.	16·44	89·91	1	4	8	200
	Lethbridge, Alta. (irrigated)	16·21	82·04	2	4	..	....
	" (non-irrigated)	14·92	79·73	2	10	..	....
	Invermere, B.C.	21·74	91·22	1	..	14	1,621
	Summerland, B.C.	21·44	91·22	3	7	18	1,322
	Saanichton, B.C.	19·05	88·41	1	5	6	760
Henning & Harving	Charlottetown, P.E.I.	19·31	90·63	1	13	16	40
	Kentville, N.S.	18·37	88·45	1	4	16	1,528
	Nappan, N.S.	20·49	92·66	..	15	13	100
	"	17·76	85·51	1	9	13	100
	Fredericton, N.B.	17·56	87·46	1	4	13	1,373
	Lennoxville, P.Q.	16·04	85·84	1	6	15	1,000
	Cap Rouge, P.Q.	20·48	90·01	..	12	8	560
	Ste. Anne de la Pocatière, P.Q.	19·37	80·07	1	9	12	103
	Ottawa, Ont.	14·79	86·02	1	..	14	1,103
	"	15·57	87·94	..	12	14	1,103
	Rosthern, Sask.	14·30	79·16	1	3	11	1,100
	Scott, Sask.	14·13	82·19	1	3	14	....
	Indian Head, Sask.	15·40	82·69	1	5	10	388
	Fort Vermilion, Alta.	16·31	86·38	2	..	..	....
	Lacombe, Alta.	12·31	72·09	..	13	11	1,562
	Lethbridge, Alta. (irrigated)	18·04	88·69	2	2	26	360
	" (non-irrigated)	14·45	79·62	2	9	15	156
	Invermere, B.C.	21·80	93·05	1	2	16	1,396
	Summerland, B.C.	20·60	91·37	4	7	22	1,333
	Saanichton, B.C.	18·28	88·49	1	3	6	980
Home Grown	Charlottetown, P.E.I.	20·79	98·09	1	7	13	640
	Kentville, N.S.	18·78	86·50	..	11	13	400
	Nappan, N.S.	20·79	93·58	1	..	13	100
	Fredericton, N.B.	18·39	91·66	1	3	11	1,972
	Lennoxville, P.Q.	17·85	91·58	1	2	14	1,000
	Cap Rouge, P.Q.	19·95	88·94	..	11	8	1,869
	Ste. Anne de la Pocatière, P.Q.	19·73	80·79	1	10	13	1,878
	Ottawa, Ont.	15·95	86·68	..	8	10	1,535
	"	16·58	93·58	..	9	10	1,535
	Rosthern, Sask.	14·40	78·66	..	15	8	104
	Scott, Sask.	13·61	72·51	..	15	14	500
	Indian Head, Sask.	16·62	89·48	1	1	10	185
	Lacombe, Alta.	12·31	69·55	1	2	12	537
	Lethbridge, Alta. (irrigated)	17·02	82·00	2	3	30	1,260
	" (non-irrigated)	15·11	80·56	2	2	13	1,620
	Invermere, B.C.	22·02	93·89	..	15	14	1,040
Horning	Charlottetown, P.E.I.	18·05	92·10	1	13	15	1,500
	Kentville, N.S.	16·41	80·02	1	1	17	320
	Nappan, N.S.	13·79	88·04	1	1	15	733

TABLE 22.—SUGAR BEETS GROWN ON THE DOMINION EXPERIMENTAL FARMS, 1925—*Concluded*

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.
	Fredericton, N.B.	19·07	92·32	1	6	15	1,097
	Lennoxville, P.Q.	17·32	92·79	1	12	17	1,940
	Ste. Anne de la Pocatière, P.Q.	19·72	83·18	1	11	13	1,079
	Ottawa, Ont.	14·97	87·06	..	4	9	1,262
	"	15·63	93·19	..	11	9	1,262
	Rosthern, Sask.	14·82	77·75	1	2	12	486
	Scott, Sask.	14·42	80·14	1	2	11	1,500
	Indian Head, Sask.	16·72	86·84	1	6	9	850
	Fort Vermilion, Alta.	16·77	88·80	1	11	..	....
	Lacombe, Alta.	11·35	67·94	1	4	13	1,560
	Invermere, B.C.	21·76	94·32	1	1	13	1,360
	Summerland, B.C.	21·55	91·60	2	7	19	212
Rabbethge	Saanichton, B.C.	18·15	86·64	2	1	10	680
& Giesecke	Charlottetown, P.E.I.	19·27	89·60	1	14	16	1,840
	Kentville, N.S.	18·51	86·88	1	1	14	1,040
	Nappan, N.S.	21·32	93·33	1	7	13	200
	"	18·61	87·06	1	12	13	200
	Fredericton, N.B.	20·12	93·83	1	9	15	1,714
	Lennoxville, P.Q.	16·91	89·50	1	8	16	1,400
	Cap Rouge, P.Q.	20·49	89·45	..	11	10	847
	Ottawa, Ont.	14·74	85·09	..	12	10	1,314
	"	15·90	85·49	..	7	10	1,314
	Rosthern, Sask.	14·27	77·27	1	3	8	1,688
	Scott, Sask.	14·46	76·12	..	13	10	1,500
	Indian Head, Sask.	16·81	90·06	..	15	9	416
	Lacombe, Alta.	12·47	72·21	1	..	12	635
	Lethbridge, Alta. (irrigated)	16·73	79·03	2	9	25	120
	" (non-irrigated)	15·48	82·24	2	10	15	80
	Invermere, B.C.	22·90	96·07	1	..	13	1,360
	Summerland, B.C.	23·55	94·48	2	13	17	1,666
Schreiber & Sons	Charlottetown, P.E.I.	19·44	98·68	2	3	15	60
	Kentville, N.S.	17·91	79·54	..	14	16	492
	Nappan, N.S.	18·41	87·38	1	5	14	1,233
	Fredericton, N.B.	18·97	93·63	1	7	16	857
	Lennoxville, P.Q.	17·38	93·03	1	12	16	....
	Ste. Anne de la Pocatière, P.Q.	19·05	81·55	1	9	12	1,990
	Ottawa, Ont.	13·67	88·49	1	3	10	1,314
	"	18·30	82·41	..	8	10	1,314
	Rosthern, Sask.	14·43	80·81	1	3	10	1,450
	Scott, Sask.	13·30	76·45	..	13	10	500
	Indian Head, Sask.	17·04	87·76	1	5	8	312
	Lacombe, Alta.	11·95	69·10	..	15	13	682
	Lethbridge, Alta. (irrigated)	17·68	83·52	1	13	26	1,840
	" (non-irrigated)	15·11	80·72	2	6	15	80
	Invermere, B.C.	21·94	91·28	1	6	17	848
	Summerland, B.C.	21·45	90·40	3	1	18	349
Vilmorin's	Saanichton, B.C.	19·29	86·58	1	9	9	40
Improved	Charlottetown, P.E.I.	19·70	95·94	2	3	15	1,500
	Kentville, N.S.	17·32	82·08	1	1	13	1,456
	Nappan, N.S.	19·21	89·86	1	6	15	433
	Fredericton, N.B.	20·29	99·17	1	6	13	1,398
	Lennoxville, P.Q.	17·78	92·41	1	5	17	1,400
	Cap Rouge, P.Q.	19·77	90·28	..	13	7	1,937
	Ste. Anne de la Pocatière, P.Q.	19·86	84·61	1	9	12	756
	Ottawa, Ont.	16·04	87·26	..	6	9	1,442
	"	15·52	87·10	..	8	9	1,442
	Rosthern, Sask.	13·21	74·69	..	14	9	1,866
	Scott, Sask.	13·89	78·00	1	1	16	1,000
	Indian Head, Sask.	16·03	86·78	..	15	8	852
	Fort Vermilion, Alta.	16·11	82·73	1	5	..	....
	Lacombe, Alta.	12·70	73·45	1	..	12	1,155
	Lethbridge, Alta. (irrigated)	16·19	81·93	2	2	26	360
	" (non-irrigated)	15·19	81·96	2	..	15	80
	Invermere, B.C.	21·61	91·43	..	15	12	974
	Summerland, B.C.	19·85	86·56	3	15	20	1,400
	Saanichton, B.C.	18·27	86·00	1	4	4	1,460
Danish Improved	Ottawa, Ont.	14·88	86·30	..	9	9	438
	"	14·69	86·90	..	13	9	438
Klein Wanzleben	Fort Vermilion, Alta.	16·10	82·64	1	12	..	....
Sidney	Fort Vermilion, Alta.	14·63	82·66	1	2	..	....
Kitchener	Fort Vermilion, Alta.	16·77	87·84	1	1	..	....
	Saanichton, B.C.	18·91	83·58	1	3	6	760
Waterloo	Fort Vermilion, Alta.	16·22	87·02	1	5	..	....
Amtorg Trading Co.	Lethbridge, Alta. (irrigated)	17·57	80·81	1	7	..	....
Chatham	Saanichton, B.C.	18·72	88·92	1	4	6	760

The detailed results of the analyses of these beets, together with certain other related data, are presented in table 22. Each sample consisted of 12 representative roots. The "yield per acre" data were calculated from the yields of small experimental plots and therefore do not carry the weight which would be attached to field results.

In the following paragraphs a summary account is given of soil and seasonal conditions obtaining at the several Farms and Stations at which the beets were grown. These particulars, which have been written up from the field notes of the several superintendents, are of considerable interest to those who are making a critical study of the sugar beet as grown in the several provinces of the Dominion with a view to the further establishment of the beet sugar industry in Canada. A summarized interpretation of the analytical data in respect to the quality of the beets is added.

Charlottetown, P.E.I.—Soil: sandy loam, 6 to 10 inches deep, manured 10 tons season of 1924, 10 tons, spring, 1925. Previous crop: barley. Sown May 21; pulled October 22. Spring late, cold and wet. Summer cool, July and August dry, June and September wet. Autumn very wet and cold.

In spite of decidedly unfavourable seasonal conditions for sugar production, all eight varieties under test gave excellent results, both as to sugar content and purity. The records show that the beets grown at this Station have been as a rule of high quality and quite suitable for sugar extraction.

Kentville, N.S.—Soil: sandy loam for 10 to 13 inches with gravelly subsoil; manured 20 tons spring 1925. Previous crop, alfalfa. Sown May 9, pulled October 27. Spring: fairly early, good weather; summer: cooler than usual with considerable rain; autumn: very cool weather with heavy rains making harvesting operations difficult.

Though of good quality the beets are not quite equal, either in sugar or purity, to those usually harvested at this Station, due no doubt to the very cool weather with heavy rains which characterized the later summer and autumn months. Almost invariably the beets grown at this point have been of exceedingly high quality.

Nappan, N.S.—Soil: Medium clay loam, 12 inches in depth with heavy clay subsoil. Manured 30 tons per acre spring of 1925. Previous crop: mixed hay. Sown May 21, pulled October 28.

Precipitation—

	Inches
April and May	3.64
June and July	8.83
August and September	6.54
October	5.75

This was an unusually wet season, both in the early summer months and during the autumn. The mean temperatures of the months of sugar development were fairly high, so that in spite of a decidedly abnormal precipitation excellent results as to quality were obtained. The yields were exceptionally good.

The results throughout are excellent and well in accord with those of previous seasons. This Farm has an almost unbroken record for beets of the highest quality.

Fredericton, N.B.—Soil: Sandy loam, 18 inches in depth with fine sand and hard pan 3 to 4 feet below surface. Manured, 15 tons, 800 pounds 4-8-6 fertilizer in the summer of 1924 and in the spring of 1925, 20 tons of manure with 800 pounds of 4-8-6 fertilizer. The crop of the previous season had been

flax on plots 1 and 2, O.P.V. on plots 3 and 4. Sown May 16, pulled October 12, 13, 14. The early spring was cool and dry with warm, dry summer and backward wet autumn.

The data are extremely satisfactory, indicating a rich and pure beet eminently suitable for sugar extraction.

Lennoxville, P.Q.—Soil: sandy loam 10 inches in depth with subsoil of gravel. Manured, 18 tons per acre, the spring of 1925. The crop of the previous season had been grain. Sown May 16, pulled October 5.

Precipitation—

	Inches
April and May	2.42
June and July	7.91
August and September	12.53

Mean temperatures—

	Degrees
May	55.68
June	62.09
July	63.82
August	64.47
September	55.19

These results are not among the highest but are fairly satisfactory. The heavy precipitation in July, August and September (17.60 inches), accompanied by comparatively low temperatures, would indicate that weather conditions were not favourable to the proper ripening of the roots.

Cap Rouge, P.Q.—Sandy loam from 15 to 20 inches deep overlying shale. In the spring of 1925 the land received 1,500 pounds acid phosphate, 300 pounds muriate of potash and 1,500 pounds of a tankage fertilizer. The crop of the previous season had been cereals. Sown May 28, pulled November 6. May was cold, dry and dull with June a little warmer but dry and dull. July was cold and wet, with August warm and bright. September was cold and dull as also was October.

Four varieties only were grown at this Station. The beets were very small (about three-quarter pounds each) and this accounts largely for the high percentage of sugar obtained.

Ste. Anne de la Pocatière, P.Q.—Soil: clay with a blue clay subsoil. Manured 18 tons per acre the spring of 1925. Sown May 16, pulled October 23. The spring was fairly good with sufficient rainfall to have a good germination. The summer was favourable enough but a little dry at the end. The autumn was a little cold with abundant rainfall.

The sugar data are satisfactory but the purity is rather low. The results for sugar are practically identical with those of the previous season.

Ottawa, Ont.—Soil: medium to light sandy loam, in excellent state of fertility. Subsoil: sand. The precipitation during the spring months of March, April and May was less than normal, 7.70 inches. During June, July and August it was 8.94 inches. The month of August was extremely dry and September exceptionally wet. The mean temperature of the summer months was approximately normal, but the weather was exceptionally cool in July. The autumn months were quite cool.

As in past seasons the beets grown on the Central Farm are among the poorest in the series. Though of fair weight they are low in sugar content and purity. Seasonal conditions at this point appear as a rule unfavourable to a rich root.

Rosthern, Sask.—Soil: Sandy loam of about six inches overlying clay. Manured 15 tons to the acre the previous season, for corn. No manuring season of 1925. Sown May 19, pulled October 12. Spring, fairly warm with sufficient rainfall: summer, abundance of moisture in June and early July and late August. Rather dry in late July and early August; moderately hot. Autumn, abundance of moisture, moderately warm and no severe frosts until October.

These beets were of poor quality, in respect to both sugar and purity. With very few exceptions, the beets grown at this northern point since the beginning of this enquiry have been of inferior quality. They could not be considered suitable for profitable sugar extraction.

Scott, Sask.—Soil: Dark brown sandy loam to about 21 inches with grey sandy loam below. Land had lain fallow, after hay the previous season. Sown May 28, pulled October 3. Spring was cold with killing frosts on May 11 but with sufficient moisture for germination. Summer was warm with sunshine slightly above the average. Hot dry weather between July 15 and August 7 after which it was cooler with more moisture.

As at Rosthern the quality of the beets was very poor, both as to sugar content and purity. The results from this Station have been almost invariably low; seasonal conditions evidently are unfavourable to a proper ripening of the crop.

Indian Head, Sask.—Soil: medium loam 7 to 10 inches with a deep subsoil of sandy loam. The land was seeded to alfalfa in 1917, hay in 1918, pastured for six years and broken in July, 1924. Sown in May and pulled October 15. In spring the temperatures were moderate with good rainfall in June, summer was hot and dry, the autumn, early part, warm and dry but latter portion cool and wet.

The results are fair only; they stand about midway between the poorest and the best in the series. Occasionally high quality beets have been grown at this point, but as a rule they do not rank with the best.

Fort Vermilion, Alta.—Soil: a dark loam of 4 feet with clay subsoil. Manured 15 wagon loads per acre season of 1924 with 10 wagon loads for the root crop of 1925. Crop of previous season: garden corn. Sown May 6, pulled September 10. Spring had a fair temperature with light precipitation, summer was very warm, with medium rainfall. Autumn medium temperature with very light precipitation. A fair-sized beet with medium sugar content. Though not roots of the highest quality, the results for the past season are decidedly better than for previous seasons.

Lacombe, Alta.—Soil: dark loam for 12 inches with subsoil of dark clay loam: summer fallowed the previous season. Sown May 20, pulled October 5. Spring approximately 3 feet of snow on ground on April 1. Monthly precipitation during year below the average until August. Total precipitation on July 30—6.78 inches; 3.87 inches during August and during September, 3.37 inches. Mean temperature during April, May, June and July averaged 3.35° above the average. August and September were cooler.

These are the poorest results in the series, the quality of the beets being very poor both as to sugar and purity. In no year of the inquiry have the results been good, evidently due to the seasonal conditions being unfavourable to the proper ripening of the crop.

Lethbridge, Alta.—Soil: Medium sandy loam with about 25 per cent of clay. Surface soil about 8 inches with plenty of organic matter. The crop of the previous year was potatoes. The roots sown on irrigated land were put

in on May 8, those on dry land on May 11; the former were pulled on October 21 and the latter on October 19. Weather was mild throughout, April, and May was quite warm with few sudden changes. Precipitation for April was 1.99 inches and for May 0.43 inches. June was a good growing month with mean temperature for the month of 59.8° and precipitation 3.40 inches. July and the first half of August were hot and very dry. Precipitation: July, .82 inches; August, 1.85 inches. Cold weather set in exceptionally early and suddenly and fall precipitation was exceptionally high, much of it coming in the form of snow. Precipitation: September, 4.86 inches; October, 1.08 inches.

At this Station beets were grown on both irrigated and non-irrigated land. As in past years the quality of the irrigated beets was excellent, the sugar content (average 17.28 per cent) and purity both being high. The non-irrigated beets were of fair quality only and decidedly inferior to those from irrigated land; the data for both sugar and purity are lower. As might be expected, the yields from the irrigated plots were almost twice those on the dry land plots.

Invermere, B.C. Soil: Fine sandy loam 8 to 10 inches deep with rocky subsoil. Manured 12 tons to the acre, season of 1925. Crop of previous season: oats, peas and vetch. Sown May 15, pulled October 14. Character of the season:—

Precipitation—

	Inches
March, April and May	2.03
June, July and August	4.57
September	1.27

Mean temperatures—

	Degrees
March, April and May	43.32
June, July and August	60.81
September	50.24

The plots were irrigated before planting and on June 20 and July 7.

These beets were grown under irrigation. These are the richest roots in the series, being exceptiionally high both in sugar and purity. The yields also were excellent.

Summerland, B.C.—Soil: gravelly loam. Manured season of 1925 at the rate of 10 tons per acre. Crop of previous season: Western Rye Grass. Sown May 5, pulled October 15. Spring was moderately warm. No frost after March 29. Soil moisture satisfactory. Precipitation fairly good. Summer very dry and hot; autumn, cool, bright, very dry.

These beets were grown on irrigated land. The sugar content is very high and the beets rank with those from Invermere. The coefficient of purity is also very high and the yields are among the highest recorded in the series.

Sidney, B.C.—Soil: loam to a depth of 10 inches with clay subsoil. Manured in the fall of 1924 with 10 tons of barnyard manure. Crop of previous season—oats. Crop sown April 16, pulled November 10.

Precipitation—

	Inches
April and May	2.26
June, July and August	1.41
September, October and November	0.61

Temperatures—

	Maximum Degrees	Minimum Degrees
April and May	85	33
June, July, August	93	42
September and October	72	30

The sugar content is sufficiently high but the yields are too low to indicate the profitable culture of this crop. Evidently the season was too dry to permit of good growth.

Interesting data are presented in table 23 which gives the averages of "sugar in juice" and "coefficient of purity" from the beets grown from the eight stocks of seed (varieties) at the seventeen farms and Stations in this investigation during 1925. These averages are calculated from the data of table 22.

TABLE 23.—SUGAR BEETS: SUGAR IN JUICE AND COEFFICIENT OF PURITY
Averages from the several varieties grown on 17 Experimental Farms and Stations throughout the Dominion, 1925.

Source of Seed and Variety	Sugar in Juice	Coefficient of Purity
	p.c.	p.c.
Canada—"Home Grown"	17·50	86·12
France—"Dieppe"	17·92	86·23
" "Vilmorin's Improved," Vilmorin, Andrieux et Cie., Paris	17·28	85·90
Germany—"Dr. Bergman"	17·97	86·84
" "Schreiber & Sons"	17·37	85·37
Russia—"Horning"	17·21	86·42
" "Rabbethge & Giesecke"	17·79	86·33
Denmark—"Henning & Harving"	17·26	85·91

These averages are exceedingly good, both as to sugar content and purity, indicating an excellent quality of beet for sugar extraction. They are practically the same as those of the previous season, so that they have an additional value.

It is significant that there should be so little difference between these figures; no variety differs markedly from the others. Evidently, they are all of first class quality and in this connection it is very satisfactory to remark that Canadian grown seed produced beets equal in richness and purity to those from imported seed of the most approved European varieties.

Particular attention may be directed to table 24 which presents averages for the percentage of sugar in juice from beets grown on the several Farms and Stations during the season of 1925, each result being the average of eight varieties under experiment. Similar results for the period 1919-1924, inclusive, are added for the purpose of showing the variation which may take place due to seasonal conditions.

TABLE 24.—AVERAGE PERCENTAGE OF SUGAR IN JUICE IN SUGAR BEETS GROWN ON DOMINION EXPERIMENTAL FARMS AND STATIONS, 1919-1925

Locality	1919	1920	1921	1922	1923	1924	1925
Charlottetown, P.E.I.	18·33	16·44	16·40	.....	18·67	19·23	19·30
Kentville, N.S.	19·25	18·36	18·06	18·72	20·43	24·71	1 8·08
Nappan, N.S.	17·83	18·01	18·08	18·45	17·61	16·98	19·49
Fredericton, N.B.	20·94	18·34	18·09	16·61	15·60	21·42	19·19
Lennoxville, P.Q.	15·91	14·55	16·01	15·12	15·99	17·51	17·29
Cap Rouge, P.Q.	16·88	16·69	17·04	21·27	18·61	.....	20·17
Ste. Anne de la Pocatiere, P.Q.	18·89	13·24	17·31	17·69	15·30	19·72	19·80
La Ferme, P.Q.	16·05	.....	.....	.....	.....	.....	.....
Ottawa, Ont.	17·79	15·09	15·61	16·44	16·16	16·36	15·57
Brandon, Man.	.....	15·24	16·82	14·14	12·19	13·36	.....
Rosthern, Sask.	.....	14·15	13·56	17·27	13·13	14·19	14·27
Scott, Sask.	14·39	15·74	15·79	17·25	19·21	15·71	14·18
Indian Head, Sask.	15·68	20·24	.....	19·70	20·12	17·10	16·52
Fort Vermilion, Alta.	17·35	.....	14·47	16·00	14·32	13·01	16·11
Beaverlodge, Alta.	.....	.....	15·77	.....	19·16	.....	.....
Lacombe, Alta.	.....	12·86	13·84	15·77	.....	.....	12·25
Lethbridge, Alta. (irrigated)	14·31	18·34	17·99	17·04	17·21	18·85	17·28
" (non-irrigated)	.....	19·35	16·63	17·57	15·92	.....	15·04
Agassiz, B.C.	17·02	16·46	15·87	16·67	17·62	16·75	.....
Sidney, B.C.	17·98	14·29	.....	.....	16·67	14·90	18·74
Invermere, B.C.	14·72	19·26	15·78	17·56	20·02	17·44	21·96
Summerland, B.C.	.....	16·85	20·03	17·36	16·92	20·08	21·33

At seven points, Charlottetown, P.E.I., Nappan, N.S., Fredericton, N.B., Cap Rouge, P.Q., Ste. Anne de la Pocatière, P.Q., Invermere and Summerland, B.C., the results stand out as exceptionally high, the average sugar in juice being over 19 per cent—with two Stations showing over 21 per cent. In three instances only did the sugar in juice fall below 15 per cent.

CO-OPERATIVE WORK WITH SUGAR BEETS

Three series or sets of experimental trials of a co-operative nature have been conducted during the past year, the beets being grown, under direction, by farmers and samples of the harvested crop forwarded to these laboratories for analysis.

SUGAR BEETS GROWN IN PRINCE EDWARD ISLAND, 1925

Co-operative field tests with sugar beets were carried out in Prince Edward Island during the past season at the instance of the Board of Trade, Charlottetown, and the provincial Department of Agriculture, P.E.I. The field work was under the direction of the Superintendent, Experimental Station, Charlottetown, and the analyses of a representative sample of the harvested beets from each plot was made by the Division of Chemistry, Experimental Farm, Ottawa.

Seed of approved factory varieties was used: a variety known as "Dr. Bergman," the seed being grown in Germany and supplied by the Dominion Sugar Co., Wallaceburg, Ont., and "Colorado," the seed being furnished by the Great Western Sugar Co., of Denver, Colorado.

Detailed data respecting the nature of soil, manuring, cultural and seasonal conditions, dates of sowing and of harvesting, etc., though affording valuable information, are too voluminous for insertion in this report. It will suffice for the present purposes to say that printed directions for the proper growing of the beets were placed in the hands of each collaborator and that the Superintendent of the Experimental Station, Charlottetown, or his assistant, visited the plots from time to time throughout the growing season.

The beets as received at the laboratory were in excellent condition: sound, not wilted, with very little evidence of forkiness. The larger number of roots were of medium size; the absence of large and very large beets may account in some measure for the high sugar data obtained.

Table 25 presents the important data of this inquiry: the initials and address (locality) of grower, name of variety, average weight of one root, percentage of sugar in juice, and coefficient of purity (percentage of sugar in solids in juice).

The series comprises sixty-four samples and it is very satisfactory to note that with scarcely an exception they have afforded data indicative of high quality, both as to sugar content and purity.

The following summary very well brings out the large number of samples which are distinctly rich in sugar, fully equal to the best as supplied to the sugar beet factories in Canada and the United States.

SUMMARY OF RESULTS

	Sugar in juice—per cent
One sample contained over	22
Two samples contained between	21 and 22
Thirteen samples contained between	20 " 21
Nineteen " "	19 " 20
Sixteen " "	18 " 19
Nine " "	17 " 18
Three " "	16 " 17
One " "	15 " 16

AVERAGES

Variety	Sugar in juice	Co-efficient of purity
	p.c.	p.c.
Colorado	19·05	86·81
Dr. Bergman	19·20	87·50

It is of interest to note in this connection that the averages of eight approved varieties grown on the Experimental Station, Charlottetown, during the past season are:—

Sugar in juice	19·30 per cent
Co-efficient of purity	93·59 "

Experiments with approved factory varieties of sugar beets have been carried on for the past fifteen years at the Experimental Station, Charlottetown, P.E.I., with a view of ascertaining the suitability of conditions of that locality for the growth of beets useful for sugar extraction. In the larger number of seasons the beets have been very satisfactory and quite suitable for factory purposes.

The results of the co-operative work now reported on receive confirmation from the Charlottetown data of this investigatory period and furnish additional favourable evidence as to the suitability of soil and seasonal conditions of the province for the culture of sugar beets.

TABLE 25.—SUGAR BEETS—CO-OPERATIVE WORK, 1925, PRINCE EDWARD ISLAND

Lab'y No.	Grower	Locality	Variety	Sugar in Juice	Co-efficient of Purity	Average Weight of one Root
				p.c.	p.c.	lb. oz.
82302	J.L.C.	Rustico	Canadian grown	18·79	88·00	1 ..
03	J.L.C.	"	Dr. Bergman	20·79	86·42	.. 15
04	T.N.	Richmond	Canadian grown	16·90	85·29	1 1
05	F.M.	Montague	"	19·79	87·84	1 6
06	W.C.R.	Pownal	"	20·16	87·80	.. 12
07	W.C.R.	"	Dr. Bergman	20·24	88·16	.. 13
08	W.J.S.	Breadalbane	"	19·84	89·86	1 2
09	W.J.S.	"	Canadian grown	19·63	90·99	1 3
10	A.P.P.	Rollo Bay	Dr. Bergman	20·88	88·28	.. 14
11	A.P.P.	"	Canadian grown	20·92	86·12	.. 11
12	H.L.		"	19·95	88·43	.. 13
13	H.L.		Dr. Bergman	19·71	89·23	.. 14
14	P.R.A.	Mt. Carmel	Canadian grown	18·48	87·16	1 5
15	P.R.A.	"	Dr. Bergman	18·02	85·72	1 2
16	P.R.	Victoria	Canadian grown	19·35	90·42	.. 8
17	P.R.	"	Dr. Bergman	19·01	90·67	.. 12
18	B.L.	Tryon West	"	21·33	87·34	1 1
19	B.L.	"	Canadian grown	19·90	89·08	1 3
20	R.F.P.	Freetown	"	18·79	88·80	1 11
21	R.F.P.	"	Dr. Bergman	17·68	85·35	1 9
22	A.R.	Milton	"	19·10	88·86	.. 12
23	A.R.	"	Canadian grown	19·53	88·76	.. 15
24	M.C.	Cape Traverse	Dr. Bergman	18·67	86·78	1 3
25	M.C.	"	Canadian grown	20·15	90·99	1 2
26	E.R.	Rollo Bay	Dr. Bergman	19·69	88·82	1 5
27	E.R.	"	Canadian grown	20·75	88·47	1 6
28	A.M.	Bedique	Dr. Bergman	18·11	88·24	.. 9
29	A.M.	"	Canadian grown	19·98	86·78	.. 9
30	E.C.	Long River	"	17·42	84·72	1 5

TABLE 25.—SUGAR BEETS—CO-OPERETIVE WORK, 1925, PRINCE EDWARD ISLAND—*Concluded*

Lab'y No.	Grower	Locality	Variety	Sugar in Juice	Co-efficient of Purity	Average Weight of one Root
				p.c.	p.c.	p.c.
31	E.C.	"	Dr. Bergman	17·97	86·38	.. 15
32		Summerside	Canadian grown	20·46	85·84	.. 6
33		"	Dr. Bergman	22·06	87·46	.. 13
34	D.N.M.	Breadalbane	Canadian grown	19·02	85·43	1 3
35	D.N.M.	"	Dr. Bergman	19·64	88·47	.. 14
36	No. 1		Canadian grown	20·57	87·68	.. 13
37	J.D.	Ina	"	17·77	82·88	1 0
38	C.G.	West Devonal	"	18·85	86·60	1 9
39	F.M.	Hampton	"	18·85	88·49	1 6
40	F.M.	"	Dr. Bergman	18·84	88·37	.. 14
41	R.J.M.	St. Colombo	"	18·32	84·28	.. 5
42	R.J.M.	"	Canadian grown	16·96	81·89	.. 9
43	R.F.	Bedique	"	18·88	85·96	1 10
44	R.F.	"	Dr. Bergman	18·44	86·10	1 14
45	H.W.	Cape Traverse	Canadian grown	19·30	87·18	.. 14
46	H.W.	"	Dr. Bergman	20·09	87·58	.. 13
47	A.A.	Bedique	"	20·70	89·00	.. 12
48	A.A.	"	Canadian grown	19·83	87·16	.. 10
49	C.E.M.	Milton	Dr. Bergman	17·93	85·70	1 11
50	C.E.M.	"	Canadian grown	19·14	85·94	1 7
51	H.A.M.	St. Peters	Dr. Bergman	19·94	88·94	.. 13
52	H.A.M.	"	Canadian grown	18·79	85·19	1 1
53	J.S.M.	West Royalty	"	17·81	84·26	1 5
54	J.S.M.	"	Dr. Bergman	18·30	85·06	1 1
55	J.O.H.	Rocky Point	"	16·44	83·81	2 4
56	J.O.H.	"	Canadian grown	15·62	81·17	2 3
57	P.F.	West Devon	Dr. Bergman	20·33	90·67	.. 11
58	P.F.	"	Canadian grown	18·55	89·41	.. 9
59	J.N.	Kelly's Cross	Dr. Bergman	17·76	87·40	2 1
60	J.N.	"	Canadian grown	18·55	86·52	1 5
61	J.S.K.	Stanchel	"	17·72	84·82	1 10
62	J.S.K.	"	Dr. Bergman	17·38	85·92	1 5
63	J.B.J.	Pownal	"	19·54	90·63	.. 7
64	J.B.J.	"	Canadian grown	20·56	85·61	.. 9
65	S.	Experimental Station		21·21	86·24	1 3

SUGAR BEETS GROWN IN NOVA SCOTIA, 1925

Thirty-one farmers co-operated in this series. (See table 26.) The seed, which was Canadian-grown, was distributed by the Superintendent of the Experimental Farm, Nappan, N.S., who also directed and inspected the field plot work and forwarded samples of the harvested crop for analysis.

TABLE 26.—SUGAR BEETS—CO-OPERATIVE WORK, 1925, NOVA SCOTIA
Variety: Canadian-grown seed supplied by the Dominion Sugar Co. Chatham, Ont.

Lab'y No.	Name	Locality	Sugar in Juice	Co-efficient of Purity	Average Weight of one Root	
			p.c.	p.c.	lb.	oz.
81982	A.C.M.	R.R. 1, Eureka	19·23	90·59	..	7
83	L.F.	R.R. 4, New Glasgow	18·88	90·86	..	10
84	W.H.M.	R.R. 1, West River Station	19·14	90·28	..	8
85	W.O.C.	" "	20·02	88·45	..	6
86	R.A.T.	River John	19·70	90·10	..	13
87	C.M.	R.R. 3, River John	18·74	89·97	..	9
88	J.M.	R.R. 2, Pictou	18·91	90·16	..	11
89	J.H.	R.R. 4, River John	19·37	91·81	..	7
90	D.M.	Sylvester	18·75	90·03	..	8
91	A.S.G.F.	Acadian Farm, Pictou	17·87	87·62	1	7
92	G.A.M.	Woodburn	18·97	89·37	..	8
93	W.A.M.	R.R 1, Pictou	18·06	88·67	..	12
94	J.M.	" "	18·56	88·49	..	9
95	J.M.	Westville	18·10	88·16	..	11
96	A.D.M.	Pictou	20·18	95·50	1	..
97	J.R.C.	R.R 1, New Glasgow	17·10	87·26	..	14
98	J.R.R.	Little Harbour	19·31	89·80	..	7
99	H.K.M.	R.R. 1, River John	18·24	91·79	..	5
82000	J.R.	R.R. 1, Pictou	16·67	90·78	..	10
01	D.M.	"	18·34	91·14	..	14
82237	D.M.	R.R. 1, River John	18·47	90·22	..	5
38	R.W.M.	King's Head	19·41	89·08	..	14
82182	D.B.		19·94	91·62	1	4
85	J.R.M.	Georgeville	17·66	85·84	..	3
82190	D.J.R.	Aresaig	18·73	87·52	1	3
82379	W.D.G.	R.R. 3, Pictou	17·95	83·90	1	9
80	W.M.	Big Island	20·84	87·96	..	15
81	J.M.		19·70	85·27	1	2
82	J.A.G.		19·10	85·65	..	11
82541	F.B.	R.R. 1, Amherst	20·57	87·04	..	10
42	S.F.	" "	17·88	85·57	..	8

These beets, almost without exception, are of exceptionally good quality, the sugar content and purity being most satisfactory. A summary of these results show:—

SUMMARY OF RESULTS	Sugar in Juice per cent
Four samples contained over	20
Nine samples contained between	19 and 20
Twelve samples contained between	18 and 19
Five samples contained between	17 and 18
One sample contained between	16 and 17

It may safely be concluded that conditions generally have been favourable to the growth of beets eminently suitable for sugar extraction.

In a number of the samples the beets would be considered too small to give a profitable tonnage. That phase of the subject, however, necessitates a separate inquiry, carried out on a larger scale; the conditions under which these trials were conducted would not permit reliable deductions of an economic nature.

SUGAR BEETS GROWN IN PRINCE ALBERT DISTRICT, SASKATCHEWAN, 1925

The Prince Albert Board of Trade through its secretary requested this division to analyse and report on a number of samples of beets grown by farmers from seed supplied by the board in the spring. Unfortunately the farmers were not furnished any directions for the proper culture of the beets. The series consisted of nine samples.

TABLE 27.—CO-OPERATIVE WORK, 1925, PRINCE ALBERT, SASK.
(Variety: Delitzscher)

Lab'y No.	Name	Locality	Sugar in juice	Co-efficient of purity	Average weight of one root
			p.c.	p.c.	lb. oz.
82513	C.Y.	Paddockwood	9·96	45·77	1 ..
14	A.A.C.	"	18·94	77·75	.. 8
15	S.S.	"	21·59	82·85	.. 9
16	E.C.E.	"	18·54	79·30	1 6
17	J.P.O'S.	"	18·92	79·21	.. 14
18	J.A.	Clouston	16·29	74·40	1 7
19	H.C.W.	Steep Creek	22·20	80·56	.. 13
20	S.B.	Lily Plains	14·29	70·36	1 12
21	B. & P.	Macdowal	19·20	75·25	.. 15

These roots, as received, were for the most part in very bad condition, which to a certain degree would vitiate the results of our examination. The roots as a series had evidently been frozen, but thawed before their arrival, resulting in a more or less soft and sticky condition and were discoloured throughout. Nos. 82515 and 82519 had evidently dried out very considerably, thus raising their sugar content. As a series the beets were smaller than were desirable but otherwise they were of fair form. A low weight of root (small size) results in too low a tonnage per acre to be profitable to the farmer; on the other hand, a very large root means, usually a reduced sugar content.

Percentages of sugar above 16 and a coefficient of purity higher than, say, 82 would be considered as desirable for profitable sugar extraction. These standards can scarcely be applied to this series by reason of the damaged condition of the roots and it would seem safer from the present work to say that the analyses had yielded results indicative of a fair quality of beet, rather than to discuss the figures in detail.

FARM OR FIELD ROOTS

The nutritive value of farm roots—mangels, turnips and carrots—as indicated by their percentages of dry matter and sugar, has been studied in these laboratories for a number of years past, the results being recorded in the annual reports of the division.

The past year's work in this investigation comprises a series of 29 samples of mangels, grown and submitted by the Division of Forage Plants, Central Experimental Farm, Ottawa, and representative of a number of the chief types more commonly grown; two varieties of so-called sugar mangels grown on the Experimental Station, Sidney, B.C., and two series of swede turnips grown on the Experimental Stations at Lennoxville and Ste. Anne de la Pocatière, P.Q.

MANGELS

The mangels submitted by the Division of Forage Plants were grouped as to type, the groups being representative of six distinct types, according to a scheme in which the length-width ratio is the chief basis of the classification. The object of this inquiry was to ascertain what relation, if any, there might be between nutritive value (as denoted by dry matter and sugar content) and type.

TABLE 28.—ANALYSIS OF MANGELS, C.E.F., OTTAWA, ONT., 1925

Type	Variety	Dry matter	Sugar in juice	Average weight of one root
		p.c.	p.c.	lb. oz.
Long	Mammoth Long Red	12·47	6·78	2 5
"	Long Red	12·20	6·12	2 3
"	Mammoth Long Red	11·41	5·57	2 5
"	Prize Mammoth Long Red	11·01	6·21	2 11
"	Mammoth Long Red	10·66	5·09	2 12
Half long	Sugar Mangold	12·71	7·68	2 10
"	Giant Sugar White	12·51	7·90	2 5
"	Svalof	12·47	6·99	2 5
"	Giant White Sugar	11·45	5·67	2 12
"	Improved Tankard Cream	11·37	3·87	2 12
Intermediate	Giant Yellow Intermediate	11·68	5·87	2 14
"	Yellow Intermediate	10·76	7·40	3 11
"	Giant Yellow Half Long Intermediate	10·52	5·29	3 6
"	Manitoba Giant Yellow	10·02	5·39	3 5
"	Champion or Gatepost	9·87	4·58	2 14
Tankard	Perfection	9·73	1·84	3 5
"	Golden Tankard	9·16	3·34	3 8
"	Eckendorffer Yellow	9·08	2·56	3 3
"	Ideal	9·01	4·16	3 5
Ovoid	Yellow Fleshed or Golden Tankard	11·45	5·29	2 11
"	Golden Tankard	10·86	4·79	3 2
"	"	10·74	4·48	3 0
"	"	10·56	4·76	3 9
"	Giant Yellow Globe	8·81	3·18	3 8
Globe	Yellow Intermediate	10·89	4·76	2 14
"	Yellow Globe	9·76	4·40	2 12
"	Prizetaker Yellow Globe	9·58	4·58	2 12
"	Golden Globe	9·40	4·39	2 7
"	Special Yellow Globe	8·44	3·17	2 9

As in previous years of this inquiry, it will be observed that, in a general way, the higher the dry matter content the higher the percentage of sugar—the chief nutrient in the mangel.

Further, as in previous records a very considerable range or "spread" is to be noted in dry matter and sugar. This indicates appreciable differences in nutritive value among the varieties. Thus the richest root contains 12.71 per cent dry matter and 7.68 per cent sugar, while the poorest in the series contains 8.44 per cent dry matter and 3.17 per cent sugar. The former is worth, weight for weight, fully half as much again as the latter.

Table 29 is interesting in showing the maxima, minima and average of the several groups.

TABLE 29.—MANGELS: DRY MATTER AND SUGAR IN JUICE
(Averages, Maxima and Minima)

Type	Dry Matter			Sugar in Juice		
	Average	Maximum	Minimum	Average	Maximum	Minimum
	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
Long	11·55	12·47	10·66	5·95	6·78	5·09
Half-Long	12·10	12·71	11·37	6·42	7·90	3·87
Intermediate	10·57	11·68	9·87	5·70	7·40	4·58
Tankard	9·25	9·73	9·01	2·97	4·16	1·84
Ovoid	10·48	11·45	8·81	4·50	5·29	3·18
Globe	9·61	10·89	8·44	4·26	4·76	3·17

The best type in respect to dry matter and sugar is seen to be the " half-long," but it should be remarked this group contains several " sugar" mangels—varieties specially bred for high sugar content.

Very close to the foregoing come the mangels under the type name " long ". These in our past work have always been among the best—indeed, omitting the special " sugar " varieties, they have stood at the head of the list.

The " intermediate " and the " ovoid " rank next practically forming one class in respect to dry matter, though the ovoid is somewhat the poorer in sugar.

The " tankard " and " globe " form the fourth class, with the globe slightly the richer both in dry matter and sugar.

The results from two samples of sugar mangels grown on the Experimental Station, Sidney, B.C., are as follows:—

	Barres Sludstrup	Barres Strino
Dry matter	11·67 p.c.	12·47 p.c.
Sugar in juice	6·93 p.c.	7·82 p.c.
Weight of one root	1 lb. 11 oz.	2 lb.
Computed yield	10 tons	11 tons, 1,700 lb.

TABLE 30.—MANGELS—DRY MATTER AND SUGAR IN JUICE, 1904-1925

Year	Number of varieties analysed	Average weight of one root		Dry matter	Sugar in juice
		lb.	oz.	p.c.	p.c.
1904	10	2	11	11·69	6·62
1905	17	3	9	10·04	4·67
1906	16	2	7	11·63	5·93
1907	10	2	11	12·64	7·46
1908	12	2	2	11·87	5·33
1909	14	3	5	11·21	6·21
1910	8	5	10	10·04	4·46
1912	23	2	9	9·51	6·43
1913	13	2	14	10·51	5·63
1914	24	2	1	12·79	7·75
1915	36	3	9	9·25	4·27
1916	26	2	..	8·86	2·66
1917	31	1	15	12·64	6·72
1918	13	2	4	11·78	6·13
1919	80	..	14	12·58	6·26
1920	42	3	8	9·18	4·07
1921	41	3	..	9·73	4·00
1922	50	2	13	12·81	5·93
1923	129	2	10	12·37	5·27
1924	141	2	12	10·42	4·49
1925	29	2	14	10·64	5·03
Average for 21 years	.....	.....		11·06	5·48

Table 30 records the averages of dry matter and sugar obtained in this inquiry since 1904. The averages for 21 years, 11.06 per cent dry matter and 5.48 per cent sugar may no doubt be regarded as representative for mangels taken as a class.

SWEDE TURNIPS

Two series of swede turnips have been analysed, one grown on the Experimental Station, Ste. Anne de la Pocatière, the other on the Experimental Station, Lennoxville, both in the province of Quebec. The results of the examination are given in the following table:—

TABLE 31.—ANALYSIS OF SWEDE TURNIPS, 1925

Variety	Average Weight of one root		Dry matter	Sugar in Juice
	lb.	oz.	p.c.	p.c.
Ste. Anne de la Pocatière—				
Good Luck	4	6	12·25	0·82
Magnum Bonum	5	1	11·87	0·82
Bangholm*	5	3	12·87	0·82
Good Luck†	5	14	12·00	1·00
Improved Lord Derby	4	5	11·76	0·62
Bangholm‡	4	7	14·40	1·00
Hall Westbury	5	1	11·73	0·72
Magnum Bonum	4	13	11·95	0·92
Ditmars	4	16	11·83	0·52
Lennoxville—				
Purple top, round	5	10	10·89	1·23
" oval	5	3	10·69	1·74
" flat	5	11	10·62	1·33
" tankard	4	13	11·57	1·53
Bronze top, round	5	7	11·32	1·23
" flat	5	4	11·01	1·23
" oval	5	10	11·16	1·13
Green top, round	4	4	10·77	0·82
" flat	4	14	10·54	0·92

* From seed grown at McDonald College, Que.
† " " Ste. Anne de la Pocatière, Que.
‡ " " Charlottetown, P.E.I.

The maximum, minimum and average percentages of dry matter and sugar in these two series may be shown as follows:—

—	Ste. Anne de la Pocatière		Lennoxville	
	Dry matter	Sugar in juice	Dry matter	Sugar in juice
	p.c.	p.c.	p.c.	p.c.
Average	12·29	0·79	10·95	1·24
Maximum	14·40	1·00	11·57	1·74
Minimum	11·73	0·52	10·54	0·82

The turnips grown at Ste. Anne de la Pocatière are distinctly higher in dry matter but lower in sugar than those from Lennoxville. This may be due in part to the fact that the varieties were not the same at both Stations, but in respect to sugar it may also be due to the less favourable temperature for the development of this nutrient during the autumn months at Ste. Anne. The percentages for dry matter at this latter Station are markedly high for swede turnips.

The average data for the past 18 years for this class of farm roots are dry matter: 10.70 per cent, sugar in juice, 1.15 per cent.

INFLUENCE OF EARLY AND LATE PLANTING AND SPROUTING ON THE YIELD AND DRY MATTER CONTENT OF POTATOES

The present record is that for 1925, the sixth year of this inquiry, which in so far as field work is concerned is being carried on at the Experimental Substation, Beaverlodge, Alta. The experiment was planned by the superintendent in 1920, and with certain slight annual modifications has been continued every season since that date.

The variety employed was the Country Gentleman. The particulars as to dates and yields and the data for the dry matter content and dry matter per acre, are given in table 32.

TABLE 32.—POTATOES: COUNTRY GENTLEMAN, YIELD AND DRY MATTER, 1925

Laboratory No.	Date of Planting	Not sprouted			Sprouted			
		Yield per acre	Dry Matter		Weeks sprouted	Yield per acre	Dry Matter	
			Per cent	Pounds per acre			Per cent	Pounds per acre
		lb.				lb.		
81719	25–4–25	24,130	18·28	4,411				
20	4–5–25	19,458	17·60	3,425				
21	4–5–25				1	19,646	17·96	3,530
22	11–5–25	17,391	17·37	3,020				
23	11–5–25				2	20,274	18·23	3,695
24	19–5–25	19,320	16·85	3,255				
25	19–5–25				3	15,916	17·82	2,837
26	26–5–25	14,288	16·74	2,592				
27	26–5–25				4	15,416	17·92	2,763
28	2–6–25	15,159	15·86	2,404				
29	2–6–25				5	17,480	18·08	3,160

In the case of the non-sprouted tubers, the longer the period between planting and harvesting, or put otherwise, the earlier the sets (non-sprouted) are planted, the higher the percentage of dry matter. In other words, late planting appears to reduce the dry matter content.

The percentages of dry matter from the crop from sprouted tubers show differences which are so small as to lie within the limits of experimental error. Since the sprouting and planting periods were concurrent, extending over five weeks, and the dry matter of the crop was practically the same for all members of the series, the conclusion may perhaps be justified that sprouting advances the growth of the potato plant, as does early planting. It has been shown that age of plant largely determines dry matter content of the tuber, therefore, it follows that pre-sprouting of the sets acts as an offset to late planting in respect to the production of dry matter.

CEREALS

WHEATS: A STUDY OF THE INFLUENCE OF HEREDITY AND ENVIRONMENT

At the instance of the Dominion Cerealist the analysis of a series of wheats grown on eighteen of the Farms and Stations of the Experimental Farm System (from Charlottetown, P.E.I., to Sidney, B.C.) has been made during the past year. The series consists of 165 samples comprising 45 varieties, all of the crop of 1924.

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.

TABLE 33—WHEATS FROM EXPERIMENTAL FARMS AND STATIONS—CROP OF 1924

Laby. No.	Milling No.	Locality	Variety	Weight of 1,000 Kernels	Moisture	Dry Matter		
						Nitrogen	Protein (Nx5·7)	Ash
				gms.	p.c.	p.c.	p.c.	p.c.
78981	24–1	Rosthern, Sask.	Garnet	28·50	9·81	2·86	16·32	1·37
78982	24–2	"	Reward	31·54	9·19	3·17	18·01	1·25
78983	24–3	"	Brownie	26·48	9·55	2·88	16·55	1·45
78984	24–4	"	Crown	28·71	10·09	3·40	19·37	2·05
78985	24–5	"	Kota	36·17	9·65	3·15	18·08	1·44
78986	24–6	"	Duchess	29·24	8·18	3·30	18·84	1·95
78987	24–7	"	Marquis 0·15	30·98	10·27	2·99	17·06	2·19
78988	24–8	"	Orchard Selection	30·09	9·98	3·04	17·33	1·47
78989	24–9	"	Sanderson Selection	31·89	9·16	2·95	16·79	1·71
78990	24–10	"	Early Red Fife	32·40	9·29	3·07	17·56	1·55
78991	24–11	"	Red Fife	30·46	8·75	3·11	17·72	1·61
78992	24–12	"	Kitchener	33·81	9·27	2·91	16·64	1·51
78993	24–13	"	Early Triumph	33·67	8·64	2·87	16·34	1·64
78994	24–14	"	Supreme	29·21	7·35	2·75	15·70	1·97
78995	24–15	"	Master	36·91	9·61	3·14	17·89	2·01
78996	24–16	"	Major	31·81	10·12	3·01	17·21	1·95
78997	24–17	"	Ruby	27·26	9·55	3·14	17·87	1·49
78998	24–18	"	Preston	33·53	9·40	2·77	15·78	1·54
78999	24–19	Brandon, Man.	Garnet	29·91	10·40	2·52	14·37	1·79
79000	24–20	"	Reward	38·37	10·13	3·19	18·19	2·06
79001	24–21	"	Brownie	19·18	10·00	2·40	13·70	1·59
79002	24–22	"	Kota	28·88	10·11	2·89	16·51	2·18
79003	24–23	"	Marquis 0·15	35·83	10·17	2·55	14·52	1·95
79004	24–24	"	Criddle's Selection	24·21	9·69	2·58	14·75	1·81
79005	24–25	"	Parker's Selection	38·84	9·92	2·96	16·90	2·23
79006	24–26	"	Red Fife	24·12	9·74	2·88	16·44	2·02
79007	24–27	"	Kitchener	26·72	9·91	2·26	12·93	1·59
79008	24–28	"	Early Triumph	45·59	9·76	2·94	16·78	2·02
79009	24–29	"	Ruby	41·48	10·16	2·98	17·04	1·72
79010	24–30	"	Quality	44·86	9·61	2·81	15·34	1·84
79011	24–31	"	Golden	29·22	9·72	2·73	15·51	1·79
79012	24–32	"	Marquis x Iumillo 11–15–44	37·16	9·68	2·83	16·20	1·78
79013	24–33	"	Red Bobs x Kota 1655	36·57	10·36	2·96	16·86	2·49
79014	24–34	"	Marquis x Kota 1656	34·72	9·69	2·97	16·90	1·94
79015	24–35	"	Marquis x Kota 1658	37·12	9·87	2·49	14·20	1·36
79016	24–36	"	Supreme	20·34	9·77	2·92	16·69	2·15
79017	24–37	"	Orchard Selection	25·81	9·68	2·92	16·63	1·61
79018	24–38	"	Marquis x Iumillo 11–15–43	35·19	9·80	2·92	16·63	1·95
79019	24–39	Scott, Sask.	Reward	40·45	10·13	3·25	18·51	1·23
79020	24–40	"	Garnet	26·66	9·34	2·93	16·70	1·36
79021	24–41	"	Brownie	21·42	10·01	3·10	17·68	1·26
79022	24–42	"	Kota	26·06	10·18	3·07	17·54	1·39
79023	24–43	"	Producer	27·44	10·16	2·97	16·95	1·40
79024	24–44	"	Marquis (for Chemist)	26·10	9·93	3·10	17·75	1·35
79025	24–45	"	Marquis 10B	26·29	9·51	2·98	16·99	1·31
79026	24–46	"	Red Fife	30·00	9·49	3·13	17·83	1·43
79027	24–47	"	Kitchener	23·63	9·74	2·64	15·06	1·07
79028	24–48	"	Red Bobs	27·39	10·13	2·86	16·34	1·23
79029	24–49	"	Early Triumph	26·76	10·11	2·85	16·24	1·16
79030	24–50	"	Supreme	26·92	9·61	2·86	16·33	1·66
79031	24–51	"	Ruby	25·20	9·51	3·16	18·01	1·51
79032	24–52	Morden, Man.	Kota	35·21	8·55	3·21	18·35	1·73
79034	24–54	"	Garnet	31·08	8·85	2·52	14·36	1·55
79035	24–55	"	Marquis 0·15	36·09	9·17	2·56	14·64	1·68
79037	24–57	"	Marquis x Kota 1653	37·92	8·33	2·39	16·43	1·78
79038	24–58	"	Ruby	31·55	9·34	2·71	15·45	1·81
79039	24–59	"	Reward	39·96	9·60	3·05	17·38	1·99
79040	24–60	"	Acme	38·19	9·92	2·63	15·01	1·62
79041	24–61	"	Iumillo	39·75	10·00	2·66	15·20	1·76
79042	24–62	Indian Head, Sask.	Reward	33·25	9·97	3·04	17·35	1·44
79043	24–63	" "	Kitchener	33·64	10·29	2·39	13·60	1·44
79044	24–64	" "	Marquis 0·15	31·85	10·22	2·76	15·78	1·53
79045	24–65	" "	Orchard Selection	29·04	9·70	2·70	15·40	1·57
79046	24–66	" "	Brownie	24·96	9·51	2·62	14·95	1·55
79047	24–67	" "	Supreme	33·00	9·75	2·52	14·37	1·53
79048	24–68	" "	Duchess	29·66	9·93	2·39	16·48	1·45
79049	24–69	" "	Red Fife	31·16	10·65	2·95	16·82	1·71
79050	24–70	" "	Kota	31·76	9·95	2·97	16·91	1·62
79051	24–71	" "	Broatch's No. 1	34·16	10·24	2·53	14·44	1·55
79052	24–72	" "	Broatch's No. 2	30·50	9·87	2·38	12·89	1·54
79053	24–73	" "	Broatch's No. 3	30·33	9·22	2·16	18·57	1·47
79054	24–74	" "	Broatch's No. 4	34·96	9·34	2·75	15·69	1·30
79055	24–75	" "	Acme	35·23	9·22	2·89	16·49	1·70
79056	24–76	Lethbridge, Alta.	Supreme	30·13	9·22	2·60	13·51	1·53
79057	24–77	" "	Red Fife	29·86	9·67	3·22	16·70	1·66
79058	24–78	" "	Early Triumph	26·53	9·87	2·56	13·31	1·53

TABLE 33—WHEATS FROM EXPERIMENTAL FARMS AND STATIONS—CROP OF 1924—*Continued*

Laby. No.	Milling No.	Locality	Variety	Weight of 1,000 Kernels	Moisture	Dry Matter		
						Nitrogen	Protein (Nx5·7)	Ash
				gms.	p.c.	p.c.	p.c.	p.c.
79059	24-79	Lethbridge, Alta	Kitchener	30·06	9·81	2·71	14·11	1·52
79060	24-80	" "	Ruby	23·16	9·88	3·24	17·27	1·63
79061	24-81	" "	Kota	24·89	9·85	3·44	17·50	1·95
79062	24-82	" "	Brownie	21·02	9·97	3·16	16·49	1·52
79063	24-83	" "	Garnet	21·84	9·85	2·87	14·96	1·56
79064	24-84	" "	Marquis 0·15	27·03	10·01	3·10	16·15	1·66
79065	24-85	" "	Reward	28·02	9·73	3·23	16·83	1·65
79067	24-87	" "	Crown 0353	30·99	9·92	3·23	16·83	1·53
79068	24-88	" "	Criddle's Selection	37·00	9·77	2·77	15·78	1·43
79069	24-89	" "	Masters 0520	33·34	9·83	3·09	17·65	1·58
79070	24-90	Fort Vermilion, Alta	Prelude	31·80	10·07	2·51	14·32	1·88
79071	24-91	" "	Kitchener	41·74	10·48	1·95	11·14	1·62
79072	24-92	" "	Red Bobs	34·80	9·86	2·26	12·87	1·60
79073	24-93	" "	Marquis	39·61	10·04	2·63	15·04	1·77
79074	24-94	" "	Red Fife	45·42	9·83	2·51	14·29	1·64
79075	24-95	" "	Garnet	29·90	9·64	2·59	14·83	1·62
79076	24-96	" "	Bishop	37·44	10·53	2·57	14·64	1·70
79077	24-97	" "	Reward	45·33	10·56	2·15	12·31	1·46
79078	24-98	" "	Huron	40·16	10·24	2·22	12·67	1·37
79079	24-99	" "	Ruby	31·26	10·69	2·42	13·81	1·58
79080	24-100	Bsaverlodge, Alta	Ruby	29·28	9·80	3·17	18·07	1·77
79081	24-101	" "	Red Bobs	36·16	9·88	3·09	17·65	1·73
79082	24-102	" "	Early Triumph	37·15	10·78	3·05	17·36	1·49
79083	24-103	" "	Kitchener	36·28	10·29	2·82	16·08	1·43
79084	24-104	" "	Early Red Fife	38·48	10·29	3·21	18·27	1·80
79085	24-105	" "	Marquis 0·15	35·30	10·70	3·11	17·78	1·79
79086	24-106	" "	Reward	34·98	10·18	3·55	20·25	1·54
79087	24-107	" "	Huron	37·36	9·83	2·78	15·93	1·75
79088	24-108	" "	Garnet	29·72	10·34	3·12	17·81	1·47
79142	24-186	" "	Turkey Red	30·82	11·00	3·18	18·13	1·40
79143	24-187	" "	"	32·75	9·89	2·53	14·43	1·51
79144	24-188	" "	Kanred	32·80	10·80	3·57	20·29	1·34
79145	24-189	" "	Kharkov 1312	31·90	10·42	3·50	19·98	2·09
79146	24-190	" "	Kharkov 22	31·97	10·44	3·27	18·63	2·37
79147	24-191	" "	Kharkov 112	48·86	10·00	2·90	16·52	1·59
79148	24-192	" "	O.A.C. 104	44·46	9·93	2·95	16·85	1·84
79149	24-193	" "	Turkey Red	33·34	9·97	3·33	18·93	1·97
79151	24-196	Belleville, Argentine	Barletta Cordova	34·07	10·67	3·00	17·11	2·02
79090	24-110	Swift Current, Sask	Reward	34·54	10·02	3·50	18·86	1·82
79091	24-111	" "	Kitchener	38·02	9·89	2·94	16·76	1·75
79092	24-112	" "	Producer	32·76	9·90	2·93	16·72	1·81
79093	24-113	" "	Marquis	34·62	9·93	3·11	17·68	2·05
79095	24-115	" "	Ruby	30·59	10·01	3·56	19·74	1·87
79096	24-116	" "	Northcote Selection	40·16	9·26	3·07	17·55	1·79
79097	24-117	" "	Supreme	36·48	9·35	2·96	16·93	1·75
79098	24-118	" "	Brownie	27·95	9·96	3·36	19·21	2·16
79099	24-119	" "	Early Red Fife	29·31	9·32	3·09	17·68	1·92
79100	24-120	" "	Garnet	31·72	9·04	3·12	17·83	1·39
79101	24-121	" "	Golden	34·22	9·34	3·19	18·16	1·97
79102	24-122	" "	Kota	32·35	8·89	3·52	20·07	1·94
79104	24-124	" "	Broatch's Fall Wheat	26·42	9·32	2·88	16·44	1·55
79108	24-152	Fredericton, N.B	Huron	35·57	11·26	2·65	15·17	1·73
79109	24-153	" "	Marquis 0·15	38·20	11·67	2·61	14·95	2·51
79110	24-154	" "	Early Red Fife	39·24	11·43	2·89	16·45	1·68
79111	24-155	" "	Ruby	32·30	11·55	2·82	16·09	1·61
79112	24-156	" "	White Russian	35·20	11·57	2·74	15·68	1·49
79113	24-157	" "	Early Russian	37·26	11·55	2·74	15·61	1·62
79114	24-158	Kentville, N.S	Marquis 0·15	28·94	9·30	2·58	14·73	1·76
79115	24-159	" "	Huron	29·78	10·99	2·77	15·80	1·82
79116	24-160	" "	Red Fife	34·03	11·22	2·78	15·88	2·05
79117	24-161	" "	Charlottetown 123	30·25	11·35	2·94	16·79	1·73
79118	24-162	Nappan, N.S	Huron	37·43	11·13	2·69	15·34	1·97
79119	24-163	"	Marquis	33·87	10·92	2·76	15·73	1·87
79120	24-164	"	Early Red Fife	39·23	11·00	2·54	14·50	1·86
79121	24-165	"	Ruby	32·11	11·35	2·75	15·67	1·70
79122	24-166	Cap Rouge, Que	Huron	37·60	11·16	2·77	15·79	2·28
79123	24-167	"	Cap Rouge	35·31	11·65	2·23	12·73	1·64
79124	24-168	"	Marquis 0·15	35·98	11·41	2·38	13·58	1·83
79125	24-169	Sidney, B.C	Red Stone	30·06	8·75	1·87	10·67	1·41
79126	24-170	"	Red Rock	43·72	9·39	1·63	9·29	1·50
79127	24-171	"	Sun	40·60	9·02	1·48	10·30	1·48

TABLE 33—WHEATS FROM EXPERIMENTAL FARMS AND STATIONS—CROP OF 1924—*Concluded*

Laby. No.	Milling No.	Locality	Variety	Weight of 1,000 Kernels	Moisture	Dry Matter		
						Nitrogen	Protein (Nx5·7)	Ash
				gms.	p.c.	p.c.	p.c.	p.c.
79128	24-172	Lennoxville, Que	White Russian	36·74	9·59	3·09	17·66	1·80
79129	24-173	" "	Ruby	32·28	9·62	3·27	18·68	1·88
79130	24-174	" "	Early Red Fife	40·44	9·65	3·08	17·58	1·70
79131	24-175	" "	Huron	37·51	9·11	3·11	17·76	2·15
79132	24-176	" "	Marquis 0·15	32·39	8·74	3·36	19·18	2·05
79133	24-177	Charlottetown, P.E.I.	Marquis	37·54	12·03	2·08	11·85	1·85
79134	24-178	" "	Early Red Fife	44·36	11·85	1·97	11·26	1·84
79135	24-179	" "	Whitehead's Wheat	40·64	11·32	2·05	11·73	2·02
79136	24-180	" "	Huron	41·18	11·22	2·03	11·60	2·05
79137	24-181	" "	White Russian	40·48	11·26	1·97	11·22	1·68
79138	24-182	" "	Early Russian	43·59	11·33	1·97	11·25	1·78
79139	24-183	Invermere, B.C.	Huron	33·57	9·60	2·83	16·15	2·21
79140	24-184	" "	Ruby	36·59	9·34	2·62	14·91	2·16
79141	24-185	" "	Marquis	35·34	10·19	2·95	16·81	2·09

The data presented in this table will be found of very considerable value in the study of the influence of environmental factors on the character and quality of the grain but they must be supplemented by those of future series before their detailed consideration, with a view to definite conclusions, would be justified.

It has, however, been thought worth while to present separately and for special consideration the data for the varieties Marquis and Garnet, since these two wheats are at present attracting special attention.

TABLE 34—MARQUIS AND GARNET WHEATS FROM EXPERIMENTAL FARMS AND STATIONS: CROP OF 1925

Lab'y. No.	Locality	Particulars (size of plot, etc.)	Variety	Weight of 1,000 Kernels	Moisture	Dry Matter		
						Nitrogen	Protein (N. x 5·7)	Ash
				grms.	p.c.	p.c.	p.c.	p.c.
83263	Brandon, Man.	5-acre field	Garnet 0652	22·74	8·16	2·45	13·95	1·75
83281	"	Variety test	"	23·14	11·01	2·36	13·47	1·63
83264	"	5-acre field	Marquis 015	29·79	9·81	2·04	11·65	2·22
83299	"	Variety test	" 015	27·68	9·93	2·47	14·05	1·86
81823	Morden, Man.	McAulay Field	Garnet	28·68	10·76	2·50	14·25	1·66
83299	"	Variety test	"	26·86	8·86	2·41	13·71	1·56
83266	"	Inf. Environment plot.	Marquis	28·13	8·12	2·73	15·56	1·72
83306	"	Variety test	"	29·20	8·81	2·73	15·58	2·11
83267	Indian Head, Sask.	5-acre field	Garnet 0652	19·44	7·70	3·04	17·34	2·07
83316	" "	Variety test	"	24·36	8·57	2·74	15·64	1·59
83268	" "	5-acre field	Marquis 015	21·86	8·02	3·19	18·22	1·95
83317	" "	Variety test	"	30·33	8·30	2·89	16·37	1·64
83269	Rosthern, Sask.	Large field	Garnet 0652	26·91	9·95	2·75	15·75	1·66
83342	"	Variety test	"	24·00	9·87	3·01	17·16	1·48
83270	"	Large field	Marquis 015	31·54	10·02	2·88	16·45	1·55
83345	"	Variety test	"	31·56	10·00	3·00	17·10	1·79
81822	Scott, Sask.	Large field	Garnet	27·52	10·73	2·74	15·59	1·28
83354	"	Variety test	"	31·82	9·93	2·83	16·15	1·34
83272	"	Large field	Marquis 015	34·41	10·37	2·87	16·32	1·84
83358	"	Variety test	"	35·78	9·78	3·04	17·32	1·34
83273	Swift Current, Sask.	Large field	Garnet 0652	23·74	7·95	3·00	17·12	1·55
83331	" "	Variety test	"	25·34	7·95	3·08	17·57	1·63
83274	" "	Large field	Marquis 015	26·10	7·81	3·23	18·41	1·38
83334	" "	Variety test	"	27·50	8·65	3·31	18·83	1·64
83275	Lethbridge, Alta.	(Irrigated) Goal Farm.	Garnet 652	28·96	10·32	2·39	13·57	1·85
83389	" "	(Irrigated) Variety test.	"	29·04	9·34	2·74	15·60	1·72
83391	" "	(Irrigated) Varisty test.	Marquis	35·74	8·54	2·55	14·54	1·70
83276	" "	(Dry land) Goal Farm.	" 015	26·90	8·93	3·27	18·66	1·76
83382	" "	(Dry land) Variety test.	"	21·21	8·13	3·41	19·42	1·91
83399	Beaverlodge, Alta.	Variety test	Garnet	28·01	7·32	2·79	15·94	1·90
83402	" "	"	Marquis	32·24	8·22	3·15	17·99	1·71
83406	" "	Potato land	Garnet	24·45	9·15	2·77	15·78	1·44
83407	" "	"	Marquis	28·52	8·51	2·84	16·13	1·32
83409	Fort Vermilion, Alta.		Garnet	32·94	9·79	2·86	16·28	1·58
83412	" "		Marquis	37·53	10·02	2·97	16·91	1·79

* The results of the examination of these two wheats and their respective flours from the milling and baking standpoint are appearing in a special bulletin by The Cereal Division.

As a rule, it may be said, the heavier the weight per 1,000 kernels the larger the berry. On this assumption the Marquis, without exception, has the larger kernel; it might be further assumed, provided that the bran coatings are of the same thickness and weight in both varieties that weight for weight, the Marquis would yield the larger weight of "straight" flour.

PROTEIN

Throughout the series, with one exception, the Marquis has given the higher protein content. Omitting, for the purposes of a strict comparison the samples grown at Lethbridge, we obtain the following averages, from fifteen samples of each variety, grown at eight Stations:—

	Protein per cent
Marquis	16.46
Garnet	15.78

The samples of Marquis from Lethbridge, Alta., furnish an excellent illustration of the influence of irrigation on the protein content of wheat. The grain from irrigated land showed 14.54 per cent, while the two samples grown on the dry land area were 18.66 and 19.42 per cent protein. These results are in entire agreement with those obtained many years ago in our studies on the influence of environmental factors on the wheat kernel.

WHEATS FROM CENTRAL BRITISH COLUMBIA

RUBY WHEAT

Lab'y. No. 80373

This sample of Ruby wheat was submitted for examination and report by the Supervisor of Illustration Stations. This wheat was grown at Smithers, Central B.C. without irrigation, on bottom land of light silty loam, in 1923. "Spring weather is generally dry, with little rain during the growing period. Seeding usually commences about the last week in April or during the first week in May and harvesting is completed by the end of August."

ANALYSIS

	Per cent	
Moisture	9.85	
Protein (N x 5.7)	13.67	
Fat	1.51	
Carbohydrates	71.27	
Fibre	2.21	
Ash	1.49	
	100.00	
Weight of 1,000 kernels	34.88	grams

The protein content is very satisfactory and the chemical data generally together with the physical characteristics—colour, hardness, translucency, etc., indicate a wheat of excellent quality.

MARQUIS WHEAT

Lab'y. No. 81561

Submitted by the Supervisor of Illustration Stations with the object of gaining information respecting the possibilities of growing in Central British Columbia a wheat suitable for export.

This wheat was grown at Telkwa in the Bulkley valley in the season of 1924, on bench land. The soil is a dark loam of 5 inches in depth with clay subsoil. The crop was not irrigated.

The wheat was sown May 2 and cut September 8, yielding 25 bushels, per acre.

ANALYSIS

	Per cent
Moisture	10.82
Protein (N x 5.7)	15.97
Ash	1.33
Weight of 1,000 kernels	40.0 grams

This is an excellent sample of Marquis, indeed it might almost be classed with wheats of exceptionally high quality. Considering the size of the berry, its plumpness and weight, the protein content is decidedly high. There is little doubt but that this wheat would yield a flour of very good baking value.

The Grain Inspector at Vancouver writes: "This sample grades No. 1 Northern. I consider this a very fine quality of Marquis wheat, well matured and of fine colour and quality."

WHEATS FROM SASKATCHEWAN

MARQUIS AND GARNET: WHEATS AND FLOURS

These two wheats, grown at the Experimental Station, Scott, Sask., in 1925, are those which were selected by the Dominion Cerealist for comparison as to flour quality, baking strength, etc. They were milled and the flour bleached by the Minnesota State Experimental Flour Mill, Minneapolis, Minn.*

ANALYSIS OF WHEATS

—	Marquis	Garnet
	p.c.	p.c.
Moisture	10·37	10·73
Protein (N x 5·7)	14·63	14·81
Ash	1·65	1·28
Weight of 100 kernels	34·41 grms.	27·52 grms.

ANALYSIS OF FLOURS

—	Marquis	Garnet
	p.c.	p.c.
Moisture	12·69	12·24
Protein (N x 5·7)	13·89	13·54
Fat	1·72	1·38
Ash	0·37	0·33
Wet Gluten	39·73	40·07
Dry Gluten	14·08	14·47
Ratio: Wet-Dry	2·82	2·77
Hydrogen ion concentration (pH)	5·65	5·76

It is evident from these results that these two wheats and their respective flours, from the standpoint of composition, are very much alike. The differences between their data are almost within the limits of experimental error and a critical discrimination between these two flours from the purely chemical data would not therefore be justified.

Both flours would unquestionably be classed as "strong" with excellent bread making qualities.

* The results of the examination of these two wheats and their respective flours from the milling and baking standpoint are appearing in a special bulletin by The Cereal Division.

WHEATS FROM ALBERTA

GARNET WHEAT

Lab'y Nos. 81224-5-6, 81594

This is a series of four samples of Garnet wheat grown on the Experimental Station, Lacombe, Alta., the examination being undertaken at the instance of the Dominion Cerealist. The series consists of the parent seed grown in the Rosthern district, Sask., in 1924 (No. 81594) and sown in 1925 on (*a*) summer-fallowed land producing No. 81224, on (*b*) sweet clover sod yielding No. 81225, and (*c*) after sunflowers giving No. 81226. The object of the enquiry was to ascertain the influence of these various soil treatments on the quality of the wheat.

ANALYSIS OF GARNET WHEAT, 1925

Lab'y No.	Soil Treatment	Moisture	Protein (N x 5·7)	Ash	Weight of 1,000 kernels
		p.c.	p.c.	p.c.	grams
81594	Parent seed	11·59	13·65	1·59	32·3
81224	On summer fallow	11·64	13·76	1·20	31·2
81225	Sweet clover sod	12·15	12·64	1·27	29·8
81226	After sunflowers	11·68	11·73	1·33	30·6

Considered on the basis of protein content, the grain from the summer-fallowed land is practically identical with the parent seed. These two are decidedly high in this important constituent.

The wheat grown on " sweet clover sod " ranks second in the series, with approximately one per cent less protein.

The grain " after sunflowers " is the poorest, with practically two per cent less protein than the parent seed.

Although the differences as noted are large enough to be significant, further and confirmatory evidence would be necessary before reaching any conclusions respecting the influence of previous soil treatment, as followed in this enquiry, on the character and composition of the wheat berry.

MARQUIS WHEAT

Lab'y Nos. 82752-3

These two samples of Marquis wheat were examined at the instance of the Superintendent, Experimental Station, Beaverlodge, Alta. They were grown in 1925 from the same stock of seed. No. 1 (82752) was from a plot of which the soil was a vegetable mould of some 4 inches in depth underlaid by heavy clay and had carried a crop of sunflowers the preceding year. No. 2 (82753) was grown on a deeper loam containing more vegetable matter and less clay and had been summer-fallowed in the previous season.

ANALYSIS OF MARQUIS WHEAT

—	No. 1	No. 2
	p.c.	p.c.
Moisture	10·91	10·36
Protein (N x 5·7)	11·53	16·70
Ash	1·61	1·45
Weight of 1,000 kernels	24·8 grms.	29·7 grms.

Description.—No. 1 kernels rather small, dull and opaque, showing starch on cross section.
No. 2 kernels fair size, reddish brown, translucent clear on cross section.

In all features No. 2, the wheat following summer-fallowing of the soil, is the superior; it has the higher protein content and the larger berry, so that it might be expected to give weight for weight compared with No. 1, more and stronger flour. The difference in protein content, 5.17 per cent, marks an almost exceptional range between wheats grown under the same seasonal condition, as in this case.

It is significant, though the explanation is not very apparent, that in these two cases—Lacombe (Central Alberta) and Beaverlodge (Grande Prairie District, Alberta)—the wheat following the summer-fallow is much superior, especially in respect to the protein content, to that grown after sunflowers.

EUREKA BARLEY

In connection with an experiment instituted in 1923 at the Experimental Sub-station for the Grande Prairie District, Beaverlodge, Alta., to ascertain the effect of various grass sods upon the ensuing yield of grain, analyses have been made of the grain and straw of the barley crop of 1924. These samples were harvested from and, representative of, five plots which in 1923 were in the following grass sods: Brome, Kentucky Blue, Meadow Fescue, Western Rye and Timothy. The results have been calculated to a water-free basis to permit of a strict comparison.

TABLE 35.—ANALYSIS OF EUREKA BARLEY (Grain and Straw.)

Lab'y No.	Previous Crop	Grain		Straw
		Weight of 1,000 kernels	Protein (N x 6·25) w.f. basis	Protein (N x 6·25) w.f. basis
		grms.	p.c.	p.c.
81017 and 81213	Brome	31·34	19·63	12·84
81021 and 81214	Kentucky Blue	36·31	18·98	12·63
81020 and 81212	Meadow Fescue	33·37	18·79	12·74
81018 and 81211	Western Rye	32·07	20·05	13·15
81019 and 81215	Timothy	36·78	18·50	11·23

The protein (N. x 6.25) results for both grain and straw are exceptionally high, indeed they would be considered abnormal for a ripened crop. Average figures for well-ripened barley—grain and straw—on the same water-free basis are 12.5 and 4.5 per cent, respectively. The samples as received of both grain and straw, had every appearance of immaturity. These exceptional results are undoubtedly accounted for by the immaturity of the crop, following unusual seasonal conditions. The superintendent at the Beaverlodge Station writing us in this connection states: "The growing conditions of the season were such as to produce a thin, dwarfed, primary growth, during the long early summer period of dry weather. When the rains came in July, a much stronger suckering growth was sent up, but this was too late to produce much substance in the kernel; in fact a good many of the heads of this late growth threshed none at all. Probably, seventy-five per cent of the crop consisted of this late growth." It is evident therefore that, as conjectured, the high protein results are due to immaturity.

On account of the immaturity of the crop the results may be considered as practically valueless for the purpose of this enquiry, viz. ascertaining the effect (if any) of various grass sods on the succeeding grain crop. It is, however, perhaps of some significance that the protein content of the barley, both grain and straw, following the timothy crop was considerably less than that of any other member of the series. Previous results in this connection had suggested to the Superintendent that a crop of timothy left less available nitrogen in the soil than other grasses.

SILAGE

The samples of silage examined during the past year number twelve, ten of which were from the Experimental Station at Lacombe, Alta. They include silages from corn, sunflower, oats, sweet clover and mixtures of oats and sunflower.

The analytical results on the samples as received and calculated to a water-free basis, are given in table 36.

SWEET CLOVER

Lab'y No. 83421

The sample was sound and free from mould, of a dark green colour, with the characteristic odour of sweet clover. There was a large proportion of rather tough stems present, with numerous heads containing seeds.

This would appear to be a wholesome, nutritious silage, fully equal in protein content to samples of first quality.

CORN

Lab'y. No. 82781

This sample was from a correspondent at Vaudreuil, Que. It was finely cut, of a pale olive green colour, with no cob present; sound with no appearance of mould. It is of average quality in respect to dry matter (23.52 per cent) but very low in crude protein. It would appear to be decidedly inferior in feeding value to corn silage of good average quality.

Lab'y No. 82067

This is a finely cut silage of a greenish brown colour unusually moist, odour rather "sour"; no cob noticed.

This silage is evidently from an immature crop, its dry matter content being about 5 per cent lower than the average for good corn silage. As compared with that from a crop cut, say, in the firm dough stage, it must be considered as decidedly inferior.

In respect to nutritive value it takes a place between the oat and sunflower silages of this series, as will be seen from a comparison of their data for dry matter, protein and fibre.

OATS

Lab'y Nos. 82062, 82069-70

The two samples of finely cut oat silage (82062-69) were of an olive-green colour and of a somewhat pungent, but characteristic odour. Of rather dry appearance; sound and good.

The sample of sheaf oat silage (No. 82070) consisted of about 10 uncut oat stalks; dark brown in colour, rather dry, sound; from the appearance of the heads, the oats had been cut at the dough stage.

TABLE 36.—SILAGES, 1925-1926

Lab'y No.	Particulars	As Received							Water-free					
									Protein					
		Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash	Acidity	Albumi-noid	Non-albumi-noid	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.	p.c.	p.c.
83421	Sweet Clover, Forest, Ont.	74·38	4·71	1·29	10·81	6·82	1·99	....	18·40		5·01	42·24	26·60	7·75
82067	Corn: Exp. Station, Lacombe, Alta.	81·68	2·82	1·71	6·57	5·26	1·96	2·14	8·53	6·86	9·31	35·83	23·78	10·69
82781	Corn: Vaudreuil, Que.	76·48	1·12	0·52	11·60	6·56	3·72	2·01	4·44	0·30	2·22	49·35	27·87	15·82
82062	Oats (100%): Exp. Station, Lacombe, Alta.	69·00	3·44	1·76	14·94	8·23	2·63	0·44	8·62	2·47	5·68	48·16	26·58	8·49
82069	Oats (large silo): Exp. Station, Lacombe, Alta.	66·34	4·12	2·79	16·57	7·83	2·35	2·36	5·87	6·38	8·29	49·27	23·24	6·95
82070	Oats (sheaf): Exp. Station, Lacombe, Alta.	69·47	3·79	1·63	12·98	9·61	2·52	0·77	7·67	4·75	5·34	42·53	31·49	8·22
82063	Oats and Sunflowers: Exp. Station, Lacombe, Alta. Oats, 75%; sunflowers, 25%.	80·07	2·71	1·23	8·67	5·33	1·99	0·97	10·60	3·02	6·13	43·48	26·79	9·98
82064	Oats and Sunflowers: Exp. Station, Lacombe, Alta. Oats, 50%; sunflowers, 50%.	82·72	2·66	1·98	5·36	5·16	2·12	1·68	12·13	3·32	11·41	31·06	29·86	12·22
82065	Oats and Sunflowers: Exp. Station, Lacombe, Alta. Oats, 25%; sunflowers, 75%.	84·31	2·37	0·75	6·53	4·18	1·86	0·62	12·80	2·32	4·78	41·63	26·69	11·78
82066	Sunflowers (100%): Exp. Station, Lacombe, Alta.	86·49	2·27	0·64	5·13	3·47	2·00	0·49	13·37	3·49	4·69	38·00	25·66	14·79
82068	Sunflowers (large silo): Exp. Station, Lacombe, Alta.	87·19	2·05	0·67	4·59	3·36	2·14	1·50	12·34	3·69	5·26	35·84	26·15	16·72
82071	Sunflowers (sheaf): Exp. Station, Lacombe, Alta.	86·84	1·87	0·59	5·08	3·64	1·98	0·33	10·42	3·80	4·42	38·55	27·71	15·10

In dry matter content these samples while fairly normal for oat silage, present a decidedly higher percentage than of either corn or sunflower.

From a comparison of the protein and fibre data with those of average oat silage, those of the samples in this series indicate a nutritive value somewhat higher than usual.

OAT AND SUNFLOWER

Lab'y Nos. 82063-4-5

These silages were of a dark olive-green colour, with a strong and rather pungent odour; sound. No. 82063 was more coarsely cut than the other two samples.

This series of three silages of oat and sunflower mixtures show a marked falling off in dry matter and protein content with the increase in the proportion of sunflower. This must in a very large measure mean a falling off in feeding value. This steady decline in nutritive value following the increased proportion of sunflower is to be attributed to the immaturity and consequent high water content of this sunflower crop.

SUNFLOWER

Lab'y No. 82066, 68, 71

The two finely cut samples were of a dark brown colour, with characteristic, pungent odour of sunflower silage; evidently from fine and slender stalks and no appearance of " heads "; sound. No. 82071, in sheaf, was in lengths of about 3 feet. The stems were very slender with leaves small and scanty; no heads.

All these sunflower silages have a very low dry matter content, their average being 13.16 per cent as compared with 24.10 per cent—the average of thirty-three samples analysed in these laboratories during the past three years. Evidently the crop was quite immature.

As a series, the data make very clear that the oat silage is the richest, the sunflower the poorest and the mixed oat and sunflower silages, as might be expected from this statement, intermediate in feeding value and showing a regular decrease in nutrient content with increasing proportions of sunflower.

TABLE 37.—FORAGE CROPS: CORN; SUNFLOWERS; CORN

(Ste. Anne de

Lab'y No.	Nature of Sample	Date of Sowing	Date of Cutting	Stage of growth	Yield per acre	Dry Matter	
						Percentage	Weight per acre
					lb.		lb.
82490 1A.	Green feed, Vetch ½ bush. Oats 2½ bush., Peas 1 bush.	May 29	Aug. 19	Early dough	5,890	19·20	1,131
82491 2A.	Corn, Longfellow	June 8	Sept. 18	Immature or silking	23,414	14·04	3,287
82495 6A.	" "	" 5	" 18	Silking	32,325	13·80	4,461
82498 9A.	" "	" 5	" 18	"	30,223	18·02	5,446
82497 8A.	" Bailey	" 8	" 18	"	20.874	16·58	3,461
82499 10A.	" Wisconsins No. 7	" 8	" 18	"	27,719	15·24	4,224
82492 3A.	Sunflower, Mammoth Russian	" 5	" 18	Half in bloom	44,310	16·22	7,185
82493 4A.	" "	" 8	" 18	"	27,893	16·97	4,733
82494 5A.	" "	" 5	" 18	"	38,850	14·30	5,555
82496 7A.	Corn and Sunflower—Longfellow and Mammoth Russian.	" 9	" 18	Silking and half in bloom.	37,605	15·02	5,648
82500 11A.	Corn and Sunflower—Early Compton and Mammoth Russian.	" 10	" 18	Silking and half in bloom.	41.500	15·65	6.494

FORAGE CROPS

CORN, SUNFLOWER, OAT—PEA—VETCH

In connection with field crops and animal husbandry work at the Experimental Station, Ste. Anne de la Pocatière, Que., the Superintendent of that Station submitted a series of green forages consisting of one sample of oat, pea and vetch mixture, five of Indian corn, three of sunflower and two of a mixture of corn and sunflower.

Oats, Pea and Vetch Mixture (Lab'y No. 82490): In dry matter and protein this forage is conspicuously the best of the series; the analysis indicates a very rich and nutritious green feed.

Corn (Lab'y Nos. 82491, 95, 97, 98, 99)

Three of the samples are of the Longfellow variety, one of Bailey and one of Wisconsin No. 7. All are reported as cut at the " silking " stage and hence are to be considered as immature—if intended for the silo. Though excellent forage as to palatability and digestibility, their nutritive value, as compared, weight for weight, with the O.P.V. forage, is very low.

Sunflower (Lab'y Nos. 82492, 3, 4)

All three samples are Mammoth Russian and cut when about half the crop was in bloom. In respect to dry matter and protein content the results are very similar to those of the corn samples; it may be fairly assumed, therefore, that there is no marked or outstanding difference in feeding value between these crops compared weight for weight at the time of collection of these samples. The sunflower crop, however, yielded much the greater weight of dry matter per acre.

Corn and Sunflower Mixture (Lab'y Nos. 82496 and 82500)

This sample, No. 82496, was from a crop of corn (Longfellow) and sunflower (Mammoth Russian) grown together and in like manner No. 82500 was from Early Compton and Mammoth Russian. The mixed crop was harvested

AND SUNFLOWER MIXTURES; OATS, PEAS AND VETCH

la Pocatière, Que.)

Fresh Material						Water-free					
						Protein					
Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash	Albu-minoid	Non-Al-buminoid	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.	p.c.
80·80	2·89	0·47	8·69	5·39	1·76	11·97	3·07	2·44	45·26	28·06	9·20
85·96	1·14	0·44	8·09	3·41	0·96	6·73	1·33	3·15	57·61	24·29	6·84
86·20	1·26	0·59	7·59	3·35	1·01	7·60	1·53	4·28	55·02	24·29	7·28
81·98	1·24	1·00	10·51	4·14	1·13	5·88	1·00	5·54	58·32	22·99	6·27
83·42	1·46	0·84	9·05	4·18	1·05	7·64	1·15	5·08	54·59	25·19	6·35
84·76	1·17	0·74	8·17	4·15	1·01	6·57	1·09	4·87	53·60	27·27	6·60
83·78	1·37	0·41	8·14	4·46	1·84	7·33	1·13	2·53	50·13	27·52	11·86
83·03	1·57	0·61	8·33	4·58	1·88	6·86	2·40	8·61	49·09	26·97	11·07
35·70	1·07	0·60	6·27	4·67	1·69	6·23	1·24	4·23	43·84	32·64	11·82
84·98	1·50	0·84	7·68	3·55	1·45	9·17	0·82	5·56	51·14	23·68	9·68
84·35	1·43	0·57	7·69	4·32	1·64	8·12	1·01	3·68	49·15	27·57	10·47

on the same date as the corn and sunflowers of this series and was approximately at the same stage of growth as the plants in the separate crops.

The data indicate that these samples contain more leaf and less stalk than those from the corn and sunflowers grown separately. Though their percentage of dry matter is not very different from that of corn and of sunflowers, the protein content is slightly higher.

OAT HAY

Oat Hay (Lab'y No. 79465)

From Experimental Station, Lacombe, Alta. The oats (Banner) were cut when about fifty per cent of the grain was in the dough stage. The sample was yellowish green and showed a large proportion of stem.

ANALYSIS

—	As received	Water-free
	p.c.	p.c.
Moisture	15·19	
Protein*	6·61	7·81
Fat (ether extract)	3·69	4·35
Carbohydrates	43·82	51·66
Fibre	25·12	29·62
Ash	5·57	6·56
	100·00	100·00
*Albuminoids	6·30	7·43
Non-albuminoids	0·31	0·38

Possibly this grain was cut a little too late to make the best quality of oat hay; previous analyses have given data indicating a somewhat higher feeding value.

SWEET CLOVER HAY

Sweet Clover Hay (Lab'y Nos. 80942-3).—These samples submitted from the Experimental Farm, Brandon, Man., were from two varieties or strains—Common White Blossom and Brandon selected grown in a series under special enquiry as to coumarin content. "The two lots had been started in the hot bed about the middle of April, and had been transplanted as individual plants into the field about May 15. The Common White sent up numerous flower stalks during the latter part of the season, whereas the "Brandon Selected" showed no signs of flowering up to the time of cutting, September 10."

ANALYSIS

—	Common White	Brandon Selected
	p.c.	p.c.
Moisture	6·44	8·51
Crude protein*	20·72	25·51
Crude fat (ether extract)	2·76	3·88
Carbohydrates	36·05	31·43
Fibre	25·43	19·97
Ash	8·60	10·70
	100·00	100·00
*Albuminoids	14·66	16·76
Non-Albuminoids	6·06	8·75
Coumarin	0·13	0·29

In respect to coumarin content the "Brandon Selected" is the higher, though testing by "tasting" at Brandon had indicated that this selection was the less bitter.

By reason of a higher percentage of protein and a lower fibre content, Brandon Selected, as cut and submitted, may be considered to have the higher nutritive value.

Lab'y No. 83422

This sample of sweet clover hay was forwarded from Forest, Ont. with a request as to its soundness and nutritive value. It contained large tough woody stems and from its colour-yellowish green to bright yellow—it was evident that the crop had been too far advanced towards maturity when cut. This was confirmed by the presence of some nearly ripe seeds. No mould was observed.

ANALYSIS

	Per cent
Moisture	10.00
Crude protein	14.13
Crude fat	2.79
Carbohydrates	36.49
Fibre	30.77
Ash	5.82
	100.00

From these data it would appear that the crop was quite far advanced when cut and in consequence the hay is too fibrous. Although it has a fair protein content it is not a very nutritious feed—the high fibre content lowering its digestibility.

CEREAL AND LEGUME HAY

Cereal and Legume Hay. Lab'y No. 82005.—This hay, submitted from the Demonstration Farm at Ste. Anne de la Parade, was from seed made up of oats 2 parts, barley ½ part, peas ¾ part and lentils ¼ part, sown May 18, at the rate of 3 bushels per acre and cut August 5.

As received this hay was very dry and of a good green colour. It appeared to be an excellent hay, although perhaps certain of the components were too ripe when the crop was harvested.

ANALYSIS

	Per cent
Moisture	5.40
Crude protein*	14.18
Crude fat	2.51
Carbohydrates	37.65
Fibre	32.28
Ash	7.98
	100.00
*Non-albuminoids	2.91
Albuminoids	11.27

Although the percentage of fibre is rather high—owing to the over ripeness of the crop when cut—this forage undoubtedly has a high nutritive value. Its richness in protein—14.18 per cent—is due to the presence of the peas, the hay from cereals without any admixture of legumes containing approximately 9.00 per cent of this nutrient.

FEEDING-STUFFS

MIDDLINGS

Lab'y No. 80438

This sample, though of fair quality, does not quite meet the standards for middlings—which are as follows:

	Per Cent
Protein, not less than	16.5
Fat, not less than	16.5
Fibre, not more than	4.5

Lab'y No. 82139

This sample had the appearance of fine shorts of good quality and the percentage of fibre would class it as a shorts rather than as middlings.

Lab'y No. 83015

This sample of middlings was used by the Animal Husbandry Division in their work in the Soft Pork Investigation.

Though slightly lower than the standard in protein these middlings in respect to fat and fibre very fully meet the requirements and might be considered of excellent quality and as quite satisfactory.

OAT PRODUCTS

Lab'y No. 80404-05

The two samples of ground or crushed oats were submitted by the Superintendent, Experimental Station, La Ferme, P.Q.—one (Lab'y No. 80404) was purchased locally, the other (No. 80405) was ground on the farm from "Feed Oats No. 1."

The sample "purchased ready ground" is of exceedingly poor quality; its analysis indicates an admixture of oat hulls. That from the oats ground at the Station is of excellent quality; the percentages of protein, fat and fibre are those of first class oats.

Lab'y. No. 83013

This sample of ground oats was drawn from the stock used in the feeding work of the Soft Pork Investigation.

The protein content is too low to allow these oats to be considered of first quality; the fibre, however, is not excessive.

Lab'y. No. 83031

The analysis shows that the oats of this feed (crushed oats) were of high grade and excellent quality.

Lab'y. No. 82072-73

These were used in experimental work in swine feeding at the Experimental Station, Lacombe, Alta.

No. 82073. "Oat chop with hulls removed." This sample of crushed or ground oats had been sifted, the larger proportion of the hulls being removed by a coarse screen. This feed from its very high percentages of protein and fat and low fibre content is to be considered a "concentrate" particularly valuable in swine feeding.

No. 82073. The analytical data would indicate that the oats used in this chop were of exceptionally high quality.

BARLEY PRODUCTS

Lab'y. Nos. 82074-75

These two samples of barley chop were submitted from the Experimental Station, Lacombe, Alta., from stock used in swine feeding experiments.

The sample of barley chop No. 82074 is of average composition in respect to protein and fat. Its fibre content is a little above the average.

The chop from the Hulless Barley (No. 82075) exhibits certain well marked features when compared with ordinary barley. It has a very much higher protein content and a decidedly lower percentage of fibre.

Lab'y. No. 83014

This is a sample of ground barley (barley chop) from the stock used by the Animal Husbandry Division, C.E.F. in swine feeding in the Soft Pork Investigation. The analysis denotes a barley of good quality and somewhat superior to No. 82074.

DISTILLERY PRODUCTS

Lab'y. Nos. 79657-58 and 82732

These three samples were from stocks supplied by the Canadian Industrial Alcohol Co., Montreal, and used in feeding experiments by the Animal Husbandry Division, C.E.F.

Lab'y. No. 79657

From rye. This is of good average quality, previous analyses of rye grains (10 samples) having given the following averages, protein 20.17, fat 6.43, fibre 15.81 per cent.

Lab'y. Nos. 79658 and 82732

From corn. The only marked difference between these samples is in their fibre content—No. 79658 containing the larger percentage and in consequence the poorer feed. The accompanying guarantee read, protein 30 per cent, fat 5 per cent, fibre 14 per cent. These samples scarcely meet their guarantee in respect to protein; their fat content exceeds by six per cent the guarantee. In fibre one is above and one below the guarantee. The averages for ten samples of corn grains analysed in these laboratories are: protein, 30.68, fat 10.11 and fibre, 12.23 per cent.

Lab'y. No. 83850

Distillery wash. This is a pale yellow watery fluid with a large amount of soft, crushed grain residues in suspension, but settling out on standing; possessing the characteristic odour of this by-product.

Its dry matter is 4.7 per cent and this, with the other data of the analysis, are in fair accord with those previously reported for this by-product.

Though its dry matter is fairly rich in all the important nutrients, the dilute character (the small percentage of dry matter) of this product should be borne in mind in its use. It must be liberally and rationally supplemented. This by-product has been chiefly used in the feeding of dairy cows. It is now very largely replaced by Distillers' Dried Grains—a product which has excellent keeping qualities and by reason of its high nutritive value can be shipped with profit. Distillery wash or slop must be fed fresh; it becomes sour and finally offensive on keeping.

RICE AND RICE PRODUCTS

The samples Nos. 81310 to 81315 were submitted by The Mount Royal Milling and Manufacturing Co., Ltd., Montreal, who write:—

"The one marked 'Meal' is obtained through a process similar to that of milling wheat and is the same by-product from rice as bran should be from wheat. 'Flour' is the straight cleaned rice reduced to flour and should contain the same food value as bald rice. 'Brown' on the samples indicates that the rice is not yet milled, having only the husk removed. We prefer to submit this rather than the cleaned rice, for whatever mineral values would be in the meal (or so called bran) should also be in the brown rice."

Lab'y No. 81310

"Rice. B. Broken". Consists of fragments of rice of uniform size essentially white, with a very few pieces showing brown coatings. A clean product with merest traces only of foreign matter.

Lab'y No. 81311

"Rice. Brown Siam". Essentially unbroken grains of a pale yellowish-brown colour; a few kernels with dark brown skin attached. Traces only of impurities.

Lab'y No. 81312

"Rice. Brown Broken Rangoon". Chiefly broken grains of a light grey colour; a small proportion of the fragments has brown coat adhering.

Lab'y No. 81313

"Rice from Japan". Essentially unbroken grains, somewhat larger and darker in colour than No. 81311 (brown Siam). A fair proportion of the kernels shows outer skin or husk.

Lab'y No. 81314

"Rice Flour", very white fine flour, with no noticeable impurities.

Lab'y No. 81315

"Rice L-Meal". Rather finely ground meal of a light greyish brown colour. Apparently clean and wholesome.

Lab'y. Nos. 81310-81314

These samples are practically identical in respect to their protein content; this means that as suppliers of what may be considered as the most important constituents of the ration, these five products may be regarded as of equal value. These protein data, further, are in close accord with those of hulled rice, and in this connection it may be pointed out that compared with meals in general used for cattle feeding, the protein content of rice is decidedly low —rice in this regard being at the bottom of the list.

The fat content of these five products (Nos. 81310-81314) lies between 1.08 per cent and 2.32 per cent. The "B. Broken" and "Rice Flour" containing approximately one per cent, "Brown Broken Rangoon" and "Brown Japan" roughly one and three-quarters per cent and "Brown Siam" two and one-third per cent.

Though a very considerable variation in fibre content is to be observed, the highest amount is only 1.40 per cent (No. 81313); the fibre in rice flour (No. 81314) is practically negligible, with 0.10 per cent.

The ash or mineral content is decidedly low—from three-quarters to one and a half per cent. This is as might be expected, since the products in question are more closely related to polished rice than to the several milling by-products of the grain. The ash content of polished rice is about 0.5 per cent; the range in the several by-products would be from 5 to 10 per cent.

The carbohydrates, which in these products are essentially starch, range from 75 to 80 per cent. Rice (hulled) is characterized by a higher carbohydrate content than that of other cereals, a feature which not only accounts for its very low percentage of protein but limits its use in the ration.

The moisture content differs but little among these samples, permitting an essentially direct comparison of the samples from the analytical data obtained.

Lab'y No. 81315

This sample labelled " L. Meal " differs from the products already discussed in several notable features—in containing nearly twice the amount of protein, about nine times as much fat and decidedly higher percentages of fibre and ash. In nutritive value it stands alone—and very much the highest—in the series.

In respect to its fibre content (4.09 per cent) this product closely approximates middlings; it is very similar to barley in both protein and fibre. The percentage of fibre is a little more than one third that of oats and of bran.

The fat content (9.67 per cent) is decidedly higher than that of the milling by-products of the cereals, though similar to that of certain manufacturing or industrial by-products *e.g.* hominy (corn) feed. The comparatively high percentage of fat, while enhancing the nutritive value of the meal, might perhaps lower the keeping qualities of the product. Unfavourable storage conditions might result in the development of rancidity.

The comparatively high percentage of ash contains but very small proportion of sand—the chief constituents apparently being potassium and magnesium phosphates. Calcium is not present in notable amounts.

All these products are clean and wholesome, essentially carbonaceous (starch) and, with the exception of " L. Meal", low in protein, fat and fibre.

Lab'y No. 83849

Rice " shorts " submitted by a correspondent at Eburne, B.C. Pale yellow meal with fragments of broken rice; no foreign matter; apparently sound and wholesome.

The percentages of protein and fat might class this feed with rice meal rather than rice shorts, but no definite classification of the milling by-products of rice has as yet been established. This is evidently a nutritious feed, very rich in fat—a fact which should be borne in mind in compounding the ration.

POULTRY FEEDS

Lab'y No. 79517

Prepared by the Molson's Brewery, Montreal and submitted by the Poultry Division, C.E.F.

This feed is partly in powder and partly in flakes, of a yellowish brown colour, with a somewhat bitterish taste. A microscopical examination revealed the presence of dried brewer's yeast (predominating) oil cake meal (traces) corn starch and salt.

This material is characterized by a very high protein content and a decidedly low percentage of fibre. This might point to a high nutritive value for poultry but practical trials would be necessary to establish its exact worth for egg production or fattening fowls. Its slightly bitterish taste would probably affect its palatability; possibly for this reason it could only be used as a small part of the ration.

Lab'y No. 81744

This Laying Mash, submitted by a correspondent in Errington, B.C. had been prepared to order from the following formula:—

	Pounds
Bran	400
Shorts	200
Ground oats	400
Corn meal	400
Feed flour	200
Beef scrap	200
Fish meal	200
Alfalfa meal	200
Salt	5

The analysis indicates a feed of excellent quality and quite suitable for laying-stock. Further, the data agree quite closely with those calculated from the formula.

Lab'y No. 82916

This sample is manufactured by the Blatchford Calf Meal Co., Toronto; brand name "Fill the Basket."

These results agree closely with previous analyses of this feed, and further, this feed fully meets its guarantee, viz. protein 19.0, fat 4.0 and fibre not more than 10 per cent.

Lab'y No. 83069

This laying mash sent from Saanichton, B.C. was prepared from the following University of British Columbia formula:

	Pounds
Bran	100
Shorts	100
Ground oats	100
Corn meal	100
Beef scrap	50
Fish meal	50

This is a mash of excellent quality, with high protein content and sufficiently high percentage of fat. The fibre content is reasonably low.

The analytical results are in agreement with those calculated from the formula.

Lab'y No. 83254

A sample of "laying mash" forwarded by a correspondent at King, Ont. and stated to be prepared from the following formula:—

	Pounds
Bran	100
Oat chop	100
Tankage (60 per cent protein)	100
Shorts	100
Corn meal	100
Salt	3

The analysis indicates a meal of high nutritive value and one that should prove suitable for laying-stock. A calculation from the formula gave figures for protein, etc. closely approximating those of this analysis.

MEAT AND BONE BY-PRODUCTS

Lab'y No. 83668

Tankage, manufactured by City Renderers Ltd., Montreal and submitted by the Animal Husbandry Division. Guarantee, 60 per cent protein. A finely ground dark brown powder with odour not too strongly marked; apparently sound and wholesome. It contains 14.03 per cent bone phosphate. This brand practically meets its guarantee as to protein.

Lab'y No. 83669

This is a sample of " unsteamed edible bone meal " the product of the City Renderers, Ltd., Montreal and submitted by the Animal Husbandry Division, Central Experimental Farm. Of a creamy-grey colour, finely ground, dry meal.

The analysis shows that it contains 24.08 per cent phosphoric acid equivalent to 52.60 per cent of phosphate of lime (bone phosphate). It is a pure bone meal of good quality.

A series of ten samples of bone meals analyzed in these laboratories gave the following data:—

—	Protein	Phosphoric acid
	p.c.	p.c.
Maximum	27·43	27·13
Minimum	24·79	23·88
Average	26·14	25·37

Lab'y. No. 85451

A sample of Swift's " Lay More Meat Scrap ", with a guarantee of 50 per cent protein. A finely ground light-brown powder, apparently sound and wholesome.

This meat scrap exceeds its guarantee in protein and contains 9.15 per cent phosphoric acid—equivalent to 19.98 per cent bone phosphate.

Lab'y. No. 85452

A sample of meat scrap manufactured by The City Renderers Ltd., Montreal, with a guarantee of 60 per cent protein.

A light-brown powder with a considerable proportion of bone fragments; apparently sound and wholesome. It does not meet its guarantee in respect to protein, but such would have been scarcely possible with bone phosphate present to the extent of 21.73 per cent, as in this case.

FISH PRODUCTS

Fish meal is a feeding-stuff product obtained by the utilization of surplus fish and fish offal, the process of manufacture comprising the reduction of the fish or offal by steam cooking, the separation by skimming and pressure of the larger proportion of the oil and the drying and grinding of the residue. The fish and fish wastes employed must be fresh and sound and the several operations carefully and thoroughly carried out, if a wholesome, palatable meal with good keeping qualities is to result. Unsound fish or waste will result in unwholesome and rancid products, unpalatable to stock, likely to produce scouring and other digestive troubles, and apt to cause tainted meats, milk, and eggs. The two essential factors in the manufacture of edible fish meals are *fresh* clean fish as raw material and the reduction to safe limits of the moisture and oil content. High-grade meals with good keeping qualities are invariably characterized by small percentages of moisture and fat.

40000—6

Lab'y. No. 79672

Fish meal, manufactured from shark, dogfish and skate (with livers removed) by the Star Construction Co., Sooke, B.C. A coarsely granulated dark, brown, oily product showing many lighter coloured bone fragments, with fishy odour but not rancid; apparently sound and wholesome.

This product has a notable percentage of protein (50.08 per cent) and bone phosphate (12.56 per cent) and consequently may be considered as a rich concentrate for tissue and bone building. The percentage of oil, however, is very high, and although this is a constituent of very considerable value from the feeding standpoint, such a large oil content would materially affect the keeping quality of the product. Under ordinary conditions of storage the meal would quickly become rancid.

Further, this product could be more safely fed with a lower percentage of oil, especially if used for pigs and poultry.

Lab'y. No. 81207

Sent from Errington, B.C., but manufacturer's name not given. A yellowish-brown powder with pieces of bone and gelatinous material, characteristic fishy odour; apparently sound and wholesome.

An excellent fish meal, though approaching the limit of safety in respect to oil content.

Lab'y. No. 83133

Fish meal prepared by Wentworth Bros., Deer Island, N.B., and submitted by Superintendent, Experimental Station, Fredericton, N.B.

A brown, rather coarsely ground meal; marked but not unpleasant fishy odour resembling that of smoked fish; apparently sound and wholesome. It contains 13.91 per cent of bone phosphate—a fair percentage of a valuable nutrient.

The percentage of moisture is too high—a feature which not only reduces the protein content but materially affects the keeping quality of the meal.

Lab'y No. 83639

From H. W. Wentworth, Fair Haven, N.B., and submitted to analysis for the Animal Husbandry Division. A light yellowish brown meal, with characteristic fishy smell. Apparently sound and wholesome.

Although satisfactory in respect to protein and fat, the moisture content is too high for good keeping qualities. Its percentage of bone phosphate is 12.10—a fair average.

Lab'y No. 83640

Meal apparently prepared from smoked fish. Also a product of H. W. Wentworth, Fair Haven, N.B. Dark brown, somewhat coarser than No. 83639, with characteristic odour of smoked fish; apparently sound and wholesome. Phosphate of lime content is 13.32. Nos. 83639 and 83640 contain salt the former 4.04 and the latter 5.94 per cent.

The high percentage of water in this sample is to be remarked. This besides reducing the protein content, militates against good keeping qualities.

Lab'y No. 83752–53

Two samples of fish scrap meal the product of the City Renderers Ltd., Montreal, and submitted by the Poultry Division. These are dry, light yellowish coloured powders, with characteristic fish meal odour, apparently sound and wholesome and from appearance would be judged of excellent quality.

These samples are practically identical as to composition and in respect to protein fall into the first class i.e., between 55 and 63 per cent. The fat or oil content is within the limits recognized for fish meals of excellent quality with

good keeping properties. The phosphate of lime content of this brand is practically 17 per cent—the range in fish meals being usually from 11 to 19 per cent. The phosphate of lime content is a valuable feature from the feeder's point of view, especially for young stock.

MISCELLANEOUS

Lab'y No. 79798

Feed or provender, submitted by a correspondent at Clarence's Creek, Ont., and stated to be milled locally.

This is an oat chop containing an excess of oat hulls. It is a fibrous and poor feed.

Lab'y No. 81221

Oat chop, submitted by a correspondent at Clarksburg, Ont., and said to be locally manufactured. It was suspected of adulteration.

The examination indicates that this feed is entirely from oats—but oats of a poor quality. There is no evidence of admixture with oat hulls.

Lab'y No. 81532

"Sampson Feed" forwarded from Stanleyville, Ont. A mixed or compounded feed containing oats and corn chiefly.

The results agree fairly closely with previous analyses of this feed.

Lab'y No. 81675

Oat and barley chop, from grain grown on a farm near Kemptville, Ont. An excellent sample of chop, with barley evidently preponderating; the protein and fat content are fully equal to those of the best quality grades, with a decidedly low percentage of fibre.

Lab'y No. 82934

Grist or provender, R. C. M. City View, Ont. Locally obtained.

This feed contains a very considerable excess of oat hulls and, further a large percentage of dark grey dust. This is shown in the analysis by the high percentages of fibre and ash. The protein content is too low for a genuine oat chop feed. This feed was reported as unfit and unwholesome.

Lab'y No. 80143

Semi-solid buttermilk, purchased from The Butcher's Hide and Tallow Co., Montreal; submitted by the Poultry Division. Apparently sound and wholesome. The data are in fair accord with those samples of this product previously analysed in these laboratories.

Lab'y No. 83537

Semi-solid buttermilk, manufactured by the Ottawa Dairy Co., and submitted by the Poultry Division.

This sample differs from those previously analysed in these laboratories in containing a much higher percentage of all the nutrients. Its dry matter—48.15 per cent—is more than twice that usually found in this by-product. Further it is naturally much richer in protein and fat, giving it a higher nutritive value than brands ordinarily found on the market.

A large number of crystal masses of lactose (milk sugar) were observed throughout this sample, the result no doubt of the unusually high concentration of this product.

40000—6½

Lab'y No. 81560

Fox biscuit manufactured by Uric Parent, Ste. Anne de la Parade, P.Q. A yellowish brown biscuit, rather soft; raisins but no particles of meat observed. Sound and slightly sweet.

Compared with other brands of fox biscuits examined in these laboratories this biscuit is very low in protein. It is therefore of inferior nutritive value and though sound and palatable its use must be supplemented with some feed of higher protein content.

Lab'y No. 83576–77

These two fox biscuits were submitted by the provincial department of agriculture, Quebec, but the names of the manufacturers could not be ascertained.

No. 1. This is not a high protein biscuit, though in this regard it is much superior to No. 2. Presumably it contains a proportion of bone as it possesses 7.65 per cent phosphate of lime.

No. 2 is exceptionally low in protein and cannot be regarded as in the same class with biscuits of high nutritive value—of which there are several brands on the market.

Lab'y No. 79482

Whole wheat flour. G. A. P. Lanoraie, P.Q. These results are in close accord with those of genuine whole wheat flour.

Lab'y No. 80839

"Damaged" wheat. This wheat (No. 3 Northern) had been damaged with water and dried. Submitted by the superintendent, Experimental Station, Cap Rouge, for report as to value for feeding purposes.

The kernels are shrunken, dark grey, with a somewhat musty or sour smell; no indication of mould.

	Per cent
Acidity	1.64
Water soluble matter	4.12

The figures for normal, sound wheat are:

	Per cent
Acidity	1.50
Water soluble matter	2.50

From the standpoint of composition this wheat compares well with good sound grain and though it has "heated" it could be fed judiciously without fear of intestinal derangement.

Lab'y No. 82676

Ground dehydrated potatoes. From Silco Products, Montreal, and submitted by the Animal Husbandry Division, Central Experimental Farm, with request for report as to its feeding value.

This sample is essentially potato starch. It is very doubtful if this would prove a suitable and economic feed.

Lab'y No. 83237

Elevator screenings, forwarded by a correspondent in Hammond, B.C., who wished to know their value in poultry feeding.

A quantitative separation gave the following results:—

	Per cent
Wheat—small, broken and shrivelled	36.43
Wild buckwheat—whole	55.53
Wild buckwheat—hulled	4.71
Ball mustard	1.22
Other weed seeds	1.11
Chaff, straw, etc	1.00
	100.00

As these screenings contain but a small proportion of objectionable weed seeds and are cheaper than corn and wheat by $1 per 100 pounds, their use, in all probability, would be found advantageous and economic. Presumably they are palatable and would be readily eaten by poultry.

Lab'y No. 83240

Split and broken peas, from the threshing of "Mackay" pea submitted by Cereal Division, Central Experimental Farm.

This product contains but a very small percentage of weed seeds, chaff, etc. It is a rich and nutritious feed almost the equal in protein content to ground peas.

Lab'y No. 83567

Flax waste. Submitted through the Flax and Fibre Division. It consists essentially of fragments of dry hard, woody stems and straw, with a very few flax seeds.

This product has no feeding value. It would undoubtedly be found unpalatable to stock—and probably injurious if eaten by reason of its harsh and brittle nature.

Lab'y No. 83666

Gluten feed, the product of the Canada Starch Co., Cardinal, Ont., and submitted by the Animal Husbandry Division.

For this product the protein content is decidedly high, a feature that materially enhances its nutritive value; usually it is in the neighbourhood of 26 per cent. Its percentages of fat and fibre are approximately those found in good average samples of gluten feed.

Lab'y No. 83667

Hog-feed tankage prepared by The City Renderers Ltd., Montreal, and submitted by the Animal Husbandry Division, Central Experimental Farm. The statement is made that this is composed of ground meat and bone scrap 55 per cent, sifted digester tankage 30 per cent and oil cake meal 15 per cent. Guarantee, protein 45 per cent.

A finely ground light-brown powder with characteristic but not marked or unpleasant meaty odour; apparently sound and wholesome. The guarantee as to protein content is well met. It contains 20.42 per cent of bone phosphate—a feature which gives it an additional value in the feeding of young stock.

TABLE 38.—ANALYSIS OF FEEDING STUFFS

Lab'y No.	Particulars	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
	Middlings	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
80438	H.O.S., Knowlton, Que.....	11·28	16·27	3·08	60·49	5·51	3·37
82139	Quaker Oats Co., Peterboro, Ont.....	10·81	18·30	6·10	55·38	6·03	3·38
83015	Western Canada Flour Mills Co.	11·60	15·99	4·86	60·78	4·16	2·61
	Oats Products						
80404	Ground oats, purchased.....	9·62	6·79	3·03	52·12	23·21	5·23
80405	" home ground.....	11·89	11·89	5·73	58·05	9·36	3·08
83013	Animal Husb. Div. C.E.F.....	11·56	9·90	6·26	59·87	9·47	2·94
83031	Ground oats, Cottam, Ont.....	11·54	13·06	4·12	60·21	8·03	3·04
82072	Oat chop, Lacombe, Alta.....	11·34	16·56	7·00	58·07	4·75	2·19
82073	" "	9·69	14·17	4·51	58·38	10·59	2·66

TABLE 38.—ANALYSIS OF FEEDING STUFFS—*Concluded*

Lab'y No.	Particulars	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
	Barley Products						
82074	Barley crop, Lacombe, Alta....	13·71	10·18	2·94	65·43	5·41	2·33
82075	Hulless barley chop, Lacombe, Alta.....	15·55	14·45	3·21	61·85	3·17	1·77
83014	Ground barley, C.E.F.....	12·91	11·40	2·13	67·36	4·04	2·16
	Distillery Products						
79657	D.D. Grains, rye.....	9·35	20·82	8·28	45·78	12·77	3·00
79658	" corn.....	3·58	28·61	11·06	37·53	16·90	2·32
82732	" "	4·29	29·34	11·61	41·01	11·92	1·83
83850	Distillery wash.....	95·31	1·19	0·32	2·65	0·21	0·32
	Rice and Rice Products						
81310	"B. Broken".....	12·50	7·43	1·08	77·76	0·38	0·85
81311	Brown Siam.....	12·43	7·40	2·32	75·80	0·83	1·22
81312	" broken Rangoon.....	12·75	7·64	1·80	75·90	0·56	1·35
81313	" Japan.....	12·25	7·50	1·75	75·64	1·40	1·46
81314	Flour.....	11·32	7·32	1·16	79·33	0·10	0·77
81315	"L. Meal".....	10·69	11·71	9·67	55·73	4·09	8·11
83849	Rice shorts.....	10·23	11·57	16·81	45·34	6·41	9·64
	Poultry Feeds						
79517	Dry mash.....	7·82	37·31	1·53	42·78	2·55	8·01
81744	Laying mash.....	11·13	20·87	6·71	46·79	6·65	7·85
82916	Blatchford's "Fill the Basket"	10·07	19·02	5·16	48·85	6·75	10·15
83069	Laying mash.....	6·44	22·99	7·55	49·11	7·28	6·63
83254	"	10·84	22·64	5·58	47·21	5·53	8·20
	Meat and Bone By-products						
83668	Tankage, C. R., Ltd.....	9·89	59·55	11·02	.....	.....	17·53
83669	Raw edible bone meal.....	6·64	24·64	7·52	.....	.....	57·65
85451	Lay-more meat scrap.....	6·86	53·54	12·72	.....	.....	22·92
85452	Meat scrap.....	6·73	50·62	16·12	.....	.....	25·17
	Fish Products						
79672	Fish meal, S. C. Co.....	4·85	50·08	27·20	.....	.....	14·86
81207	" R. J. T.....	9·61	60·24	15·73	.....	.....	13·44
83133	" W. B., N.B.....	19·67	42·90	11·64	.....	.....	14·65
83639	" H. W., N.B.....	20·09	55·81	7·21	.....	.....	16·36
83640	" H. W., N.B.....	32·86	38·95	7·60	.....	.....	19·01
83752	" C. R. Co.....	10·15	57·92	12·89	.....	.....	19·31
83753	" C. R. Co.....	9·93	57·22	12·86	.....	.....	19·54
	Miscellaneous						
79798	Feed or provender.....	6·31	11·49	4·20	62·28	12·06	3·66
81221	Oat chop.....	10·33	9·76	5·67	61·08	9·92	3·24
81532	Sampson feed.....	10·04	11·69	6·35	61·75	6·91	3·26
81675	Oat and barley chop.....	13·15	10·83	3·64	63·94	5·72	2·72
82934	Grist or provender.....	3·22	9·38	10·87	55·56	13·14	7·83
80143	Semi-solid buttermilk.....	79·49	9·84	1·81	.....	.....	2·62
83537	" "	51·85	15·71	5·51	.....	.....	4·38
81560	Fox biscuit, U. P.....	13·76	7·02	3·95	73·52	0·39	1·36
83576	" J. A. T. (1).....	6·52	12·51	2·34	69·53	0·72	8·36
83577	" J. A. T. (2).....	6·72	7·34	4·69	79·50	0·33	1·42
79482	Whole wheat flour.....	12·27	14·79	3·20	66·17	2·10	1·47
80839	Damaged wheat.....	11·34	14·28	.....	.....	.....	1·60
82676	Dehydrated potatoes.....	13·09	0·48	0·17	85·84	.....	0·42
83237	Elevator screenings, B.C.....	10·90	12·58	3·01	66·16	5·47	1·88
83240	Split and broken peas.....	10·73	20·70	1·21	61·38	3·51	2·47
83567	Flax waste.....	5·30	3·17	1·54	28·21	56·16	5·62
83666	Gluten feed.....	5·84	31·13	4·07	46·84	7·32	4·80
83667	Hog feed tankage.....	5·90	47·28	12·12	6·25	3·32	25·13

INSECTICIDES AND FUNGICIDES

As in recent years a large portion of this work was carried on in co-operation with members of the Entomological Branch stationed at Annapolis Royal, N.S. This work entailed the analysis of a number of brands of calcium arsenate and lead arsenate from both Canadian and American manufacturers and allied insecticidal and fungicidal preparations.

The outstanding features disclosed by the analysis of the various brands of calcium arsenate may be briefly summarized as follows:—

(1) The samples were far from uniform and in several cases there existed a wide variation in different consignments from the same manufacturer.

(2) The total arsenic oxide content of several brands varied from 6 to 10 per cent below the guarantee.

(3) In some instances the water-soluble arsenic greatly exceeded the guarantee.

Calcium arsenate may have a high water-soluble arsenic oxide content as determined by the official methods of analysis and still not prove as dangerous to foliage as some arsenates with a low water-soluble arsenic content, determined by the same method.

The wide variance in the samples of calcium arsenate analysed afforded an opportunity to bring to fruition a method for determining the stability of the arsenates when applied to foliage on which we had previously been engaged. By this method it may be judged with a high degree of certitude the behaviour of the arsenical when applied to foliage—whether or not it will be apt to cause leaf burning.

COMBINED INSECTICIDE AND FUNGICIDE SPRAY

A special study covering the combination of calcium arsenate or lead arsenate with aluminium sulphate—lime sulphur spray, developed at the Annapolis Royal laboratory, was undertaken to determine the amount of soluble arsenic liberated when an insecticide was incorporated in the spray, and the character of the spray residue. The combined spray is superior in adherence and may be used with a greater degree of safety, especially under Nova Scotian conditions, than the straight lime-sulphur spray.

ARSENATE OF LIME

Of the four samples of arsenate of lime examined two satisfactorily met their guarantee. The remaining two samples, Nos. 81927 and 81928, cannot be considered technically as calcium arsenates but rather as the result of an endeavour to utilize directly the arsenical ores of Nova Scotia.

TABLE 39.—ANALYSIS OF ARSENATE OF LIME, 1925-26

Lab'y No.	Source of Sample	Vendor or Submitter	Arsenic Oxide As_2O_5		Arsenious Oxide As_2O_3		Moisture
			Total	Water soluble	Total	Water soluble	
			p.c.	p.c.	p.c.	p.c.	p.c.
80010	John Cowan Chemical Co., Montreal	A. A. Eisner, Somerset, N.S.	43·09	0·41	.....	.....	.....
81927	Prof. Murphy, Halifax	A. Kelsall, Annapolis Royal, N.S.	35·96	.....	5·22	2·38	.....
81928	Prof. Murphy, Halifax	A. Kelsall, Annapolis Royal, N.S.	29·65	.....	3·20	0·40	.....
93258	Niagara Sprayer Co., Middleport, N.Y.	W. A. Ross, Vineland, Ont.	41·17	0·51	.....	.....	1·62

Sample No. 80010 was submitted with the remarks that it had caused foliage injury. The results, as disclosed by analysis show it to be of good quality; its percentage of water-soluble arsenic is quite low and should not, under proper conditions of spraying, cause foliage injury.

ARSENATE OF LEAD

The samples analysed were well made—light, fluffy powders, low in water-soluble arsenic and satisfactorily meeting all requirements.

TABLE 40.—ANALYSIS OF ARSENATE OF LEAD, 1925-26

Lab'y No.	Source of Sample (Manufacturer)	Vendor or Submitter	Arsenic Oxide As_2O_5		Lead oxide	Moisture at 100° C.
			Total	Water soluble		
			p.c.	p.c.	p.c.	p.c.
80504	Hemmingway & Co., London, England	Wm. Rennie Co., Ltd., Toronto	32·31	0·26	.....	.....
82428	"Orchard Brand," Gen. Chem. Co., San Francisco, U.S.A.	P. G. Koop, Summerland, B.C.	31·98	0·46	66·50	0·32
83259	Niagara Sprayer Co., Middleport, N.Y.	W. A. Ross, Vineland, Ont.	32·35	0·37	64·69	0·22

PARIS GREEN

Lab'y No. 80505

Paris Green—Manufactured by Blundell, Spence and Co. and submitted by Wm. Rennie & Co., Ltd., Toronto.

ANALYSIS

	per cent
Arsenious oxide (As_2O_3)	55·99
Water-soluble arsenious oxide (As_2O_3)	2·01
Cupric oxide (CuO)	30·88

The water-soluble arsenious oxide is somewhat higher than usually found in well-made "greens."

"WETTABLE" SULPHUR

Lab'y No. 79336

"Niagara Dry Mix" or "Niagara Wettable Sulphur" manufactured by The Deloro Chemical Co., Deloro, Ont. and submitted by W. E. Ross, Vineland, Ont. The sample was intimately mixed and finely ground.

ANALYSIS

	per cent
Sulphur	64·60
*Calcium oxide	16·97
Magnesium oxide	11·88
Lead arsenate	3·30
Copper (as metallic)	0·52
Water-soluble arsenic oxide (As_2O_5)	0·12

*Calcium present as hydrate, sulphate, caseinate and carbonate.

It is quite probable that the small percentage of copper found was due to contamination from the mixer—the mixing-machine not having been thoroughly cleaned out from a previous mix.

Lab'y No. 79948

" Wettable " sulphur, manufactured by the Eastern Lime Co., N.S. and submitted by C. T. Ferguson, Bridgetown, N.S.

ANALYSIS

	per cent
Sulphur	64·70
*Calcium oxide	22·57
Copper (as metallic)	0·28
Arsenic oxide (As_2O_3)	0·68
Water-soluble arsenic oxide (As_2O_3)	0·40

*Combined as carbonate, sulphate, hydrate and caseinate.

The copper and arsenic found are in all probability accidental, due to contamination from the mixing machine.

COPPER CARBONATE

Lab'y. No. 83674

Submitted by the Assistant, Experimental Station, Scott, Sask., obtained from the National Drug and Chemical Co., Montreal.

Lab'y No. 83675

Submitted by the Assitsant, Experimental Station, Scott, Sask., obtained from the Saskatoon Drug and Stationery Co., Saskatoon, Sask.

ANALYSIS

		per cent
Lab'y No. 83074.	Copper (as metallic)	53·61
Lab'y No. 83075.	Copper (as metallic)	54·58

Both samples were of good quality and finely ground.

NICOTINE PREPARATIONS

Samples as received were deep-coloured, opaque liquids, in general, showing a separation of solid matter from one-third to one-fourth of their volume. Samples Nos. 80796, 81945 and 82625 were strongly acid. In Sample No. 82556 fermentation had taken place which would result in loss of nicotine.

TABLE 41.—NICOTINE PREPARATIONS

Lab'y No.	Sender	Nicotine	
		By weight	By volume
		p.c.	p.c.
79815	S. J. Ritchey, St. John, N.B.	0·061	0·062
80673	S. J. Ritchey, "	.....	0·20
80796	J. F. Munroe, "	1·98	2·49
81695	S. J. Ritchey, "	0·48	0·625
81945	J. F. Munroe, "	0·42	0·49
82556	S. J. Ritchey, "	0·21	0·25
82625	J. F. Munroe, "	0·52	0·59

ROACH POWDER

Lab'y. No. 82167

Mysterious Roach Powder submitted by A. U. Meikle, Department of Soldiers' Civil Re-establishment. This sample as received was a very light, yellowish, unctuous powder. The analysis afforded the following data:

ANALYSIS

	Per cent
Moisture and volatile (in vacuo at 70° C)	10.31
Boric (boracic) acid	82.36
Arsenic (as metallic As)	18 p.p.m.

The sample also contained a certain quantity of a sweetening agent and of an oil.

FLIT

Lab'y No. 83194

Flit. Submitted by A. U. Meikle, Department of Soldiers' Civil Re-establishment. To be used as a control for roaches in one of the Departmental Hospitals.

An amber coloured liquid, essentially kerosene (S. Gr. 0.8068) with a small quantity of methyl salicylate (synthetic oil of wintergreen).

DUST

Lab'y No. 83018

Dust. Submitted by Victor Powlowski, Vilna, Alberta who stated that it collected on the binder during harvesting, ruining his crops. As received the sample was a reddish coloured powder.

Microscopical examination showed the "dust" to be summer rust-spores.

FLY SALT

Lab'y No. 82471

Fly salt. Manufactured by the Barton Salt Co., Hutchinson, Kansas. This sample was received for analysis from the United Fly Salt Co., Omaha, Nebraska. This material was a greyish black coloured crystalline powder.

ANALYSIS

	Per cent
Superfine sulphur	25.67
Pulverized charcoal	3.11
Sodium chloride	70.74

Lab'y No. 83571

Fly salt. Manufactured by the United Fly Salt Co., Omaha, Nebraska and received from the Animal Husbandry Division for analysis.

This material was a yellowish-coloured fine crystalline preparation.

ANALYSIS

	Per cent
Common salt	81.92
Sulphur, finely ground	14.27
Calcium oxide (CaO)	2.15

An extract from the literature of the manufacturers is quoted as follows:—

"This product is a combination of ingredients that takes the place of ordinary stock salt and when used by domestic animals and poultry will protect them against flies, ticks, lice, other insects and mites."

The product is patented and from the patent the following claim has been abstracted:—

"A chemical compound used internally by live stock for preventing insects from staying on the body of live stock, said compound comprising a mixture of salt, sulphur and calcium."

COMPOUNDS OR PREPARATIONS SOLD AS SEED AND SOIL DISINFECTANTS AND STIMULANTS OF GROWTH AND GERMINATION

Lab'y No. 79426

Germisan: Manufactured by Fahlberg, List & Co., Mageburg, Germany; distributed through Ronsheim and Moore, London, England; claimed to contain an organic mercury compound capable of disinfecting seed and stimulating germination and subsequent growth.

As received, a pinkish coloured powder, alkaline in reaction, effervescing strongly on treatment with dilute acid.

Qualitative analysis revealed mercury (as a mercuric salt) sodium and traces of iron, alumina, silica, calcium and potassium, with carbon dioxide, chlorides, phenol and organic matter.

" Germisan " appears to be an organic chlorophenol mercury compound with sodium and potassium as carbonates or chlorides. Incorporated in this sample there is a red dye which is probably added to facilitate the distinction between the treated and untreated seed.

Tests made recently in Germany show that after pickling grain for five minutes with Germisan, 79 per cent of the mercury was absorbed by the grain.

Lab'y No. 79427

Uspulum: Manufactured and distributed by The Bayer Co., Inc., New York, N.Y. Claimed to contain chlorophenol mercury and to be used as a seed disinfectant, partial soil disinfectant and as a germination and growth stimulant; claimed to be harmless when sprinkled on living plants.

As received, a greyish-coloured powder, alkaline in reaction, effervescing strongly on the addition of dilute acid.

Qualitative examination revealed mercury (as a mercuric salt), sodium, and traces of potassium, iron, alumina and phosphates with carbon dioxide, chlorides, phenol, sulphates and organic matter.

" Uspulum " may be regarded as an organic chlorophenol mercury compound with sodium and potassium as carbonates or sulphates and contains a red and blue dye.

Tests recently conducted in Germany show that when grain is pickled for five minutes with " Uspulum", 85 per cent of the mercury is absorbed by the grain.

Lab'y No. 79428

Semesan: Manufactured and distributed by E. I. Dupont de Nemours Co., Inc., Wilmington, Delaware; claimed to contain: hydroxymercurichlorophenol sulphate 30 per cent, inert material 70 per cent, and to possess the same qualities as the previous samples.

As received, a greyish-yellow powder, alkaline in reaction, effervescing strongly with dilute acid.

Qualitative analysis revealed mercury, in both states of oxidation though essentially in the higher or mercuric state, calcium and sodium with traces of iron, manganese, potassium and phosphates, also carbon dioxide, chlorides, sulphates, phenol and organic matter.

" Semesan " is an organic chlorophenol sulphate compound of mercury, with calcium, sodium and potassium as sulphates, carbonates and chlorides.

Lab'y No. 79429

Bayer Compound. Manufactured and distributed by The Bayer Co., Inc., New York, U.S.A. claimed to contain nitrophenol mercury and to be used similarly to previously described preparations.

As received, a reddish orange-coloured powder, alkaline in reaction, effervescing strongly with dilute acid.

Qualitatively there was revealed mercury (in the mercuric condition), sodium and traces of potassium, iron, alumina, and phosphates with chlorides, carbon dioxide, phenol and organic matter.

It is an organic mercury compound with sodium and potassium as carbonates or chlorides. The chloride of sodium (salt) is probably added to increase the solubility of the compound rather than as a filler. There is present also a basic orange dye.

Lab'y No. 79430

Bayer Dust. Manufactured and distributed by the Bayer Co., Inc., New York, N.Y. claimed to contain nitrophenol mercury and to be used similarly to previously described samples.

As received, a yellow powder, neutral in reaction.

A qualitative examination revealed mercury (in the mercuric condition) barium, sodium, and traces of potassium, iron, alumina, silica and phosphates, with sulphates, chlorides, phenol and organic matter.

This " dust " is an organic compound of mercury with sodium and potassium as sulphates or chlorides. The inert material is barium sulphate.

Lab'y No. 79431

Dupont Dust No. 12. Manufactured and distributed by E. I. Dupont de Nemours Co., Inc., Wilmington, Delaware. To be used similarly to previously described samples.

As received, an orange coloured powder, alkaline in reaction, effervescing strongly with dilute acid.

Qualitatively there was revealed mercury (both as mercurous and mercuric, though essentially the latter), calcium, sodium and traces of potassium, iron, alumina, magnesium and phosphates with carbon dioxide, chlorides, sulphates, phenol and organic matter.

It is an organic phenol compound of mercury with calcium sodium and potassium as carbonates, sulphates or chlorides. There is present a basic orange dye.

Lab'y. No. 79432

Duponst Dust No. 13. Manufactured and distributed by E. I. Dupont de Nemours Co., Inc., Wilmington, Delaware.

As received, a creamy white powder, alkaline in reaction, strong effervescence with dilute acids.

Qualitatively there was found mercury (mainly as mercuric), calcium, sodium, potassium and traces of iron, alumina and silica, with carbon dioxide, chlorides, sulphates, phenol and organic matter.

This " Dust " is an organic phenol compound of mercury with calcium, sodium and potassium as sulphates, carbonates and chlorides.

Lab'y. No. 79433

Kalimat. Manufactured and distributed by Chicago Process Co., Chicago, Ill., claimed to contain formaldehyde as the active principle and to stimulate growth and insure against winter-killing. Recommended by the German Government Biological Station for use against smut in grains particularly.

As received, a greenish-coloured fluid, acid in reaction.

Qualitative examination: formaldehyde and potassium are the main ingredients with traces of calcium, iron, alumina, sodium and chlorides.

" Kalimat " is essentially a solution of formaldehyde and potassium, probably as the chloride. No other active principle was identified. The solution contains a green dye.

Lab'y. No. 79434

Super-Kalimat. Manufactured and distributed by Chicago Process Co., Chicago, Ill., claimed to contain formaldehyde as the active principle and to be used as above.

As received, a yellowish-green fluid, acid in reaction.

A qualitative examination revealed formaldehyde, mercury (as mercuric), potassium and traces of sodium, iron, calcium, alumina, and silica, with sulphates and chlorides.

" Super-kalimat " is an aqueous solution of formaldehyde, a mercury compound, and potassium and sodium as sulphates or chlorides.

WELL WATERS FROM FARM HOMESTEADS

A review of the reports issued during the past year on waters submitted to the Division for examination permits the following classification:—

	Per cent
Pure and wholesome	45
Suspicious and probably dangerous	27
Seriously polluted	16
Saline (not potable)	12

It is extremely encouraging to note the large percentage (45) of waters returned as " pure and wholesome ". This is the first year in the history of the Experimental Farms that the proportion of good waters has reached such a high figure. It has in the past fluctuated between 20 and 35 per cent.

Since the establishment of a separate Division of Bacteriology, investigations into the wholesomeness of water supplies have been carried on with an additional degree of thoroughness; the examinations in this field are fuller than heretofore and the reports, as a result, are more illuminating and helpful. In this connection it is desirable to add that from the bacteriological point of view the day and hour of collecting the water sample should be recorded and that the sample should be shipped *without delay*. The bacterial count may alter with the passage of time, thereby invalidating results and the conclusions deducted from these results. The sooner the sample arrives at the laboratories the better.

It may be pointed out that decisions concerning the hygienic purity of a well water can only be safely arrived at by a careful balancing of all the information available, respecting the supply. The results afforded by chemistry and bacteriology give a very much higher probability of correctness of judgment than those from either science alone. However, the data from these two sciences may fail to decide a difficult case if full knowledge of the well and its surroundings is lacking. It is very important therefore that the questions on the schedules sent out by the Division of Chemistry to all applicants should be answered as fully and explicitly as possible. It is not at all improbable that the points suggested in this schedule may direct a farmer's attention to the importance of distances, depths, and protection, and enable him to rectify for himself some error that may have been made in the location or construction of some old well.

As so many samples are received which on account of insufficiency, dirty container or other cause, are useless for the purpose of analysis, farmers desiring an analysis are urged before collecting the sample to write to the Division of Chemistry for a copy of the necessary directions.

SOFT PORK INVESTIGATION

At the request of the Secretary of the Meat Packers Association, investigatory work has been carried out during the past few months in co-operation with the Division of Animal Husbandry with the object of determining the factors which cause the production of soft pork. At the present time the investigation is still in progress and the results will be detailed in a later report.

APPLE WRAPS

Continuing the enquiry respecting the influence of various plain, waxed and oiled papers on apples in storage, undertaken in co-operation with the Division of Horticulture, analyses have been made of several samples of papers used for wrapping apples at the Experimental Station, Summerland, B.C.

Analyses of a few typical samples are given in table 42.

TABLE 42.—RESULTS OF ANALYSIS OF APPLE-WRAPS

Lab'y No.	Description	Moisture	Petrolic ether extract
		p.c.	p.c.
80415	Plain wax, No. 3 wrap	4·69	26·59
80416	Wax stripe, No. 5 wrap	2·94	48·84
82383	No. 1, Eastern oil	6·81	15·01
82384	No. 2, Western oil	7·12	13·47
82385	No. 3, Violet lines	9·68	14·05
82386	No. 4, Sulphite wrap	11·60	0·61

DEHYDRATED FRUITS AND VEGETABLES

Twenty-seven samples were examined.

Six samples of dehydrated apples were examined for sulphite content. The maximum amount found was 0.16 parts of sulphur dioxide per 2000.

One sample of dehydrated peaches was found to contain 0.61 parts of sulphur dioxide per 2000.

In co-operation with the Division of Horticulture twelve samples of fruits and six samples of vegetables were examined for water content both before and after dehydration.

Results of analyses are given in tables 43 and 44.

TABLE 43.—WATER CONTENT OF FRESH AND DEHYDRATED FRUITS

Lab'y No.	Fruit	Water, per cent	
		Fresh fruit	Dehydrated fruit
80526	Raspberries	81·12	6·44
80527	"	84·27	8·16
80528	"	81·61	9·75
80529	"	82·44	8·30
81508	Cherries	82·20	16·40
81510	Thimbleberries	81·46	14·89
81513	Pumpkins	93·86	26·16
81512	Crabapples	86·40	12·51
81457	Pumpkins	92·63	.....
81506	"	93·07	32·09
81505	"	88·63	81·26
81925	"	93·40	8·02

TABLE 44.—WATER CONTENT OF FRESH AND DEHYDRATED VEGETABLES

Lab'y No.	Vegetables	Water per cent	
		Fresh vegetable	Dehydrated vegetable
80613	Carrots	89·06	6·55
80614	Beetroots	90·76	15·32
81307	Marrow	94·65	15·24
81873	Celery	89·50	9·67
81911	Potatoes	76·49	16·31
81929	Squash	80·87	9·58

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

During the year 2,305 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 REPORTED ON DURING THE YEAR 1925–26

Condensed and evaporated milks	870
Milk powders	433
Evaporated apples	561
Colours and inks	5
Salts and preservatives	31
Spices and condiments	41
Denaturing oils	33
Lards, lard compounds and edible oils	11
Canned and preserved fruits	131
Tomato products	61
Sausages, potted and preserved meats and fish pastes	56
Pickled pork and bacon	7
Miscellaneous	65
Total	2,305

CONDENSED AND EVAPORATED MILKS

Eight hundred and seventy samples were examined. A summary of results is given in table 45.

TABLE 45.—SUMMARY OF RESULTS OF ANALYSES OF CONDENSED AND EVAPORATED MILKS

Number of samples	Net Weight		Per cent number under weight	Total Solids			Fat		
	Number of samples	Net Weight		Number of samples	Total Solids	Per cent number below standard	Number of samples	Fat	Per cent number below standard
					p.c.			p.c.	
Condensed									
277	Ave. 14·03 Max. 14·74 Min. 13·41		36				312	Ave. 8·31 Max. 9·38 Min. 7·99	2
35	Ave. 7·02 Max. 7·09 Min. 6·89		20						
Evaporated									
456	Ave. 16·06 Max. 16·69 Min. 14·74		41	327	Ave. 31·57 Max. 32·02 Min. 30·95	nil	326	Ave. 9·13 Max. 9·37 Min. 8·98	5
5	Ave. 12·01 Max. 12·14 Min. 11·80			225	Ave. 25·78 Max. 27·95 Min. 25·58		224	Ave. 7·86 Max. 8·11 Min. 7·67	
91	Ave. 6·11 Max. 6·27 Min. 5·76		9						

Forty-five samples (16 per cent) of condensed milk had "Sugar down," that is, a deposit of milk sugar at the bottom of the can. The number of samples of evaporated milk which were under weight is high and shows an increase of 20 per cent over the figures for last year.

One sample of sterilized cream (Keepsweet) gave on analysis 17.75 per cent fat and 25.26 per cent total solids.

The contents of three cans of table milk and cream were found to be badly curdled and quite unfit for consumption. All these cans were quite normal in appearance from the outside. In one sample of evaporated milk, the casein was completely coagulated. The milk was normal in odour and taste and there was no apparent fermentation.

SKIM-MILK, WHOLE MILK AND CREAM POWDERS

Four hundred and thirty-three samples were examined. A summary of results is given in table 46.

TABLE 46.—SUMMARY OF RESULTS OF ANALYSES OF WHOLE MILK, SKIM-MILK AND CREAM POWDERS

Moisture			Ash		Fat		
Number of samples	Moisture	Per cent Number above Standard	Number of samples	Ash	Number of samples	Fat	Per cent number below Standard
	p.c.			p.c.		p.c.	
Skim-milk Powder							
285	Ave.....2·80	1	285	Ave.....8·17			
	Max.....7·58			Max.....8·56			
	Min.....0·91			Min.....7·04			
Whole Milk Powder							
137	Ave.....1·60	nil	137	Ave.....5·98	137	Ave.....27·40	12
	Max.....4·23			Max.....7·30		Max.....50·87	
	Min.....0·45			Min.....4·22		Min.....11·59	
Cream Powder							
7	Ave.....0·80			Ave.....2·43	7	Ave.....68·68	
	Max.....1·49			Max.....2·63		Max.....69·95	
	Min.....0·45			Min.....2·04		Min.....65·31	

All samples examined were free from borates and carbonates.

Five samples of skim-milk powders and one of whole milk powder were given full chemical analysis. The results are shown in table 47.

TABLE 47.—RESULTS OF FULL CHEMICAL ANALYSES OF SKIM-MILK AND WHOLE MILK POWDERS

Lab'y No.	Description	Moisture	Fat	Ash	Hydrated Lactose	Casein	Soluble Albumen
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
78967	Skim-milk powder.....	2·65	1·63	8·32	55·59	25·00	6·50
78968	" "	2·65	1·62	8·38	56·57	25·10	6·22
79803	" "	3·14	0·18	8·23	55·17	24·13	7·63
79804	" "	3·00	0·14	8·28	55·51	25·84	5·89
80250	" "	2·31	0·38	8·13	52·02	24·99	6·80
80249	Whole milk powder.....	1·68	25·23	6·23	39·18	19·94	4·58

Two samples of "Klim" milk powders gave per cent moistures 7.50 and 7.23 and per cent ash 7.51 and 7.55, respectively.

EVAPORATED APPLES

Five hundred and sixty-one samples were examined for water content. Table 48 gives a comparison of results of analysis for the last six years.

TABLE 48.—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		
1920-21	449	21·4	33·5	8·5	43	9½
1921-22	729	20·6	29·9	5·1	44	6
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

SALTS AND PRESERVATIVES

Thirty-one samples were examined. One sample of "Prague" salt contained 5.87 per cent of potassium nitrite. All other samples were free from adulteration.

SPICES AND CONDIMENTS

Forty-one samples were examined. Four were adulterated.

COLOURS AND INKS

Four samples of dyestuffs were examined. One was a non-permissible coal tar dye. One sample of branding ink was examined and found to be free from arsenic.

DENATURING OILS

Thirty-three samples were examined. A summary of results is given in table 49.

TABLE 49.—NUMBER AND PERCENTAGE NUMBER OF DENATURING OILS WHICH SATISFY THE VARIOUS STANDARD TESTS

Tests	Standards required	Satisfy requirements	
		Number	Percentage Number
All		11	33
Flash point	Not below 75° C. (167° F.)	31	94
Boiling point	" 205° C. (401° F.)	21	64
Specific gravity	" 0·819	32	97
Taste	Easily recognized when present in the proportion 1 part oil to 1000 parts fat	20	61

LARD, LARD COMPOUNDS AND EDIBLE OILS

Eleven samples were examined, including pea-nut and cottonseed oils and a sample of "flex," a hardened vegetable oil compound. All samples were free from adulteration.

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CANNED AND PRESERVED FRUITS

One hundred and thirty-one samples were examined, including fifty-one samples of Canadian jams and marmalades, sixty-three samples of imported jams and marmalades and fifteen samples of fresh fruits and fruit pulps.

A summary of results of analyses of jams and marmalades is given in table 50.

TABLE 50.—SUMMARY OF RESULTS OF ANALYSES OF CANADIAN AND IMPORTED JAMS AND MARMALADES FOR GLUCOSE, PRESERVATIVES AND COAL TAR COLOURS

Description	Glucose			Preservatives Benzoates and Salicylates			Coal Tar Colours		
	Number of samples examined	Number containing Glucose	Per cent number containing Glucose	Number of samples examined	Number containing Preserv-atives	Per cent number containing Preserv-atives	Number of samples examined	Number containing coal tar colour	Per cent number containing coal tar colour
Jams and marmalades manufactured in Canada	41	2	4	48	8	16	50	15	30
Imported jams and marmalades	59	nil	nil	63	1	2	58	5	10

No samples of jam were found to contain preservatives in excess of the maximum amount allowed by the regulations.

In none of the samples examined was non-permissible coal tar colour found.

SAUSAGES, POTTED AND PRESERVED MEATS AND FISH PASTES

Fifty-six samples were examined under this heading.

Thirty-one samples of sausages were examined for water, protein and starch content.

Summaries of results are given in tables 51 and 52.

TABLE 51.—SUMMARY OF RESULTS OF ANALYSES OF SAUSAGES FOR WATER, PROTEIN AND STARCH

Thirty-one samples	Water per cent	Protein (N x 6·25) per cent	Water: Protein Ratio	Starch per cent
Average	55·5	11·8	4·8	3·2
Maximum	69·2	17·1	6·2	8·0
Minimum	42·8	8·4	3·6	0·4

TABLE 52.—NUMBER AND PERCENTAGE NUMBER OF SAUSAGES CONTAINING WATER AND STARCH IN EXCESS OF AMOUNTS ALLOWED BY THE REGULATIONS, AND SUMMARY OF WATER–PROTEIN RATIOS

	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	6	6	11	20	24	31	nil
Per cent number	19	19	35	64	78	100	nil

Ten samples of sausages and meats were examined for preservatives. One sample only was found to contain a small amount of benzoate.

Two samples of weiner sausages were examined for added colour. Both were found to be free.

Five samples of fish pastes were examined and four were found to contain coal tar colour.

Ten samples of potted meats were found to be free from preservatives and added colour.

PICKLED PORK AND BACON

Seven samples were examined for nitrite content. The maximum amount of sodium nitrite allowed by the regulations is 0.02 per cent or 200 parts per million.

Four samples contained amounts of sodium nitrite in excess of the regulations.

TOMATO PRODUCTS

Sixty samples of tomato products were examined.

The average, maximum and minimum percentages of total solids of thirty-one samples of tomato pastes were 36.1, 43.1 and 21.7, respectively.

Thirty-two samples of tomato paste were examined for net weight, preservatives (benzoates and salicylates) and coal tar colours.

All were found to be free from preservatives and coal tar colours.

Twenty-six samples of tomato ketchups, soups, pulps and chili sauces were examined for preservatives (benzoates and salicylates) and coal tar colours.

Twelve samples contained preservatives (seven, benzoates, and five salicylates).

Five samples contained preservatives in excess of the maximum amounts allowed by the regulations, one sample having as much as 5.86 parts per 5,000 of salicylic acid.

Twelve samples contained coal tar colour, ponceau 3 R. (S. & J. 56) a permitted colour—being found in all of them.

MISCELLANEOUS

Sixty-five samples were examined under this heading. They included, soups, bean cakes, lemon curds, pickles, mince meats, flavouring powders, flours, lubricating oils, gelatin, thickeners, sugars and baking-powders.

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