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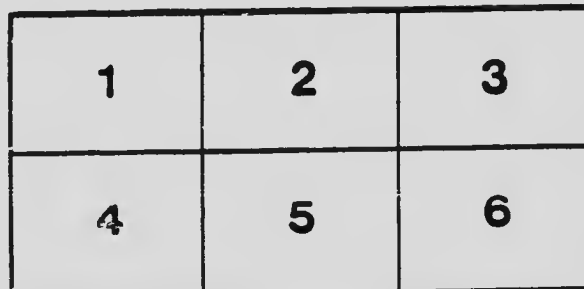
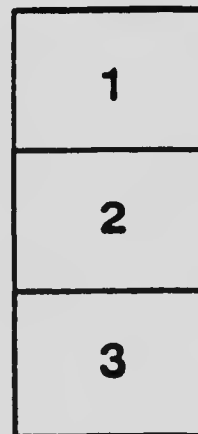
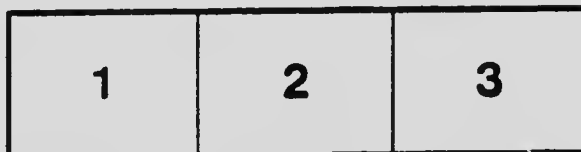
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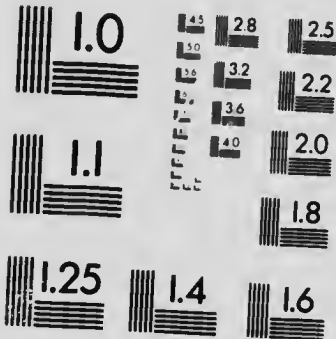
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FARM FEEDS

GRAINS, MILL FEEDS AND CONCENTRATES

THEIR NATURE AND COMPOSITION

BY

FRANK T. SHUTT, M.A., D.Sc.

Director of Experiments

BULLETIN No. 36

SECOND SERIES

1919

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Published by authority of the Hon. T. A. CREER, Minister of Agriculture, Ottawa.

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

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The Honourable

The Minister of Agriculture,
Ottawa.

Sir, —I have the honour to submit herewith, for your approval, the manuscript of Bulletin No. 36, of the Second Series, entitled "Farm Feeds: Grains, Mill Feeds and Concentrates, their Nature and Composition", and prepared by the Dominion Chemist, Dr. Frank T. Shutt.

At the present time especially, when prices of the classes of feeds dealt with in this publication are so high, there is a pressing need of the farmer being given information as to the actual value of the feeds most commonly found on our markets, in order that he may purchase these intelligently and economically.

The data given herein are presented in a practical, easily-understood way, ready for application to any case which may arise in the farmer's feeding operations and I would recommend the early distribution of this publication to the live stock sections of our mailing lists.

I have the honour to be, sir,

Your obedient servant,

J. H. GRISDALE,
Director, Dominion Experimental Farms.

OTTAWA, JAN. 20, 1919.

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INTRODUCTION.

The purpose of this bulletin is to supply to the farmer, as simply and directly as may be possible, information as to the nature, composition and nutritive qualities of the more important feeds found on the market. This information is largely based on the analyses of numerous samples of these materials submitted to examination in the chemical laboratories of the Dominion Experimental Farms during the past three or four years.

One of the chief means by which the farmer and dairyman in these days may expect to make his work more profitable is by judiciously buying the feeding stuffs he needs to supplement the home-grown fodders. Directly or indirectly, prices of milling and industrial by-products of feeding value have reached figures hitherto unknown in the Dominion and there is no immediate prospect of their reduction. Further, while many of the well known feeds have been kept up to their standard quality there have appeared upon the market not a few that are exceedingly poor, some practically worthless, and these are sold at prices little if anything below those of feeds far superior in nutritive value. Under these conditions the economical purchasing of concentrates has become a problem of no small importance, one that it well repays to study closely, and especially will this be true on farms requiring large amounts of bought feed. More than ever before, the farmer must study not merely the relative prices of the various feeds upon the market, but also their composition, especially as to their percentages of protein, fat and fibre. Price is not invariably and inevitably an indication of nutritive value. This we have repeatedly shown, and the farmer must endeavour to correlate price with composition before making his selection. If in this he needs assistance, we shall be glad to advise, provided he can furnish the necessary information as to prices and the quality of the feeds he has under consideration.

And in this connection we must point out that he should insist on the vendor furnishing a guarantee as to protein, fat and fibre content for such products as the Commercial Feeding Stuff Act provides are to be sold under guarantee. The farmer should bear in mind that, altogether apart from the matter of wilful adulteration or imposition, many of the by-products are put upon the market in several grades and it is not sufficient to order, say, cotton seed meal, gluten feed, dried distiller's grains and many similar high priced concentrates, without first ascertaining whether the price asked be in accordance with the grade or quality.

While the composition of a feed as determined by analysis is all-important towards the establishment of its feeding value, the fact must not be overlooked that palatability is a quality which may markedly influence a feed's usefulness. Unfortunately it is not always possible to ascertain by chemical means whether a feed will prove acceptable to stock; the presence in a meal of finely ground weed seeds, many of which are bitter to the taste, may not be detectable by analysis. Palatability and wholesomeness are attributes that can be ascertained only by actual feeding trials.

The value of a feeding stuff depends on its composition and on the digestibility of its nutrients. All feeding stuffs are composed of the same constituents (known as nutrients), but they differ widely in their value to the animal from the fact that the proportions and the digestibility of these constituents vary greatly. These constituents are: moisture, protein, fat, carbohydrates, fibre, ash. We shall not here attempt any complete account of these nutrients, but merely emphasize one or two points in connection therewith, which will enable the farmer to purchase his feeds to the best advantage.

NUTRIENTS.

PROTEIN.—This constitutes the nitrogenous portion of the feed. Its chief function in the animal is the formation of body tissues and fluids—muscle, blood and milk.

Of all the nutrients, it is the most important and valuable, for no other can take place in this essential flesh-forming work. Without it, or if it is in insufficient quantities, the animal cannot thrive, grow or produce milk.

Fat or Oil.—Of the non-nitrogenous constituents, fat has the highest nutritive value. It is used in the animal for the production of fat—the fat of the body and of the milk; for the generation of vital heat, and as a source of energy or power to do work.

Carbohydrates.—These include starch, sugar and allied substances, which as a rule constitute the larger part of the dry matter of a feed. Their function in the animal is to produce heat and energy (for which purpose they are less valuable weight for weight than fat) and under certain circumstances they may become a source of body fat.

Fibre.—This is the least valuable of the nutrients. In composition and function it is similar to the carbohydrates, but it is less valuable to the animal by reason of its being less digestible. An excess of fibre, especially if it is of a woody nature, depresses the digestibility of the other nutrients and thus may reduce the value of an otherwise excellent feeding stuff. A certain amount of fibre is required to give bulk to the feed, to ensure a constant out of the feed through the stomach and intestines, but this is secured in the usual roughages—hay, ensilage, etc.

Ash.—This is the mineral matter taken from the soil by the plant in its growth. It is composed chiefly of lime, magnesia, potash and soda combined with phosphoric and other acids. In the animal it assists in the formation of bone (largely phosphate of lime) and furnishes that small quantity of mineral matter found in all animal tissues.

The farmer buys feeding stuffs chiefly to enrich his home-grown fodders and grains with protein and fat, and thus make them more effective; in other words, to make a well-balanced ration. The value of purchased feeds will depend chiefly, therefore, on their percentages of protein and fat, and, to some extent, on a low fibre content. If such be the case, it is obvious that the character of the farmer's grains and roughages will in a large degree determine the character and the amount of the concentrates to be purchased. The richer in protein the home-grown grains and fodders, the smaller will be the amount of the high-priced mill feeds necessary to purchase. This consideration is an important one and it should induce the farmer, as far as it may be practicable, not only to grow as much of his feed as possible, but to see to it that it is of the kind that furnishes in the highest degree obtainable the necessary protein. As an example of what may be effected by paying attention to this matter, the case of timothy and clover hays may be cited. These differ markedly in their protein content and hence in their nutritive value. Clover hay frequently possesses twice the amount of protein found in timothy. Hence the question, not merely of the amount of feed necessary to buy, but also its character, will be largely determined by the nature of the hay grown. The more protein the farmer can supply from his own crops the less he will find it necessary to buy; and in all probability the more profitable will be his feeding operations.

Various methods have been proposed and used for arriving at a comparative value of feeding stuffs. Some of these, by reason that they are rather complicated and involve the use of coefficients of digestibility, energy values, etc., are not generally applicable in every day work on the farm; others are comparatively simple of operation and, though not yielding results of the same order of accuracy as the more elaborate methods, they furnish results sufficiently close to the truth for the practical purposes of the farmer. One of these simpler methods we may now describe.

We have said that the farmer buys feeding stuffs chiefly to enrich his home-grown fodders and feeds with protein and fat. The value of these purchased feeds will depend therefore, primarily and chiefly, on their percentages of *Protein* and *Fat*. We can, therefore, compare feeds on this basis and obtain the price per protein-fat unit in the several meals under consideration.

THE PROTEIN-FAT UNIT VALUE.

Add together the percentages of protein and fat and divide the sum into the price per ton; the result will be the price of the protein-fat unit in the feed.

Example: Two samples of cottonseed meal are offered, the one at \$40 per ton, the other at \$50 per ton. Which is the better value?

The particulars of the two brands as gathered from the guaranteed analysis are as follows:—

	A. \$40 per ton	B. \$50 per ton.
Protein.....	26.59	37.62
Fat.....	5.81	7.91
Fibre.....	19.97	9.37
A. $26.5 + 5.81 = 32.31$		
40.00		
32.31	\$1.24 price of protein-fat unit.	
B. $37.62 + 7.91 = 45.53$		
50.00		
45.53	\$1.10 price of protein-fat unit	

It is thus apparent from these simple calculations that the price asked for the same weight of protein and fat is 14 cents higher in "A" than in "B".

The relative value per ton of "A" as compared with "B" may be found as follows:
 32.31 (protein-fat units in "A") $\times$ \$1.10 (price of protein-fat unit in "B") = \$35.57.

Thus it is seen that with "A" at \$50 per ton, "A" is not worth more than approximately \$35.57, whereas the price asked for it was \$40 per ton.*

In the following pages the farmer will find interesting and valuable information respecting a comparatively large number of feeds and feeding stuffs on the Canadian market. As our correspondence on this subject of feeds has of late greatly increased, it is expected that the analyses and particulars here given will be found useful to a large number of our readers.

WHEAT: ITS BY-PRODUCTS.

BRAN, SHORTS OR MIDDINGS AND FEED FLOURS.

Bran, shorts or middlings and feed flour are by-products in the milling of wheat. Of these, bran and shorts constitute the two most widely used and valuable "concentrates" used in stock feeding in the Dominion. They are rich in digestible protein and in addition possess considerable amounts of digestible carbohydrates and fat. Their fibre content is not high, provided they are free from foreign material, and they furnish notable amounts of the mineral elements, more particularly phosphorus and potash. This mineral matter or ash, however, contrary to the general impression, is not rich in lime.

Bran consists of the outer integuments of the wheat berry and in the best grades is entirely in the form of light, clean, large flakes. These characteristics, together with freedom from sweepings, weed seeds, etc., denote bran of good quality. Bran is of peculiar value for the dairy cow, promoting the milk flow, furnishing the protein and other nutrients necessary for the production of milk, acting as a mild laxative and giving bulk to lighten the ration containing heavier and coarser meals and thus assisting digestion.

* There exists no simple method of computation whereby the farmer may strictly compare, as to nutritive value, foods of a different character and nature, as, for instance, oil-cake meal and hay. The method here described, however, and which is based on the protein-fat content, is particularly adapted to a close comparison of two or more brands of the same feed (e.g., brands of cottonseed meal among themselves) and is more or less applicable for the comparison of feeds of a similar nature or origin, e.g., the cereal grains.

The series here reported on consists of samples taken for the most part from brans, shorts and feed flours used in feeding experiments conducted at the Central Experimental Farm by the Animal Husbandry Division, 1917, and fairly represent those products as milled and sold at that time by the larger milling companies of Canada.

In fat, the numbers of the series differ but little from one another, the average being 4.37 per cent.

The Adulteration Act calls for the following standard for bran: protein not less than 14 per cent, fat not less than 3 per cent and fibre not more than 10 per cent.

Lab'y. No.	Particulars.	Moist- ure.	Protein.	Fat.	Carbo- hydra- tes.	Fibre.	Ash.
18216	Ontario & Manitoba Milling Co., Ltd.	8.70	16.43	3.33	55.20	9.58	7.76
18226	Maple Leaf Milling Co., Ltd.	9.15	16.75	3.24	57.36	7.64	5.89
20422	Ogilvie Milling Co., Ltd.	12.38	17.50	4.23	50.96	9.47	5.46
25411	Farmers' Club, Merrickville, Ont.	8.45	14.25	.68	59.66	8.59	5.37
25412	" " " " " " " " " " " "	7.86	14.20	4.86	56.05	11.68	5.35
26410	Maple Leaf Milling Co., Ltd.	11.16	15.58	4.94	55.83	7.91	4.58
28982	Western Milling Co.	8.53	13.23	1.71	57.79	9.98	5.82
28983	Lake of the Woods Milling Co.	8.68	14.24	4.71	56.49	10.10	5.66
29618	" " " " " " " " " " " "	7.99	11.65	4.61	55.90	11.19	5.66
30529	Western Canada Flour Mills, Toronto	10.67	14.66	5.49	53.64	10.45	5.08
	Average	9.51	15.09	4.38	55.73	9.62	5.60
	" from 8 samples of bran in 1903. ...	11.07	14.52	4.37	54.19	10.14	5.71

In fat, the samples now reported on vary from 3.80 per cent to 7.03 per cent, the average being 5.08 per cent. The average for the 1933 samples was 5.24 per cent. The fibre content of about a dozen samples is as follows:

The fibre content of shorts should be considerably lower than that of brim. The average of the present series is 6.75 per cent, decidedly higher than that found in 1903, which was 5.23 per cent.

The standard of quality fixed for shorts reads: protein not less than 15 per cent, fat not less 4 per cent, and fibre not more than 8 per cent.

Analysis of Shorts and Middlings, 1917.

Lab'y. No.	Particulars.	Moist- ure.	Protein.	Fat.	Carbo- hydra- tes.	Fibre.	Ash.
	<i>Shorts.</i>						
8640	Western Canada Flour Mills	6.35	16.35	6.40	60.62	6.30	3.91
18227	Maple Leaf Milling Co.	9.51	15.04	4.32	60.09	6.34	4.70
18790	Robin Hood Brand.	9.26	18.06	4.64	58.09	6.18	3.77
19654	Canadian Cereal and Flour Co., Limited.	8.23	17.19	6.02	55.31	8.87	4.38
26411	Western Canada Flour Mills	12.79	16.14	3.80	57.94	6.63	3.30
29296	Maple Leaf Milling Co.	10.73	15.40	4.31	60.09	5.38	4.09
29594	Western Canada Flour Mills	8.13	15.79	6.32	57.88	7.61	4.27
29617	" " " "	11.46	15.65	4.60	57.28	6.88	4.13
30160	Hart Gregory, Komoka, Ont.	11.10	15.81	4.67	56.95	6.72	4.72
30241	R. J. Wilson, Charing Cross, Ont.	10.89	15.60	4.61	57.72	8.28	5.00
31171	M. Laundry, Clarence Creek, Ont.	9.45	15.40	4.95	58.39	7.36	4.45
	Average, 1917.	9.81	16.03	4.97	58.04	6.90	4.25
	" 1903.	10.34	15.93	5.24	59.58	5.23	3.68
	<i>Middlings.</i>						
14706	Pollyhurst, N.B.	10.78	15.81	4.29	58.04	6.62	4.48
29648	Robin Hood Milling Co.	8.12	16.86	7.03	56.59	7.07	4.33
29649	Lake of the Woods Milling Co.	2.22	16.41	5.07	61.07	4.91	3.30
	Average for Shorts and Middlings, 1917	9.21	16.10	5.08	58.29	6.75	4.20

THE COMPOSITION OF BRAN AND SHORTS AS MILLED UNDER THE REGULATIONS OF THE
CANADA FOOD BOARD, 1918.

The tremendous and ever-increasing demand for Canadian flour for military and civilian use overseas has compelled the Canada Food Board, in order as far as possible to meet these requirements, to issue regulations "lengthening" the milling extraction, which means that the Board has ordered the production of more flour from a given weight of wheat than was customary in pre-war times, indeed, until April 1918, the date of the new regulations.

Hitherto, it has been the practice of Canadian millers to make 196 pounds of flour from about 270 pounds of wheat—approximately 72.5 per cent extraction—10 pounds of such flour (of lower grades) being generally used in the preparation of middlings. This resulted in, approximately, 81 pounds of offal—bran, shorts and middlings—from 270 pounds of wheat.

Under the new regulations it is required that—as regards spring wheat of the Prairies Provinces—196 pounds of flour shall be made from 258 pounds of wheat—practically a 76 per cent extraction—this flour being known and sold as “Government Standard Flour”. The making of feed flour, commonly known as Red Dog, and of middlings, is prohibited. The result is that about 59 pounds of bran and shorts are milled from 258 pounds of wheat—a reduction of approximately 25 per cent in the amount of feed, compared with that made before the regulations came into force. These facts explain in a large measure the present shortage and difficulty in obtaining bran and shorts and, further, explain why the floury, mealy middlings, so valuable in pig and calf feeding, are no longer obtainable.

Subsequent to the enforcement of the new regulations (April 1918) samples of bran and shorts were obtained direct from the mills of a number of the leading firms, and submitted to analysis.

Average Composition of Bran and Shorts subsequent to New Regulations of Canada Food Board, 1918, (76 per cent Extraction).

	Bran.	Shorts.
Moisture.....	7.13	7.22
Protein.....	15.84	17.67
Fat.....	4.98	5.16
Carbohydrates.....	57.26	57.25
Fibre.....	11.51	8.52
Ash.....	5.35	4.18
	100.00	100.00

Comparing the composition of the bran and shorts milled under the recent regulations with that of these feeds as previously manufactured, we find:

1. That the bran now made (regulations of April, 1918) is approximately, 0.75 per cent richer in protein, 0.5 per cent richer in fat, and contains 1.5 per cent more fibre.
2. That the shorts under the new regulations are approximately 1.75 per cent richer in protein, very similar in fat content, and contain about 2.5 per cent more fibre.

These results are in the direction that might have been anticipated, for the closer extraction of the floury particles (essentially starch) under the new regulations would more particularly increase the percentage of protein and fibre, which are characteristic of the bran coat constituents of wheat. The greatest difference is found in the shorts, which now more closely approach fine bran, and from which are absent the small percentages of low grade flour which hitherto gave them their mealy, floury condition.

Nothing very definite can be said about the digestibility of the new bran and shorts, as no special digestion experiments have been made with them, but the probability is that, as far as dairy cows and steers are concerned, there will be very little difference from the pre-regulation feeds; the somewhat higher protein content may be largely offset by the larger percentage of fibre. But, in the case of young pigs and calves, it may fairly be concluded that the new shorts, owing to their more fibrous character, will not be so nutritious or suitable.

FEED FLOUR: Several grades of feed flour were until recently found on the market, some being quite floury in appearance, while others are apparently a mixture of shorts and low grade flour.

There is apparently as yet no Canadian standard for this class of feed, but the average composition as given by an American authority is 18.4 per cent protein, 4 per cent fat and 3 per cent fibre.

Analysis of Feed Flour.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
20917	Maple Leaf Milling Co. "Ideal Feed Flour"	6.35	21.68	2.41	62.93	3.69	2.91
20918	" " " " "	6.22	21.56	4.04	62.22	2.96	3.00

The two samples here reported are considerably higher in protein than the above average. In 1913, we reported the average composition of samples of feed flour previously examined in these laboratories as follows: Protein 18.11 per cent, fat 2.94 per cent, fibre 1.48 per cent.

BARLEY AND BARLEY PRODUCTS.

GROUND BARLEY.

Though the composition of barley will depend somewhat on the variety and the climatic conditions under which it is grown, it may be said that, as a rule, compared with oats, it is higher in carbohydrates and lower in protein, fat, fibre and ash. Averages from American and Canadian sources may be given as follows:—

	AMERICAN AVERAGES.		CANADIAN AVERAGES.	
	Barley.	Oats.	Barley.	Oats.
Moisture.....	9.3	9.2	11.9	9.5
Protein.....	11.5	12.4	10.6	11.8
Fat.....	2.1	4.4	2.1	4.7
Carbohydrates.....	69.8	59.6	68.9	59.7
Fibre.....	4.6	10.9	4.1	11.4
Ash.....	2.7	3.5	2.4	2.9
	100.00	100.00	100.00	100.00

Speaking broadly, ground barley would be mealier (due to a larger percentage of starch) than ground oats, but the latter would be slightly richer and stronger, though decidedly the more fibrous feed.

While not a highly nitrogenous concentrate, ground barley is a very valuable meal for almost all classes of live stock. For dairy cattle, as part of the meal ration, it appears to be approximately equal to crushed oats. It can be advantageously used as a supplement to skim milk in calf feeding and is especially palatable to pigs, producing, in conjunction with dairy by-products, a bacon of high quality.

Analysis of Barley.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
18699	Experimental Farm, Agassiz, B.C.....	10.53	11.98	2.14	67.88	5.19	2.28
26113	Central Experimental Farm, Ottawa	8.79	12.91	1.23	67.85	6.06	3.16
26115	" " " "	11.96	12.51	1.82	66.32	4.44	2.95
29294	" " " "	10.99	11.32	1.60	68.64	5.02	2.43
29556	Wisconsin Pedigree, No 5.....	10.99	11.92	1.77	66.77	5.77	2.78
	Average.....	10.65	12.13	1.71	67.49	5.30	2.72

Laboratory No. 26413.—Barley meal from a six-rowed variety of barley grown on the Central Experimental Farm, Ottawa, and used in feeding tests with swine by the Animal Husbandry Division.

This sample is characterized by a somewhat high protein content. The percentage of fat is decidedly low. In both fibre and ash it is slightly above the average.

Laboratory Nos. 26415 and 29294.—Samples from stock purchased in Ottawa in 1916, for use in feeding experiments conducted by the Animal Husbandry Division. They were both of good quality, but, as in sample No. 26413, the percentage of fat is below the average.

Laboratory No. 29556.—This six-rowed variety "Wisconsin Pedigreed Barley No. 5," was grown from imported seed (Wisconsin, U.S.) near Thamesville, Ont. The claim was made that a high protein content (15 per cent) had been developed in this variety, but the sample as analysed was by no means the best in this respect in the series. The weight of 1,000 kernels was 26.1948 grams, indicating a light and small berry.

BARLEY FLOUR.

Laboratory No. 24289.—This feed from the Archibald Cereal Mills Co., Beachville, Ont., is a by-product from the manufacture of pot barley and stated to "consist of the end of the kernel and the polishings of the barley proper."

Analysis.

Moisture.....	9.44
Protein.....	16.44
Fat.....	5.14
Carbohydrates.....	56.76
Fibre.....	7.42
Ash.....	4.80
	109.00

OATS AND OAT PRODUCTS.

GROUND OATS.

Oats form the principal and most important cereal crop for live stock feeding in Canada. The quality of oats depends very largely on the relation of kernel to hull; the percentage of the latter in oats of good average quality is between 25 per cent and 30 per cent, while in light oats it may considerably exceed 40 per cent. Oat hulls are very poor feed, containing about 3.0 per cent protein, and over 30 per cent fibre and are very indigestible. Oat hulls are frequently used as an adulterant of chop feeds. In ground oats, however, the hulls, in giving bulk to the meal, serve a useful mechanical purpose in "making the meal lighter and more easily digested."

Ground oats constitute a safe and nutritious feed, very suitable for horses, cattle and sheep. With the hulls sifted out, it is more especially useful in the feeding of young calves and pigs. Compared with barley, oats are richer in protein, in fat or oil and in bone-forming constituents, but on the other hand they are more fibrous. A more detailed consideration of these two cereals has been given in the chapter on ground barley.

Analysis of Ground Oats.

Lab'y. No.	Particulars.	Moisture.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
16999	Grain Growers' B. C. Agency, New Westminster, B.C.....	5.27	11.95	3.92	64.45	10.92	3.49
19651	Central Experimental Farm ..	8.44	10.35	4.73	61.65	11.23	3.69
20421	" " " ..	10.95	13.53	6.11	56.08	10.32	3.01
26416	" " " ..	11.40	11.38	2.75	61.73	9.53	2.81
29298	" " " ..	8.10	12.39	3.72	62.81	9.90	3.08
30528	Experimental Station, Cap Rouge.....	9.96	10.80	4.95	58.95	11.62	3.72
	Average.....	9.02	11.73	4.36	60.94	10.65	3.28
<i>Hulless Oats.</i>							
14483	Central Experimental Farm.....	10.84	15.89	5.00	63.68	2.32	2.27

Very little in the way of special comment is necessary. The percentage of protein ranges from 10.35 to 13.53 per cent, fat from 2.75 to 6.11 per cent and fibre from 9.90 to 11.62 per cent. It will be seen that the average of the series is very close to those already quoted, which is taken from both our own and American sources.

HULLESS OATS.

Laboratory No. 14483.—The table of analysis includes the results from a sample of Hulless oats grown on the Experimental Farm, Ottawa, 1914. By comparing its

data with the average of ordinary, well-matured oats this hullless variety is seen to be richer in protein and very considerably lower in fibre. It undoubtedly possesses a very high feeding value.

CHOP FEEDS.

Under this caption we discuss a number of miscellaneous mill feeds or chops submitted by correspondents in various parts of the Dominion. For the most part they are essentially oat by-products with a low percentage of protein and a high fibre content. Many of these contain an excessive amount of oat hulls and such are of inferior quality and possess but little feeding value. Some of them, however, contain an admixture of corn, barley and other cereals, and may have very considerable feeding value. These feeds were not branded as to percentages of protein, fat and fibre nor did they carry any guarantee as to composition. While some of them are put out under brand names by large milling concerns, others are the product of the local grist mill.

OAT FEEDS.

The analyses of this series given in the subjoined table show the limits of protein to be 4.70 per cent to 6.80 per cent, fat 1.36 per cent to 2.28 per cent, fibre 21.24 per cent to 28.07 per cent. These results indicate materials of inferior quality and possessing extremely low feeding value. They all contain an excessive amount of oat hull and are, in consequence, very fibrous and indigestible. The presence of this hull was masked, in certain of the samples, by the fine condition to which the feed had been ground. Evidence of the inferior quality of these feeds was confirmed by the testimony of several correspondents, one of whom stated that he had lost a number of young pigs and calves from the use of the feed, while a second, speaking of another feed, alleged that it was rejected by stock and had caused digestional trouble when they had been starved to it.

Owing to their extremely low nutritive value and exceedingly fibrous character, it is very doubtful whether such feeds could be economically used for any class of stock, yet some were being sold at ridiculously high prices.

Analysis of Oat Chop Feeds.

Lab'y. No.	Particulars.	Moisture.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
27455	Western Canada Flour Mills.....	8.74	4.77	1.87	50.97	28.01	5.64
28738	Brackman-Ker Milling Co.....	6.65	6.38	1.74	55.46	24.42	5.15
28754	From Goderich, Ont.	5.73	6.80	2.28	57.67	22.67	5.45
30189	Canada Flour Mills Co., Ltd.....	6.48	4.70	1.36	53.17	28.07	6.24
30725	Western Canada Flour Mills, Ltd.....	10.47	4.89	1.58	55.72	21.24	6.10
31007	Origin not stated.....	10.05	5.29	1.57	62.90	27.03	3.16
20199	Quaker Oats Co.....	3.20	7.70	2.77	58.63	23.86	3.84
20553	From Simard, Que.....	4.80	6.48	2.47	52.62	27.75	5.88
	Average	7.01	5.90	1.95	54.64	25.31	5.18
<i>Oat Hulls.</i>							
11270	From Verigin, Sask	3.80	3.44	2.12	56.92	28.10	5.62

MIXED CHOP FEEDS.

In the foregoing paragraph we have dealt with a number of feeds which were essentially oat by-products, many of which were heavily adulterated with oat hulls and were, in consequence, of extremely low nutritive value.

There are however, a large number of chop feeds on the market which, while largely composed of oat products, also contain a certain percentage of corn, wheat, barley, etc. The series now considered may be regarded as examples of this class.

Analysis of Mixed Chop Feeds.

Laboratory No.	Particulars.	Name	Moisture.	Protein.	Fat	Carbohydrates	Fibre	Ash
10808	Robin Hood Mills, Moosejaw, Sask.	Dutch Dairy Feed	7.10	10.74	2.59	58.19	16.27	5.11
25767	Manufacturers of "Force".....	Feed..	6.78	10.45	2.66	69.18	7.39	3.31
28838	Quaker Oats Co.....	Banner Cattle Feed	11.33	8.14	2.13	66.85	8.68	2.87
30784	From Rimouski, Que.....	Feed..	12.86	5.56	.68	52.21	26.70	1.96
29018	From Washago, Ont.....	Mill Feed	9.83	9.69	2.54	63.93	10.70	3.31
28256	From Harriston, Ont.....	Mill Feed	8.40	9.95	1.59	61.64	12.09	3.42
28102	From Montreal, Que.....	"Montlee C"	7.08	8.85	2.56	61.19	12.59	7.82
16961	Grain Growers B. C. Agency, New Westminster.	Mixed Concentrates.	7.85	14.53	9.61	51.12	7.73	6.16
29753	Robin Hood Mills, Moosejaw, Sask..	"Jersey" Pig Feed.	11.02	13.62	3.17	65.06	4.70	2.38
30854	Origin not stated.	Feed..	12.33	11.75	2.76	60.47	9.47	3.22
11056	Tillson Rolled Oats Co.....	"Mealine"	7.95	17.19	6.10		2.48	
31577	Quaker Oats Co., Peterboro, Ont....	Schunacher Feed.	10.45	11.62	3.60	59.30	11.45	3.68
39998	Quaker Oats Co., Peterboro, Ont....	Schunacher Feed.	9.75	11.48	3.58	60.50	11.10	3.59
49175	Quaker Oats Co., Peterboro, Ont....	Schunacher Feed.	11.59	10.90	2.21	59.73	11.09	3.79
11057	Canadian Cereal Co., Woodstock, Ont. Branch.	Oat Flour	6.55	14.88	6.05		4.97	
11058	Canadian Cereal Co., London, Ont. Branch.	Oat Flour	8.87	13.06	2.62		11.17	
21230	Archibald Cereal Mills Co., Woodstock.	Oat Flour	7.95	17.25	7.83	60.93	3.44	2.60

Laboratory No. 10808.—This feed meets the requirements of the Act for chop feeds as regards protein and fat, but is too high in fibre. Inspection showed it to contain a considerable amount of oat hulls and some unground weed seeds.

Laboratory No. 25767.—A by-product in the manufacture of the well-known breakfast food "Force." It is essentially a wheat product. Though not a feeding stuff of high nutritive value from the standpoint of protein and fat, its comparatively low fibre content is a favourable feature, more especially if intended for young stock.

Laboratory No. 28838.—This feed on examination was found to consist chiefly of corn and oats with a few weed seeds. The material is imperfectly crushed or cracked rather than ground, and a large proportion of the oat hulls were practically entire and very hard and sharp. The sample may contain a certain proportion of added hulls. Further, the appearance of the feed gives rise to the suspicion that mill sweepings are present.

A mechanical analysis furnished the following data:—

Coarsely cracked corn and whole oats, retained on 10-mesh screen..	15 per cent.
Fine meal passing 20-mesh screen.....	21 "
Finely cracked corn and oat hulls retained on 20-mesh screen	64 "

This feed, it was alleged, had caused the deaths of several calves and young cattle, after being used for a week or ten days as the exclusive food. Other and older animals had manifested symptoms of illness (unthriftiness and slight hemorrhages) for some time and recovered after this feed was discontinued. Post mortem examination of the young animals, which had died while being fed this meal, showed acute inflammation of the large intestine.

Though one of the best in the present series, this is a low grade chop feed. It must be considered as quite unsuitable for swine and young stock generally, not merely on account of its low feeding value, but chiefly by reason of its harsh nature due to the presence of a large proportion of oat hulls. It might be found safer and somewhat more palatable if more finely ground; but this, though making it less injurious as a mechanical irritant to the intestinal tract, would not add materially to its nutritive value nor make it a desirable feeding stuff.

There is no evidence that the death of the young stock resulted from the presence of any poison in the feed. Death was probably caused by malnutrition, accentuated by the inflammation and hemorrhages set up by the sharp, harsh character of the feed.

Laboratory No. 30784.—A finely ground, light chocolate-coloured meal with distinct but not unpleasant odour. Examination proved the presence of cottonseed hulls. The results indicate an exceedingly low feeding value; indeed it may be regarded as practically worthless.

Laboratory No. 28048.—This is stated to be a mixture of oat and barley chop with cottonseed meal. Microscopical examination showed that it consisted essentially of oat and barley products. It was bought at the rate of \$35 per ton. This is a feed of rather poor quality and decidedly inferior to bran, which, our correspondent stated, could be bought at a much lower price.

Laboratory No. 28256.—This is stated to contain wheat, corn, barley, cottonseed meal and oat shorts. Microscopic examination showed it to consist essentially of oat and barley products, with some wheat and corn. This, in nutritive value, is somewhat poorer than No. 28048, containing less fat and a higher percentage of fibre. It is decidedly inferior to bran and shorts and must be regarded as a low grade feed.

Laboratory No. 28492.—This was sent by a correspondent in Nominique, who reported that it was refused by all classes of live stock; even mixed with a fair proportion of bran it was eaten only with repugnance. On persisting in the feeding of this material to swine and poultry several animals died, apparently partly from starvation and partly from digestive derangement. It was purchased at Nominique at the rate of \$36 per ton.

This feed was extremely coarse and fibrous, with very little fine meal. It had a slightly rancid odour. It was found on examination to contain—with a number of other weed seeds—mustard, lambs' quarters, black bind-weed, etc., with glumes and fragments of cereal straws. It evidently consisted in part of screenings or mill waste of a worthless character.

It is an inferior feed and quite unsuitable for the feeding of swine and poultry.

We do not consider that this feed contained any active poison but that the bad results from its use are to be attributed to its coarse, fibrous nature, its low feeding value and the presence of pungent, unpalatable weed seeds.

Laboratory No. 16961.—This is an acceptable and superior feed comparing favourably with bran of good quality as to protein and fibre and decidedly richer in fat than this feeding stuff.

Laboratory No. 29753.—A rather coarsely-ground dark-coloured meal, in which mustard and several other kinds of weed seeds were detected. It is a feed of good quality, with a fair percentage of protein and a low fibre content. The unpalatability of this feed, complained of by our correspondent, is no doubt due to the presence of certain pungent weed seeds.

Laboratory No. 11056, "Mealine".—This feed is stated to come from the manufacture of "rolled oats" and to consist of the fine meal sifted out in the operation. The data indicate that this would be a satisfactory feed of very considerable nutritive value.

Laboratory Nos. 31577, 39993, 40175. "Schumacher" Feed.

This is essentially an oat chop feed. The manufacturers state that it contains wheat, corn, barley, oat hulls, middlings and shorts, oatmeal, screenings, flour, cottonseed meal and grain mill by-products. Their guarantee is: protein not less than 10.5 per cent, fat 4 per cent, fibre not more than 10.5 per cent. Inspection reveals the presence of a considerable proportion of oat hull and other mill refuse. While by no means a high grade concentrate, it is distinctly superior to many oat chop feeds on the market, both as to nutritive value and palatability.

Of the three samples analysed, two are almost identical in protein, fat and fibre, the third (No. 40175) is somewhat lower in protein and fat. Considered generally, this feed meets its guarantee as regards protein, but fails to do so in respect to fat and fibre.

Laboratory Nos. 11057-8, Oat Flours.—These are the by-products of two oat meal mills. The analytical data point unmistakably to the superiority of No. 11057; it is nearly two per cent higher in protein and 3½ per cent richer in fat and is much lower in fibre. No. 11058 was the more finely ground and might be taken from mere inspection as the more valuable, especially as No. 11057 showed some hulls. These two samples will illustrate the value of analysis for ground feeds.

Laboratory No. 24290.—Of the oat flours examined, this sample probably possesses the highest nutritive value.

While a number of the most worthless feeds on the market are oat products, consisting largely of oat hulls, our analyses have shown that there are also oat feeds of very considerable nutritive value. These latter consist of the floury siftings obtained in the manufacture of oatmeal and rolled oats and are characterized by a practical absence of hulls.

CORN AND CORN PRODUCTS.

CORN MEAL.

Indian corn is probably the most palatable and highly relished of all the cereals used in feeding live stock. It is not, however, a well-balanced grain for extensive use in feeding; while rich in starch and oil, it is lacking in protein and mineral matter. It is therefore more suitable for fattening-stock than for cows producing milk or in calf or for young and growing stock. Indeed for all classes of live stock it must be supplemented with feeds rich in protein and ash constituents, if satisfactory results are to be obtained. It is particularly relished by poultry, but must be sparingly fed to layers or they will become unproductive through over-fatness. In fattening poultry also its excessive use tends to the development of adipose tissue rather than the production of a properly fleshed fowl.

Analysis of Ground Corn (Corn Meal).

Laboratory No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
19653	Locally ground, Ottawa	11.59	9.40	5.61	70.96	1.44	1.60
20424	" Yellow Dent"	12.67	9.06	5.89	69.19	1.64	1.65
26414	Purchased in Ottawa.	12.75	9.50	2.32	72.29	1.57	1.57
29611	" "	12.20	9.57	1.78	73.08	2.23	1.14
	Average from American sources.....	11.30	9.30	3.80	72.00	2.30	1.30

Special breeding experiments have been carried on in recent years in the United States towards developing varieties of corns characterized by high percentages of protein, oil and starch, respectively. This work has resulted in corns of widely different composition being found on the market. Nos. 19653 and 20424 are somewhat richer in fat than average corn meal, while Nos. 26414 and 29611 are considerably below the average in this nutrient. As will be seen from the table of data, all four samples in protein approach closely the average from American sources.

CORN FEED (HOMINY FEED).

Analysis of Corn Feed.

Laboratory No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
18228	Purchased in Ottawa.....	6.98	11.16	6.61	60.57	3.09	2.59
20123	"	9.84	11.83	8.66	63.02	4.42	2.53
25933	Oriental Flour & Feed Co., St. Thomas, Ont.....	6.30	11.41	7.52	67.45	4.77	2.53
	Average American Hominy Feed—high grade.....	10.10	10.60	8.60	64	4.40	2.60
	Average American Hominy Feed—low grade.....	9.10	9.50	6.20	64.00	8.50	2.70

Corn or hominy feed is a palatable, wholesome feed, fairly rich in protein and with a high fat content. It is much relished by stock and has been used extensively and satisfactorily in the United States in the feeding of dairy cows, steers and swine. The analysis indicates that it would possess a higher nutritive value than corn meal.

CORN BRAN.

The hull of corn, consisting of two layers, an outer and an inner, both quite thin, constitutes corn bran. This product is not frequently found on the market as such, but is usually sold mixed with the other by-products, as gluten feed, etc. It is decidedly inferior to wheat bran in feeding value, being much lower in protein and fat and higher in fibre. According to certain indications, corn bran as sold on the market is a variable product, some samples apparently containing more or less of the gluten layer underlying the true bran coats and such feed is naturally of higher nutritive value than the pure bran.

Laboratory No. 28434.—This sample of corn bran was forwarded by a correspondent in Toronto, with an inquiry as to its value compared with wheat bran. It was a bright, clean feed consisting of thin skin of the corn finely ground, without any foreign admixture. It was not purchased under guarantee and its source could not be learned.

Analysis.

	Corn Bran. No. 28434.	Wheat Bran. Average.
Moisture.....	6.59	11.5
Protein.....	5.91	15.7
Fat.....	1.16	4.3
Carbohydrates.....	68.33	53.4
Fibre.....	16.63	8.7
Ash.....	1.35	6.4
	100.00	100.00

Corn bran of this quality is seen to be a very poor feeding stuff, distinctly inferior in nutritive value to wheat bran. A comparison of the two materials shows that wheat bran contains nearly three times the protein, practically four times the fat and half the fibre present in corn bran.

GLUTEN FEED.

Gluten feed is one of several by-products in the manufacture of starch and glucose from corn. There are several grades on the market, the composition of which is largely determined by the process of manufacture employed. Speaking generally, gluten feed consists of the corn bran or hulls with the gluten of the grain (set free in

the separation of the starch) but there is always present a certain proportion of germ and a small amount of starch which has remained with the gluten on the sieves when the softened and crushed grain is washed in a current of water to separate the bulk of the starch. The germ is separately treated, corn oil cake or germ meal, a rich feeding stuff, resulting after the expression of the greater part of the oil. Gluten meal, consisting essentially of the gluten of the corn grain and containing about 5 per cent of protein has practically disappeared from the market, this by-product being mixed with the bran and sold as gluten feed.

Two grades of gluten feed are generally recognized on the American market, a high grade containing approximately 25 per cent protein and 4 per cent fat and a low grade carrying about 17 per cent protein; gluten feed, therefore, as with all concentrates of the nature of by-products, should be purchased only on guaranteed analysis.

Analysis of Gluten Feed.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohy.	Ash.
14665	Edwardsburg Starch Co.	13.20	30.63	1.04	1.95	0
18214	Canata Starch Co., Cardinal, Ont.	6.41	25.51	1.90	6.74	0.82
19230	Lennoxville, P.Q.	5.96	26.44	2.13	7.56	0.82
19294	Edwardsburg Starch Co.	5.65	29.74	2.02	1.59	0.82
19351	Canata Starch Co., Cardinal.	7.70	26.79	2.84	6.30	0.80
20118	" " " Edwardsburg.	9.25	24.12	5.23	3.8	0.84
26191	" " " Fort Wm., Ont.	8.71	23.66	2.21	7.1	1
29612	" " " Cardinal, Ont.	6.49	24.82	1.91	6.7	0
31017	" " " Cardinal, Ont.	9.74	30.12	2.76	8.14	0.7
31018	St. Lawrence Starch Co., Ft. Credit, Ont., Jersey Brand.	10.06	18.91	2.49	3.4	1
	Average.	8.32	26.02	2.78	5	1.02
	Average from American sources.	9.20	25.00	3.50	7	1

GLUTEN MEAL.

It has already been pointed out that gluten meal is a much richer feeding stuff than gluten feed, ranking with the best and most nutritious of the concentrates. Unfortunately, it is rarely to be obtained. One source only during the past year, the product of the Corn Products Refining Co., New York, and it proved to be of excellent quality, as shown by the following analysis:

Analysis of Gluten Meal.

Moisture.	10.00
Protein.	25.00
Fat.	4.00
Carbohydrates.	50.00
Fibre.	1.00
Ash.	0.00

Since this feeding stuff is a heavy, close meal, its judicious use implies its admixture with feeds of a looser character—such as bran, crushed oats, etc.—to permit its more complete attack by the digestive fluids and its better assimilation by the animal.

The corn by-products in general are very palatable and greatly relished by stock. Further, their protein is highly digestible, so that if prices permit they can be used satisfactorily and advantageously in the meal mixtures for both dairy cows and fattening steers.

CHICK FEEDS.

Two "chick feeds" examined at the request of the Poultry Division,—

Laboratory No. 17322.—"Royal Canadian," Graham Bros., Ottawa, said to consist of peas, rice, wheat and corn

Laboratory No. 17323.—Chick feed, manufactured by Park and Pollard, Boston, Mass., and stated to contain, among other ingredients, oil cake and fish scrap.

	Laboratory No. 17322.	Laboratory No. 17323.
Moisture.. . . .	9.14	9.77
Protein.. . . .	11.10	11.60
Fat.. . . .	5.88	3.60
Carbohydrates.. . . .	68.76	6.05
Fibre.. . . .	2.31	2.81
Ash.. . . .	2.74	3.17
	100.00	100.00

In protein, No. 17323 is decidedly the richer and therefore we might suppose, for tissue building, the superior. In fat, however, No. 17322 takes the first place, being some 2 per cent higher in this constituent than No. 17323. As regards fibre, the feeds are equally satisfactory.

Poultry authorities differ as to the proportion of protein, fat and fibre that should be present in an ideal chick feed, but from practical trials both the feeds here reported upon have been pronounced satisfactory.

FLAX AND FLAX PRODUCTS.

Flax seed is characterized by large percentages of protein and oil and is consequently a grain of high nutritive value. Though valuable in the raising of calves, it is not generally used in stock feeding, by reason of the important uses its oil finds in commerce.

Twenty samples of flax seed, representing as many distinct strains, grown on the Experimental Farm, were submitted to analysis; the results from this investigation, together with an average from American sources, may be given as follows:—

Analysis of Flax Seed.

	Protein	Oil
Average, 20 samples Canadian grown seed.. . . .	21.77	37.10
Average, 50 samples American grown seed.. . . .	22.60	33.79

OIL CAKE MEAL—LINSEED MEAL.

The extraction of oil from flax seed leaves a residue which, when ground, is known as oil-cake meal. Oil-cake meal, linseed meal or simply oil meal, is one of the most wholesome and highly nutritious of all the concentrates. Used judiciously and in limited quantities, it may form a most valuable ingredient in the ration for all classes of farm stock.

Two methods of extraction of the oil from the flax seed have been generally used. That employing simply pressure to the crushed seed, known as the "old process," results in a meal with somewhat less protein, but richer in oil than that from the "new process" in which the oil is dissolved out of the crushed seed by naphtha, the excess of naphtha being subsequently driven out of the residue by steam and the mass dried and bagged.

The following data are from analysis of oil-cake meals analysed in the Farm laboratories:—

Analysis of Oil Cake Meal.

Lab'y No.	Particulars.	Protein.	Oil.
1904	Canadian Linseed Oil Mills.....	32.00	6.38
1920	Dominion Linseed Oil Co.	29.56	10.84
1922	" " "	27.06	13.75
1921	Canadian Linseed Oil Mills.....	32.12	6.41
1923	" " "	31.62	9.98
8015	Sherwin-Williams Paint Co.	31.06	8.73
8044	" " "	37.75	8.47
8016	Dominion Linseed Oil Co.	36.19	11.93
8058	" " "	31.31	7.62
11002	Livingstone Co., Baden.....	31.60	2.01
19052	Sherwin Williams Paint Co.	34.95	7.71
20119	" " "	36.50	8.67

These samples, representing the product of several large and reputable Canadian firms, are all undoubtedly from genuine stock of good quality. Nevertheless, the wide range in protein and fat content observed emphasizes the importance of purchasing this concentrate on guaranteed analysis.

The oil-cake meals in the subjoined table have been analysed during the past year; they were said to have been manufactured by the "screw process" which judging from the percentages of fat, is akin to the "old process" and does not involve the use of naphtha as a solvent. It is worthy of note, however, that in protein content they fully equal the "new process" meal, so that the meal by the "screw process" may be said to possess the good qualities of both old and new process oil-cake meals. For comparison the average composition of the latter is appended.

Analysis of Oil-Cake Meal (Screw Process).

Lab'y No.	—	Moisture.	Protein	Fat or Oil.	Carbohydrates.	Fibre.	Ash.
26190	Sherwin-Williams, Screw process.....	7.61	36.72	6.51	36.81	7.12	5.23
26442	" " "	7.25	35.26	7.98	36.52	8.08	4.91
29295	" " "	9.68	37.01	8.01	33.95	6.24	5.05
29015	" " "	9.00	38.22	7.98	33.59	6.30	4.83
	Old process (average).....	9.8	33.9	7.8	35.7	7.3	5.5
	New process (average).....	9.0	37.5	2.9	36.4	8.9	5.5

FLAX SEED CHAFF.

Flax chaff consists essentially of the broken hulls or capsules of the flaxseed; there was also present in the samples received and here reported on, a considerable amount of flax straw which is of a particularly harsh and brittle nature.

Analysis of Flax Chaff.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
11266	Can. Flax Mills, Drayton, Ont.	6.93	13.44	6.42	43.11	32.06	8.05
20141	" " St. Catharines, Ont.	5.81	16.34	16.26	28.67	28.90	4.02
25165	Can. Flax Growers' Assn. St. Marys, Ont.	5.02	10.40	1.64	32.67	35.95	14.32

Laboratory No. 11206.—The analysis shows a notable amount of protein, evidently from the presence of a certain quantity of flax seed. It might, therefore, in spite of its high fibre-content, be supposed to be of some feeding value. If, by fanning or siev-

ing, the proportion of chaff and fragments of straw could be reduced, the material would rank with many feeds of recognized worth, but, in its present condition, its value as a feed is extremely doubtful. We think that it would be found unpalatable and possibly injurious by reason of the brittle, harsh straw it contains.

Laboratory No. 20141.—This sample consisted chiefly of the broken bolls or capsules of the flax seed, but contained also a small proportion of shrivelled flax seed and a few fragments of flax stems or straw.

The comparatively high protein and fat percentages found in this product are undoubtedly due to the presence of a considerable amount of flax seed. If the flax straw that is present could be removed, this material would no doubt be usable and valuable as a feeding stuff.

Laboratory No. 25165.—As in the preceding samples, this material consisted chiefly of flax bolls or capsules with a certain amount of flax straw, but contained no flax seed.

This product is of very doubtful feeding value. It is very low in the more valuable nutrients and very high in fibre. It is harsh in nature, and its unpalatability is accentuated by a certain amount of flax straw—a material of peculiarly coarse and brittle nature. It would, we believe, be largely rejected by cattle, and if eaten, even in small quantities, is of such an indigestible character that we could not speak at all hopefully as to any future for it as a feeding stuff.

FLAX SEED AND BOLLS.

Laboratory No. 20140.—This sample was submitted by the Canadian Flax Mills, Ltd., St. Catharines, Ontario, and had been prepared by grinding together the seed and bolls. "This meal contains all the seed and all the bolls obtained in the threshing operation."

analysis of Flax seed with Bolls.

Moisture.....	5.62
Protein.....	31.50
Fat.....	19.39
Carbohydrates.....	18.66
Fibre.....	20.19
Ash.....	4.64
	100.00

We do not know of any experimental or other work in the feeding of a meal produced by the grinding together of the flax seed and bolls, but the present analysis would indicate a material with notable amounts of protein and fat. These in themselves would make the feed one of high nutritive value, but unfortunately they are associated with a very considerable amount of fibre, an undesirable component, when in excessive quantities, in concentrated feed stuffs. To what extent this fibre might affect the digestibility of the protein and fat, we cannot say, but the data obtained on the present sample would indicate that this material is worthy of trial.

FLAX-STRAW SHIVES.

Flax-straw shives are woody fragments of flax straw broken off in the process of retting. To answer numerous inquiries as to their possible use in stock feeding several samples have been examined and submitted to analysis.

Analysis of Flax-straw Shives.

Lab'y No.	Particulars.	Moisture.	Protein	Fat.	Carbohydrates.	Fibre.	Ash.
11207	Green flax straw.....	4.69	8.00	1.93	29.36	51.58	4.17
11208	Dew-retted straw.....	4.36	3.44	1.29	22.56	59.30	2.59
20142	Can. Flax Mills, Ltd.....	6.25	3.65	1.32	26.36	60.85	1.62
26166	" Growers' Association.....	4.57	2.15	2.02	22.56	64.55	2.15

The analysis of this material shows a very low protein and fat content and an excessive percentage of fibre. This, coupled with the extremely coarse, lumpy and brittle nature of the product, indicates that it is useless from the standpoint of feeding. It would undoubtedly be found unpalatable to stock and, possibly, injurious.

COTTON-SEED MEAL.

Cotton-seed meal is ground cotton-seed cake, the residue obtained in the manufacture of cotton-seed oil. The hulls being removed by machinery, the kernels "are crushed, heated, placed between cloths and subjected to hydraulic pressure to remove the oil." A hard, yellowish cake results, which is then ground to a more or less fine meal, or, for a certain trade, broken into small pieces.

Cotton-seed meal is variable in composition and is found on the market in several grades, the quality depending chiefly on the thoroughness with which the hulls have been removed before the seed is crushed. It should always be purchased on guarantee. High grade meals carrying from 38 to 42 per cent protein are of a bright, light-yellow colour, inferior grades from unhulled or partially hulled seed with less than 30 per cent protein and an excessive amount of fibre are darker, due chiefly to the presence of hulls. But it is impossible to judge accurately of the quality from mere inspection of the fine meal, and, therefore, the purchaser should insist on a guarantee as to its percentages of protein, fat or oil and fibre. While the lower grades may be advantageously used, the price should correspond to their protein and oil content, always remembering that excess of fibre is generally objectionable and depresses the digestibility of the meal.

Cotton-seed meal ranks with the higher protein feeds on the market and is a very valuable feeding stuff when carefully and somewhat sparingly used. It has been found especially useful in the feeding of dairy cows and fattening steers, bringing up cheaply and satisfactorily the protein content of the meal ration. This concentrate, however, cannot, in ordinary farm practice, be safely fed to calves and pigs; even when used to the extent of a few ounces daily, it may cause acute indigestion, diarrhoea followed by death. Neither can it be advantageously used for laying hens. It has been found that eggs from hens fed cotton-seed meal, though quite normal externally, are seriously affected, the whites becoming thin and watery and the yolks dark and mottled within a few days after being laid. Though as regards flavour and odour there is nothing objectionable, the changes referred to would render the eggs unsaleable.

Analysis of Cotton-Seed Meals.

Lab'y, No.	Particulars.	Moisture.	Protein.	Fat.	Carbo- hydrates.	Fibre.	Ash.
1907	From Barbadoes	10.73	26.50	5.84	30.83	19.97	6.43
1908	" "	7.82	26.06	4.17	38.34	18.69	4.32
9794	" the West Indies	6.93	35.12	9.66	32.39	9.70	6.20
14664	" Memphis, Tenn., Owl Brand, ..	7.16	37.77	7.56	29.93	19.81	6.77
16505	" Jacksonville, Fla	8.55	37.15	7.16			
16506	" Toledo, Ohio	10.45	40.41	7.38			
18218	" Michigan Farmers' Brand"	5.78	43.52	7.08	29.61	6.93	7.03
20126	" Pioneer Cotton seed Meal"		42.87	10.78			
20426	" Michigan Farmers' Brand"	8.33	43.50	8.23	23.75	9.65	6.54
20570	Forwarded without particulars	5.58	43.95	6.60	27.99	9.65	6.32
20551	" "	6.65	43.20	8.89	25.91	8.79	7.26
25986	Japanese Decorticated	10.47	32.99	9.14	28.69	10.93	7.48
26189	Bartlett's "Michigan Farmers"	9.10	40.06	7.29	28.95	8.36	6.24
28759	" Bee Brand" Little Rock, Ark.	8.39	38.85	6.41	29.62	10.32	6.41
28984	" United Farmers" Co. Brand.	7.78	34.43	6.08	30.32	15.84	5.55
29610	" Farmers' Brand "	8.59	38.47	7.01	29.60	10.13	6.11
30829	Ashcroft, Wilkinson Co., Atlanta, Ga., U.S.A.	10.06	35.09	5.90	30.53	12.52	5.99

As a guide in the buying of cotton-seed meal we append the average composition as regards protein, fat and fibre of the three grades generally recognized in the United States.

	Protein. Per cent.	Fat. Per cent.	Fibre. Per cent.
Cottonseed meal—Choice	44.1	9.1	8.1
" " Prime	39.8	8.3	10.1
" " Good	37.8	8.2	11.5

RICE AND RICE PRODUCTS.

RICE MEAL.

In the manufacture of table rice several by-products result. Certain of these and more particularly rice bran and rice polish are valuable in stock feeding. First, the rough rice or "paddy" is hulled. Rice hulls are rough and woody and practically

Composition of Rice and Its Products.

	Moisture.	Protein.	Fat.	Carbo- hydrates.	Fibre.	Ash.
Rough rice.....	9.6	7.6	1.9	66.7	9.3	4.9
Polished rice.....	12.3	7.4	.4	79.0	.4	.5
Rice polish.....	11.9	9.1	62.3	1.9	4.8	
Rice bran, high grade.....	1	12.1	11.4	44.3	12.4	9.7
Rice bran, low grade.....	9.5	10.9	9.8	42.7	15.8	11.3
Rice meal.....	9.5	11.8	11.6	48.7	9.3	9.1
Rice hulls.....	9.3	3.3	1.1	34.0	35.4	16.9

Analysis of Rice Meal and other Rice By-products.

Laby. No.	Particulars.	Mois- ture.	Protein.	Fat.	Carbo- hydra- tes.	Fibre.	Ash.
<i>Rice Polishings.</i>							
17352	G. G. Agency, N. Westminster, B.C.	11.85	12.16	9.02	56.35	3.36	7.26
<i>Rice Bran.</i>							
30723	A. R. W., Vancouver, B.C.	9.38	13.00	10.54	28.61	11.52	26.45
<i>Rice Shorts.</i>							
27472	Imp. Rice Mills, Vancouver, B.C.	13.02	13.34	7.66	52.67	5.13	8.18
<i>Rice Meal.</i>							
1901	Mt. Roy. Mfg. Co., Cote St. Paul, Que.	8.39	12.31	12.39	47.51	11.11	8.29
17317	Imp. Rice Mills, Vancouver, B.C.	9.88	12.96	11.89	52.23	3.01	7.02
18701	Source unknown, bought in	10.62	11.70	9.02	53.39	3.14	6.13
22134	" " Vancouver	9.82	14.60	9.78	52.14	3.04	10.62
21694	" "	9.34	13.96	7.92	56.88	3.35	8.55
25543	" " bought in Quebec	7.14	12.71	11.55	50.79	5.04	7.77
27467	Martin Robertson, Ltd., Vancouver	11.53	13.13	15.36	43.61	6.85	9.52
27468	" " New Type "	11.83	13.43	15.29	41.80	5.85	8.79
27469	" " Old Type "	12.18	9.94	7.59	60.44	4.40	5.45
27470	Mt. Royal Milling Co., Victoria, B.C.						
	" " Secmeco "	11.28	13.28	14.47	49.73	2.86	8.38
27471	" " Pakling "	12.81	13.71	10.41	49.57	4.90	8.60
27886	Rangoon Rice Meal, Impt	7.72	13.93	16.21	47.38	5.42	9.26

indigestible; further, they have sharp and flinty edges and points, which are exceedingly irritative to the intestinal tract. Though occasionally used in the making of brands of the poorer classes of rice feeds, their presence must be considered a serious and dangerous adulteration.

Secondly, the outer skin of the rice is removed. This constitutes rice bran. This product, if free from hulls, is rich in protein and fat and is a nutritious feed. It is sold usually with the addition of the rice germ and this increases the percentage of oil, which unfortunately has a tendency to become rancid. When fresh and free from rancidity, rice bran is a concentrate of considerable value for dairy stock and swine.

After the bran coats are removed, the kernels are polished; the by-product so produced constitutes rice polish or polishings. This feed, which consists of the "creamy outside layer of cells," has a moderately high protein and fat content with a very low percentage of fibre; it is undoubtedly a highly nutritious and wholesome feeding stuff.

Rice meal is a somewhat variable feed, consisting essentially, in the better brands, of rice polish with a certain proportion of rice bran. Some brands contain chit rice, low grade and broken rice, more or less finely ground. It has an extensive use in the feeding of dairy cows and swine. Poor brands of rice meal may be adulterated with rice hulls. With some mills the term rice meal is, presumably, used to designate rice polishings. Rice feed and rice shorts are also terms somewhat loosely employed by the trade; usually these feeds are composed of rice bran, polishings and meal in varying proportions but may contain a notable amount of finely ground rice hulls. Hence the necessity of purchasing on guaranteed analysis.

The data for the Rice Polishings (No. 17352) agree fairly well with those of the American average for this feed.

The sample of Rice Bran (No. 30723) appears to be normal as regards protein, fat and fibre, but is abnormally high in ash, due to the presence of sand or other foreign matter. So much inert matter practically bans this material as a useful feed for most classes of live stock.

It is somewhat difficult to place the Rice Shorts (No. 27472) among the rice products. It evidently contains a larger proportion of rice polishings than is present in ordinary rice meal. In protein it is quite equal to the rice meals in the series, but in fat content, like No. 27469, it takes a much lower rank. It is free from any excessive amount of fibre.

With reference to rice meal, the most important of the rice milling by-products, it will be observed that, with the exception of No. 27469, the samples show a very fair constancy as to protein content—the range being from 11.7 to 14.6 per cent, with an average of 13.25 per cent. On the other hand, in fat and fibre content, the series exhibits very considerable variation; the limits of the fat being 7.59 and 16.24 per cent, those for the fibre being 2.86 and 11.11 per cent, the latter results, however, being of an exceptional character. The fibre content normally appears to be between 3 and 6 per cent.

With respect to the sample of Rangoon rice meal (No. 27886) specially imported for us by the Mount Royal Milling and Manufacturing Co., Montreal, from Glasgow, Scotland, for examination and comparison with rice meals as manufactured in the Dominion, the Glasgow correspondent writes as follows: "Rangoon meal is the most important rice meal used in Great Britain. As far as I can learn it is used for all kinds of live stock but not alone, as it is too rich in oil and cloying. A great part of the importation goes into compound cakes in the proportion of a quarter to a fifth of the whole contents. This cake is fed to all kinds of stock—pigs, sheep and cattle—for fattening. For dairy stock the meal is used in much the same proportion as the cake, but, of course, in this the feeder would use his own judgment." This meal is considerably higher in oil or fat than the best Canadian samples; in protein and fibre, however, it is very similar.

ELEVATOR SCREENINGS.

The composition of screenings as produced at the elevators and resulting from the cleaning and grading of wheat and other grain, is extremely variable. If largely composed of small and broken wheat kernels, the product will in all probability possess a comparatively high feeding value. But there is usually present a certain proportion of weed seeds of an objectionable character from the feeding standpoint. In many

samples of screenings, the objectionable weed seeds predominate. It is certainly true that many weed seeds have a nutritive value, indeed some are quite rich in protein and oil. If palatable, such may be advantageously used in stock feeding and their presence need not be objected to. Unfortunately, however, many weed seeds, if not actually harmful, are at least so pungent, bitter and distasteful to stock as to render the meal from screenings containing them absolutely unpalatable. This is especially true of the so-called "black seeds" consisting mainly of the seeds of several members of the mustard family, all of which contain an oil of an exceedingly pungent character. It will thus be seen that screenings form which the unpalatable seeds have been separated may be a very valuable feeding stuff; on the other hand, the crude and unseparated screenings may be so distasteful to stock as to be entirely refused by them.

The following are among the earlier analyses of elevator screenings and refuse. They were made in the Farm laboratories some years ago (1908) and are inserted here for the purposes of comparison with samples of more recent date. They serve also to illustrate the great variation in composition that may exist among such products.

Analysis of Elevator Screenings, Weed Seeds, etc.

Name.	Elevator.	Moisture.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
Ground feed from flax screenings	J. G. King & Co., Port Arthur, Ont.	7.39	13.88	11.71	45.29	15.30	6.43
Flax refuse (before grinding).....	" "	5.54	9.05	5.23	46.13	25.04	9.09
Fine flax screenings No. 3.....	" "	5.77	17.44	18.41	29.55	12.85	15.98
Small seeds from wheat.....	" "	7.20	16.44	10.53	45.40	16.02	4.41
Feed from wheat and flax screenings	" "	10.57	12.18	5.90	53.74	12.35	5.26
Small seeds cleaned from flax....	" "	4.41	18.78	21.48	33.27	9.51	9.55
" " broken wheat, small oats, etc., ready for grinding.....	" "	7.62	15.50	9.64	54.86	17.21	5.17
Flax chaff.....	" "	8.54	14.12	7.75	56.40	8.36	4.83
Buckwheat chaff.....	" "	7.68	6.66	4.15	62.55	13.88	5.68
Fine broken stalks.....	" "	10.00	7.87	2.55	63.72	13.22	2.64
Wheat chaff.....	" "	10.43	11.68	3.62	55.64	14.28	4.35
	" "	6.25	5.31	2.49	45.80	27.50	12.65

WEED SEEDS.

The following series consists of weed seeds that may occur more or less abundantly in elevator screenings. No sample, naturally, would contain them all and the proportions in which they may be present will vary according to the district from which the grain is obtained and from season to season. Their analysis, however, will be of interest as indicating the composition of screenings when one or other of these weed seeds predominates. The separation of the weed seeds for the purpose of analysis was kindly undertaken by the Seed Branch, Department of Agriculture. The analysis was made in the Farm laboratories in 1913.

Analysis of Weed Seeds.

Name of Weed.	Moisture.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
Wild buckwheat.....	7.48	10.16	2.89	70.00	7.29	2.18
Wild mustard.....	6.50	26.95	23.78	18.27	19.32	5.18
Ball mustard.....	6.62	12.72	16.26	25.32	35.84	3.24
Half-ear mustard.....	5.78	22.29	22.95	25.63	12.32	4.03
Tumbling mustard.....	5.28	22.91	21.14	30.27	10.73	6.67
Stinkweed.....	6.99	21.46	20.61	29.04	16.23	5.67
Black bindweed.....	9.65	10.43	1.75	67.20	8.75	2.92
Lamb's quarters.....	9.21	15.43	6.64	46.99	18.69	3.68
Pig weed.....	10.74	14.47	2.46	50.9	17.19	4.24
White cockle.....	12.99	16.34	4.01	56.10	7.98	2.61
Cow cockle.....	10.37	11.66	3.54	65.50	6.56	2.37
Purple cockle.....	10.60	16.73	6.53	57.72	5.16	3.26
False flax.....	5.27	25.50	34.19	21.17	8.31	5.56
Bladder campion.....	11.91	?	4.32	53.23	12.35	3.27
Wild oats.....	9.33		3.89	56.56	15.12	4.47

Following the analysis of the above a very considerable number of samples, representative of separations from screenings by sieves ranging from $\frac{1}{32}$ to $\frac{1}{16}$ -inch mesh, were examined. The analytical data indicate materials of considerable feeding value, but a number of them, owing to the presence of mustard seeds, were found to be unpalatable.

In the year 1915 a series of feeding trials, to ascertain the practical value of elevator screenings and certain separations therefrom, was undertaken by the Division of Animal Husbandry and in connection therewith the analyses recorded in the following table were made. The screenings were obtained from the elevators at Fort William and the feeds therefrom were finely ground before being used:—

Analysis of Elevator Screenings.

Lab- oratory No.	—	Moisture.	Protein.	Fat.	Carbo- hydrates.	Fibre.	Ash.
20429	"Complete screenings".....	9.01	13.00	7.61	51.68	13.48	5.16
20428	"Screenings without black seeds".....	10.32	14.25	5.67	61.81	5.22	2.73
20427	Black seeds.....	9.72	16.37	12.43	43.48	12.14	5.76

Complete Screenings: The composition of this product, as furnished by the Seed Commissioner, may be stated as follows:—

Scalpings.....	37 per cent.
Succotash flax.....	7 "
Buckwheat screenings.....	18 "
Black seeds.....	38 "
	100 "

"Scalpings", as in the first instance by means of a $\frac{1}{4}$ -inch perforated zinc screen, has the following approximate composition:—

Wheat, shrunken and broken grains.....	65 per cent.
Oats, barley, flax, wild oats, grass seeds.....	25 "
Wild buckwheat, lambs' quarters, stinkweed, ball mustard, cockle, ragweed and other weed seeds.....	3 "
Chaff, etc.....	7 "
	100 "

"Succotash Flax" product which passed through the flax screen was found to consist of:—

Flax.....	30 per cent.
Wheat, small and broken grains.....	40 "
Weed seeds.....	15 "
Chaff, etc.....	15 "
	100 "

"Buckwheat Screenings", passing through the buckwheat screen but remaining on the flax screen; its examination gave the following results:—

Wild buckwheat.....	58 per cent.
Wheat, oats, flax, rye grass.....	29 "
Weed seeds.....	9 "
Chaff, etc.....	4 "
	100 "

"Black Seeds", the portion passing through the $\frac{1}{4}$ -inch screen referred to above, and which constitute 38 per cent of the complete screenings, was made up of the following weed seeds:—tumbling mustard, wormseed mustard, wild mustard, hare's-ear mustard, lambs' quarters, cinquefoil, false flax, shepherd's purse, pepper grass, stinkweed, chaff, dust, sand, etc.

The analytical data of the complete screenings (No. 20429) would indicate a feed of a very fair quality. It is moderately rich in protein and very rich in fat; the only objectionable feature, from the analytical standpoint, is the somewhat high fibre content. The large proportion of black seeds present, however, renders the material unpalatable and probably unwholesome to all classes of stock.

The removal of the "black seeds" (the portion of the screenings which renders them distasteful to stock) resulted in the sample of "screenings without black seeds" (No. 20428). Compared with the "complete screenings", it possesses a higher protein content, a somewhat smaller percentage of oil and very much less fibre. Judging therefore from the analytical data, this material should prove superior to the complete screenings. It further has the great advantage of being palatable.

The "black seeds" (No. 20427), as has been pointed out, consist essentially of the seeds of several mustards, though many other fine weed seeds are present. The product is very rich in protein and in oil, but, as already remarked, owing to the unpleasant pungency of the latter, the material is not usable as a stock feed.

From among the samples of screenings examined in 1916, we select three of a more or less representative character. These feeds were sold in the ground condition, so that no information could be obtained as to the proportions of the several seeds present.

Analysis of Screenings. (1916).

Laboratory No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
26523	Government Elevator, Fort William.....	13.24	13.45	4.95	61.86	4.13	2.37
27696	" " Calgary.....	9.05	11.14	3.48	52.96	15.96	8.32
27697	" " ".....	9.32	11.20	4.25	58.31	11.39	5.54

Laboratory No. 26523.—Ground screenings used in experimental feeding work by the Animal Husbandry Division at the Central Farm. From the standpoint of composition this sample is quite satisfactory, though somewhat lower in fat than many samples previously analysed. It was found a palatable and useful feeding stuff.

Laboratory Nos. 27696-7.—In protein the two samples are practically identical, but No. 27696 is somewhat inferior by reason of its much higher fibre content. Both are fibrous, coarse feeds and of comparatively low nutritive value. These feeds unfortunately, though high in protein, proved most unsatisfactory, all classes of stock refusing them. The grinding of the material had masked the presence of unpalatable and pungent seeds. These samples serve to emphasize in the purchase of ground screenings the necessity of ascertaining the palatability and wholesomeness of the feed, in addition to its composition.

STANDARD RECLEANED SCREENINGS.

More recently, and particularly during the past six months, analyses have been made of a number of samples of purified or re-cleaned screenings, that is screenings from which the larger proportion of objectionable weed seeds (mustards, etc.) have been removed at the Government Terminal Elevator, Port Arthur. These screenings have been generally known as "Buckwheat Screenings" from the large proportion of wild buckwheat seed they contain.

From the following results it will be seen that the product in all three samples, consists approximately of 50 per cent wheat. The next largest component is wild buckwheat, which in No. 30781 is 40 per cent, in No. 30981, 46 per cent, and in No. 31202, 23 per cent. A small proportion of this seed in each sample is hulled. The composition of wild buckwheat seed has been given in the table of analysis of weed

seeds. The data permit us to compare the two grains which make up the greater proportion of this feed. Wild buckwheat seed contains approximately four-fifths of the protein, is slightly richer in fat, but is decidedly higher in fibre. In carbohydrates

Botanical Analysis of Recleaned Screenings.

	Laboratory No. 30781.	Laboratory No. 30981.	Laboratory No. 31202.
Small, broken and shrivelled wheat.....	49.53	50.19	52.70
Wild buckwheat (unhulled).....	36.08	37.12	21.00
Wild buckwheat (hulled).....	4.54	9.41	2.20
Oats.....	2.66	1.58	9.50
Flax seed.....	0.99	0.64	2.30
Wild mustards, etc. (weed seeds).....	0.48	0.81	3.80
Chaff, fragments of straw, hulls, etc.....	5.72	0.72	8.50
	100.00	100.00	100.00

the two grains are practically equal. These analyses and a study of wild buckwheat lead us to conclude that this grain, while not highly nitrogenous or very rich in fat, is of very fair feeding value and may be considered an excellent and palatable feed for cattle, pigs and poultry. Theoretically, wild buckwheat seed may be said to possess about seventy five per cent of the value of wheat for feeding purposes. The proportion of oats in the samples varied from 1 per cent to 9.5 per cent, flaxseed from .6 to 2.3 per cent, wild mustards from .5 to 4.6 per cent and chaff, etc., from .7 to 8.5 per cent.

Analysis of Recleaned Screenings.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbo- hydra- tes.	Fibre.	Ash.
30781	Whole (Ottawa).....	13.76	11.90	2.83	61.18	6.12	4.51
30782	Ground (Ottawa).....	14.07	11.84	2.07	64.53	5.36	2.13
30981	Whole (Brandon).....	10.72	12.75	4.57	64.26	5.34	2.36
31202	" (Ottawa).....	11.33	14.16	5.72	58.63	7.12	2.90

These data may perhaps serve to indicate the limits of the several nutrients in well cleaned "Buckwheat" screenings. They further indicate a feed which should prove nutritious and fattening. Practical feeding experiments have furnished evidence as to the palatability and wholesomeness of these screenings for cattle, swine and poultry.

The more important features as brought out from work with screenings generally—a work which has extended over several years—may be summarized in the following paragraph.

In the purchase and use of elevator screenings there are three points to be borne in mind, (1) composition, (2) palatability and wholesomeness and (3) fineness of grinding.

With regard to composition, screenings are most variable, as might be expected from the very nature of the material. They may be a valuable feed, or, on the other hand, worthless and dangerous. It is quite impossible to predict from mere inspection of the ground sample the feeding value of the screenings; an analysis is necessary as a guide to their economic purchase and use.

Palatability and wholesomeness are attributes which can be ascertained only by actual feeding trials, though tasting the material will detect extreme pungency, bit-

The above samples fall broadly into two classes, one containing 17.5 to 20 per cent protein with fat from 4.0 to 6.0 per cent, the other with from 29.0 to 33.0 per cent protein and 6.5 to 12.75 per cent fat.

DRIED BREWERS' GRAINS.

This by-product from the manufacture of beer ranks high as a concentrated feed, being rich in protein and moderately rich in fat, palatable and fairly digestible. Its use has been chiefly for dairy cows, for which it is considered an excellent and desirable feeding stuff.

Analysis of Dried Brewers' Grains.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
13827	Molson's Brewery, Montreal.	8.10	21.10	4.14	48.43	13.83	4.40
13903	Brewery in Sherbrooke, Que.	8.17	18.11	4.51	51.81	13.49	3.38
14663	Farmers' Feed Co., Toronto.	9.26	22.67	5.66	42.20	16.43	3.78
14974	Brassière Champlain de Québec.	11.22	25.98	2.10	43.60	11.47	5.73
	Average from American sources	8.20	19.90	5.60	51.70	11.00	3.50

From the nature of the product and its manufacture, some variation in composition is to be expected, but it is evident that best grade samples of dried brewers' grains will contain 20 to 25 per cent of protein, 4 to 5.5 per cent of fat and 11 to 13 per cent of fibre.

CALF MEALS.

Proprietary calf meals are mixtures of various concentrates such as oil-cake meal, ground flax seed, locust bean meal, ground cereals and mill feeds, sugar, etc., in varying proportions and containing in some instances certain small quantities of mild drugs or aromatic principles alleged to act as appetizers, tonics and correctives. Though varying in composition, calf meals as a class are highly nutritious feeds, being more or less rich in digestible protein, fat and carbohydrates and low in fibre. They are intended as whole milk substitutes and as supplementary feeds to skim milk in the feeding of young calves and the larger number of them have proved quite suitable for that purpose. Experimental work, however, has conclusively shown that these proprietary calf feeds are not indispensable in calf-raising and that the farmer and dairyman can, at much less expense, compound a mixture from standard meals that will prove equally nutritious and satisfactory.

The data in the accompanying table have been obtained from the analysis of a number of calf meals under practical test by the Animal Husbandry Division.

Analysis of Calf Meals.

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
1901	Bibby's Cream Equivalent	10.40	12.75	11.19	57.88	4.70	3.08
26417	" " "	8.26	16.52	12.82	49.87	6.30	6.22
26529	" " "	7.33	17.47	15.40	46.89	6.23	6.18
1902	Blatchford's Calf Meal	9.17	23.44	10.13	38.86	8.47	4.93
26525	" " "	10.36	24.28	5.96	47.71	6.82	4.87
26521	"Royal Purple" Calf Meal	8.47	21.27	38	51.52	4.37	4.59
26526	Caldwell's Calf Meal	20.97	21.50	0	48.11	5.02	3.00
26527	"Gold Dollar" Calf Meal	10.02	27.18	3.90	49.16	4.16	3.98
26528	C. E. Farm Calf Meal, No. 1 (Ottawa)	9.62	12.17	9.57	60.15	5.75	2.74
30530	" " " (Cap Rouge)	12.16	11.30	9.19	60.34	4.34	2.56
30383	Prepared at Spencerville, Ont.	8.94	24.44	13.85	41.91	3.73	4.13

Laboratory Nos. 1901, 26417 and 26520.—Bibby's Cream Equivalent, manufactured by J. Bibby and Sons, Limited, Liverpool, England. The ingredients of this meal, ground flax seed, wheat flour, barley meal, ground peas, ground beans, rice and bean meal (probably locust bean meal) are among the chief components. This is considered one of the best meals on the market and has an excellent reputation. The more recent analysis (1914) indicates a meal considerably richer in protein than that examined in 1901. The advice and directions for use furnished with the meal are sane and based on correct principles of calf feeding.

Laboratory Nos. 1902 and 26525.—Blatchford's Calf Meal, manufactured by the Blatchford Company, Waukegan, Illinois. It is stated to be composed of locust bean meal, ground flax seed, wheat flour, barley meal, ground peas, ground beans, rice polish, old process oil meal, cocoanut meal, cottonseed meal, dried milk, fengroek, anise and salt. From practical calf feeding experiments this appears to be a satisfactory calf meal; but it has been found that, unless properly fed, it has a tendency to scour the calves. From the standpoint of composition—it is very rich in protein—it undoubtedly ranks among the concentrated feeding stuffs of high value.

Laboratory No. 26524.—Royal Purple Calf Meal, manufactured by the Jenkins Manufacturing Company, London, Ontario. All ingredients are not known, but ground flax seed appears to be the main constituent. This meal has given excellent satisfaction when judiciously used. In both protein and fat its high percentages place it in the class of superior calf feeds.

Laboratory No. 26525.—Caldwell's Calf Meal, manufactured by the Caldwell Feed Company, Dundas, Ontario. This is stated to contain wheat, oats, corn, linseed, peas, locust beans and molasses. While possessing a very satisfactory protein content, and no doubt very palatable by reason of the sugar (molasses) present, attention must be called to its extremely low percentage of fat, which must be considered as an unsatisfactory feature in a feed for young calves.

Laboratory No. 26527.—Gold Dollar Calf Meal, manufactured by W. R. Cummings, Ottawa, stated to consist of equal parts of locust bean meal, fine ground corn, blood flour, low grade flour and ground flax seed. This should be an excellent meal, though it is decidedly lower in fat than many of the older brands upon the market, which have earned a reputation for successful calf-raising. It is eminently satisfactory as regards protein.

Laboratory Nos. 26528 and 30530.—C. E. Farm Calf Meal, No. 1, a home-made meal suggested by the Animal Husbandry Division and composed of ground oats 2 parts, ground corn 4 parts and ground flax seed 1 part.

No. 26528 was prepared and used on the Central Farm, Ottawa.

No. 30530 was compounded at the Experimental Station, Cap Rouge, Que.

This mixture contains from one-half to two-thirds the amount of protein found in the larger number of proprietary calf meals. It has a very satisfactory percentage of fat and is free from all excess of fibre. Its components are palatable and acceptable to stock and the formula here used permits of the preparation of a fairly cheap and nutritious meal.

Laboratory No. 20353.—This meal was prepared by a local feed firm at Spencer-ville, Ontario, and is stated to consist of flax meal, buckwheat shorts, cottonseed meal, low-grade flour and oatmeal. In both protein and fat this meal must be considered as possessing high values, and the low fibre content would undoubtedly enhance its nutritive qualities for young stock. The presence of cottonseed meal, however, is most undesirable, for, though this feed is rich in protein and fat, and can be used to advantage for adult animals of many classes, it is peculiarly unsuited to young stock, acting, if fed continuously or in large amounts, as if it were poisonous, and frequently proving fatal.

BEANS.

SOY BEAN, SOYBEAN CAKE AND MEAL.

The soybean is an important and valuable legume, furnishing a high protein fodder and a seed from which a rich concentrate—soybean cake—results after the expression of the larger proportion of the oil. The soybean is extensively grown in Manchuria, Japan and Corea, where the seed is used largely both as human food and in the feeding of animals. It is stated that the plant "produces the largest amount of seed of any legume suited to temperate climates" and that "early varieties have been developed that ripen seed wherever corn will mature". It has been grown largely in several states of the Union but has not, so far, been cultivated to any extent in Canada and our chief experience with it has been as a forage crop and as a crop for green manuring. The plant, being rich in nitrogen, yields a fodder similar to alfalfa and a valuable crop for enriching the soil.

Laboratory Nos. 28342-43.—Of the varieties grown experimentally by the Division of Botany at the Central Experimental Farm, Ottawa, in 1916, we have submitted to analysis the seed of two which had matured. In the following table we give the results and, for comparison, there has been added the average composition of the soybean as quoted by American authorities, obtained presumably from the analysis of many varieties grown in the United States.

Analysis of Soybean (Grain).

	Lab'y No. 28342 "Black Eyebrow".	Lab'y No. 28343 "Manchu".	American Average.
Moisture	5.58	5.78	9.9
Protein	32.98	30.83	36.5
Fat or oil	20.05	20.35	17.5
Carbohydrates	30.87	32.56	26.5
Fibre	4.88	4.40	4.3
Ash	5.64	6.05	5.3
	100.00	100.00	100.00

The only difference of any significance between the two varieties grown here is in their protein content, "Black Eyebrow" being approximately 2 per cent richer than "Manchu". In oil, the varieties are almost identical.

The composition of the soybean, as determined by averaging American data, differs from that of the samples now examined in that the latter (Canadian-grown) is about 2.5 per cent richer in oil and from 3.5 per cent to 5.5 per cent poorer in protein.

Analysis of Soybean Cake and Meal.

Lab'y No.	Particulars.	Moist- ure.	Pro- tein.	Fat.	Carbo- hy- drates.	Fibre.	Ash.
17729	Kasai & Co., Osaka, Japan.....	8.04	38.76	7.95	35.45	3.21	6.5
26794	Manchurian, imported from Yokohama, Japan	11.48	38.65	8.07	29.75	5.43	6.6
31615	American origin (?).....	10.97	45.77	3.28	29.06	5.15	5.7
	Soybean Cake Meal, American average....	11.8	41.40	7.40	28.70	5.30	5.4

Though but little known in Canada, this feeding product enjoys a most favourable reputation in England and on the European continent as a valuable feeding stuff, especially useful in the feeding of dairy cattle. It has been shown to be essentially equal to linseed oil cake and cottonseed cake meal, both high protein concentrates. It is reported as wholesome, palatable and highly nutritious. It is very rich in protein and contains a notable percentage of oil or fat. These features, with its low fibre content, combine to place soybean cake among the best and most valuable of the concentrates in stock feeding.

The sample No. 31615, the original source of which could not be learned, differs from the two samples imported from Japan in being decidedly richer in protein and much poorer in fat.

VELVET BEAN CAKE.

The velvet bean (*Mucuna utilis*) is a tropical plant cultivated largely as a forage crop in the Southern States. It is grown also for its seed, a yield of 20 to 30 bushels per acre being reported from the Florida Experiment Station. The seed is a high protein grain used for many classes of farm stock in Florida, Georgia and the adjoining states but regarding which, as a wholesome feed, the experience recorded is somewhat conflicting. No data could be found as to Velvet Bean cake, which is presumably the residue after the expression of the oil.

One sample only (No. 30827) has been submitted to us, being forwarded by Messrs. Ashcroft, Wilkinson Co., of Atlanta, Georgia. Its analysis afforded the following data:—

Analysis of Velvet Bean Cake.

	No. 30827.	Velvet Bean Seed.
Moisture.....	11.80	11.7
Protein.....	16.92	26.8
Fat.....	3.36	6.4
Carbohydrates.....	50.73	51.0
Fibre.....	13.29	7.5
Ash.....	3.90	2.6

Though probably a useful feed, it is evidently one that has resulted from the employment of the "seed in pod" rather than the pure seed, in the expression of the oil. This is indicated chiefly by the low protein and high fibre content. In every particular it is distinctly inferior to soybean cake.

PEA PRODUCTS.

The grain of the common field pea (Canada field pea, *Pisum sativum*), like all leguminous seeds, is characterized by a high percentage of protein (22-25 per cent), which is very largely digestible. Genuine pea meal is therefore a concentrate of very considerable nutritive value. It is relished by all classes of stock and has been more especially used in Canada for finishing swine—pea-fed pork and bacon being considered of the highest grade or quality.

Analysis of Peas and Pea Products.

Name.	Moisture.	Protein.	Fat.	Carbo- hydrates.	Fibre.	Ash.
Peas (Arthur variety).....	5.41	23.50	1.01	62.57	4.90	2.58
Pea meal.....	8.80	25.50	1.71	53.53	7.13	3.30
Ground pea chips.....	8.02	25.91	2.19	61.19	0.20	2.19
Pea dust.....	8.37	26.16	2.77	48.70	10.28	3.72
Ground pea bran.....	8.61	28.53	5.89	48.44	8.11	4.92
Split peas.....	6.45	27.63	0.94	61.46	0.97	2.61
Pea hulls.....	5.54	5.63	0.41	34.66	51.29	2.45
Pea feed.....	7.84	16.00	1.21	41.09	31.05	2.78
".....	7.30	14.12	1.50	39.44	35.23	2.61
".....	7.70	17.37	1.32	49.48	21.45	2.67

It may be pointed out, however, that various pea products have from time to time appeared on the market, and they should be purchased only on guaranteed analysis, as they may differ widely in feeding value from pure pea meal, due to an admixture with pea hulls. In the foregoing table the analysis of such feeds is given, the larger number of these materials having been purchased in western Ontario and used in feeding experiments by the Division of Animal Husbandry, Experimental Farm, Ottawa.

The hull of the pea is an extremely poor feed, containing only 5 per cent of protein and over 50 per cent of fibre. The inferior quality of the several pea feeds noted in the foregoing table, as compared with pea meal, is due to the presence of hulls. Though they might legitimately be sold at prices commensurate with their nutritive value, to sell such feeds as pea meal is a fraudulent practice. When these feeds are offered for sale in a finely ground condition, an analysis only will determine their composition and value.

MISCELLANEOUS FEEDS.

PEANUT MEAL.

This product results from the manufacture of peanut oil, either from the hulled or the whole peanuts, the former making the richer meal. It ranks with the most valuable concentrates, being rich in digestible protein and fat, with a low fibre content. It is largely employed in Europe for dairy cows and fattening steers and is deserving of wider use in this country. It is wholesome and palatable and relished by all classes of stock.

Analysis of Peanut Meal.

Laboratory No.	Particulars.	Moisture.	Protein.	Fat.	Carbo- hydrates.	Fibre.	Ash.
20634	Oilseeds, Co. Bayonne, N. J.	4.45	42.84	15.49	32.85	4.30	8.98
26193	" " " "	7.52	41.89	9.63	28.51	3.65	6.49
30828	Ashcroft, Wilkinson Co., Atlanta, Ga.	8.78	31.42	6.95	21.67	27.72	3.46
31183	Peanut Extracts, origin un- known.	4.80	31.69	42.33	15.11	3.12	2.95
Average	Peanut meal from hulled nuts	10.70	47.60	8.0	23.70	5.10	4.90
"	" " whole "	5.60	28.49	11.1	27.0	23.10	1.50

Laboratory Nos. 20634 and 26193.—These samples were from stock used in experimental feeding work by the Animal Husbandry Division of the Central Farm and were manufactured by the Oil Seeds Co., Bayonne, N.J., and known as the Alpha Brand. They are of excellent quality, being from hulled nuts and free from foreign matter.

Laboratory No. 30828.—The low percentage of protein and the very high fibre content point to this meal having been made from whole, unhulled nuts.

Laboratory No. 31183.—This product was sent in by a correspondent in Port Credit, Ontario, with a request for a report on its nutritive value. The name of the manufacturer or particulars as to origin could not be ascertained. It apparently consists of rather finely broken peanuts, with a certain proportion of the brown skin. There were no hulls present. This material, by reason of its high percentages of the principal nutrients and especially of fat, is a concentrate of very considerable value. Owing to its very rich character it should be fed in moderation and mixed with other and poorer feeds. It would undoubtedly be found palatable and nutritious and quite suitable, if judiciously used, for many classes of live stock.

COCOANUT MEAL.

Cocoanut cake is the residue left after the expression of the oil from the flesh of the cocoanut. Cocoanut meal is simply the ground cake.

This feeding stuff is a soft material of a light brown colour and a clean, bright appearance, possessing in a fair degree the pleasant odour and sweet taste of the cocoanut. It is very palatable and is much in favour among the dairymen of British Columbia, into which province it has been imported from the Hawaiian Islands, via San Francisco. It has also been occasionally found in the Nova Scotia markets, being imported from Port of Spain, Trinidad.

Analysis of Cocoanut Meal

Lab'y No.	Particulars.	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.
1900	Imported from Port of Spain, Trinidad...	14.65	21.37	5.92	41.34	11.19	5.53
1902	" " the Hawaiian Islands.....	5.57	22.37	9.10	29.18	23.07	5.71
31622	" " " "	7.29	20.46	6.89	45.00	13.91	6.45

These data agree fairly well with those from American sources and indicate a concentrate of very considerable feeding value. Though as yet it has not been very largely used in Canada, European and American experience alike indicate that it may be successfully used for horses, sheep, swine and, particularly, dairy cows. Hitherto, we have found that its price, considering its composition and compared with that of the various milling feed products on the market, has been reasonable and this fact leads us to the conclusion that a considerable economy might be effected by its more extensive use. One drawback to the general use of cocoanut meal is that it is apt, on storage in hot weather, to become rancid.

DATE MEAL.

This product was forwarded by the Superintendent of the Experimental Farm at Agassiz, B.C., who during the summer of 1916 carried on a pig-feeding experiment therewith.

It is prepared by Messrs. Martin and Robertson, Ltd., Vancouver, and stated to be made by grinding together refuse dates and rice meal in equal proportions. The price was \$50 per ton.

The Superintendent writes: "Our experiment consists in feeding two lots of hogs; the ration for one lot being made by making a mixture $\frac{1}{2}$ wheat shorts and $\frac{1}{2}$ date meal; for the other lot shorts and date meal were used in equal proportions. Both rations are complemented by skim milk and green feed."

Analysis of Date Meal.

	No. 27419.	No. 27497.
Water.....	13.74	22.74
Crude protein.....	9.11	7.41
" fat.....	6.84	5.12
Carbohydrates.....	59.14	56.59
Fibre.....	5.72	3.90
Ash.....	5.45	4.26
		100.00

This meal, while not ranking with concentrates rich in protein, is fairly well supplied with fat and, being comparatively low in fibre, should constitute a palatable and acceptable feeding stuff. The moisture content, and especially that of No. 27497, is too high; no doubt the meal would be improved, particularly as to its keeping qualities, by being artificially dried before bagging. It could not be used as a meal to

increase the protein content of the ration—indeed its use would require supplementing by a higher protein concentrate—and considering its comparatively low percentage of protein we are of the opinion that the price is too high. The sugar present, furnished by the date, would no doubt make the meal very acceptable to stock.

In forwarding sample No. 27497, the Superintendent writes: "We consider this a meal of much better quality than the one sent you some weeks ago (No. 27419). The bulk represented by the first sample is heating badly and has become sour, while the bulk represented by this sample is still in excellent condition."

ALFALFA GRAINS.

Laboratory No. 11559.—This purports to be a mixture of ground alfalfa and dried brewers' grains and the claim is made for it that it is "equal in milk-producing power to twice its weight of bran though sold at the same price." Our correspondent states that his cows do not like it and will eat bran in preference.

In appearance it is similar to ground hay, though closer inspection reveals the presence of hulls, presumably of barley. It is of a yellow-green colour and has the characteristic odour of alfalfa hay.

The following data allow a comparison, from the standpoint of composition, of the feeding stuffs here discussed:

Analysis of Alfalfa, Alfalfa Grains, etc.

	Moisture.	Protein	Fat.	Carbohydrates	Fibre.	Ash.
	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
Alfalfa grains.....	7.59	17.59	4.92	47.02	18.38	4.54
Alfalfa hay.....	8.4	14.3	2.2	42.7	25.0	7.4
Dried brewers' grains.....	8.2	19.9	5.6	51.7	11.0	3.6
Bran.....	11.1	14.5	4.4	54.2	10.1	5.7

While containing more crude protein and being somewhat richer in fat than bran, this feed is very considerably higher in fibre. The fibrous nature of the feed, together with the fact that the nutritive value of the crude protein in alfalfa hay is not equal to that in bran, make it extremely doubtful if this mixture has feeding properties greater than those of bran. Its exact value as a milk producer could, of course, be ascertained only by actual test.

ALFALFA MEAL.

Laboratory No. 18703.—This is simply ground alfalfa hay. It is a product used in certain of the western United States, but so far has not been largely fed in Canada. The sample analysed is from stock used in feeding experiments at Agassiz, B.C.

Analysis.

Water.....	9.42
Protein.....	11.08
Fat.....	2.22
Carbohydrates.....	29.99
Fibre.....	24.08
Ash.....	10.21
	100.00

Since the percentage of crude protein in the material approaches closely that of bran, it has been stated that these two feeds have practically the same nutritive value. This, however, is not the case; the alfalfa meal is much the inferior, for a large proportion of its crude protein is in the non-albuminoid form, ranking in nutritive properties not higher than the carbohydrates. In bran the protein is practically all in the form

of the more valuable true albuminoids, the sole nutrient furnishing the supply of organic nitrogen necessary for the wants of the body.

MILLET SEED.

As a grain for use in feeding stock millet seed has been seldom employed on this continent, though some little experience has been gained with it in fattening swine, for which purpose it appears to be satisfactory. Possibly a use may be found for it in the feeding of chicks. Millet is more generally known as an annual forage plant.

Laboratory No. 28508.—This sample of millet seed (*Echinochloa crusgalli*) was forwarded by a correspondent at St. Jean Baptiste de Rouville, Que., with a request for an analysis and report as to its feeding value.

Analysis.

Water.....	9.14
Protein.....	11.70
Fat.....	2.55
Carbohydrates.....	63.51
Fibre.....	9.34
Ash.....	3.76
	100.00

From the analysis we should judge this grain to possess a fair feeding value, not unlike that of buckwheat. As so little is known as to the palatability and wholesomeness of millet seed for stock feeding, it would be advisable to use it at first in small quantities and with some precaution, noting effects, if any, upon the animals. Unless finely ground, much of the nutritive value of the grain would be lost, by reason of it passing through the animal undigested.

COCOA SHELLS.

Cocoa shells, cocoa bean shells or cocoa bean husks, is a waste or by-product of the cocoa and chocolate factory. The analysis of three samples of this material examined at the laboratories of this Division is appended.

Analysis of Cocoa Shells.

Lab'y No.	Particulars.	Moisture.	1	2	Carbohydra-tes.	Fibre.	Ash.
1898	Sent from Halifax, N.S.	5.12	16.44	12.92	45.43	13.17	6.92
16811	Agassiz, B.C.	6.44	16.89	11.02	43.33	15.10	8.22
24657	Sent by Department of Agriculture, Victoria, B.C.	7.61	16.77	12.39	41.57	12.96	8.70

In both protein and fat content this refuse material ranks with many of the richest feeding stuffs, but unfortunately it has a very low digestibility. As regards palatability there seems no reason why it should not be found fairly satisfactory and as in certain localities it can be very cheaply obtained further experiments seem desirable to ascertain if it could not be utilized to advantage in stock feeding. For such feeding trials the shells, which are very brittle, should be finely ground and at first used in small proportions in the grain ration. It may be found possible to increase the amount to two or more pounds per day, in steer feeding and for dairy cows, but actual experimental work is necessary before the safe and profitable amount per diem can be known.

The fertilizing constituents in Nos. 1898 and 24657 were determined and the following data obtained:

Fertilizer Constituents.	No. 1898.	No. 24657.
Nitrogen.....	2.63	2.60
Phosphoric acid.....	0.98	1.10
Potash.....	2.59	2.95

This material is very rich in fertilizing elements and more especially in nitrogen and potash. If this refuse were burnt the phosphoric acid and potash could be recovered in the resultant ash, but the nitrogen would be lost. If it were fed, a much larger return would be obtained, for in the solid and liquid excreta the larger part of all three elements would be recovered.

FOX BISCUITS.

The black fox industry has in recent years reached such proportion in the Maritime provinces—and especially in Prince Edward Island—that the rational and economical feeding of foxes has become a subject of special interest and importance. An official of the Department of Agriculture, P.E.I., in asking for advice and analytical help in this matter, writes: "It is now becoming a matter of economic importance that the rations used in breeding and raising foxes should be safe, nutritive and well balanced. We must buy a large proportion of the food used and it is most desirable that we should buy to the best advantage." We have accordingly submitted to analysis a number of the brands of "fox biscuits" now largely used in this industry. The samples were forwarded from Charlottetown, P.E.I.

Analysis of Fox Biscuits.

Lab'y. No.	Particulars.	Moisture	Protein	Fat	Carbo- hydrates	Fiber	Ash
25547	Christie's Kennel Biscuits, Toronto...	8.11	22.27	6.77	58.84	1.09	3.01
25548	Cod Oil Biscuit, New York.....	7.55	18.47	4.82	58.89	1.15	9.12
25549	Island Fox Biscuit, P.E.I.	8.92	19.45	7.06	60.63	1.71	2.23
29160	Imperial Fox Biscuit, P.E.I.	5.36	18.16	3.93	61.67	.90	6.99
29161	Imperial Blood Biscuit, P.E.I.	4.05	23.75	4.14	58.96	1.29	7.81
29162	Seyker's Fox Biscuit, Québec.....	5.65	17.36	1.37	63.79	2.94	8.89

Laboratory No. 25547.—Hard, dark-brown biscuit from half to three-quarters of an inch in thickness, interior yellowish brown and showing a fair number of large pieces of meat, rather porous or open in structure.

Laboratory No. 25548.—Hard biscuit, light-brown throughout, about half an inch in thickness, of close texture and showing some meat in very small pieces.

Laboratory No. 25549.—Hard, dark-brown biscuit, with interior lighter in colour and somewhat open in structure.

Laboratory No. 29160.—Of a light-brown colour; on breaking, the interior is seen to be decidedly grey, of close texture, hard and brittle, not showing much meat on fracture, but such as is present is in fairly large pieces.

Laboratory No. 29161.—Of a dark-brown colour, showing greyish-brown on breaking, meat in many small pieces throughout biscuit, very close texture, readily broken.

Laboratory No. 29162.—Of a dark-brown colour throughout, very close texture and with meat in very small pieces.

All the biscuits were sound and, apparently, palatable and the data for the protein and fat content may, presumably, be regarded as indicating their relative nutritive value.

DRIED BEET PULP.

This by-product of the beet sugar factory, sometimes known as sugar beet meal, is a feed that can be used for cattle and sheep as a component of the meal ration or, moistened, as a succulent feed taking the place of ensilage and roots. It is manufactured or prepared by simply drying the exhausted or extracted beet slices or sections

(beet pulp) as they come from the large diffusion cells, a specially constructed drier which makes the process a continuous one being employed. The fresh or wet beet pulp contains from 80 per cent to 90 per cent of water and this fact necessitates, if the material is to be used with economy, that it be fed in the more or less immediate neighbourhood of the factory. Dried beet pulp contains about 8 per cent of moisture and hence can be stored, shipped and used as a meal product. It is a palatable, wholesome feed, though not one that can be used as a source of protein or fat in the ration. Its function would rather be as a diluent to give the necessary bulk and furnish carbohydrates when heavy and highly nitrogenous concentrates are used. Its average composition may be given as follows: Water, 8.3 per cent; protein, 8 per cent (of which 4 per cent is digestible), carbohydrates, 61 per cent; fat, 7 per cent; fibre, 17.5 per cent; ash, 4.5 per cent. These results clearly show that dried beet pulp does not rank with the high protein concentrates nor with those which are rich in fat. It has, nevertheless, proved a valuable and useful feed for dairy cattle and sheep when purchased at a price commensurate with its composition.

The samples here recorded are the product of the Dominion Sugar Company, Wallaceburg, Ont., their analysis being made for the Animal Husbandry Division.

Analysis of dried Beet Pulp.

	No. 1903.	No. 28524.	No. 29616.
Moisture.....	7.61	9.77	7.01
Protein.....	7.62	9.45	9.81
Fat.....	0.40	0.45	0.26
Carbohydrates.....	59.49	59.69	61.43
Fibre.....	20.85	17.61	18.73
Ash.....	4.03	3.00	2.76
	100.00	100.00	100.00

While it has been found a palatable food for cattle and sheep, experiments at the Central Farm have shown that it is unsatisfactory and practically useless in poultry feeding. The poultry manager states that, though for a time the birds—laying-hens and fattening cockerels—appeared to relish the material, they very soon tired of it, and it was then impossible to get them to eat sufficient to make it of any value in the ration.

MOLASSES: MOLASSES FEEDS.

Cane Molasses or "*Blackstrap*", a by-product from the refining of cane sugar, is a palatable and appetizing material. In addition to its nutritive value, which is entirely dependent on its sugar content, molasses is considered, when fed in moderation, to increase the digestibility of roughages used therewith and to assist in keeping the animal in a healthy condition. In general feeding and viewed simply as a furnisher of nutrients useful in the animal economy, molasses must be regarded as a sugar feed, supplying practically no protein or fat. Unlike beet-root molasses, the molasses from the sugar-cane is not characterized by a bitter taste and further is comparatively free from those salts which give the former its excessively laxative properties when too liberally used. Samples of molasses analyzed in the Farm laboratories have shown a total sugar content varying from 45 to 67 per cent.

Analysis of Cane Molasses.

	A.	B.	No. 14660.	No. 20425.
Cane sugar.....	50.27	50.05	38.21	61.41
Glucose and reducing sugars..	1.95	5.00	22.36	
Total sugars..	52.22	55.05	60.57	61.41

Molasses, used in moderate quantities, may find a place, if prices permit, in the daily ration, but it is more especially useful in the feeding of roughages otherwise unpalatable.

MOLASSINE MEAL.

This feeding stuff is manufactured by the Molassine Co., Ltd., Greenwich, London, England. It is prepared from the crude cane molasses and peat or moss—the latter constituent acting simply as an absorbent and matrix and not adding to the nutritive value of the material, though counteracting, it is claimed, the tendency to “looseness” frequently induced when molasses alone is fed. This “meal” is in the form of a loosely-held-together mass, brownish black, slightly moist and sticky, but readily crumbling on handling.

Analysis of Molassine Meal.

	No. 17749.	No. 15054.
Cane sugar.....	35.04	26.91
Glucose and reducing sugar.....	4.03	8.41
Total sugars.....	39.12	35.32

MOLASQUIT.

This is a product made in Demarara, British Guiana, from sugar-cane fibre or pith (dis-integrated sugar-cane from which the sugar has been expressed) and cane molasses. The cane fibre is very absorbent and constitutes an excellent medium for holding the molasses and presenting it in a convenient form for feeding; it does not, however, contribute in any appreciable degree to the nutritive value of the mixture. In appearance, this feed is brown and fibrous and slightly sticky. It has the odour of the coarser, unrefined grades of molasses. The analysis of two samples follows:—

Analysis of Molasquit.

	Laboratory No. 12869.
Cane sugar.....	15.86
Glucose and reducing sugar.....	27.84
Total sugars.....	43.70

This is a sugar feed of excellent quality.

CALDWELL'S MOLASSES FEED.

This is manufactured by the Caldwell Feed Co., Ltd., Dundas, Ont., and stated to be composed of 80 to 84 per cent cane molasses and sphagnum moss. The latter is employed simply as an absorbent and to present the molasses in a convenient form for feeding, though it is held that the moss-like peat prevents any undue laxative effect following the use of molasses in large quantities.

Analysis of Caldwell's Molasses Feed.

	Laboratory No. 15053.
Cane sugar.....	28.92
Glucose and reducing sugars.....	15.94
Total sugars.....	44.86

This material compares very favourably, as regards sugar content, with the larger number of commercial feeds of a similar nature.

Some years ago there was upon the market a feed made from the two by-products of the beet sugar factory, namely the exhausted beet pulp and the crude molasses. These, by the aid of suitable machinery, were dried, concentrated and converted into a palatable feed. The product was rather variable in composition, our analysis showing a sugar content from 9.8 per cent to 26.9 per cent in the four samples examined.

There was also, some years ago, a Canadian molasses feed which was compounded from certain offals of oats, corn, wheat and cane molasses. In addition to the 13 per cent sugar, it was found to contain 14.0 per cent of protein, so that it might be considered both a nourishing and a palatable feeding stuff.

Molasses and molasses feeds are, as already pointed out, essentially sugar feeds; their value for supplying protein and fat is, as a rule, negligible. Sugar has a high value in the animal economy as a source of heat and energy and in the formation of fat. Its ready solubility and the ease with which it is digested and assimilated give sugar a high place among the carbohydrates for these purposes. Apart from their direct food value, molasses and molasses feeds are stated to act beneficially in stimulating the appetite and digestion and in keeping the animal in a thrifty condition. They are frequently used in preparing animals for the ring. Though these feeds are extremely palatable and highly relished by cattle, it is doubtful if they can economically be employed to form any large proportion of the ration, not merely by reason of their poverty in protein and fat, but from the relatively high prices at which they are sold. It is difficult to justify their use, at their present market prices, simply on the basis of their nutritive value.

TANKAGE: BEEFSCRAP.

Tankage is a by-product of the packing house. The meat scraps and trimmings, waste, fat and bones, etc., are cooked in tanks by steam under pressure; the fat that separates is drawn off and the residue dried and ground. The product so obtained is known by several names—tankage, meat meal, meat scrap, meat and bone meal, flesh meal, etc. It is essentially a nitrogenous feed containing 40 per cent to 60 per cent protein, with fat from 1 per cent to 10 per cent. The amount of bone present is variable and the proportion of this constituent will naturally affect the protein content. It is one of the concentrates that should always be bought on guaranteed analysis. If thoroughly made from fresh material, it is a highly valuable concentrate. To a limited extent it has been used in the feeding of horses, cattle and sheep (for which it has been found useful when employed in small quantities and as a special source of protein), but these animals, as a rule, find it unpalatable and refuse to eat it. It has been more generally fed to swine and poultry. For both these latter classes of stock, tankage and similar feeds have been found a valuable source of protein and bone-forming material.

There are many inferior brands on the market, containing hair, hoof and other materials worthless from the feeding standpoint. Particular care should be taken in purchasing tankage and meat meals to see that they are perfectly sound and free from foreign matter of a worthless or harmful character. The use of decayed or rancid meats will assuredly result in intestinal derangement—diarrhoea, etc.—and possibly prove fatal. It is a feed which readily spoils if stored in a warm, damp place.

Analysis of Tankage—Beef Scrap.

Lady, No.	Particulars.	Moisture.	Protein.	Fat.	Carbo- hydrates	Fibre.	Ash.
11250	Package, Harris-Abattoir	6.49	58.50	9.89		4.15	20.95
18225	" " " " " " " " " " " "	6.85	62.89	7.66	3.38	2.42	16.86
19650	" Swifts Can. Co.	13.15	59.25	9.55	.33	2.69	14.93
29297	" " " " " " " " " " " "	11.69	56.8	10.82	2.93	1.53	16.12
28332	Beef Scrap, Gunn-Langlois....	40.61	11.69	13.28			28.36
28333	" " " " " " " " " " " "	39.56	16.69	18.62			21.52
31157	" " " " " " " " " " " "	10.30	57.88	11.70	.66	2.05	17.41
29284	" " origin unknown	4.11	44.71	7.38			33.33
29179	" " P. Burns & Co.	6.16	44.91	5.86			31.75

Laboratory Nos. 11250 and 18225.—"Harb Tankage".—This is a fine dark-brown, dry powder, with the characteristic and somewhat unpleasant odour of tankage and similar products. The percentages of protein and fat are very fairly satisfactory for materials of this class, and the physical condition is apparently good. The low percentage of moisture present enhances its keeping qualities.

Laboratory Nos. 19650 and 29297.—"Swifts' Digester Tankage".—This meal, both as to condition and composition, ranks with brands of the best quality. Its phosphate of lime (bone) content however is somewhat lower than that found in products of this character especially prepared for poultry use.

Laboratory Nos. 28332 and 28333.—"Beef Scrap for Poultry." These are essentially crushed green bone and meat scraps, sold fresh for immediate poultry use. These materials, by reason of their high water content, could not be safely stored for any length of time. The phosphate of lime content in No. 28332 was 25.03 per cent and, in No. 28333, 13.40 per cent. This indicates that, while the former is almost exclusively composed of bone, the latter is largely of the nature of meat scrap. For laying stock we should consider No. 28332 the more suitable, partly from its higher bone content and partly from its lower percentage of fat.

Laboratory No. 31157.—This is beef scrap sold in the dried and granular form for poultry use. It is of average quality as regards protein and contains approximately 11 per cent of bone phosphate.

Laboratory No. 29284.—This "Poultry Feed" or "Beef Scrap" was forwarded from Trail, B.C. The name of the manufacturer could not be ascertained. In the letter submitting it, our correspondent says "It is sold cheaper than standard grades. No analysis is given or statement as to manufacturer. After using it for three months with unsatisfactory results I have become suspicious as to its quality and I have lately received complaints regarding it from other poultrymen. Please analyse it and say if you would consider it suitable as a poultry feed."

Its protein content is 44.74 per cent and it contains 27.84 per cent phosphate of lime. In point of composition it leaves nothing to be desired, but its condition is quite unsatisfactory. It appears to have been made largely from offal or unsound material, or has become unsound before being placed on the market. It was submitted to the Dominion Poultry Husbandman for his opinion as to its suitability for use in poultry feeding. He said "We have examined the sample and would certainly advise against its use as a food for poultry; it is rather of the nature of a fertilizer than a feed."

Laboratory No. 29479.—Forwarded by a correspondent at Proctor, B.C., and stated to be "Ideal Poultry Food" manufactured by P. Burns and Co. Like No. 29284, the material is satisfactory as to composition; indeed the similarity of the two analyses would indicate that both samples represent one and the same product. Regarded as a food, like the preceding sample, it is quite unsatisfactory and probably unwholesome. The sample was submitted to the Poultry Husbandman who writes "While this sample is not so bad as some that have been sent in lately, it is not a feed that we could recommend for poultry use."

Poultry feeders should be careful to see that materials of this character are sweet and sound; otherwise the health of the stock is endangered. Unsound meat products are particularly dangerous, causing diarrhoea and other digestive and intestinal troubles.

FISH MEAL: FISH MEAL FEEDS.

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, impalatable to stock, likely to produce scouring and other digestive troubles and apt to cause tainted meats, milk and eggs.

The composition of fish meal varies greatly, depending on the nature of the raw product—whole fish or offal—and the thoroughness with which the several steps in its preparation have been carried out. It appears to be essential to the keeping qualities of the meal that the oil should be extracted fairly thoroughly, and the high grade meals are those with a low oil content.

Fish meal, though usually containing a notable amount of oil, is essentially a nitrogenous concentrate, containing, as a rule, from 50 per cent to 60 per cent protein. There is frequently present, especially if fish offal has been used, a high percentage of phosphate of lime. This feature may be a valuable one from the feeder's point of view, especially for young stock and also in enhancing the fertilizing value of the resultant manure.

Fish meal has in recent years been more or less extensively used as a feeding stuff in Great Britain, Germany, Norway and Sweden and several other European countries, and, when of good quality and fed judiciously, it has given excellent result with several classes of live stock. It is stated that, fed in small quantities (as a supplementary feed to bring up the protein content of the ration), it is readily eaten by swine, sheep, cattle, horses and poultry, with no harmful or detrimental results to the animals or their products. It has proven more particularly suitable for pig feeding for which, with various grain meals, it has been largely employed in Europe.

FISH MEAL FEEDS are mixtures or compounds made by incorporating with the fish meal, during the process of manufacture, shorts, bran, molasses or other feeding stuffs in varying proportions, together with small amounts of charcoal, sulphur, salt, etc., with a view of adding to the wholesomeness and palatability of the product as well as to its keeping qualities. Very little experience is on record with regard to the practical and economic feeding value of these fish meal feeds and the whole matter must at the present time be considered in the experimental stage. Evidently much work has yet to be done in their preparation before it can be said that they satisfactorily meet the requirements of the stock feeder, as to palatability, wholesomeness, economy in feeding and keeping qualities.

The larger number of the samples in the present series are fish meal and fish meal feeds prepared by Mr. J. B. Fickling of the Commission of Conservation at the Fisheries Research Station, Port Dover, Ontario.

Laboratory No. 28534.—Fish meal, "Hog Feed Concentrate", No. 10 (previously marked No. 12).

Fish meal (mixed fish).....	65 parts.
Shorts.....	25 "
Sulphur.....	1 "
Salt.....	2 "
Charcoal.....	3 "
Hydrated lime.....	4 "
Molasses.....	2 gallons per 100 pounds.

Laboratory No. 28537.—Fish Meal, "Poultry Scratch Food", complete food No. 13 (previously No. XSVIII).

Fish meal.....	12 parts.
Hydrated lime.....	10 "
Charcoal.....	2 "
Shorts.....	76 "

Laboratory No. 28538.—Fish Meal, "Cattle Feed Concentrate", No. 12 (previously marked No. 14).

Fish meal (mixed fish).....	65 parts.
Shorts.....	1 "
Bran.....	15 "
Salt.....	2 "
Hydrated lime.....	1 "

Laboratory No. 28672.—Fish Meal, "Hog Feed Concentrate", No. 12 P.D.

Fish meal (mixed fish).....	75 parts.
Shorts.....	12 "
Sulphur.....	1 "
Charcoal.....	2 "
Salt.....	2 "
Hydrated lime.....	2 "
Molasses.....	1 gallon per 100 pounds.

Laboratory No. 28674.—Fish Meal, "Poultry Scratch Feed", Complete Food No. 15 (previously marked No. 13 P.D.)

Fish meal.....	16 parts.
Charcoal.....	5 "
Shorts.....	85 "
Molasses.....	2 gallons per 100 pounds.

Respecting the samples collected from the supplies shipped to the Central Farm, Ottawa, we conclude from the analytical data that Poultry Scratch Food, Lab'y No. 28958, is the same as No. 28674 (No. 13 P.D.), though there is a marked discrepancy between the percentage of ash in the two samples. Nos. 28504-06 are taken from different boxes of the same consignment of Fish Meal No. 10, "Hog Feed Concentrate." No. 29614 is also the "Hog Feed Concentrate No. 10", but was taken from a later and distinct shipment of this feed received from Port Dover. No. 29407 was taken from a shipment labelled No. 12, "Hog Feed Concentrate". The unfortunate confusion at the point of manufacture in the labelling of the samples and shipments has prevented the identification with certainty of several of the products. We think, however, that the products may be classified as follows:—

1. Fish Meals:—

- a. From waste consisting of viscera and contents (No. 28533).
- b. From whole fish (No. 28536).

These two samples are essentially alike as to moisture content, being very dry. As to protein, that from the whole fish is decidedly the richer, while as regards oil (fat) the meal from the viscera and contents stands first; practically, in this matter, the protein and oil replace one another. In the case of No. 28533 (from waste) the percentage of protein (51.35 per cent) is practically twice that of the oil, whereas in No. 28536 (from whole fish) the percentage of protein (61.88 per cent) is three times the percentage of oil. The whole fish contains the larger percentage of phosphate of lime. Both samples were sound, free from rancidity and apparently wholesome. Though these products, as submitted, were very dry, it seems open to question whether materials of this character, when carrying such high percentages of oil, would not become rancid and unpalatable in warm weather. It is noteworthy in this connection that the best grades of imported fish meal have a much lower oil content.

2. Fish Meal Feeds:—

- a. Hog Feed Concentrate.
- b. Cattle Feed Concentrate.
- c. Poultry Scratch Food.

There would appear to be two "Hog Feed Concentrates", the one containing 65 parts of fish meal and 25 parts of shorts (Nos. 28534, 29405-6 and 29614). The other (Laboratory No. 28673) made up of 75 parts of fish meal and 12 parts shorts, both

containing small proportions of molasses, sulphur, charcoal, salt and lime. The "Cattle Feed Concentrate" (Laboratory No. 28338) is stated to consist of fish meal 57 parts, shorts 15 parts, bran 15 parts, with a little salt and lime.

Two "Poultry Scratch Foods" are included in the series, the one (No. 28337) made up of fish meal 12 parts, shorts 76 parts, with charcoal and lime, the other, fish meal 10 parts, shorts 85 parts, molasses 2 gallons per 100 pounds of meal, with 5 parts of charcoal.

The preliminary work in the feeding trials with these meals instituted at the Central Farm, Ottawa, by the Animal Husbandry and Poultry Divisions has not been promising, the animals exhibiting a distinct dislike to the meals. Whether this unpalatability can be overcome by still further reducing the amount in the ration (the proportion of fish concentrate remaining such as to make its use economic) remains for further investigatory work to ascertain. If this is not found to give satisfactory results, changes in composition or in the process of manufacture will be necessary. We are inclined to the opinion that in the preparation of these meals the oil has not been sufficiently extracted. As fish meals of good quality, palatable and wholesome to most classes of live stock, have been and are manufactured in Europe, there would seem to be no insurmountable difficulty in achieving success in Canada. There are undoubtedly at times large quantities of surplus and waste fish and fish offal, both at the coastal and inland waters fishing stations, which at present go to waste or at least are not put to their best use. The matter is, therefore, one worthy of further investigatory work, more particularly as to the careful and thorough preparation of the original fish meal from the fresh surplus fish and offal and in the compounding of the several meals.

Laboratory No. 26192.—This is an imported fish meal known as the Grimsby Brand, manufactured by Green and Baxter, Peterborough, England. It is claimed to be made entirely from fresh, sound, white fish and that by a refined process the percentage of oil in the resultant meal has been very greatly reduced. It is guaranteed to contain 61.5 per cent protein and 3 per cent oil, with phosphate of lime amounting to 19.83 per cent. Our analysis of the sample taken from the supply used by the Animal Husbandry Division showed 58.68 per cent protein, 4 per cent oil, and 18.04 per cent phosphate of lime. It will be observed that this brand of fish meal differs markedly from the fish meals prepared at the Fisheries Research Station, Port Dover, Ontario, in containing much less oil—4 per cent as compared with 26.91 per cent and 20.34 per cent.

The Animal Husbandry Division has conducted tests with this meal on dairy cows and swine and found it eminently satisfactory both as to palatability, wholesomeness and as a source of protein in the ration. It must be fed judiciously, especially at the outset. The general conclusion is that it can be advantageously used in the feeding of both dairy cattle and swine, provided the meal can be obtained at a price comparable with high protein feeds in this country.

Laboratory No. 28630.—This fish meal was prepared and submitted for analysis by Mr. Frank A. Bolser, Spa Springs, Nova Scotia, who writes that it is the "residue from small herrings that has been twice through the compressor to extract all the oil." This meal requires further drying in order that it might keep well; with its present large percentage of water we feel assured it could be used only for immediate consumption. Dried to a water content of from 5 to 10 per cent, and a further reduction in its oil content, this meal should be a wholesome and valuable protein concentrate. Apparently, it was prepared merely as an experiment to ascertain the possibilities in this direction and has not been offered for sale.

Laboratory No. 30107.—Pafeo Brand Fish Meal, manufactured by the Pacific American Fisheries, Bellingham, Washington, U.S.A.

The analysis of this product, for the most part, is in accord with that of high grade fish meals and, fed judiciously, it would undoubtedly prove a valuable concentrate. It

is rather rich in oil and this feature may affect its keeping qualities, especially in warm, moist weather.

Laboratory No. 31303.—Fish scrap manufactured by the Maritime Fish Corporation, Canso, N.S., is a by-product in the preparation of fish glue. The material used in the manufacture of the glue is stated to be fresh and sound.

This material contains a notable though not very high percentage of protein and a large amount of phosphate of lime; it is very low in fat; we are of the opinion that it could be used advantageously after further grinding in the feeding of pigs and poultry. It was perfectly sound as received and its very low oil content would ensure its good keeping even under unfavourable conditions. As received, this scrap was in a coarse, broken-up condition containing a large proportion of sharp and splinter-like bone fragments. It is dry and for the most part brittle, so that in all probability its reduction to a coarse powder would not be difficult or expensive. In its present condition it is too coarse, harsh and sharp to be safely used in feeding.

Laboratory No. 31574.—This fish meal was forwarded for report by a correspondent in British Columbia. It was in the form of a dry, granular, rather coarse powder and was perfectly sweet and sound. From the standpoint of composition and condition, this product appears to be of excellent quality; the analytical data indicate very satisfactory percentages of protein, fat and phosphate of lime.

TRIMILK WASTE.

Laboratory No. 90922.—This is a waste or by-product in the manufacture of Trimilk by the Canadian Milk Products Co., Toronto, and was forwarded for trial in poultry feeding.

The analysis of this sample afforded the following data:

Water.....	4.51 per cent.
Protein (casein).....	26.50 "
Fat.....	2.32 "
Carbohydrates (milk sugar).....	62.32 "
Ash.....	7.32 "

This product is characterized by a high protein content, but the proportion of fat is decidedly low. It should therefore be used, essentially, as a source of protein and supplemented by feeds richer in fat. In that way, if the price permitted, we think it could be advantageously used in poultry feeding.

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