BRAN, SHORTS, MIDDLINGS AND FEED FLOUR

AN INVESTIGATION TOWARDS REVISED STANDARDS

By

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

AND

S. N. HAMILTON, B.A.,
Associate Chemist

DIVISION OF CHEMISTRY
DOMINION EXPERIMENTAL FARMS

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
BULLETIN No. 2 — NEW SERIES

Published by direction of the Hon. W. R. Motherwell, Minister of Agriculture,
Ottawa, January, 1922

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OTTAWA, ONT., January 31, 1922.

The Honourable the Minister of Agriculture,
Department of Agriculture,
Ottawa, Ont.

SIR,—I have the honour to transmit herewith the manuscript of Bulletin No. 2 of the new series entitled "Bran, Shorts, Middlings and Feed Flour, An Investigation towards Revised Standards." This bulletin has been prepared by Dr. Frank T. Shutt, Dominion Chemist, assisted by Miss S. N. Hamilton, Associate Chemist.

Its preparation arose from recent demands on the part of many Canadian live stock organizations for feeds of a more uniform and higher standard, as well as of greater suitability, especially for the feeding of young stock. This demand was particularly in connection with feeds composed of wheat by-products. Joint meetings were held by the millers' associations, live stock associations and representatives from the Seed Branch and Experimental Farms Branch of the Federal Department of Agriculture.

The outcome of these meetings was the selection of trial samples, especially of shorts and middlings, and the production of samples, by various mills, of wheat by-products milled to conform as nearly as possible with the trial samples referred to above. Samples from the preliminary lots milled and from other lots based on these were carefully examined by the Division of Chemistry and by the Seed Branch, and the results of this work and the recommendations based thereon towards the formation of an acceptable new standard of analysis for these types of feeds are included in the following bulletin. This work should be of distinct value to millers since the new standards will be based thereon. It should also interest our live stock men as the principal users of these products and will also be of value in a general way to all those interested in agriculture. The publication of these results would, therefore, seem to be warranted.

I have the honour to be, sir,

Your obedient servant,

E. S. ARCHIBALD,
Director, Dominion Experimental Farms.

CONTENTS

BRAN, SHORTS, MIDDLINGS AND FEED FLOUR

BY

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

AND

S. N. HAMILTON, B.A.,
Associate Chemist

INTRODUCTION

The purpose of this inquiry was to determine the quality and composition of the milling by-products of wheat—bran, shorts, middlings and feed flour—as at present found on the Canadian market, the results to be used chiefly

1. In ascertaining how far the present standards for these feeding stuffs, in respect to percentages of protein, fat and fibre, as set forth in the regulations of the Feeding Stuffs Act, are to-day strictly applicable, and

2. In determining the cause or causes of the complaints constantly being received from farmers and stock raisers respecting the unsuitability of much of the present day shorts or middlings, more especially for the feeding of swine and young stock.

These may be considered the special objects of this investigation and their significance and importance will be obvious to all farmers. The conditions which led to the desirability of undertaking this inquiry may be briefly discussed as follows:—

Reference to the numerous analyses of bran and shorts made in the Farm laboratories during the past two or three years and reported in the publications of this division, will make it abundantly evident that in certan important features, more particularly in respect to protein and fibre, much of the bran and shorts as now milled does not conform to the present standards. The differences have been indicated and discussed and the desirability of a revision in certain essentials emphasized.

Before attempting a revision of these standards, it was concluded that the wisest course would be to make a wide and comprehensive survey of the field, collecting and submitting to examination and analysis a large number of authentic samples thoroughly representative of the products of Canadian mills. The data now presented include the results from several of such series obtained throughout the Dominion, and it is believed that they may be fairly used as a basis in the consideration of the revision of the present standards.

The numerous complaints respecting the character of the shorts and middlings received by this division for some time past, from many widely distant parts of the Dominion emphatically called for an inquiry. Dissatisfaction has been more or less general. Shorts or middlings are widely used in the feeding of young pigs—it is the feeding stuff (with milk) generally recognized as the most suitable and valuable for promoting growth and thrift in this class of live stock. The charge is that very much of the shorts as now placed on the market is quite unsuitable for this purpose, that it is unpalatable and frequently refused to the point of starvation. Not a few instances have been cited in which fatal results have followed the persistent employment of certain grades or kinds of shorts. As a feeding stuff for pigs and especially young pigs, shorts—as a class—have fallen into grave disrepute.

This inquiry and our examination of many samples of shorts and middlings—the terms are popularly and indiscriminately used for the same product—forwarded

to the Farm laboratories for some time past, make it apparent that there are two causes either or both of which may be responsible for the trouble referred to in any particular sample.

Marked changes in modern milling practice whereby a larger proportion than heretofore of flour particles are removed from the by-products, bran and shorts, have resulted in a shorts distinctly different in appearance and character to the mealy, floury shorts or middlings of some years ago and which are now so difficult to obtain in many districts. The flour particles which gave the old-time shorts their mealiness now find their way into feed flour or low grade "red dog" flour, and this practice has resulted in a shorts resembling, for the most part, fine bran—a product far inferior to the mealy, floury shorts for pig feeding, chiefly for the reason that it contains a higher percentage of fibre and less starch.

Undoubtedly another cause for the dissatisfaction referred to is the practice adopted by some mills of grinding and mixing with the shorts the "mill run screenings." These screenings will contain a certain proportion of small and shrivelled wheat, but they consist largely of weed seeds. The character and proportion of these screenings present in the shorts are variable and largely determined by the grade or quality of wheat used. The presence of these screenings may not materially affect the composition of the shorts or middlings in respect to protein, fat and fibre content, but it may profoundly affect the value and the utilization of the shorts as a feeding stuff for swine. Many of these weed seeds contain bitter principles and thus render the shorts distasteful and unpalatable to stock. Further, certain of the weed seeds found in screenings are directly noxious and toxic, and the presence of these, even in small quantities, would certainly impart to the shorts undesirable and possibly dangerous qualities, especially if used for young animals. Our conclusion in this matter is that the inclusion of screenings in the milling by-products of wheat is a most undesirable practice and one that should be discontinued. Many of the weed seeds in screenings are unobjectionable, have a distinct feeding value, and on economic grounds their use for live stock may well be urged. The employment for certain classes of live stock of well-ground screenings which, previous to grinding, have been carefully freed from unpalatable and poisonous weed seeds, is undoubtedly worthy of trial by the farmer, but we believe that it will be found in the best interests of farmer and miller alike to keep the bran, shorts and feed flour as free as possible from their admixture. At the best, the presence of screenings in these feeding stuffs must be considered an adulteration.

BRAN

Bran consists of the outer integuments or coatings of the wheat berry and in the best grades is entirely in the form of light, clean, large flakes. These characteristics, together with fredom from sweepings, weed seeds and other foreign matter, denote bran of good quality. Bran from the larger mills with machinery for the more complete separation of the flour particles will be less "floury," and slightly higher in protein and fibre than bran from the smaller mills.

The present standard for bran is:—

Protein, not less than 14 per cent.
Fat, not less than 3 per cent.
Fibre, not more than 10 per cent.

Fifty-seven (57) samples of bran, representative of the product, without screenings, of forty-two mills have been submitted to analysis. Though no assurance accompanied the samples, we have every reason to believe that, with one or two exceptions, these

brans were milled essentially from hard spring wheat. These brans fall into the following series according to the source through which they were collected:—

Series I.—One sample, Laboratory No. 54335, submitted by the Canadian National Millers' Association, per Seed Branch, Department of Agriculture, Ottawa, as a type sample. It was prepared by the Ogilvie Flour Mills Company, Montreal, and stated to be "in the opinion of the millers a fair average sample of a first-class bran free from screenings."

Series II comprises fourteen (14) samples of bran collected for the purpose of this inquiry from fourteen mills throughout the Dominion and submitted by the Canadian National Millers' Association. The secretary of the association in writing for these samples requested the millers to send the products of spring wheat only, of fair average quality and free from screenings.

Series III consists of thirty-five (35) samples of bran collected from thirty-three (33) different mills in the Dominion (not including the Maritime Provinces) by the district inspectors of the Seed Branch, Department of Agriculture. The instructions to the inspectors were to label the samples "with screenings" in all cases in which screenings had been incorporated.

Series IV.—One sample (Laboratory No. 56440) selected and submitted by Mr. W. Hill, milling expert, at the instance of the Seed Commissioner. Mr. Hill recommended this as a type or standard sample. It was milled from western hard winter, 1921 crop.

Series V.—This consists of six (6) samples taken from six out of a consignment of ten bags milled by the Interprovincial Flour Mills Company, Renfrew, Ont. This consignment had been prepared at the instance of the Seed Commissioner, to be of similar or identical quality with that of the samples chosen by Mr. Hill and to be used as type samples for use as standards at mills.

COMPOSITION OF BRANS, 1921

Laboratory No.	Milling Firm	Moisture	Protein	Fat	Carbohydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
Series I							
54335	Ogilvie Flour Mills Co., Montreal.....	10·36	17·11	4·18	52·12	10·85	5·38
Series II							
54426	St. Lawrence Flour Mills Co., Montreal	9·36	18·68	4·65	50·23	11·45	5·63
54429	Quaker Oats Co., Peterborough.....	8·21	17·04	7·30	50·18	11·45	5·82
54468	Outlook Flour Mills Co., Outlook, Sask.	9·35	18·85	4·55	50·36	11·25	5·64
54470	Ellison Milling & Elevator Co., Lethbridge, Alta.....	8·45	19·42	4·33	53·45	9·10	5·25
54472	Tavistock Milling Co., Tavistock, Ont.	8·90	17·13	4·35	54·66	9·55	5·41
54475	Interprovincial Flour Mills Co., Saskatoon, Sask.....	9·21	19·74	5·65	48·68	11·25	5·47
54567	H. B. Faber, Wellesley, Ont.....	8·15	16·09	4·55	52·21	13·30	5·70
54569	Victory Flour Mills, Vancouver, B.C..	9·35	14·81	5·03	52·84	12·52	5·45
54572	Ogilvie Flour Mills Co., Montreal.....	11·60	17·08	4·00	51·80	10·32	5·20
54627	*Neil, McCahill, Forest, Ont.....	10·26	14·07	6·47	54·65	9·20	5·35
54634	Dresden Flour Mills Ltd., Dresden, Ont.....	10·57	17·44	3·62	52·09	10·68	5·60
54641	Maple Leaf Milling Co., St. Catharines, Ont.....	9·16	16·28	7·10	50·36	10·55	5·95
54644	Easterbrook Milling Co., Eburne, B.C.	9·10	18·80	4·60	52·08	11·07	4·35
54671	*R. A. Thompson, Lynden, Ont.....	12·08	14·98	3·90	50·64	11·40	7·00

* Brans from winter wheat.

COMPOSITION OF BRANS, 1921—*Concluded*

Laboratory No.	Milling Firm	Moisture	Protein	Fat	Carbohydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
SERIES III							
55192	Quaker Oats Co., Saskatoon, Sask.....	10·00	17·84	4·53	51·23	11·15	5·25
55199	Interprovincial Flour Mills Co., Saskatoon, Sask.....	10·65	16·54	5·45	52·41	9·48	5·47
55200	Interprovincial Flour Mills Co., Saskatoon, Sask.....	10·65	17·27	5·59	51·63	9·45	5·41
55202	Robin Hood Mills, Moosejaw, Sask....	10·25	17·74	5·22	50·40	10·81	5·58
55395	D. Craig & Sons, Arnprior, Ont.....	10·40	13·94	3·43	56·17	10·55	5·51
55396	Fisher's, Pembroke, Ont.....	11·04	15·81	7·10	50·03	10·30	5·72
55399	Quaker Oats Co., Peterborough, Ont..	10·47	15·67	4·13	53·41	10·45	5·87
55404	Interprovincial Flour Mills, Renfrew, Ont.....	10·36	14·32	3·89	54·16	11·70	5·57
55406	Renfrew Flour Mills, Renfrew, Ont....	10·72	16·82	5·80	48·79	12·07	5·80
55409	Peterboro Cereal Co., Peterborough, Ont.....	10·54	17·13	5·26	51·94	9·85	5·28
55416	Findlay-Woods, Lindsay, Ont.....	11·22	13·60	3·30	54·19	11·50	6·19
55418	Maple Leaf Milling Co., Peterborough, Ont.....	10·20	17·13	4·77	50·33	11·15	5·42
55424	Empire Flour Mills, Ltd., St. Thomas, Ont.....	10·18	17·39	4·03	51·48	11·11	5·81
55426	T. Dexter & Sons, London, Ont.....	10·36	15·10	2·87	52·52	13·15	6·00
55428	Lucan Milling Co., Lucan, Ont.....	10·52	15·07	3·47	54·16	11·00	5·78
55462	Gillespie Grain Co., Edmonton, Alta..	11·47	15·14	4·22	51·18	12·00	5·99
55463	Hedley Shaw Milling Co., Medicine Hat, Alta.....	12·10	16·49	4·97	50·99	10·00	5·45
55464	Alberta Flour Mills, Edmonton, Alta.	11·75	18·06	4·66	51·50	9·25	4·78
55465	Easterbrook Milling Co., Eburne,B.C.	11·72	13·69	2·62	54·36	11·55	6·06
55471	Western Canada Flour Mills, Edmonton, Alta.....	11·64	16·66	4·32	50·41	11·47	5·50
55473	Victory Flour Mills, Medicine Hat, Alta.....	11·79	15·22	4·94	51·93	10·60	5·52
55474	Vancouver Milling and Grain Co., Vancouver, B.C.....	11·58	17·04	4·28	50·19	11·10	5·81
55476	Ogilvie Flour Mills Co., Medicine Hat, Alta.....	11·66	16·71	4·29	50·16	11·33	5·85
55477	Ellison Milling and Elevator Co.,Lethbridge, Alta.....	11·62	16·21	4·71	50·76	10·80	5·90
55478	Interprovincial Flour Mills, Strome, Alta.....	12·09	14·97	4·31	52·59	10·57	5·47
55479	Taylor Milling and Elevator Co.,Lethbridge, Alta.....	12·29	17·34	5·23	49·81	9·75	5·55
55485	Lake of the Woods Milling Co., Keewatin, Ont.....	11·35	16·23	3·73	50·57	12·35	5·77
55494	King Milling Co.....	11·33	17·78	3·86	51·29	10·40	5·34
55498	Hayne Milling Co.....	11·13	15·27	2·25	55·28	10·10	5·97
55502	Western Canada Flour Mills Co., Winnipeg, Man.....	11·07	17·85	4·44	51·69	9·85	5·10
55506	Rutherford Milling Co., Blenheim, Ont.....	11·20	14·51	2·49	53·06	12·07	6·67
55648	Wm. Snider, Waterloo, Ont.....	11·82	14·20	4·15	53·76	10·17	5·90
55657	Lake of the Woods Milling Co., Keewatin, Ont.....	12·14	15·95	5·60	49·83	11·00	5·48
55659	Ogilvie Flour Mills Co., Fort William, Ont.....	11·71	16·13	5·82	49·84	10·87	5·63
55696	J. C. McLellan & Co., Powassan, Ont.	10·35	13·73	4·73	58·72	7·70	4·77
SERIES IV							
56440	Interprovincial Flour Mills, Renfrew, Ont..... (Hill sample)	11·10	15·30	4·58	51·83	11·44	5·75
SERIES V							
57392	Interprovincial Flour Mills Co., Renfrew, Ont.....	13·65	16·74	3·35	49·16	11·55	5·55
57393	" " " ..	13·28	16·54	3·42	49·17	11·87	5·76
57394	" " " ..	14·88	17·06	3·63	49·29	10·25	4·89
57746	" " " ..	12·94	17·06	3·83	48·73	11·80	5·64
57747	" " " ..	14·59	17·11	3·92	47·72	11·60	5·06
57748	" " " ..	14·40	17·17	3·72	48·02	11·53	5·16

Series I.—This bran, submitted as a type or standard sample, without screenings, is clear and bright, with rather small flakes, which are essentially free from floury particles. It contains very little—traces only—of foreign matter, consisting chiefly of oat hull. From examination or inspection it would be adjudged a good average bran.

Chemical analysis proves it to be a bran of very considerably higher protein and fat content than that required by present standards. The percentage of fibre however exceeds, though not greatly, that permitted by the regulations.

Series II.—Examination shows this series of fourteen to contain members differing widely as to size of flakes. With the exception of Nos. 54627 and 54671 differences as to colour and starchiness are not outstanding, nor are there any marked instances of the presence of foreign matter. Though by no means identical as to appearance, no sample of the series would be condemned as of inferior quality.

Nos. 54627 and 54671 are brans from "winter wheat." They are lighter or paler in colour and more floury than the remainder of the series. Both samples are characterized by a comparatively low protein content. In all probability, though not so labelled, No. 54569 is also from winter wheat.

The limits of variation and averages in protein, fat and fibre for the series are as follows:—

	Protein	Fat	Fibre
Maximum	19·74	7·30	13·30
Minimum	14·07	3·62	9·10
Average	17·17	5·00	10·93

Series III.—As in the case of Series II, the brans of Series III vary widely in colour, in size of flakes and in flouriness. They are all presumably free from screenings and but very few show more than traces of foreign matter, e.g., chaff, etc. They are all, judged by appearance, of good quality. Though it has been assumed that these brans are milled from hard spring wheats—or essentially so—the paler and more floury character of Nos. 55416, 55426, 55428, 55465, 55498, 55506 and 55648 might indicate that a part of the wheat, at least, used in their production was winter wheat. It is significant that these presumedly winter wheat brans are seven out of ten samples with a low protein and fat content.

The limits of variation and the averages in protein, fat and fibre for the series are:—

	Protein	Fat	Fibre
Maximum	18·06	7·10	13·15
Minimum	13·60	2·25	7·70
Average	16·01	4·41	10·76

Series IV.—This bran is particularly clean and free from foreign matter, rather dark in colour, with small flakes which show little or no flouriness.

Chemically, it is seen to possess a fair but not high protein content; it is one considerably less than the average protein content of either of the two preceding series, but one that would meet the present requirements of the Act. The percentage of fat is that of good quality bran. The fibre content is decidedly high, compared with the figure for fibre in the present regulations and with the averages obtained from Series II and III.

Series V.—The special interest attached to this series is that the six samples comprising it are from one consignment and that this consignment was milled to conform in all essential features to the sample selected as a standard and constituting Series IV. Furthermore, it was prepared at the same mill as that of Series IV.

Very little difference in appearance is to be observed between members of this series; they are moderately fine as regards size of flake, fairly bright, not floury and practically free from foreign matter. It would be difficult—indeed practically impossible—to distinguish by physical characters the samples of this series from that of Series IV.

The samples of this series, in respect to protein, may be said to fall into two groups, differing from each other by approximately 0·5 per cent of this constituent. Further, in this regard it is to be noted that neither group agrees very closely with the selected type sample (Series IV) with which in physical and chemical characters the consignment was expected closely to conform.

In fat the results throughout the series are fairly close, but decidedly lower than that of Series IV.

With the exception of Lab'y No. 57394 (Series V), there is an excellent agreement in fibre content throughout both series.

From our study of the brans examined in this investigation, and more particularly those of Series IV and V, it would seem extremely difficult and perhaps impossible *by inspection* to judge closely of the protein and fat content of a clean bran; strong similarity in physical characters does not appear to be a guarantee of as great similarity in composition.

The limits of variation and the averages in protein, fat and fibre for the series are:—

	Protein	Fat	Fibre
Maximum	17·17	3·92	11·87
Minimum	16·54	3·35	10·25
Average	16·95	3·64	11·43

Reviewing in summary the results of the foregoing series we have the following data, averages for series analysed in 1920, 1918, 1917 and 1903 being added for the purposes of comparison:—

COMPOSITION OF BRAN—AVERAGES

Series	No. of Samples	Protein	Fat	Fibre
		p.c.	p.c.	p.c.
I	1	17·11	4·18	10·85
II	14	17·17	5·00	10·93
III	35	16·01	4·41	10·76
IV	1	15·30	4·58	11·44
V	6	16·95	3·64	11·43
Average Series I–V	57	16·40	4·47	10·88
1920	51	15·64	4·81	10·63
1918	–	15·83	4·98	11·51
1917	10	15·09	4·38	9·62
1903	8	14·52	4·37	10·14

Discussion of Results

Protein.—The evidence of this inquiry in our opinion justifies the raising of the present standard for protein to 15 per cent.

To support this, in addition to the fact that the general average for all the series is 16·40 per cent, we find that in nine samples only of the fifty-seven examined did the protein fall below 15 per cent and that, of these, seven are presumedly brans from winter wheat.

Fat.—The data of this investigation would warrant, we believe, making a new fat standard, viz., 3·5 per cent.

Our general averages since 1903 for this nutrient have never fallen below 4 per cent and usually they have been considerably higher than that figure. The average of the present inquiry is 4·47 per cent. Only four of the fifty-seven samples analysed have a fat content markedly lower than 3·5 per cent, and these are from winter wheat.

Fibre.—The average for this constituent from the five series is 10·88 per cent. For a number of years past our averages for fibre in bran have well exceeded 10 per cent, the present limit. In suggesting a new limit of 11·5 per cent for fibre, a figure in consonace with the present results, we are not bringing forward one which would permit the presence of appreciable amounts of foreign matter, e.g., chaff, hulls, etc.

This investigation, therefore, would seem to point to the following chemical requirements as applicable to bran as milled at present, free from screenings and other foreign matter:—

Bran.—Protein not less than	15·0	per cent
Fat not less than	3·5	"
Fibre not more than	11·5	"

BRAN WITH SCREENINGS

Three samples only of bran "with mill run screenings" were received; they were included with the samples of Series III. All these on close inspection show the presence of ground weed seeds and chaff, but from a casual or cursory examination the foreign matter is not obvious. Unless the percentage of "mill run screenings" is comparatively high, the presence of this foreign matter is masked and its proportion difficult to estimate.

The character of the screenings is undoubtedly a factor in this connection; a considerable amount of fine chaff and hull might escape detection without colse scrutiny of the sample, but a comparatively small proportion of wild buckwheat is at once noticeable.

BRAN WITH MILL-RUN SCREENINGS

Lab'y. No.	Milling Firm	Moisture	Protein	Fat	Carbohydrates	Fibre	Ash
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
55414	Peterboro Cereal Co., Campbellford, Ont.	11·19	15·62	4·52	50·21	12·62	5·84
55421	Quance Bros., Delhi, Ont.	10·65	17·20	4·43	51·60	11·00	5·12
55651	Lake of the Woods Milling Co., Keewatin, Ont.	12·32	15·57	5·02	49·13	12·60	5·36

As far as the percentages of protein and fat in these brans are concerned the data could not be used as a measure of the foreign matter present—the figures fall within the limits of these nutriments in pure bran. In respect to fibre, the percentage in two of the samples is certainly high and would condemn the brans, but the evidence at hand would not permit us to say that the fibre content could be used as a determinative factor for screenings in bran. The range in fibre in the brans discussed in this bulletin is 7·70 to 13·30 per cent, and in the screenings (to be considered later in this bulletin) 2·55 to 14·47 per cent—the former almost entirely wheat, the latter very largely chaff and hull. Average results would show a lower fibre content in screenings than in bran.

SHORTS AND MIDDLINGS

Shorts and middlings "is the coarser material sifted out from the products of a second treatment of the wheat kernel by crushing the coarsely ground material that is sifted out from the bran after the first grinding."

The terms shorts and middlings in present usage among farmers are practically interchangeable, but we find that this product varies very considerably in both nature and composition. Many samples closely resemble fine bran, others have a floury, mealy appearance approaching the coarser grades of feed flour. The several series included in this inquiry contain a large number of shorts of the former class, but practically all types are present, ranging from products of the nature of fine bran to those of a mealy, floury nature possessing a large proportion of low-grade flour. It is the latter type which, by reason of its low fibre content and mealy nature, is particularly useful in the feeding of young pigs and calves, while the former—the coarser, bran-like class—finds its chief use in the ration of dairy cattle.

The results of this investigation, with those of laboratory work with shorts during the past five years, considered in relation to widespread dissatisfaction expressed regarding the nature of many brands of this feeding stuff for swine, would seem to make it desirable that there should be at least two classes or types of this feed placed on the market under separate and distinct names. The type characterized by its bran-like qualities might be known as shorts, while the term middlings might be restricted to the mealy, floury feeds with a lower fibre content. Further to distinguish these two types, the descriptive words "white" or "floury" might be used as a prefix to the term middlings.

The present standard for "shorts or middlings" is:—

Protein, not less than 15 per cent.
Fat, not less than 4 per cent.
Fibre, not more than 8 per cent.

Eighty-four (84) samples of shorts or middlings, representative of the products of thirty-eight mills, have been submitted to analysis. According to source of collection these arrange themselves into the following groups.

Series I comprises three samples, one designated "pure shorts," one "shorts with mill-run screenings," the third "pure flour middlings." These were submitted per Seed Branch by the Canadian National Millers' Association, Montreal, as types. The shorts with mill-run screenings were milled by The Quaker Oats Co., Peterborough, and the middlings by the St. Lawrence Flour Mills Co., Montreal.

Series II consists of twenty samples, nine of which were labelled "pure shorts," four, "shorts with mill-run screenings," and seven, "middlings," collected for the purpose of this inquiry by the Canadian National Millers' Association from fourteen mills throughout the Dominion.

Series III includes forty-five (45) samples, twenty-nine labelled "pure shorts," three, "shorts and screenings," and thirteen, "middlings." These are the product of thirty-two mills and were collected by the district inspectors of the Seed Branch to serve as representative samples of mills throughout the Dominion with the exception of the Maritime Provinces.

Series IV consists of three samples selected and submitted at the instance of the Seed Commissioner by the milling expert, Mr. W. Hill, as type or standard samples. They are stated to be from western hard wheat, 1921 crop, and are labelled shorts, shorts with screenings and feed middlings.

Series V comprises six samples, three of shorts and three of feed middlings from a consignment milled by the Interprovincial Flour Mills Co., Renfrew, Ont., at the instance of the Seed Commissioner, to be similar to the types selected by Mr. Hill for shorts and feed middlings respectively. The consignment was intended to furnish standard or type samples of these feeds for use at mills.

Series VI is a sample labelled "white middlings with mill-run screenings," submitted by the St. Lawrence Flour Mills Co., Montreal.

Series VII.—This is an experimental series consisting of a fine shorts (passing 40 by 40 mesh sieve from composite sample of shorts), a sample of feed flour and four samples compounded of these two, in the proportions stated in the subjoined table of data. These compounded samples were made chiefly for the purpose of obtaining a feed or middlings which might be suitable for pig feeding, its chemical data to form a working basis towards the establishment of a standard in respect to protein, fat and fibre for this class of feeding stuff.

The following table presents the detailed analytical data from Series I to VII inclusive. The tabulation of this table, as already remarked, has been made according to "source of collection," and not as to character of feed. In subsequent tables, the feeds have been arranged in groups according to labelling and the average composition of each type of feed calculated for each series.

Laboratory No.	Milling Firm	Labelling	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
			p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
SERIES I								
53997	.....	Pure shorts.....	7·00	18·73	5·60	57·98	6·50	4·19
54271	Quaker Oats Co., Peterborough, Ont.....	Shorts with mill run screenings.....	7·06	19·39	5·53	54·67	8·31	5·04
54272	St. Lawrence Flour Mills Co., Montreal....	Pure flour middlings.....	6·87	21·21	6·16	56·04	5·55	4·17
SERIES II								
54427	St. Lawrence Flour Mills Co., Montreal....	Shorts with mill run screenings.....	6·85	19·28	6·15	54·22	8·92	4·58
54428	" " "	Middlings.....	6·12	19·26	6·95	57·76	6·10	3·81
54430	Quaker Oats Co., Peterborough, Ont.....	Shorts.....	6·32	19·21	4·65	56·58	8·45	4·79
54469	Outlook Flour Mills, Outlook, Sask.....	Shorts with mill run screenings.....	8·70	20·20	6·05	52·84	7·53	4·68
54471	Ellison Milling and Elevator Co., Lethbridge, Alta.....	" " "	8·80	17·61	4·52	57·85	7·10	4·12
54473	Tavistock Milling Co., Tavistock, Ont.....	" " "	8·75	17·89	6·75	54·52	8·00	4·09
54474	" " " "	Middlings.....	8·35	18·15	5·15	56·40	7·97	3·98
54476	Interprovincial Flour Mills Co., Saskatoon, Sask.....	Shorts.....	7·83	18·03	5·55	57·37	7·15	4·07
54568	H. B. Faber, Wellesley, Ont.....	"	9·05	17·12	6·47	54·09	8·92	4·35
54570	Victory Flour Mills, Vancouver, B.C.....	"	9·30	18·15	4·90	56·23	8·97	4·45
54571	" " "	Middlings.....	10·10	15·00	4·40	63·92	3·48	3·10
54573	Ogilvie Flour Mills, Montreal, Que.....	Shorts.....	10·90	16·83	4·25	56·47	7·45	4·10
54574	" " "	Middlings.....	11·45	18·40	5·67	53·28	7·05	4·15
54628	*Neil McCahill, Forest, Ont.....	Pure shorts.....	9·98	14·52	4·60	60·00	6·85	4·05
54635	Dresden Flour Mills Co., Dresden, Ont...	"	10·85	18·28	5·87	52·80	8·45	4·75
54642	Maple Leaf Milling Co., St. Catharines, Ont.	Maple Leaf middlings.....	7·08	17·64	3·97	62·21	4·75	4·35
54643	" " "	Rex middlings.....	9·40	16·71	7·16	53·06	9·17	4·50
54645	Easterbrook Milling Co., Eburne, B.C....	Shorts.....	8·98	19·61	5·20	56·04	6·22	3·95
54646	" " "	Middlings.....	9·26	18·12	6·10	57·82	5·35	3·35
45672	*R. A. Thompson, Lynden, Ont.....	Pure shorts.....	11·65	16·11	4·25	55·31	7·78	4·90
	*Shorts from winter wheat.							
SERIES II								
55197	Interprovincial Flour Mills, Saskatoon, Sask.....	Shorts.....	9·99	16·73	4·97	60·15	5·00	3·16
55198	" " "	"	10·23	16·95	5·11	59·36	5·22	3·13
55393	D. Craig and Sons, Arnprior, Ont.....	Middlings.....	9·89	17·90	3·50	62·84	3·45	2·42
55399	Fisher's, Pembroke, Ont.....	Shorts.....	9·59	17·55	6·65	53·96	7·54	4·68
55400	Quaker Oats Co., Peterborough, Ont.....	White middlings (no screenings).....	10·01	16·91	5·48	59·72	4·85	3·03
55401	" " "	Shorts (no screenings).....	10·48	17·68	6·54	52·79	8·15	4·36

55402	Maple Leaf Milling Co., Peterborough, Ont.	White middlings	10·39	17·90	5·48	58·08	5·00	3·15
55405	Interprovincial Flour Mills, Renfrew, Ont.	Shorts	9·60	17·81	5·48	54·11	8·90	4·10
55407	Renfrew Flour Mills, Renfrew, Ont	Shorts (straight)	9·94	18·65	7·10	51·47	8·45	4·39
55408	Peterborough Cereal Co., Peterborough, Ont	Pure shorts	9·98	18·86	6·80	51·97	7·87	4·52
55410	" " "	Middlings	9·23	19·54	6·55	55·06	6·75	3·87
55411	Peterborough Cereal Co., Campbellford, Ont	Shorts or middlings, pure	10·02	17·60	5·55	58·46	5·07	3·30
55412	Pembroke Milling Co., Pembroke, Ont	Shorts	10·64	18·32	5·45	55·65	6·20	3·74
55413	" " "	Middlings or feed flour	11·24	15·22	2·53	68·41	1·12	1·48
55415	Findlay Woods, Lindsay, Ont	Shorts	10·59	14·55	5·72	56·73	8·57	3·84
55422	Lucan Milling Co., Lucan, Ont	Pure shorts	10·14	13·85	3·98	60·78	7·55	3·70
55425	Empire Flour Mills Ltd., St. Thomas, Ont.	Pure middlings	9·75	18·84	4·48	58·77	5·01	3·15
55427	D. Dexter & Sons, London, Ont	Middlings with mill run screenings	9·96	16·59	4·35	56·90	8·15	4·05
55461	Interprovincial Flour Mills, Strome, Alta.	Shorts	10·80	17·12	5·87	56·86	5·55	3·80
55466	Gillespie Grain Co., Ltd., Edmonton, Alta.	Shorts	10·35	16·53	6·16	56·70	6·20	4·06
55467	Victory Flour Mills, Vancouver, B.C.	Pure wheat shorts	10·90	17·81	6·48	53·45	7·10	4·26
55468	Ogilvie Flour Mills Co., Medicine Hat, Alta.	Clean shorts	10·90	18·42	6·03	52·53	7·67	4·45
55469	Easterbrook Milling Co., Eburne, B.C.	Shorts from soft wheat	11·62	16·95	4·04	54·81	7·85	4·73
55470	Vancouver Milling and Grain Co., Vancouver, B.C	Pure shorts	11·48	18·61	5·67	51·64	8·30	4·30
55472	Hedley Shaw Milling Co., Medicine Hat, Alta	Shorts	11·22	17·79	5·07	56·27	5·90	3·75
55475	Ogilvie Flour Mills Co., Ltd., Medicine Hat, Alta	Dairy middlings without screenings	11·23	18·59	5·18	55·63	5·50	3·87
55480	Alberta Flour Mills, Edmonton, Alta	Pure shorts	11·34	15·43	4·73	57·49	7·47	3·54
55481	Taylor Milling and Elevator Co., Lethbridge, Alta	"	11·54	17·71	5·25	53·81	7·35	4·33
55482	Victory Flour Mills, Vancouver, B.C.	Middlings and red dog flour	11·49	13·89	2·55	68·19	2·07	1·81
55486	Lake of the Woods Milling Co., Keewatin, Ont	Pure wheat shorts	10·30	18·31	5·49	54·93	6·82	4·15
55487	Ellison Milling and Elevator Co., Lethbridge, Alta	Shorts	10·30	17·30	5·14	57·12	6·00	4·14
55489	Esterbrook Milling Co., Eburne, B.C.	Middlings and red dog flour	11·09	14·46	4·23	61·55	4·37	3·30
55495	King Milling Co	Pure shorts	10·46	18·09	5·78	56·47	5·48	3·72
55499	Hayne Milling Co	"	11·02	16·25	3·85	57·50	6·87	4·51
55502	Western Canada Flour Mills Co., Winnipeg, Man	"	10·22	19·08	5·54	54·24	6·95	3·97
55507	Rutherford Milling Co., Blenheim, Ont.	"	10·94	15·38	3·68	59·31	6·23	4·46
55649	Wm. Snider, Waterloo, Ont	"	11·11	15·96	5·67	56·85	4·13	3·28
55653	Lake of the Woods Milling Co., Keewatin, Ont	"	11·26	18·67	6·12	52·63	7·15	4·17
55655	" " "	Special middlings	11·99	18·09	4·85	56·97	4·87	3·25
55658	" " "	Shorts with screenings	11·59	18·57	6·67	52·95	6·27	3·95
55660	Ogilvie Flour Mills Co., Fort William, Ont.	O Dairy middlings	11·73	17·21	4·60	60·94	2·90	2·62
55662	" " "	Acadian middlings	10·76	16·97	5·56	58·57	4·90	3·24
55663	" " "	Shorts with mill run screenings	11·35	16·88	5·92	54·12	7·70	4·03
55695	Quaker Oats Co., Ltd., Saskatoon, Sask.	" " "	9·10	19·06	5·26	54·13	8·25	4·20
55697	J.C. McClellan & Co., Powassan, Ont.	Pure shorts	10·08	14·21	4·08	65·12	3·60	2·91

Laboratory No.	Milling Firm	Labelling	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
			p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
SERIES IV								
56441	Interprovincial Flour Mills Co., Renfrew, Ont.	Standard Feed middlings	11·72	16·83	3·48	63·17	2·77	2·03
56442	Turtle Mt. Milling Co., Boisevain, Man.	Shorts with screenings	9·78	17·84	5·93	52 13	9·38	4·94
56443	Interprovincial Flour Mills, Renfrew, Ont.	Shorts	12·56	17·87	5·82	52·12	7·20	4·43
SERIES V								
57395	Interprovincial Flour Mills, Renfrew, Ont.	Shorts	14·23	18·36	5·37	51·62	6·60	3·80
57396	" " "	"	14·51	18·83	5·44	50·49	6·90	3·83
57397	" " "	"	14·58	18·00	5·12	52·03	6·30	3·97
57398	" " "	Feed middlings	12·45	16·64	3·38	63·75	1·97	1·81
57399	" " "	"	12·13	16·68	3·58	63·59	2·12	1·90
57400	" " "	"	12·13	16·79	3·37	64·21	1·67	1·83
SERIES VI								
54021	St. Lawrence Flour Mills Co., Montreal, Que	White middlings with mill run screenings	10·80	18·87	5·10	56·38	5·10	3·75
SERIES VII								
53991	Lake of the Woods Milling Co.	High grade feed flour	11·66	19·24	3·50	63·42	·65	1·53
53992	" " "	Shorts—composite sample	8·79	18·52	5·82	58·21	4·87	3·79
53993	" " "	Composite A Shorts 80% feed flour 20%	8·63	18·79	5·25	59·62	4·35	3·36
53994	" " "	" B " 60% " 40%	9·10	18·81	4·85	61·22	3·20	2·82
53995	" " "	" C " 40% " 60%	9·47	19·08	4·37	61·83	2·65	2·60
53996	" " "	" D " 50% " 50%	9·57	19·02	4·77	61·07	2·80	2·77

Series I.—The sample of *"pure shorts"* is eminently satisfactory from the standpoint of composition; it very fully meets the present legal requirements.

The *"shorts with mill-run screenings,"* though slightly higher in fibre than the standard for shorts permits, could not, from the standpoint of chemical composition, be condemned. It is excellent both in protein and fat. Examination of the sample, however, revealed the presence of screenings, though not in excessive quantities.

The *"pure flour middlings,"* though a clean and in many respects a desirable product, is not typically representative of the mealy, floury middlings particularly desired for pig feeding. It is very high in both protein and fat and probably approaches the limit in fibre for this class of feed.

Series II—Pure Shorts.—The nine samples of pure shorts, i.e., shorts without screenings, exhibit the following limits: protein, 14·52—19·61 per cent; fat, 4·25—6·47 per cent; fibre, 8·97—6·22 per cent. Two of these samples were from winter wheat and gave the lowest percentages of protein, viz., 14·52 and 16·11. The minimum protein content of the samples from hard spring wheat was 16·83 per cent. With respect to fat, only two of the samples, and these are from winter wheat, fall appreciably below 5 per cent. As regards fibre four samples exceed 8 per cent, but from inspection these appear to contain a certain small amount of foreign material, e.g., screenings, chaff, etc.

Shorts with Screenings.—The limits for the four samples labelled "shorts with screenings" are: protein, 17·61—20·20 per cent; fat, 4·52—6·75 per cent; fibre, 7·10—8·92 per cent.

Middlings.—The limits of the seven samples in this series are: protein, 15·0—19·26 per cent; fat, 3·97—7·16 per cent; and fibre, 3·48—9·17 per cent. One of these samples, No. 54643, although not so stated, undoubtedly contains a considerable proportion of screenings. It is of a branny nature and contains 9·17 per cent fibre. The next two highest in fibre are Nos. 54474 and 54574, with 7·97 per cent and 7·05 per cent. These are decidedly brannier than the remaining four of the series which are distinctly in the class of mealy, floury middlings with fibres ranging from 3·48 to 6·10 per cent and averaging 4·92 per cent.

Series III—Pure Shorts.—Twenty-nine samples of this series were according to labelling without screenings. Their limits are: protein, 13·85—19·08 per cent; fat, 3·68—7·10 per cent; and fibre, 3·60—8·90 per cent. Of the twenty-nine samples analysed, twenty-four (24) contain more than 16 per cent protein and more than 5 per cent fat; twenty-five samples have a fibre content less than 8 per cent.

Shorts with Screenings.—The limits of the three samples thus labelled are: protein, 16·88—19·06 per cent; fat, 5·26—6·27 per cent; and fibre, 6·27—8·25 per cent.

Middlings.—The limits of the twelve samples are: protein, 13·89—19·54 per cent; fat, 2·55—6·55 per cent; and fibre, 1·12—6·75 per cent. Of this series two contain more than 5 per cent fibre and these are of the nature of fine shorts rather than mealy middlings. This series also contains one sample which is typically, by nature and composition, a feed flour. Averaging the remaining nine, which from both appearance and analysis may be regarded as satisfactory middlings, we have a fibre content of 4·16 per cent.

Middlings with Mill-run Screenings.—This sample (No. 55427) meets its guarantee with respect to protein, fat and fibre. It is not, however, correctly speaking, a middlings, but is rather of the nature of fine shorts and may be cited as an example of the present practice of using the term shorts and middlings for the same product and interchangeably.

Series IV—Shorts.—This is a clean, bright sample free from foreign matter. From appearance and composition it would be adjudged eminently satisfactory.

Shorts with Screenings.—This sample is characterized by a high fibre content. The presence of a probably large percentage of screenings is indicated by the dull, dirty appearance of the sample.

Middlings.—From the standpoint of appearance (colour, texture, etc.), this is a very desirable product; its satisfactory character as a middlings is further indicated by its fibre content, which is practically midway between that of feed flour and shorts.

Series V—Shorts.—The three samples of shorts here recorded are all from the same consignment. They show great uniformity, both as to character and composition. The limits of protein are: 18·0—18·83 per cent; fat, 5·12—5·44 per cent; and fibre, 6·30—6·90 per cent. They differ from the type or standard samples of Series IV, to which they should be similar, in being approximately 0·5 per cent higher in protein, 0·5 per cent lower in fat, and 0·6 per cent lower in fibre.

Middlings.—The three samples of middlings are quite uniform in character and composition, and the figures of their analysis as regards protein and fat approach very closely those of the middlings in Series IV. In fibre they are distinctly lower.

Series VI.—This sample of *middlings with screenings* presents no very objectionable features, judging from appearance; evidently the proportion of screenings present is quite small. Analysis, however, shows that in fibre it closely approaches the limit for this class of feeding stuff.

For the purpose of studying more broadly the foreging data with a view to obtaining results useful in the revision of the present standards, the following tables of averages have been prepared. They furnish averages in protein, fat and fibre of the shorts, shorts with screenings, and middlings in the several series examined.

COMPOSITION OF PURE SHORTS—AVERAGES

Series	No. of Samples	Protein	Fat	Fibre
		p.c.	p.c.	p.c.
I	1	18·73	5·60	6·50
II	9	17·54	5·08	7·80
III	29	17·17	5·45	6·73
IV	1	17·87	5·82	7·20
V	3	18·39	5·31	6·60
Average	43	17·38	5·73	6·95

Discussion of Results

Protein.—The average protein content of the forty-three samples of pure shorts is 17·38 per cent. The average of Series II, consisting of nine samples submitted by milling firms, is 17·54 per cent. The average of Series III, comprising twenty-nine samples collected by the department's inspectors, is 17·17 per cent. The special type sample of Series IV contains 17·87 per cent. The three samples of Series V, taken from a consignment specially milled to serve as a type or standard, gave an average of 18·39 per cent.

Only six samples of the forty-three analysed fall below 16 per cent; five of these are in all probability from winter wheat.

The data of this investigation therefore would warrant the raising of the present standard for protein to 16 per cent.

In arriving at this figure we have taken into consideration that shorts from winter wheat and mixtures containing winter wheat may be milled and offered for sale. If it were not for this contingency, the limit might well be placed at 16·5 per cent or even 17·0 per cent.

Fat.—The average from each of the series for this constituent is over 5·0 per cent; nine samples only of the entire number analysed showed less than this amount.

Averages for fat from series of shorts analysed in 1903, 1917 and 1920 are all 5·0 per cent or over.

We conclude that the results of this inquiry would justify the raising of the present standard for fat to 5 per cent.

Fibre.—The present standard for fibre permits 8·0 per cent as a maximum and we consider that this limit in any revision should remain unchanged. This, though liberal, cannot well be lowered as there are five of the forty-three samples examined which have a fibre content slightly higher than 8 per cent and there is no evidence to show that these contain any appreciable amount of chaff or other foreign matter.

This investigation, therefore, would seem to point to the following chemical requirements as applicable to pure shorts, *i.e.*, free from screenings:—

SHORTS—Protein, not less than 16·0 per cent.
Fat, not less than 5·0 per cent.
Fibre, not more than 8·0 per cent.

COMPOSITION OF SHORTS WITH MILL-RUN SCREENINGS—AVERAGES

Series	No. of Samples	Protein	Fat	Fibre
		p.c.	p.c.	p.c.
I	1	19·39	5·53	8·31
II	4	18·74	5·87	7·89
III	3	18·17	5·95	7·40
IV	1	17·84	5·93	9·38
Average	9	18·52	5·86	7·94

From the standpoint of chemical composition, it is evident that no objection could be taken to this product save on the grounds of a somewhat high fibre content. This conclusion is confirmed by the work done in these laboratories for some years past. It is extremely improbable, under any circumstances, if by chemical analysis the screenings content in shorts can be estimated either as to quality or amount.

If for any reason, therefore, it is thought desirable, in addition to the product "pure shorts," to place upon the market for feed "shorts with mill-run screenings," the presence of the screenings should be prominently stated on the tag or bag. As already stated, we are not in favour of this product, but, if permitted, it should be regarded as a compounded feed and sold under guarantee as to its protein, fat and fibre content.

COMPOSITION OF MIDDLINGS—AVERAGES

Series	No. of Samples	Protein	Fat	Fibre
		p.c.	p.c.	p.c.
I	1	21·21	6·16	5·55
II	7	17·61	5·63	6·29
III	12	17·13	4·57	4·23
IV	1	16·83	3·48	2·77
V	3	16·70	3·44	1·92
Average	24	17·37	4·76	4·54

Series I.—This sample is rather of the nature of fine shorts than of middlings. It would be considered most excellent as a shorts—it is very rich in both protein and fat—but it evidently contains too high a proportion of what might be termed the bran elements. This is indicated chemically by the comparatively high fibre content and physically by absence of flouriness or mealiness.

Series II.—As shown on page 17, if three of the seven samples of this series are omitted from the average—the three which are distinctly branny in nature and therefore ruled out as not of the character desired for this feed—we obtain an average fibre content of 4·92 per cent. The average protein of these remaining four samples is 17·53 per cent and of fat, 5·30 per cent.

Series III.—This series is much more consistently labelled than Series II; nine of the twelve samples, as pointed out on page 17 are to be regarded as eminently satisfactory from every point of view. It is worthy of note that their fibre content is considerably less than 5 per cent.

Series IV and V.—These four samples appear to be very satisfactory both as to nature or character and composition. For the purpose for which middlings are specially desired they must be considered of excellent quality. In no instance does the fibre exceed 3 per cent.

From a careful consideration of the foregoing data and facts and eliminating those samples which by their high fibre content are not of the nature of the product desired, we believe the following limits will be found fair to the miller and satisfactory to the purchaser:—

Middlings—Protein, not less than 16·5 per cent.
Fat, not less than 3·5 per cent.
Fibre, not more than 4·5 per cent.

Speaking generally this will be a new product and in all probability there will be at first some difficulty in obtaining uniformity as to nature and composition throughout the Dominion, but with an earnest effort on the part of the miller, using suitable screens, we believe that no serious difficulty will be encountered in producing a middlings to meet this requirement.

COMPOSITION OF MIDDLINGS WITH MILL-RUN SCREENINGS—AVERAGES

Series	No. of Samples	Protein	Fat	Fibre
		p.c.	p.c.	p.c.
III	1	16·59	4·35	8·15
VI	1	18·87	5·10	5·10
Averages	2	17·73	4·72	6·62

The averages of this series are, with the exception of that for fibre, very close to those of pure middlings. The sample in Series III is in reality a shorts with screenings and this fact accounts for its high fibre. The sample in Series VI is of the nature of middlings, as evidenced by its mealy nature and its fibre content. It is not, however, to be classed with the more mealy samples of this inquiry.

As in the case of shorts, the presence of screenings in middlings may not be indicated by chemical analysis. This renders it all the more desirable to exclude objectionable weed seeds, by enactment, from this feed, which, from its special uses, it is essential to keep free from all unpalatable and noxious properties.

FEED FLOURS

The investigation includes twenty samples of feed flour (red dog flour, low grade flour) collected throughout the Dominion (with the exception of the Maritime Provinces) by the inspectors of the Seed Branch, Department of Agriculture. Certain of these were sold under brand names.

No Canadian standard for this class of feed has yet been established, and we find on the market several grades, varying from those which are of the nature of flour to those which might be classified as middlings.

The following table presents the analytical data, together with certain other particulars of the samples examined:—

Laboratory No.	Milling Firm	Labelling	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
SERIES III			p.c.	p.c.	p.c.	;.c.	p.c.	p.c.
55191	Quaker Oats Co., Saskatoon, Sask.	Red Dog flour	9·95	17·52	2·79	64·39	3·10	2·25
55196	Interprovincial Flour Mills, Saskatoon, Sask.	Feed flour "Ace." No screenings	11·07	14·87	2·51	70·29	0·39	0·87
55201	Robin Hood Mills, Moosejaw, Sask.	Red Dog	10·28	16·09	3·50	68·21	0·68	1·24
55394	Fishers', Pembroke, Ont.	Feed flour	9·62	18·32	1·50	67·29	1·75	1·52
55398	Renfrew Flour Mills, Renfrew, Ont.	"	9·15	16·82	1·98	67·28	2·55	2·22
55403	Interprovincial Flour Mills, Renfrew, Ont.	"	10·77	16·28	3·30	64·76	2·95	1·94
55417	Campbell & McNab, Douglas, Ont.	"	9·86	19·03	3·92	61·78	3·00	2·41
55419	Quance Bros., Delhi, Ont.	Red Dog flour	9·86	17·62	3·01	65·03	2·40	2·08
55423	Empire Flour Mills, Ltd., St. Thomas, Ont.	Feed Flour	10·36	17·23	2·84	66·33	1·48	1·76
55483	Hedley Shaw Milling Co., Medicine Hat, Alta.	"	11·28	16·72	3·00	64·13	2·60	2·27
55484	Lake of the Woods Flour Mills, Keewatin, Ont.	Empire Flour Feed, 50 p.c. low grade flour, 50 p.c. shorts.	10·71	18·77	4·14	59·41	3·95	3·02
55488	Vancouver Milling and Elevator Co., Vancouver, B.C.	Feed Flour	9·92	18·29	4·58	61·60	2·95	2·66
55497	King Milling Co.	"	11·48	15·35	2·59	67·84	1·27	1·47
55500	Hayne Milling Co.	"	11·63	14·24	1·90	70·05	1·15	1·03
55504	T. H. Taylor, Chatham, Ont.	"	10·42	17·29	4·61	60·10	4·37	3·21
55509	Rutherford Milling Co. Blenheim, Ont.	"	11·16	14·81	2·74	68·50	1·42	1·39
55647	Wm. Snider, Waterloo, Ont.	"	11·83	18·01	3·70	63·16	1·22	2·08
55652	Lake of Woods Milling Co., Keewatin, Ont.	" Shorts with screenings 1 part. Low grade flour 1 part.	11·58	16·96	4·39	60·71	3·75	2·61
55664	Ogilvie Flour Mills Co., Fort William, Ont.	Imperial Low Grade Flour	10·87	18·33	4·14	63·71	0·68	2·27
55699	J. C. McClellan & Co., Powassan, Ont.	Low Grade Flour	10·64	12·73	2·89	71·49	0·55	1·70

The limits of variation and averages in protein, fat and fibre for the series are as follows:—

	Protein	Fat	Fibre
Maximum	19·03	4·61	4·37
Minimum	12·73	1·50	·39
Average	16·76	3·20	2·11

In 1920, a series of eight brands of feed flour was analysed in these laboratories, with the following results:—

	Protein	Fat	Fibre
Maximum	18·24	5·65	5·10
Minimum	14·40	2·60	1·47
Average	15·58	3·82	3·48

It may not be necessary or desirable at this time to establish any standard for this product, but the evidence to date might be considered as indicating that the following figures would fairly represent the quality of the better class of feed flours: protein, 18·0 per cent; fat, 3·5 per cent; and fibre, 3·5 per cent. Owing to the lack of uniformity among low grade feed flours there are on the market to-day many which are inferior to a flour of this quality but at the same time some brands which show higher protein and less fibre.

SCREENINGS

Since for some time past it has been permitted to sell "shorts with mill-run screenings," it was thought desirable to ascertain what effect, if any, the presence of these screenings might have on the percentages of protein, fat and fibre of the shorts. To this end a series of samples of screenings wes collected by the district inspectors of the Seed Branch at a number of mills throughout the Dominion. The series comprises thirty samples, twenty-one of which were received in the whole condition and nine were ground.

The limits of varieties and averages of protein, fat and fibre are as follows:—

	Protein	Fat	Fibre
Maximum	16·68	9·66	14·47
Minimum	12·00	1·77	2·55
Average	14·40	4·05	6·68

It is at once obvious that the composition of mill-run screenings, with the exception of the protein content, is extremely variable and that in consequence it would be impossible from an analysis of any specific sample of "shorts with screenings" to state, even approximately, the amount of screenings present. There are screenings, as to composition, very close to shorts and others again which differ widely, save perhaps in protein. No general statement, therefore, from chemical work can be made as to the influence of screenings on shorts in respect to protein, fat and fibre content.

As is well known, the character of screenings is extremely variable; samples containing a large proportion of wheat will undoubtedly possess a comparatively high feeding value, others with preponderating amounts of weed seeds possessing a nutritive value may also show fairly high percentages of protein and fat, and, again, there is a third class which is rendered worthless or worse than worthless by the presence of chaff, dust and sweepings and, more dangerous still, poisonous weed seeds.

The variable character of screenings is well illustrated in the subjoined table, which contains the condensed results of a "separation" of the twenty-one unground samples of the series. The separation was made in detail, determining the percentage of grain and of each variety of weed seed, etc., present, but for the purposes of this inquiry the results have been more simply classified. Under the heading "Weed seeds with a certain nutritive value," there are included wild buckwheat, lamb's quarters, wild oats, seeds of grasses, clovers, etc., while among the noxious weed seeds have been placed those designated by the Act as injurious to live stock, and comprising chiefly hare's ear mustard, ball mustard and wild mustard. In connection with this matter, it is well to point out that we have no assurance that the former—the weed

Laboratory No.	Milling Firm	Labelling	Moisture	Protein	Fat	Carbo-hydrates	Fibre	Ash
SERIES III			p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
55194	Quaker Oats Co., Saskatoon, Sask	Unground screenings as used in shorts, with mill run screenings.	10·91	15·40	3·58	38·69	4·60	4·20
55195	Interprovincial Flour Mills, Saskatoon, Sask	Mill run screenings	10·05	15·30	9·27	56·06	6·11	3·21
55203	Robin Hood Mills, Moosejaw, Sask	Recleaned "A Screenings"	10·69	15·28	5·58	60·81	5·14	2·50
55430	Peterboro Cereal Co., Peterborough, Ont.	Screenings	10·30	14·70	3·30	60·90	7·85	2·95
54431	Quaker Oats Co., Peterborough, Ont.	Unground Screenings with dust	9·68	13·27	2·70	59·69	11·2ɔ	3·41
55432	Interprovincial Flour Mills Co., Renfrew, Ont.	Ground Screenings	10·46	15·55	4·46	61·68	4·90	2·95
55433	Maple Leaf Milling Co., Pembroke Ont.	Ground Screenings	9·66	13·21	3·34	55·67	14·47	3·65
55434	T. Dexter & Sons, London, Ont.	"	11·23	14·87	4·40	50·95	11·35	7·20
55491	Interprovincial Flour Mills, Strome, Alta.	"	11,23	13·18	2·14	65·92	5·55	1·98
55496	King Milling Co.	Screenings, not recleaned	11·68	15·83	4·02	61·66	4·47	2·34
55508	Rutherford Milling Co., Blenheim, Ont.	" "	10·68	13·42	1·77	63·82	5·75	4·56
55632	D. Craig & Sons, Arnprior, Ont.	Screenings	11·48	13·55	1·81	67·53	3·33	2·30
55633	Renfrew Flour Mills Co., Renfrew, Ont.	"	11·60	13·36	2·31	65·85	4·30	2·58
55634	Pembroke Milling Co., Pembroke, Ont.	"	11·48	13·44	3·62	59·46	8·60	3·40
55635	Findlay-Woods, Lindsay, Ont.	"	11·50	13·02	3·21	63·92	5·50	2·85
55636	Quance Bros., Delhi, Ont.	Spring Wheat screenings	11·51	13·61	3·53	60·50	7·70	3·15
55637	" "	Winter Wheat screenings	12·15	13·71	2·00	62·42	6·60	3·12
55638	Lucan Milling Co., Lucan, Ont.	Screenings	12·30	15·07	2·87	62·38	5·05	2·33
55639	" " "	"	12·00	13·68	2·75	63·53	5·10	2·94
55640	Vancouver Milling and Grain Co., Vancouver, B.C.	Screenings from wheat used to mix with feed.	11·48	16·33	2·18	64·52	2·55	2·94
55641	Interprovincial Flour Mills, Strome, Alta.	Whole screenings	11·33	12·72	3·16	65·07	5·45	2·27
55642	Easterbrook Milling Co., Eburne, B.C.	Screenings from wheat, sold as Ground Screenings.	10·77	13·59	5·43	57·38	6·10	6·73
55643	Ogilvie Flour Mills, Medicine Hat, Alta.	Screenings to grinder	11·15	15·21	4·24	59·45	7·10	2·85
55644	Interprovincial Flour Mills, Renfrew, Ont.	Screenings	10·96	16·68	5·57	58·88	4·27	3·64
55645	Peterboro Cereal Co., Campbellford, Ont.	"	11·69	14·57	4·83	58·37	7·27	3·27
55646	Lake of Woods Milling Co., Keewatin, Ont.	"	10·73	16·16	9·66	51·66	8·05	3·74
55654	" " " "	Mill run Screenings	11·85	14·97	6·25	53·76	9·35	3·82
55656	" " " "	Ground mill run screenings	11·19	15·66	6·37	52·38	10·42	3·98
55661	Ogilvie Flour Mills, Fort William, Ont.	Mill run screenings	12·78	14·71	4·92	55·89	8·35	3·35
55698	J. C. McClellan, & Co., Powassan, Ont.	Screenings	10·32	12·00	2·45	68·99	4·05	2·19

seeds with a certain nutritive value—do not impart, in some degree, undesirable properties to the feed containing them.

UNGROUND SCREENINGS
(Percentages by Weight)

Laboratory No.	Wheat	Oats and other Grains	Weed seeds with a certain nutritive value	Weed seeds objectionable or poisonous	Chaff, straw, refuse, etc.
55194	35·7	1·0	48·2	2·1	13·0
55195	40·2	7·3	24·4	–	28·1
55496	72·2	8·3	12·2	1·0	6·3
55508	47·4	45·8	·7	–	6·1
55632	91·5	3·3	3·9	–	1·3
55633	70·6	6·9	14·3	–	8·2
55634	49·5	6·1	36·6	·7	7·1
55635	47·8	19·3	5·0	–	27·9
55636	20·1	41·1	27·6	·1	11·1
55637	55·7	32·6	2·3	–	9·4
55638	73·3	6·7	16·1	–	3·9
55639	61·4	27·4	1·0	–	10·2
55640	76·3	1·9	17·3	–	4·5
55641	48·8	–	29·0	·1	22·1
55642	70·0	3·9	15·2	·7	10·2
55643	61·5	–	19·6	–	18·9
55644	40·9	·2	21·0	–	37·9
55645	28·4	4·4	21·1	·2	47·9
55646	18·4	2·4	22·3	9·2	47·7
55654	26·4	3·0	43·7	5·5	21·4
55698	82·9	13·8	2·5	–	·8

To discuss the foregoing briefly, the variation in composition may first be pointed out. In wheat (small, broken and shrivelled kernels) they range from 18 per cent to 91 per cent and in this connection it may be stated that it is the percentage of wheat present which essentially determines the feeding value of screenings. It is therefore obvious that the series contains samples of widely differing value.

While it is satisfactory to note that the percentage of poisonous weed seeds is practically negligible in the larger number of samples, the percentages of other weed seeds may assume very notable proportions. These seeds, as already intimated, must not be classed, from the standpoint of nutritive value, with wheat and other cereals or their milling by-products; they are certainly of an inferior order, chiefly by reason of a certain degree of unpalatability. Of course, the percentages recorded in the last column of the table represent worthless material, material which lowers the value of the remainder. Its presence is distinctly detrimental.

The exclusion of screenings from the milling by-products of wheat has been urged; this does not mean that they are valueless. Recleaned screenings, with but negligible percentages of worthless and noxious material ought, we think, to be able to find a place on the market of feeding stuffs on its own merits. We are further of the opinion that as part of a compounded feed of higher quality, i.e., one containing shorts, ground oats, barley, or other suitable meal, these recleaned screenings could be utilized to make a desirable and useful feeding stuff for certain classes of live stock. Such a feed should be palatable and would, of course, be sold under guarantee as to protein, fat and fibre.

NOTE

For further information, the reader is referred to the following publications, which may be obtained free of charge upon writing the Publications Branch, Department of Agriculture, Ottawa:—

Report of the Dominion Chemist, 1920-21.
Commercial Feeding Stuffs, Bulletin 47, Second Series.
Recleaned Elevator Screenings as a Food for Live Stock, Pamphlet 18.
Farm Feeds, Bulletin 36.