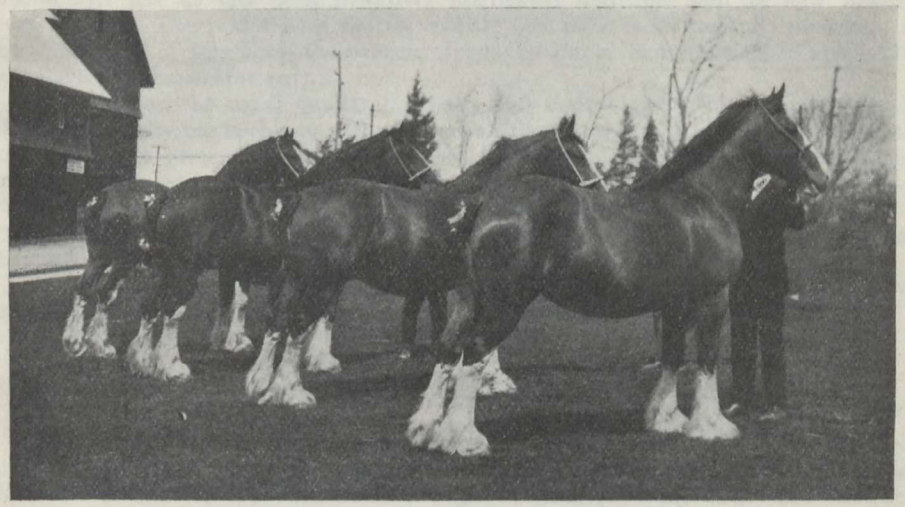
DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

ANIMAL HUSBANDRY DIVISION

INTERIM REPORT OF THE DOMINION ANIMAL HUSBANDMAN

G. B. ROTHWELL, B.S.A.

FOR THE YEAR ENDING MARCH 31, 1922



Clydesdale Mares at the Central Experimental Farm

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THE ANIMAL HUSBANDRY DIVISION

In presenting the report for the Animal Husbandry Division for the year ending March 31, 1922, credit should be given to the several members of the divisional staff. Mr. Geo. W. Muir, Animal Husbandman, has had direct charge of all experimental work with dairy cattle and sheep besides general supervision of the activities of the division for considerable periods. The sections of this report dealing with dairy cattle and sheep have been prepared by Mr. Muir. Mr. W. G. Dunsmore has had charge of investigations with swine as per his report herewith, and has handled the volume of work incidental to records, registrations, sales and shipping, besides being responsible for the preparation of bulletins, articles, and the review of current live stock literature, etc. Mr. S. J. Chagnon, the most recent addition to the staff, has done considerable work in the province of Quebec preparatory to agricultural survey work anticipated for the summer of 1922. He has also conducted analytic work with reference to ventilation systems, as reported by him, and assisted in new lines of dairy manufacture, etc. Mr. Robt. Cunningham has had immediate supervision of the routine of live stock work with all classes of stock, beside experiments conducted. Particular credit is due to him for good records made and under way, and for careful and expert attention generally throughout the year.

Particular satisfaction is afforded in the case of dairy cattle by the fact that tuberculosis has at last been definitely eradicated and the herd is now nearing accreditation. The junior herd shortly coming into milk is of excellent promise. In the upbuilding of this herd, the progeny from the Bang herd maintained since 1916 has played an important part.

With horses, the usual quality has been well maintained. Unfortunately, as in the past, difficulty has been met with in securing the services of a stallion of sufficiently good quality to properly mate with the half-dozen mares of unusual excellence now forming the nucleus of breeding operations.

Sheep have done exceedingly well, due largely to improved range conditions.

The herd of swine has formed a field for much experimental work in feeding and breeding, and ranks to-day as one of the best breeding herds in Canada.

In the dairy, a new cheese, of promise, has been developed, as a result of investigations along new lines of dairy manufacture.

DAIRY CATTLE

The dairy cattle continue to show marked improvement in both type and production. There are at this date 159 head of dairy cattle in the barns, this number being made up of 152 pure-breds and 7 grades. All of these cattle are kept for breeding, experimental and demonstration work.

PURE-BRED BREEDING CATTLE

Ayrshires	30	milch cows,	25	heifers,	13	bulls
Holsteins	25	" "	25	"	10	"
Jerseys	9	" "	5	"	3	"
French-Canadians	2	" "	4	"	1	"

GRADE BREEDING STOCK

Ayrshires	1	milch cow,	3	heifers
Holsteins	2	" "	1	"

AYRSHIRES

The Ayrshire herd has not increased in numbers to any great extent, but the improvement in quality is particularly noticeable, especially in the young heifers. There is a string of the latter bred to freshen in the fall of 1922 that should make history for the breed. In this lot are a number of imported-in-dam heifers that show considerable promise. Considerable misfortune was experienced with the imported cows in that 50 per cent proved to be tubercular and two others non-breeders. Nevertheless, some creditable records have been made and better ones are now in the making. The progeny of the imported bull "Overton Lord Kyle" are proving to be exceptionally good and look capable of following their sire in the show-ring. There were no additions to the herd by way of purchases during the year.

HOLSTEINS

Good progress can be reported with this breed of cattle. No losses have been sustained and some excellent records have been made as will be noticed by referring to the table giving records further on in this report. Special mention might be made of the cow, "Grace Fayne Aggie." This cow completed a record of 15,610 pounds of milk and 633 pounds of fat in 321 days and produced two calves inside of thirteen months. Since last freshening in December, she has made records of 34·12 pounds butter in seven days and 142·68 pounds butter in thirty days. She kept up at this rate until the end of March so that an even better record is likely this lactation period. Two bulls are being used on the herd. One is an excellent son of the famous show and breeding bull "King Segis Alcartra Spofford" and out of a 30-pound cow. His daughters show excellent promise. The other bull is of American breeding noted for high fat production. He also is leaving some very typey heifers.

JERSEYS

The Jersey herd has increased in both numbers and quality. No purchases have been made into this herd during the past year. Some creditable records have been made, as will be seen by referring to the tables given elsewhere in this report. The herd sire, "Rower's Golden Maid's Prince," purchased during the previous fiscal year, has proved his value by siring some calves that show exceptional promise as dairy animals.

FRENCH-CANADIANS

The French-Canadian herd has been much reduced in size as it has been found that there is little call for information concerning this breed outside of its native province and the Experimental Station at Cap Rouge, Que., takes care of the inquiries from that province. In accordance with the policy of keeping only those classes of stock which are most popular in or best suited to the district surrounding the Farm or Station concerned, the French-Canadian breed will eventually be eliminated at the Farm at Ottawa.

SALE OF BREEDING STOCK

The policy with regard to sales of breeding stock has always been to offer nothing but what will be a credit to the breed and an assurance of improved stock to the purchaser. Considering breeding and individuality, the prices asked are invariably moderate. As yet only bull calves have been available, but it is hoped within a very few years to be able to offer females also. During the year the following bulls have been disposed of: four Ayrshire, four Holstein, one Jersey, and one French-Canadian. In addition, three Ayrshire heifers were shipped to the Experimental Station at La Ferme.

SUMMER FEEDING

Pasture areas on the Farm being limited, outside areas are obtained for all dry cows and heifers. These animals had an abundance of pasture, consequently were in good condition when stabled in the fall. The milch cows were not so fortunate in that they have a very small area of land for pasture and this being always new meadow it soon gets tramped down. As a consequence, they are only charged up with two months' pasture in a season.

During the time that they are at pasture they receive supplementary feeding in the form of ensilage and soiling crops of various kinds. Each successive year that this practice is followed the value of silage for mid-summer feeding is more clearly demonstrated. A considerable quantity of silage left over from the 1921 winter feeding period was available for this purpose. At March 31, 1922, one of the large silos was just opened, so that silage for feeding during the coming summer is again insured.

WINTER FEEDING

An abundance of roughage crops consisting of clover hay, silage and roots, was available for the winter feeding of the dairy cattle. During the summer and fall of 1921, the grain markets were down to quite a low level and as most of the winter's supply of grain feeds was bought at that time it was procured at reasonable prices. The ration fed the milk cows consisted of:—

Corn silage	25-35	pounds
Hay	6- 8	"
Roots or beet meal	10-80	"
Meal	2-20	"

The meal mixture for the milk cows consisted for the most part of bran, 5 parts; brewers' grains, 5 parts; hominy, 3 parts, and nutted oilcake, 3 parts.

This was fed in most cases at the rate of one pound for every four pounds of milk produced. About one per cent each of salt, ground charcoal and ground rock phosphate are added to this meal mixture. The charcoal tends to correct digestive irregularities while the salt and ground rock phosphate supplement the minerals in the ration.

The senior yearling and two-year-old heifers not in milk are fed a ration of corn silage and rough hay or straw, but receive no meal unless in exceptional cases of low condition or unthriftiness. Younger heifers are allowed a fairly liberal grain ration to get all the growth possible at as early an age as possible.

EXPERIMENTAL FEEDING

THE VALUE OF DRIED BEET PULP IN THE DAIRY COW'S RATION

Project 81.—Owing to the supply of this product on the market and the lack of definite information as to its value in the dairy cow's ration, it was thought advisable to conduct an experiment in an endeavour to arrive at its actual and replacement values. The experiment was divided into four parts, as follows:—

1st. Dried beet pulp vs. one-half usual grain mixture.

2nd. Dried beet pulp vs. one-half root ration.

3rd. Dried beet pulp vs. one-half usual silage ration.

4th. Dried beet pulp vs. all usual silage ration.

All parts of the experiment were run simultaneously, one row of milk cows in the main barn being used for each part of the experiment. Each part of the experiment was divided into three periods of three weeks each. The last week only of each

period was used for taking of data. The first and last periods were averaged, which average was directly comparable to the second period as it eliminated the natural decline in milk flow. For the first three-week period all the cows were getting their regular ration of hay, corn silage or roots, and grain mixture. During the second three-week period, the replacement with beet pulp was made. The third three-week period the cows received their regular ration again. The regular ration consisted of hay, corn silage and meal mixture in the case of lots 1, 3 and 4, and of hay, roots and meal mixture in the case of lot 2. The amount fed of each ingredient in the ration varied with the breed of cattle and the amount of milk they then produced. The meal mixture was made up of wheat bran, 5 parts; brewers' grains, 5 parts; hominy 3 parts; and oilcake meal, 3 parts.

The prices put upon the feeds used in the experiment were as follows:—

Meal mixture	$32 00 per ton
Dried beet pulp	21 90 "
Hay	9 00 "
Corn silage	*3 90 "
Roots (mangels)	*4 75 "

* Cost to produce figures.

When feeding the dried beet pulp it was soaked with cold water. It was found that it would take up about three times its own weight of water when soaked in this way, and swelled up considerably as a consequence.

Part I.—In this part of the experiment one-half the meal mixture in the ration was replaced by dried beet pulp. The replacement was made on a dry matter basis. On this basis it was found that 322 pounds of beet pulp were required to replace 332·5 pounds of meal mixture.

The data for this part of the experiment are given below:—

TABLE I—DAIRY CATTLE FEEDING EXPERIMENT No. I, 1921-22

PART I—DRIED BEET PULP VS. GRAIN

Items		Period 1	Period 2	Period 3	Average of periods 1 and 3
Experimental Ration		Regular ration	Beet pulp replacing half meal in ration	Regular ration	Regular ration
Number of cows in test	No.	9	9	9	9
Pounds of milk produced by 9 cows	lbs.	2,020·00	1,978·00	1,726·5	1,873·2
Average milk per cow per day	"	32·00	31·4	27·4	29·7
Average per cent fat in milk	%	3·62	3·48	3·79	3·70
Total lbs. fat produced by 9 cows	lbs.	73·15	68·83	65·42	69·28
Average pounds fat per cow per day	"	1·16	1·09	1·04	1·10
Total meal consumed	"	665·00	332·50	665·00	665·00
Total hay consumed	"	441·00	441·00	441·00	441·00
Total beet pulp consumed	"	.....	332·00	.....	.....
Total ensilage consumed	"	3,150·00	3,150·00	3,150·00	3,150·00
Meal mixture consumed per 100 lbs. fat produced	"	909·00	483·00	1,016·5	962·7
Beet pulp consumed per 100 lbs. fat produced	"	.....	467·8	.....	.....
Meal mixture consumed per 100 lbs. milk produced	"	32·9	16·8	38·5	35·7
Beet pulp consumed per 100 lbs. milk produced	"	.....	11·2	.....	.....
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	10·64	5·32	10·64	10·64
Value of beet pulp fed	$	.....	3·53	.....	.....
Value of roughage fed	$	8·02	8·02	8·02	8·02
Total cost of feed	$	18·66	16·87	18·66	18·66
Feed cost to produce 100 pounds fat	$	25·50	24·52	28·52	27·02
Feed cost to produce 100 pounds milk	$	·92	·85	1·08	1·00

It will be seen from the preceding table that the half beet pulp, half grain ration produced 105 pounds more milk than the straight grain ration. It will also be seen that the average per cent butter fat in the milk was ·22 of a per cent lower when beet pulp was fed than when the regular ration was fed. This drop in per cent fat was sufficient to reduce the total production of fat to a point below that produced by the regular ration in spite of the fact that the ration containing beet pulp gave the most milk. However, this drop in fat did not hinder the beet pulp ration producing both milk and butter fat more economically than the regular ration. The 322 pounds of beet meal consumed proved equal to 370 pounds of meal mixture, 25 pounds of hay and 176 pounds of ensilage, which, at the prices quoted for these feeds, would give beet pulp a value, *in this particular combination of feeds,* of $39.60 per ton.

Part II.—In this part of the experiment one-half of a straight root ration of 90 pounds was replaced by beet pulp, again on the dry matter basis. It was found that 126 pounds of beet pulp were required to replace 1,260 pounds of roots.

The data for this part of the experiment are given below:—

TABLE II—DAIRY CATTLE FEEDING EXPERIMENT No. I, 1921-22

PART II—DRIED BEET PULP VS. ROOTS (MANGELS)

Items		Period 1	Period 2	Period 3	Average periods 1 and 3
Experimental Ration		Regular grain mixture, roots and hay	Regular grain mixture, roots, beet pulp and hay	Regular grain mixture, roots and hay	Regular grain mixture, roots and hay
Number of cows in test	No.	4	4	4	4
Pounds of milk produced by 4 cows	lbs.	1,030·00	1,149·50	1,063·50	1,046·70
Average milk per cow per day	"	36·80	41·05	37·98	37·40
Average per cent fat in milk	%	3·11	3·20	3·21	3·16
Total pounds fat produced by 4 cows	lbs.	32·04	36·76	34·18	33·11
Average pounds fat per cow per day	"	1·15	1·31	1·22	1·18
Total meal consumed	"	350·00	350·00	350·00	350·00
Total hay consumed	"	168·00	168·00	168·00	168·00
Total roots consumed	"	2,520·00	1,260·00	2,520·00	2,520·00
Total beet pulp consumed	"	.....	126·00	.....	.....
Meal mixture consumed per 100 lbs. fat produced	"	1,092·30	952·10	1,004·00	1,058·15
Beet pulp consumed per 100 lbs. fat produced	"	.....	342·7	.....	.....
Meal mixture consumed per 100 lbs. milk produced	"	34·00	30·40	30·30	32·15
Beet pulp consumed per 100 lbs. milk produced	"	.....	10·90	.....	.....
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	5·60	5·60	5·60	5·60
Value of beet pulp fed	$	.....	1·38	.....	.....
Value of roughage fed	$	6·74	3·75	6·74	6·74
Total cost of feed	$	12·34	10·73	12·34	12·34
Feed cost to produce 100 pounds fat	$	38·51	29·18	36·10	37·30
Feed cost to produce 100 pounds milk	$	1·20	·93	1·16	1·18

It will be seen from the preceding table that the half beet pulp, half root ration produced 102·8 pounds more milk than the straight root ration. The per cent butter fat in the milk was slightly higher when beet pulp was fed, so that the beet pulp ration produced the most milk and butter fat as well as the cheapest milk and butter fat. In this case, the 126 pounds of beet meal consumed proved equal to 35 pounds of meal, 17 pounds of hay and 1,512 pounds of roots, which, at the prices quoted for these feeds, would give beet pulp a value, *in this particular combination of feeds,* of $67.50 per ton.

Part III.—In this part of the experiment, one-half the regular ration of ensilage was replaced by beet pulp, again on the dry matter basis. It was found that 308 pounds of beet pulp replaced 1,053·50 pounds of silage.

The data from the experiment are given below:—

TABLE III—DAIRY CATTLE FEEDING EXPERIMENT No. I, 1921-22

PART III—DRIED BEET PULP vs. ONE-HALF USUAL SILAGE RATION

Items		Period 1	Period 2	Period 3	Average of periods 1 and 3
Experimental Ration		Regular grain mixture, silage and hay	Regular grain mixture, silage, beet pulp and hay	Regular grain mixture, silage and hay	Regular grain mixture, silage and hay
Number of cows in test	No.	7	7	7	7
Pounds of milk produced by 7 cows	lbs.	1,097·00	1,101·50	885·00	991·00
Average milk per cow per day	"	22·40	22·50	18·00	20·20
Average per cent fat in milk	%	4·05	3·6	4·03	4·04
Total pounds fat produced by 7 cows	lbs.	44·90	39·67	35·64	40·27
Average pounds fat per cow per day	"	·92	·81	·73	·82
Total meal consumed	"	392·00	392·00	392·00	392·00
Total hay consumed	"	294·00	294·00	294·00	294·00
Total beet pulp consumed	"	.....	308·00	.....	.....
Total ensilage consumed	"	2,107·00	1,053·5	2,107·00	2,107·00
Meal mixture consumed per 100 lbs. fat produced	"	873·00	988·1	1,100·00	986·5
Beet pulp consumed per 100 lbs. fat produced	"	.....	776·4	.....	.....
Meal mixture consumed per 100 lbs. milk produced	"	35·7	35·5	44·3	40·00
Beet pulp consumed per 100 lbs. milk produced	"	.....	28·0	.....	.....
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	6·27	6·27	6·27	6·27
Value of beet pulp fed	$	.....	3·37	.....	.....
Value of roughage fed	$	5·42	3·37	5·42	5·42
Total cost of feed	$	11·69	13·01	11·69	11·69
Feed cost to produce 100 pounds fat	$	26·03	32·80	32·80	29·41
Feed cost to produce 100 pounds milk	$	1·07	1·18	1·32	1·19

It will be seen from the preceding table that the one-half silage, one-half beet pulp ration produced 110·5 pounds more milk than the straight silage ration. Also that the average per cent butter fat was ·44 of a per cent lower when the beet pulp was used than when the straight silage ration was fed. As a consequence, less butter fat was produced on the beet pulp ration than on the straight silage ration. Both milk and butter fat were produced cheaper on the straight silage ration than on the beet pulp ration. In this case, the 308 pounds of beet pulp consumed proved equal to 43 pounds of meal, 32 of hay and 1,285·5 pounds of ensilage, which, at the prices quoted for the latter feeds, would give beet pulp a value, *in this particular combination of feeds,* of $21.68 per ton.

Part IV.—In this part of the experiment, beet pulp replaced all of the silage in the ration. The replacement was again figured on the dry matter basis and the 1,806 pounds of ensilage required 504 pounds of beet meal. This figured out at 12 pounds per cow per day and it was found that it was more than they would consume, consequently the ration was reduced to 10 pounds per day, or 420 pounds for the period.

The data for this part follow:—

TABLE IV—DAIRY CATTLE FEEDING EXPERIMENT No. I, 1921-22

PART IV—DRIED BEET PULP VS. ENSILAGE

Items		Period 1	Period 2	Period 3	Average periods 1 and 3
Experimental Ration		Silage	Beet Pulp	Silage	Silage
Number of cows in test	No.	6	6	6	6
Pounds of milk produced by 6 cows	lbs.	648·00	709·50	538·50	593·2
Average milk per cow per day	"	15·4	16·9	12·8	14·1
Average per cent fat in milk	%	4·34	3·90	4·46	4·40
Total lbs. fat produced by 6 cows	lbs.	28·16	27·66	24·05	26·10
Average pounds fat per cow per day	"	·67	·66	·57	·62
Total meal consumed	"	224·00	224·00	224·00	224·00
Total hay consumed	"	252·00	252·00	252·00	252·00
Total beet pulp consumed	"	.....	420·00	.....	.....
Total ensilage consumed	"	1,806·00	.....	1,806·00	1,806·00
Meal mixture consumed per 100 lbs. fat produced	"	794·3	809·8	931·4	862·8
Beet pulp consumed per 100 lbs. fat produced	"	.....	.....	.....	.....
Meal mixture consumed per 100 lbs. milk produced	"	34·5	31·5	41·6	38·0
Beet pulp consumed per 100 lbs. milk produced	"	.....	59·1	.....	.....
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	3·58	3·58	3·58	3·58
Value of beet pulp fed	$	.....	4·60	.....	.....
Value of roughage fed	$	4·65	1·13	4·65	4·65
Total cost of feed	$	8·23	9·31	8·23	8·23
Feed cost to produce 100 pounds fat	$	29·22	34·02	34·22	31·72
Feed cost to produce 100 pounds milk	$	1·27	1·31	1·53	1·40

It will be seen from the preceding table that the straight beet pulp ration produced 116·3 pounds more milk than the straight silage ration. The average per cent butter fat was ·5 of one per cent lower when beet pulp was fed than when silage was fed. However, both milk and butter fat were produced more cheaply when the silage ration was fed than when beet pulp was being fed. In this case, 42 pounds of meal, 48 pounds of hay and 2,149 pounds of silage proved equal to 420 pounds of beet pulp, thus giving the latter feed a value of $24.14 per ton when used in this particular combination of feeds.

Conclusions

Judging from the results of the foregoing experiments, it may be concluded:—

First. That dried beet pulp is an economical feed to use for dairy cattle feeding, provided the cost of same bears a proportionate relation to other feeds at prices given herein.

Second. That dried beet pulp can be used to replace either the meal mixture, the roots or the ensilage of an ordinary ration.

Third. That dried beet pulp gives the best and most economical results when used to replace the meal mixture or roots of an already well-balanced ration rather than when used as a substitute for other succulents, such as ensilage, in the ration. This is indicated by the calculated values of $39.60, $67.50, $21.68, and $24.14 per ton, respectively, which are to be taken not as actual values but rather as relative values under the different methods of feeding.

Fourth.—That dried beet pulp gives the best results when used in comparatively small quantities, i.e., at from 4 to 5 pounds per day rather than at the maximum of 10 pounds per day (dry weights).

Fifth. That dried beet pulp soaks up about three times its own weight of water, therefore it is always advisable to soak it thoroughly before feeding. Cold water

may be used, but observations made subsequent to the carrying on of this experiment go to show that palatability is increased by soaking with hot water. Palatability and feeding value could be further increased by adding a little molasses to the water with which the beet pulp is soaked.

Sixth. That, while dried beet pulp is effective in keeping up and increasing the milk flow, this increase is accompanied by a slight decrease in the per cent butter fat in the milk, except in a case where an already watery ration such as roots is being fed. This decrease in per cent butter fat is not sufficient to be of importance in commercial feeding but would be of importance in short time test work as in the Record of Merit where the highest possible percentage of butter fat in the milk is looked for.

SUNFLOWER ENSILAGE VS. CORN ENSILAGE

Project 82.—During the season of 1921 a considerable acreage of sunflowers was grown for ensilage purposes.* The crop was ensiled similarly to corn silage in a separate silo. After filling, the silo was not opened until the latter part of December. As the silo was only about half filled, the silage on the top was spoiled to quite an extent owing to lack of pressure. However, when the spoilt material was removed that underneath proved of fairly good quality, the quality improving as the silage was used out. It was of dark brown, uninviting colour and had a rather unpleasant rancid odour as compared to corn silage. When first given to the cattle, they did not take to it very readily but they gradually got used to it and subsequently consumed as much of it as of corn silage, but it was noticeable that they never consumed it with the same evident relish. The following table, supplied by the Division of Chemistry, gives a comparison of the analysis of corn and sunflower silage. The former was cut when about the late milk stage and pretty well eared, while the latter was cut when about 30 per cent in bloom:—

ANALYSIS OF SILAGES

—	Corn Silage		Sunflower Silage	
	Fresh material	Dry matter	Fresh material	Dry matter
Moisture	76·17	.....	74·38	
Crude protein	1·93	8·11	1·95	7·58
Fat	2·57	10·81	1·60	6·23
Carbohydrates	10·70	44·89	11·26	43·95
Fibre	7·22	30·29	8·69	33·95
Ash	1·41	5·90	2·12	8·29
	100·00	100·00	100·00	100·00
Albuminoid nitrogen	.....	0·77	.....	1·10
Non-albuminoid nitrogen	.....	0·52	.....	0·11
Acidity in fresh material	.....	3·68	.....	2·35

*For details of cultural work, see Field Husbandry Division Report.

From the above table it will be seen that there are no outstanding differences between these two silages that can be brought out by chemical analysis. There is a slight difference, however, in favour of corn silage in the crude protein content, and again, in greater degree, in the crude fibre content, when figured on a dry matter basis. The high crude fibre of the sunflower silage would have a tendency to lower the digestibility of this crop. The variation in the proportion of albuminoid and non-albuminoid protein is also evident, the crude protein in the corn silage being only 59·3 per cent albuminoid protein, while the crude protein in the sunflower silage is 90·0 per cent albuminoid protein. This is important as the albuminoid form is the more valuable of the two. However, as will be seen later in this report,

this advantage, in the case of the sunflower silage, was offset by other factors. It is well to keep in mind, however, that in a comparison between sunflower and corn silages, the crude protein, albuminoid protein and crude fibre contents are factors that may be affected one way or the other by the degree of maturity of the respective crops.

To determine the relative feeding value of these two silages, a feeding experiment was conducted, starting on December 26, 1921, and finishing on March 19, 1922. All the cows in the main barn not on special test work were used in this experiment. All the ingredients in the ration except the silages were kept constant. The silages were interchanged every three weeks according to the following schedule:—

Period 1.—December 26 to January 15—Corn silage.
Period 2.—January 16 to February 5—Sunflower silage.
Period 3.—February 6 to February 26—Corn silage.
Period 4.—February 27 to March 19—Sunflower silage.

The first two weeks of each period were considered as a transition period and the data obtained during the last week only used as a basis of comparison. By averaging the results of the first and third periods and comparing them with those obtained in the second period, a means of comparison was obtained wherein any error due to natural decline in milk flow is eliminated. The average of periods two and four compared with period three, affords a second or check comparison. The per cent fat of the milk was taken by means of a composite sample for each individual cow during the last week of each period and the total fat computed individually on the basis of the milk produced during the week.

The feeds used were charged at cost or cost to produce prices as follows:—

Meal mixture	$32 00 per ton
Beet pulp	21 90 "
Hay	9 00 "
Ensilages	3 90 "

It is to be noted that the cost of growing corn and sunflower ensilage was practically identical.

The following tables give the results of the two comparisons made:—

TABLE I—DAIRY CATTLE FEEDING EXPERIMENT No. 2, 1921-22

SUNFLOWER SILAGE VS. CORN SILAGE

Item		Period 1	Period 2	Period 3	Average Periods 1 and 3
Experimental Ration		Corn Silage	Sunflower Silage	Corn Silage	Corn Silage
Number of cows in test		31	31	31	31
Pounds of milk produced by 31 cows	lbs.	5,578·00	5,122·00	5,125·00	5,351·00
Average milk per cow per day	"	25·41	23·60	23·62	24·66
Average per cent fat in milk	%	3·97	3·95	4·07	4·02
Total pounds fat produced by 31 cows	lbs.	221·27	202·46	208·70	214·98
Average pounds fat per cow per day	"	1·02	0·93	0·96	0·99
Total meal consumed	"	1,659·00	1,659·00	1,659·00	1,659·00
Total hay consumed	"	1,302·00	1,302·00	1,302·00	1,302·00
Total beet meal consumed	"	1,190·00	1,190·00	1,190·00	1,190·00
Total ensilage consumed	"	6,692·00	6,692·00	6,692·00	6,692·00
Silage consumed per 100 pounds fat produced	"	3,024·35	3,305·34	3,207·00	3,115·67
Silage consumed per 100 pounds milk produced	"	119·97	130·65	130·57	125·27
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	27·54	27·54	27·54	27·54
Value of silage fed	$	13·05	13·05	13·05	13·05
Value of other roughage fed	$	18·89	18·89	18·89	18·89
Total cost of feed	$	59·48	59·48	59·48	59·48
Feed cost to produce 100 lbs. fat	$	26·88	29·38	28·50	27·69
Feed cost to produce 100 lbs. milk	$	1·07	1·16	1·16	1·11

TABLE 2—DAIRY CATTLE FEEDING EXPERIMENT No. 2, 1921-22

SUNFLOWER SILAGE VS. CORN SILAGE (CHECK)

Item		Period 2	Period 3	Period 4	Average Periods 2 and 4
Experimental Ration		Sunflower Silage	Corn Silage	Sunflower Silage	Sunflower Silage
Number of cows in test		28	28	28	28
Pounds of milk produced by 28 cows	lbs.	4,861·00	4,964·00	4,461·50	4,461·25
Average milk per cow per day	"	24·80	25·33	22·76	23·78
Average per cent fat in milk	%	3·92	4·04	3·97	3·94
Total pounds fat produced by 28 cows	lbs.	190·64	200·75	177·32	183·98
Average pounds fat per cow per day	"	0·97	1·02	0·90	0·93
Total meal consumed	"	1,575·00	1,575·00	1,575·00	1,575·00
Total hay consumed	"	1,176·00	1,176·00	1,176·00	1,176·00
Total beet meal consumed	"	1,078·00	1,078·00	1,078·00	1,078·00
Total ensilage consumed	"	6,034·00	6,034·00	6,034·00	6,034·00
Silage consumed per 100 pounds fat produced	"	3,165·13	3,005·72	3,402·88	3,284·00
Silage consumed per 100 pounds milk produced	"	124·13	121·55	135·26	129·69
FINDINGS FROM EXPERIMENT					
Cost of meal mixture fed	$	25·20	25·20	25·20	25·20
Value of silage fed	$	11·77	11·77	11·77	11·77
Value of other roughage fed	$	17·09	17·09	17·09	17·09
Total cost of feed	$	54·06	54·06	54·06	54·06
Feed cost to produce 100 pounds fat	$	28·36	26·93	30·49	29·42
Feed cost to produce 100 pounds milk	$	1·11	1·09	1·21	1·16

Deductions

The number of cows used, the length of time over which the tests extended, the manner in which the per cent fat calculation was made, and the method by which the error due to natural decline in milk flow was eliminated, bespeak accuracy in the foregoing data.

By glancing over the two tables, it will be seen that in every case in the amount of milk produced, per cent fat in milk, silage consumed per 100 pounds fat and milk produced and cost to produce 100 pounds fat and milk, the corn silage excelled the sunflower silage. The difference is not large but it is sufficient to be decisive and to show the general superiority of corn silage.

The one outstanding point is the effect of the sunflower silage ration on the per cent fat. As a general rule when the milk flow decreases the per cent fat in the milk increases slightly. However, the effect on the per cent fat is not sufficient to be more than noted in passing.

Judging from the analytical data given, one would expect practically equal results from both silages. The fact that equal results are not obtained can be fairly safely said to be due to the unpalatability of the sunflowers, a factor not measurable by chemical analysis.

The feeding of sunflowers in moderate quantities had no undue effect on either the bowels or the kidneys of the cows.

The last and undoubtedly the most important deduction of all is that, while sunflower silage is not equal to corn silage for dairy cows, it is such a close competitor that it should receive first consideration as a substitute in those districts where, owing to climatic conditions, the corn crop is at all uncertan or unproductive.

CALF FEEDING EXPERIMENTS

Project 88.—In view of the fact that a large number of dairy bred calves are sent to the market annually when anywhere from a few days to three weeks old, at which latter date they are not any more than fit for human food, it was considered advisable to conduct an experiment to determine the advisability from a revenue producing standpoint of feeding such calves for a longer period in an attempt to make better veal of them.

Accordingly some thirty calves such as are ordinarily found on the market in the spring of the year were purchased. These were divided into three lots of ten each. These lots were again subdivided into groups A and B, so that a better check could be kept on the three lots. Both groups in each lot were fed alike as follows:—

Lot 1.—Fresh, unpasteurized, whole milk from the start, to which was added a little C.E.F. calf meal mixture towards the end of the experiment. In addition, they received a dry grain mixture of equal parts corn, bran and oilcake meal as soon as they would eat same and had hay as they wanted it, but a negligible quantity only was consumed.

Lot 2.—Fresh, unpasteurized, whole milk for ten days, then skim-milk plus a home mixed calf meal composed of oatmeal, 2 parts; ground corn, 2 parts; ground flax, 1 part. They also had hay and dry grain as in lot 1.

Lot 3.—Fresh, unpasteurized, whole milk for ten days then skim-milk plus Blatchford's calfmeal. They did not do at all well on the Blatchford's calfmeal, consequently at the end of thirty-six days they were changed over to the home mixed calfmeal mixture. (See table II for a comparison of the results obtained on the different feeds.) They also received hay and dry grain as in lot 1.

These lots were kept on experiment for a period of fifty-six days and then sold on the Montreal market. In one subdivision of each lot a calf was either lost or proved especially unthrifty and was removed.

The data obtained are given below:—

TABLE I—CALF FEEDING EXPERIMENT

Lots		1	1a	2	2a	3	3a
Feed		Whole milk and C.E.F. meal	Whole milk, and C.E.F. meal (check)	Whole milk, skim milk and C.E.F. meal	Whole milk, skim-milk and C.E.F. meal	Whole milk, skim-milk, C.E.F. meal and Blatch-ford's	Whole milk, skim-milk, C.E.F. meal and Blatch-ford's
Number of animals in group		4	5	4	5	5	4
Gross initial weight	lbs.	380·0	419·0	342·0	400·0	420·0	326·0
Average initial weight	"	95·0	83·8	85·5	80·0	84·0	81·5
Gross finished weight	"	535·0	669·0	510·0	638·0	657·0	505·0
Average finished weight	"	133·7	133·8	125·0	127·6	131·4	125·5
Number days in experiment	days	56	56	56	56	56	56
Total gain per group per period	lbs.	155·0	250·0	168·0	238·0	237·0	176·0
Average gain per animal per period	"	38·7	50·0	42·0	47·6	47·4	44·0
Average daily gain per group per period	"	2·76	4·46	3·0	4·25	4·23	3·14
Average daily gain per animal per period	"	0·69	0·892	0·75	0·85	·846	0·785
Amount whole milk per group per period	"	2,152·0	2,710·0	482·0	602·5	627·5	502·0
Amount whole milk per animal per period	"	528·0	542·0	120·5	120·5	125·5	125·5
Amount skim-milk per group per period	"	.....	.....	1,934·0	2,417·5	2,372·5	1,898·0
Amount skim-milk per animal per period	"	.....	.....	483·5	483·5	474·5	474·5
Amount C.E.F. meal per group per period at $2.68 per cwt	"	48·0	60·0	77·6	97·0	34·0	27·2
Amount C.E.F. meal per animal per period at $2.68 per cwt	"	12·0	12·0	19·4	19·4	6·8	6·8
Amount Blatchford's meal per group per period at $5.80	"	.....	.....	.....	.....	48·0	38·4
Amount Blatchford's meal per animal per period at $5.80	"	.....	.....	.....	.....	9·6	9·6
Amount dry grain per group per period at $1.46 per cwt	"	10·0	15·0	16·0	20·0	20·0	16·0
(a) Total cost of feed per lot, whole milk, $2.50, skim 35c. per cwt	$	55·86	70·37	22·14	27·67	28·46	22·75
(b) Total cost of feed per lot, whole milk, $1.75, skim 20c. per cwt	$	39·46	50·04	15·60	19·53	20·20	16·16

TABLE I—CALF FEEDING EXPERIMENT—*Concluded*

Lots		1	1a	2	2a	3	3a
Feed		Whole milk and C.E.F. meal	Whole milk and C.E.F. meal (check)	Whole milk, skim-milk and C.E.F. meal	Whole milk, skim-milk and C.E.F. meal	Whole milk, skim-milk, C.E.F. meal and Blatch-ford's	Whole milk, skim-milk, C.E.F. meal and Blatch-ford's
Number of animals in group		4	5	4	5	5	4
(c) Total cost of feed per lot, whole milk $1.25, skim 20c. per cwt.	$	28·76	36·49	13·26	16·56	17·06	13·65
Cost of feed per head, whole milk, $2.50, skim milk, 35c. per cwt.	$	13·96	14·07	5·53	5·53	5·69	5·69
Cost of feed per head, whole milk, $1.75, skim-milk, 20c. per cwt.	$	9·86	10·00	3·90	3·90	4·04	4·04
Cost of feed per head, whole milk, $1.25, skim-milk, 20c. per cwt.	$	7·19	7·29	3·31	3·31	3·41	3·41
Cost of feed per head, per day, whole milk, $2.50, s. milk, 35c. per cwt.	$	0·249	0·251	0·098	0·098	0·101	0·101
Cost of feed per head, per day, whole milk, $1.75, s. milk, 20c. per cwt.	$	0·176	0·178	0·069	0·069	0·072	0·072
Cost of feed per head, per day, whole milk, $1.25, s. milk , 20c. per cwt.	$	0·128	0·13	0·059	0·059	0·06	0·06
Cost to produce 1 lb. gain, whole milk, $2.50, s.milk, 35c. per cwt.	$	0·36	0·281	0·131	0·116	0·12	0·128
Cost to produce 1 lb. gain, whole milk, $1.75, s.milk, 20c. per cwt.	$	0·254	0·200	0·086	0·082	0·085	0·091
Cost to produce 1 lb. gain, whole milk, $1.25, s.milk, 20c. per cwt.	$	0·185	0·145	0·078	0·069	0·071	0·077
Original cost of animals at $5.06 per head	$	20·24	25·30	20·24	25·30	25·30	20·24
(1) Original cost of animals at $5.06 per head + cost of feed (a)	$	76·10	95·67	42·38	52·97	53·76	42·99
(1) Original cost of animals at $5.06 per head + cost of feed (b)	$	59·70	75·34	35·84	44·83	45·50	36·40
(1) Original cost of animals at $5.06 per head + cost of feed (c)	$	49·00	61·78	33·50	41·86	42·36	33·89
Original cost of animals at $2.00 per head	$	8·00	10·00	8·00	10·00	10·00	8·00
(2) Original cost of animals at $2.00 per head + cost of feed (a)	$	63·86	80·37	30·14	37·67	38·46	30·75
(2) Original cost of animals at $2.00 per head + cost of feed (b)	$	47·46	60·04	23·60	29·53	30·20	24·16
(2) Original cost of animals at $2.00 per head + cost of feed (c)	$	36·76	46·49	21·26	26·56	27·06	21·65
Selling price at 5 cents per pound.	$	26·75	33·45	25·50	31·90	32·85	25·10
Net loss per group (a 1)	$	49·35	62·22	16·88	21·07	20·91	17·89
Net loss per group (b 1)	$	32·95	41·87	10·34	12·93	12·65	11·30
Net loss per group (c 1)	$	22·25	28·23	8·00	9·96	9·51	8·79
Net loss per animal (a 1)	$	12·33	12·44	4·22	4·21	4·18	4·47
Net loss per animal (b 1)	$	8·23	8·37	2·58	2·58	2·53	2·82
Net loss per animal (c 1)	$	5·56	5·64	2·00	1·99	1·90	2·19
Net gain or loss per group (a 2)	$	−37·11	−46·92	− 4·64	− 5·77	− 5·51	− 4·65
Net gain or loss per group (b 2)	$	−20·70	−26·59	+ 1·90	+ 2·37	+ 2·65	+ 0·94
Net gain or loss per group (c 2)	$	−10·01	−13·04	+ 4·24	+ 5·34	+ 5·79	+ 3·45
Net gain or loss per animal (a 2)	$	− 9·27	− 9·38	− 1·16	− 1·15	− 1·10	− 1·16
Net gain or loss per animal (b 2)	$	− 5·17	− 5·31	+ 0 47	+ 0·47	+ 0·53	+ 0·23
Net gain or loss per animal (c 2)	$	− 2·50	− 2·60	+ 1·06	+ 1·06	+ 1·15	+ 0·86
Selling price required to break even (a 1)	cts.	14·22	14·30	8·30	8·30	8·01	8·56
Selling price required to break even (b 1)	"	11·16	11·26	7·01	7·02	6·84	7·25
Selling price required to break even (c 1)	"	9·15	9·23	6·56	6·56	6·37	6·75
Selling price required to break even (a 2)	"	11·93	12·01	5·90	5·90	5·83	6·12
Selling price required to break even (b 2)	"	8·82	8·97	4·62	4·62	4·60	4·81
Selling price required to break even (c 2)	"	6·83	6·95	4·16	4·16	4·15	4·31

Deductions

It will be noted that in working up the data obtained three different sets of values (marked *a*, *b* and *c*) have been used for the milk and skim-milk consumed with the idea of getting figures on this work with milk at different values. Similarly, two sets of values (marked 1 and 2) have been placed on the calves at the start: first, the actual cost price in this experiment, and second, the nominal sum of $2, which is the most that could be secured for the majority of such calves were they sold by the farmer as soon as dropped. These alternative cost figures must be kept in mind when studying the data given in table I.

From table I it will be seen that the average daily gain of the different lots was practically the same, there being a difference of only ·024-pound between the three lots. The order of highest gains was lot 3, lot 2 and lot 1. In other words, skim-milk and a calf meal proved to be as efficient as whole milk in producing gains on these calves.

The average cost of feed per animal in the respective lots, with milk and skim-milk at the then prevailing values of $2.50 and 35 cents per cwt. respectively, and with grain mixtures at the cost prices given, was $14.02 for lot 1, $5.53 for lot 2, and $5.69 for lot 3. When it is considered that the gains were practically equal and the quality of the whole milk lot not materially advanced, the economy of feeding such calves a whole milk ration is certainly to be questioned.

The average cost per pound gain in the respective lots was: lot 1, 32 cents; lot 2, 12·3 cents; and lot 3, 12·4 cents.

The different sets of cost figures used as outlined above make possible six sets of profit or loss deductions. These can best be presented in tabular form as follows:—

Cost price of calves at $5.06 and milk at—	A Prices	B Prices	C Prices
	$ c.	$ c.	$ c.
Loss per animal—Lot 1	12 38	8 30	5 60
" " " Lot 2	4 21	2 58	2 00
" " " Lot 3	4 32	2 67	2 04

Cost prices of calves at $2 and milk at—	A Prices	B Prices	C Prices
	$ c.	$ c.	$ c.
Gain or Loss per animal—Lot 1	−9 32	−5 24	−2 55
" " " Lot 2	−1 16	+0 47	+1 06
" " " Lot 3	−1 13	+0 38	+1 00

A study of the above tabulation derived from table I shows that a very low valuation must be placed on the calves as well as a very low valuation on the milk fed to them if a profit of any account is to be realized from the feeding of dairy bred calves for veal purposes. The last six lines of table I show the prices per pound it would have been necessary to obtain for the calves to have avoided loss.

In the case of lot 3, the animals in which lot were started on Blatchford's calf meal, it was found necessary to change their ration as they were not doing well. Consequently they were put on the C.E.F. meal mixture for the remainder of the experiment. Table II is presented to show the results obtained on the different meals:—

TABLE II—CALF FEEDING EXPERIMENT

Lots		3	3a	3	3a
Feed		Whole milk skim-milk, Blatch-ford's	Whole milk, skim-milk, Blatch-ford's	Whole milk, skim-milk, C.E.F. meal	Whole milk, skim-milk, C.E.F. meal
Number of animals in group	.....	5	4	5	4
Gross initial weight	lbs.	420·0	326·0	558·0	416·0
Average initial weight	"	84·0	81·5	111·6	104·0
Gross finished weight	"	558·0	416·0	657·0	502·0
Average finished weight	"	111·6	104·0	131·4	125·5
Number days in experiment	days	36	36	20	20
Total gain per group per period	lbs.	138·0	90·0	99·0	86·0
Average gain per animal per period	"	27·6	22·5	19·8	21·5
Average daily gain per group per period	"	3·83	2·38	4·95	4·3
Average daily gain per animal per period	"	0·766	0·595	0·99	1·075
Amount of whole milk consumed per group per period	"	627·5	502·0	.....	.....
Amount of whole milk consumed per animal per period	"	125·5	125·5	.....	.....
Amount of skim-milk consumed per group per period	"	1,172·5	938·0	1,200·0	960·0
Amount of skim-milk consumed per animal per period	"	234·5	234·5	240·0	240·0
Amount of Blatchford's meal consumed per group per period	"	48·0	38·4	.....	.....
Amount of Blatchford's meal consumed per animal per period	"	9·6	9·6	.....	.....
Amount of C.E.F. meal consumed per group per period	"	.....	.....	34·0	27·2
Amount of C.E.F. meal consumed per animal per period	"	.....	.....	6·8	6·8
Amount of dry grain consumed per group per period	"	20·0	16·0	.....	.....
Amount of dry grain consumed per animal per period	"	4·0	4·0	.....	.....
Total cost of feed per lot	$	22·95	18·37	5·51	4·41
Total cost of feed per head	$	4·59	4·59	1·10	1·10
Total cost of feed per head per day	$	0·127	0·127	0·055	0·055
Feed cost to produce 1 pound gain	$	0·166	0·204	0·055	·051
Original cost of animals at $5.06 and $6.10	$	25·30	20·24	34·03	25·37
Original cost of animals + cost of feed	$	48·25	38·61	39·54	29·78
Selling price at 5 cents per pound	$	27·91	20·80	32·85	25·10
Net loss per group	$	20·34	18·81	6·69	4·68
Net loss per animal	$	4·06	4·45	1·33	1·17

PRICES OF FEEDS

Whole milk	2.50 per cwt.
Skim-milk	0.35 "
C.E.F. meal	2.68 "
Blatchford's meal	5.80 "
Dry meal	1.46 "

It will be noted that in the matter of cost of feed, cost to produce one pound gain, and profit or loss per group, the advantage was most decidedly on the side of the C.E.F. calf meal mixture.

Conclusions to be drawn from these experiments:—

First.—That the feeding of dairy bred calves for one to two months for veal purposes is not an economical proposition where milk may be sold at city prices.

Second.—That under conditions applying at the time, it would be more economical for the farmer to sell any such calves not fit for retaining as breeding animals for what they will bring or knock them on the head and feed them to the poultry.

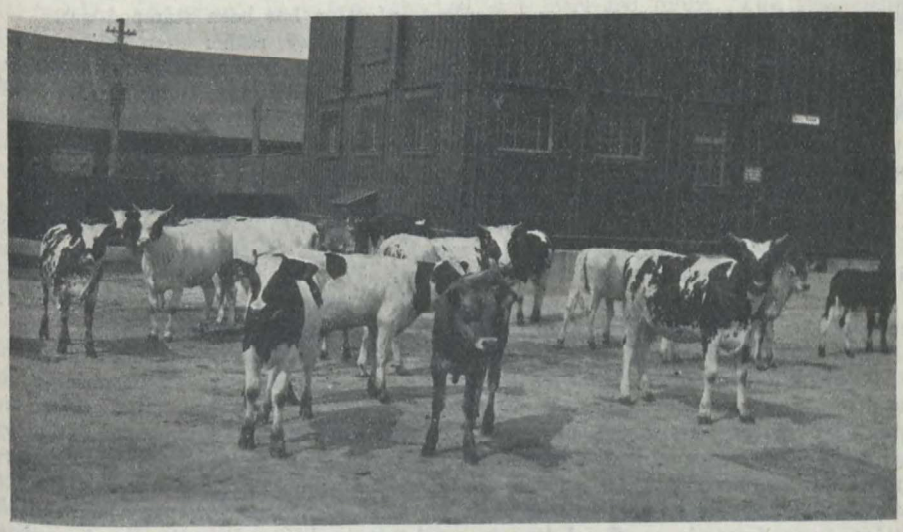
Third.—That for raising calves for dairy purposes skim-milk and a home mixed calf meal mixture is much more economical and even more efficient than is whole milk.

Fourth.—That in many cases a farmer can mix his own calf meal and have a better and cheaper product capable of giving better results than a commercial product.

RAISING THE DAIRY CALVES

Project 84.—The dairy bred calves raised on the Farm have been handled as in the previous year when the method used was reported on as follows:—

They are fed pasteurized whole milk for from three to five weeks; then they are gradually changed over to a ration of skim-milk and a calf meal. The one at present in use consists of 2 parts ground corn, 2 parts fine ground oats or oatmeal and 1 part ground flax. This has proved a satisfactory and economical meal. It is scalded, allowed to stand for a time, and then fed with the skim-milk. As soon as the calves learn to eat they are fed a little dry grain mixture consisting of 4 parts bran, 3 parts oats, and 1 part ground corn. The younger calves receive this mixture dry in the manger, while the older ones receive it on their silage. Second cut alfalfa and clover hay comprise the remainder of the ration. Water is kept before the older calves at all times, watch being kept to see that they do not take too much. Calves



Ayrshire, Holstein and Jersey calves at the Central Experimental Farm.

under six months are not allowed out to pasture except at night, it being considered inadvisable to subject them to the heat of the sun and to the flies in the middle of the day. This method of calf feeding has given most satisfactory results, as is evidenced by the condition of the calves, which draw favourable comments from the many visitors to the calf barns.

In calculating the cost of raising the calves, the following prices have been placed upon the feeds used:—

Whole milk	$1 50 per cwt.
Skim-milk	30 "
Calf meal	2 50 "
Grain mixture	2 00 "
Roots	4 75 "
Silage	3 90 "
Hay	9 00 "

Under this system of feeding and with feeds charged at the above prices, it was found that it cost on the average $19.31 to raise the calves to six months of age and $19.29 to feed them during the six months' to twelve months' period.

HISTORY OF THE EXPERIMENTAL FARM BANG HERD

NECESSITY AND REASONS FOR ESTABLISHMENT

For a number of years prior to the year 1916, the herds on the Central Experimental Farm had persistently given a small number of reactors to the subcutaneous test for tuberculosis. No great alarm was felt, nevertheless some apprehension was always evidenced at the approach of the annual or semi-annual test.

Due to changes in the technique of the test or possibly to other more obscure causes, however, during the period elapsing between 1916-19 very heavy reactions to the tuberculin test were suffered. With the why and wherefore of these sudden and widespread reactions it is not the purpose here to enter into discussion. Suffice to say that the depths remained unplumbed until the triple and finally the combined tests were adopted. Thanks to the accuracy, particularly of the latter, it may be reported with satisfaction that at this juncture the herds at the Central Experimental Farm have successfully passed two combined tests and that there is every reason to believe that this most persistent and virulent infection has been stamped out.

During the period of the heaviest reactions, however, rather than lose not only highly valuable individuals but also families, into the upbuilding of which had gone much careful selection, it was decided to establish an isolation or Bang Herd. While this move was therefore primarily prompted by a thoroughly practical motive—to save valuable breeding stock—there was a secondary and from the experimental standpoint, an infinitely more valuable reason, namely, to collect further information as to the practicability and from all angles, the true economy of this system.

"How quickly do cows in a tubercular herd decline?" "What is the percentage of reactions in the progeny of tubercular cows?" "What are the main difficulties met with?" "Is production affected?" "Does it pay?" The foregoing are only a few of the questions asked in connection with such a venture. Therefore, after several years uninterrupted operation of an isolated herd and having reached a point where it is hoped that this herd will have but few more entrants, it has been deemed advisable to recapitulate the results from as many angles as possible. It will be observed by the discriminating reader, that the writers are practical stockmen, and therefore not equipped with the knowledge of the student of veterinary anatomy or pathology. For much of the information, as pertaining to diagnosis and post-mortem examination, due acknowledgment must be made to the officials of the Health of Animals Branch, under which officials tuberculin test work has been carried on for many years at the Ottawa farm, formerly as official departmental tests and latterly under the Accredited Herd System.

THE PREMISES

Fortunately most favourable premises were available in the way of a comfortable, well ventilated and well drained barn on an outlying farm distant some two miles from the Central Experimental Farm. This comparative proximity has greatly facilitated operations. The cattle, while absolutely isolated, have had every attention that is given the everyday business herd. A number of creditable records have been made as will be seen later, these under commercial conditions purely, where the merit and ability of the cow were alone responsible.

THE CATTLE

Only cows of high order, individually and from the standpoint of record, were considered eligible; many individuals of lesser value were admitted where they were well advanced in pregnancy at time of reaction, and these were slaughtered immediately after freshening in many cases. Of the individuals no specific mention will be made at this juncture. Suffice to say that the breeds, Holstein, Ayrshire and Jersey, some 66 head, many of them among the best cows of the herd, have been in this isolated herd, some for a few days, others for several years.

THE ATTENDANT

A good cattleman has attended this herd throughout. Living adjacent to his charges, he has had no contact whatever with the clean herd on the home farm.

DAILY ROUTINE

Stable routine has been such as that of the good commercial barn. The cattle have been well fed, with water before them, milked regularly, kept clean and well-bedded, kept clipped as required and groomed daily. In summer pasture has been available. In winter a certain amount of exercise has been found possible. Regular winter exercise outdoors has not been a feature, however. The stable has been unfailingly well ventilated.

The milk of this herd has been called for early each morning and carried to the Dairy building on the home Farm. Here it has been specially and separately pasteurized in a Wizard pasteurizer with attached self-registering thermometer (Tycos dial-faced). The charts have been checked and inspected daily. The temperature has uniformly been raised to 150° F., kept there twenty minutes, cooled to separating temperature, separated, the cream ripened and churned and the skim-milk fed to calves and pigs. In short, absolute reliance has been placed upon the efficiency of a good machine carefully handled and checked by automatic device and bacterial tests.

Utensils, such as pails, strainers, etc., have not left the premises. The eight-gallon cans used to transport the milk from the isolated premises to the dairy have been specially marked and used for this purpose only. They are separately washed, scalded, rinsed and finally subjected to thirty minutes sterilization under twenty-five pounds steam pressure in a Pfaudler autoclave.

THE ROUTINE OF BREEDING AND HANDLING OF CALVES

Breeding the reactors presented somewhat of a problem until an evil not unmixed with good befell the main herd in the reaction at different times of two young bulls of the highest order, individually, and from the standpoint of breeding and record. These bulls were used in the isolated herd for some time. Previous to their entry the reacting breeding cows were bred to the bulls on the home farm on neutral ground. Such practice, while it may be regarded as a weak link, was a necessary evil and handled with a recognition of this fact.

The handling of calves has been recognized as a problem of paramount difficulty. The plan adopted has been to remove the calf from the dam, and dry it as thoroughly as possible after disinfecting the navel. As soon as possible thereafter the calf has been removed to the calf barn on the home farm and placed in an isolated pen for several days. That through such necessary treatment much trouble might result will be recognized by those familiar with normal or approved calf-rearing methods. Concerning these results more will be stated in a later discussion.

Cost of Operation and Returns, December 1, 1916, to November 1, 1921

Records for the Bang herd have been kept carefully, each cow having her separate feed account and being credited with the pounds of milk she produced and the value of the progeny dropped.

The milk was valued at $2.25 per cwt., which was the average ruling price for milk during the five years covered by this report.

Every calf raised to one week old was valued according to its breeding. It will be seen in a later table that a number of the calves died from various causes at early ages, while some others reacted later.

The herd is credited with 1,325 tons of manure, valued at $2 per ton.

The meal mixture fed was a well-balanced one varying somewhat from time to time according to the market price of the different feeds. A charge of $55 per ton has been taken as a good average for the five years, 1917 to 1921, inclusive.

Hay and silage were charged at the cost of production, which is $7 per ton for hay and $3.25 per ton for silage.

Straw was used for bedding only, and was charged at $4 per ton.

The rent for the buildings was $75 per year.

As will be noted in the following table, the profits from the herd over and above all expenses were $6,177.43:—

TABLE I—COST OF OPERATION AND RECEIPTS FROM BANG HERD, DECEMBER 1, 1916, TO NOVEMBER 1, 1921

Receipts—			
Value of milk	$15,098 06		
" calves	4,360 00		
" manure	2,650 00		
		Gross returns	$22,108 06
Expenses—			
Feed (meal, silage, hay)	$ 8,815 63		
Pasture	200 00		
Straw	440 00		
Rent of buildings	375 00		
Labour	6,100 00		
		Expenses	15,930 63
		Profit	$ 6,177 43

THE PROGENY

As previously stated, every calf born alive was immediately taken to the calf barn at the Central Experimental Farm. Of the eighty calves so removed, four died and seventy-six were raised to one week old. The death of these four calves was undoubtedly due to the exposure necessitated by the trip during cold winter days, one having died on the way while the others died a few days later from pneumonia.

As stated before, the calves were valued at the age of one week according to their breeding. The bulls were sold as breeders at different ages.

Six calves were lost by abortion and two died at birth.

TABLE II—PROGENY

Name of cow	Number calves born alive	Value	Number calves that died	Number calves that never reacted	Number reacting	Number in herd	Number sold
		$					
Ottawa Kate	3	225	.....	1	2	1	.....
Ottawa Snowdrop	1	20	.....	.....	1	.....	.....
Sybil of Fieldhouse	3	150	.....	2	1	.....	2
Ottawa March Ormsby	3	90	2	1	.....	.....	1
Flavia 2nd C	1	40	1	.....	.....	.....	.....
Strathglass Leonora	2	150	.....	1	1	.....	1
Strathglass White Rose	1	75	.....	.....	1	.....	.....
Strathglass Anna	1	75	.....	1	.....	.....	1
Denty 3rd Queen	1	30	.....	1	.....	.....	1
Ottawa Blue Duchess	3	100	3	.....	.....	.....	.....
Ottawa Sultana	1	30	1	.....	.....	.....	.....
Brampton Beulah	2	90	1	.....	1	.....	.....
Brampton Fanny Cowslip	2	70	1	1	.....	1	.....
Rosa Bonheur Flower	3	225	1	1	1	.....	.....
Lady Grey	3	150	.....	2	1	2	.....
Marjorie 8th of Ottawa	4	300	1	3	.....	2	1
Ottawa Kate 3rd	1	30	1	.....	.....	.....	.....

TABLE II—PROGENY—*Concluded*

Name of cow	Number calves born alive	Value	Number calves that died	Number calves that never reacted	Number reacting	Number in herd	Number sold
		$					
Ottawa Kate 2nd	1	50			1		
Rhoda Korndyke Queen	3	120	2		1		
Helena Keyes Posch	3	300		1	2	1	
Conway Posch Butter Girl	2	60	1	1		1	
Flavia 2nd B	1	50		1			1
Topsy Keyes	3	150		2	1		2
Ottawa Pietertje Ormsby	3	120	1	2		1	1
Marjorie 9th of Ottawa	1	50			1		
Ottawa Mirabel	1	25	1				
Tilly Masterpiece	1	50		1		1	
Ormsby Rhoda Maud	1	35		1			1
Korndyke Canary Butter Maid	2	180		2		1	1
Golden Minnie of Don	1	35		1			1
Ottawa Princess	1	35		1			1
Flavia 2nd of Ottawa	1	75		1		1	
Flavia 2nd D	1	75		1		1	
Ottawa Woodcrest Lyn	2	100		2		1	1
Canaan Beauty 2nd	1	75		1		1	
Lulu Posch Regina	1	60		1		1	
Beauty of Oaklawn	1	60		1		1	
Faforit Fayne	1	50		1		1	
Dalwhatswood Blossom 2nd	1	60		1		1	
Catlinn's Barbara	1	60		1		1	
Oliva Schuilling De Kol	1	75		1		1	
Maud of Fernbrook 5th	1	50		1		1	
Old Hall Maggie	1	75		1		1	
Hairshaw Tibbie	1	75		1		1	
Dunlop Betsy	1	75		1		1	
Culcaigrie Dot	1	75		1		1	
Bettina	1	25		1			1
Greenbank Rilla 6th	3	150		1	2		1
Brampton Stockwell Joy	1	35	1				
Total	80	4,360	18	45	17	26	18

The foregoing table shows a list of the cows that dropped live calves while in the Bang herd and gives the number of calves dropped by each cow, the value of the calves, the number that died, the number of reactors, non-reactors and what became of the latter ones.

Fourteen calves died when between the ages of one week and six months, at which time they are first tested for tuberculosis. This means a loss of 18 per cent during calfhood, which is rather high, especially in view of the good care they receive in the main calf barn.

The causes of death were pneumonia, digestive troubles, navel infection and a few unknown causes.

The reason for this heavy mortality is hard to find. It is quite improbable that this was due to a lack of vitality in the calves coming from tubercular dams, there being nothing in the general appearance of the calves to indicate such lack. In addition, some cows have dropped more than one calf. The later ones, born when it is reasonable to suppose that tuberculosis in the dam would be more advanced, have been raised successfully and have developed into strong individuals, while the earlier calves died.

Of the sixty-two calves raised to six months or over, *i.e.*, an age at which they could be tuberculin tested, seventeen have reacted, or so far 27·4 per cent of the progeny of the Bang herd have proved to be tubercular.

The Bang theory is that the progeny of tubercular animals is likely to be free from tuberculosis if removed immediately to clean quarters and fed on milk free from tuberculosis germs.

The percentage of reactors in the progeny of the Bang herd noted above cannot be used as a criticism of the Bang system, for the reason that the calves were not removed to absolutely clean quarters. The herd into which the calves were taken had been showing a few reactions to each semi-annual test up to the time of the test conducted in November, 1921. If from this date no further reactors are found in either the progeny of the Bang herd or in the main herds, then positive proof of the infection having taken place after the calves came from the Bang herd will have been obtained. However, this remains to be proved.

One reason for the belief that the calves from the Bang herd which reacted later in the main herd, got their infection from the doubtful main herd, was that of the seventeen only seven reacted at the time the first test was applied, the other ten cows reacting later after having passed one or two tests, showing that theirs was in all probability a later infection.

As to whether calves from tubercular dams are more apt to become infected when exposed to the disease, no statement can be made as yet. Of the calves that did not react, nineteen have been sold as breeders, while twenty-six are still in the main herd. They are all as healthy looking and as good individually as animals raised from tuberculosis free cows.

HEALTH OF HERD AND POST-MORTEM RESULTS

The general health of the Bang herd from observations would be characterized as normal or average.

The following table will show the actual conditions as shown by post mortem:—

TABLE III

Name of Animal	Date Reacted	Date Killed	Number Months in Bang Herd	Post-Mortem
Marjorie 8th of Ottawa	Nov. 16, 1917	Nov. 22, 1921	48½	*Bad*—Bronchials, mediastinals, lungs full of purulent and caseous lesions.
Ottawa Kate	Nov. 29, 1916	Nov. 29, 1920	48	*Bad*—Both bronchials, mediastinals, both lungs, mesenterics, a spreader. (Carcass condemned).
Sibyl of Fieldhouse	Mar. 12, 1917	Nov. 29, 1920	44	*Bad*—Bronchials, lungs, mediastinals, liver and mesenterics, all full.
Ottawa March Ormsby	Mar. 12, 1917	Nov. 10, 1920	43½	*Medium*—Mediastinals calcified, lesion in left lung caseous. Mesenterics quite extensive lesions.
Topsy Keyes	Feb. 8, 1918	Nov. 5, 1920	33	*Slight*—Mediastinal and one small lesion in lung both caseous.
Ottawa Blue Duchess	Apr. 10, 1917	Apr. 8, 1920	36	*Medium*—Bronchial, mediastinal, small nodules in both lungs.
Lady Grey	Nov. 6, 1917	June 2, 1920	31	*Slight*—Right bronchial caseous; left bronchial recent infection mediastinal slight.
Brampton Beulah	Apr. 10, 1917	Oct. 1919	29½	No P.M.—Sent to Health of Animals Branch.
Brampton Fanny Cowslip	Apr. 10, 1917	Oct. 1919	29½	" " "
Rose Bonheur Flower	Nov. 6, 1917	Apr. 8, 1920	29	*Bad—Carcass condemned*—A spreader.
Rhoda Korndyke Queen	Nov. 6, 1917	Mar. 1, 1920	28	*Slight*—Small lesions in both bronchials.
Conway Posch Butter Girl	Feb. 8, 1918	Apr. 24, 1920	26½	*Slight*—Slight infections in bronchials and mediastinals.
Brampton Stockwell Joy	Nov. 6, 1917	Sept. 24, 1919	21½	*Bad*—Mediastinal only, but badly infected.
Kate 4th	Nov. 6, 1917	Sept. 24, 1919	21¼	*Medium*—Mesenteric and portal infection.
Denty 3rd's Queen	Apr. 10, 1917	Jan. 2, 1919	21	*Medium*—Mediastinals bad—bronchials slight.
Bettina	Apr. 19, 1917	Jan. 20, 1919	21	
Shadelawn Lassie	Apr. 23, 1920	Nov. 22, 1921	19	*Slight*—Small lesions in mesenterics. Suspicious in liver and lungs.
Marjorie 9th of Ottawa	May 19, 1919	Nov. 5, 1920	18½	*Very bad*—Bronchials, mediastinals, full—calcified. Lungs full open purulent lesions. Bad spreader.
Ormsby Rhoda Maud	May 19, 1919	Nov. 5, 1920	18½	*Bad—Carcass condemned.* Lungs, mediastinals and bronchials full of purulent lesions.
Flavia 2nd B	May 2, 1918	Oct. 11, 1919	17	No P.M.—Sent Research Sta. of Health of Animals Branch.
Ottawa Kate 2nd	Nov. 6, 1917	Apr. 7, 1919	17	*Bad*—Open case. Big lesion in right lung.
Ormsby Canaan Beauty	June 10, 1919	Nov. 5, 1920	16½	*Bad*—Bronchials, mediastinals and lungs all affected more or less.
Ottawa Sultana	Apr. 10, 1917	Sept. 24, 1918	16	*Very bad—Condemned.* Several infections and lesions.
Nellie Keyes Duplicate	May 2, 1918	July 20, 1919	14¼	Clean.
Flavia 2nd C	Mar. 12, 1917	Apr. 13, 1918	14	*Medium*—Bronchials and mediastinals—1 lesion right lung. 2 spots in liver.
Ottawa Mirabel	May 19, 1919	June 2, 1920	12½	*Bad*—Mediastinal full and calcified. Bronchials caseous.
Ottawa Snowdrop	Nov. 29, 1916	Nov. 26, 1917	12	*Slight*—Right bronchial and mediastinal slight infection all caseous.
Strathglass White Rose	Mar. 12, 1917	Mar. 13, 1918	12	*Slight*—Two very small infections in left and right bronchials.
Tilly Masterpiece	May 19, 1919	Apr. 8, 1920	11	*Medium*—Bronchials, mediastinals, small area in lungs.
Golden Minnie of Don	May 19, 1919	Apr. 14, 1920	11	*Medium*—Both bronchials and mediastinals affected.
Duchess of Briar Crest	Nov. 3, 1919	Oct. 10, 1920	11	*Medium*—Both bronchials—caseous lesions.
Flavia 2nd of Ottawa	Mar. 1920	Jan. 13, 1921	10	*Bad*—Mediastinals, lungs, liver and mesenterics all more or less affected.
Flavia 2nd D	Mar. 1920	Jan. 13, 1921	10	No evidence.
Faforit Fayne	June 18, 1920	May 15, 1921	10	*Medium*—Both bronchials and mediastinals purulent and full.
Yankee Girl	Dec. 22, 1918	Sept. 24, 1919	9	*Slight*—Left bronchial only.
Strathglass Marguerite	Mar. 12, 1917	Nov. 26, 1917	8½	*Bad*—Left bronchial full and caseous. Small nodules in mediastinals. Spreader.
Strathglass Anna	Mar. 12, 1917	Nov. 26, 1917	8½	*Medium*—Small nodule in right bronchial. Mesenterics all caseous.

TABLE III—*Concluded*

Name of Animal	Date Reacted	Date Killed	Number Months in Herd	Post-Mortem
Ottawa Lady Evelyn	Mar. 12, 1917	Nov. 26, 1917	8½	*Bad*—Both pharyngeal glands filled. Mesenterics bad.
Leonora of Ottawa	May 2, 1918	Jan. 20, 1919	8½	*Medium*—Mesenterics bad. Mediastinals and bronchials slight.
Ottawa Princess	May 19, 1919	Jan. 8, 1920	8½	*Very bad*—Generalized case.—*Carcass condemned.*
Ottawa Bessie Ann	Apr. 1920	Nov. 29, 1920	8	No lesions found.
Pietertje Walker	Mar. 1920	Nov. 5, 1920	8	*Bad*—Bronchial and mediastinals full and caseous. Lungs many large and open lesions.
Bessie Lyn	Nov. 29, 1916	June 7, 1917	7	*Slight*—Lesions in post pharyngeal—calcified and walled off.
Susan Calamity Posch	Apr. 23, 1920	Nov. 29, 1920	7	*Slight*—One small nodule in lung.
Bennie Preferee	Nov. 29, 1916	May 2, 1917	6	*Slight*—Small injection in ant. mediastinal.
Ottawa Kate 3rd	Nov. 6, 1917	May 13, 1918	6	*Medium*—Mediastinals small and calcified. Lungs small and caseous.
Flavia 3rd B	May 19, 1919	Oct. 1919	5	No P.M.—Sent to Health of Animals Branch.
Ottawa March Segis	May 19, 1919	Oct. 1919	5	" " " "
Oliva Schuilling De Kol	Nov. 15, 1920	May 15, 1921	5	Both bronchials and mediastinals slightly affected.
Rhoda Jewel	Apr. 10, 1917	Aug. 15, 1917	4	*Slight*—5 very small nodules in bronchials.

Of the fifty-one cows slaughtered, the majority were removed to make room for other more valuable reactors, and comparatively few on account of clinical symptoms of advanced tuberculosis. Of the latter, there were not more than six cases. On the other hand, there were a number of cows that had outlived their usefulness but were still in excellent condition which, upon slaughter and examination, proved to be highly generalized and advanced cases. This goes to prove what has been repeatedly observed, namely, that a cow may be in an advanced stage of tuberculosis and still not show any outward symptoms of the disease. Furthermore, our experience with this herd has shown that a cow may be in an advanced stage of tuberculosis and still produce milk quite heavily and profitably. Another outstanding observation *re* the health of the herd was that quite a large percentage of the cows when slaughtered showed only old calcified lesions while a few showed two distinct sets of lesions, one old and calcified and the other recent and open. This would go to show that in many cases, nature, assisted by a rugged constitution in the animal, had hemmed in the infection and thus put the animal in the non-spreader class. The secondary set of open lesions in some animals were likely due to reinfection through being stabled with spreader cases.

It will be noted in the table that some cows that were in the Bang herd two, three, and even four years, have proved to be but slightly infected. On the other hand, some that were in this herd only a few months proved to be badly infected. Another class not noted in the above table are those which are slaughtered immediately upon reaction, amongst which are found numerous generalized open cases, all of which goes to show that infection may take place rapidly and run a rapid course, or an animal may be some time in developing the disease even when amongst diseased animals and, when eventually infected, may show considerable resistance to the ravages of the disease. Results of infection apparently depend on the virulence of the strain of bacteria introduced and on the power of resistance in the animals.

RECORDS OF MERIT AND RECORDS OF PERFORMANCE MADE BY TUBERCULAR COWS

The following table is a list of milk and butter-fat records made by some cows of the Bang herd. Records of Merit in the case of Holsteins and Records of Performance in the case of Holsteins and Ayrshires are shown.

TABLE IV.—RECORDS MADE BY BANG HERD COWS—R.O.M. AND R.O.P.

1. RECORDS OF MERIT

Animal	Age	Milk	Fat	Butter	Days
		lbs.	lbs.	lbs.	
Helena Keyes Posch	6 yrs. 8–23	690	22·57	28·22	7
		3,059·5	93·05	116·32	30
		5,947·5	176·51	220·64	60
		8,452·5	252·49	315·61	90
Korndyke Canary Butter Maid	2 yrs. 5–24	404·5	15·42	19·28	7
		1,545·5	55·25	69·07	30
Ormsby Rhoda Maud	2 yrs. 11–5	354·5	12·86	16·07	7
		1,431·5	50·41	63·07	30
Ottawa March Ormsby	3 yrs. 5–22	466·0	17·41	21·77	7
		1,857·5	7·01	87·52	30
Ottawa Pietertje Ormsby	2 yrs. 3–16	393	15·19	19	7
		1,647·5	61·83	77·30	30
	3 yrs. 5–1	439	15·93	19·92	7
		1,722·5	63·37	79·22	30
Topsy Keyes	9 yrs. 0–12	453	16·48	20·61	7
		1,909·5	66·77	83·47	30
Conway Posch Butter Girl	8 yrs. 0–21	458	16·76	20·96	7
		1,929	68·57	85·72	30
Bessie Lyn	4 yrs. 8–1	558	22·97	28·72	7
		2,429	90·52	113·15	30

2. R.O.P. Records

Animal	Breed	Class	Milk	B. Fat	% Fat	Days
			lbs.	lbs.		
Helena Keyes Posch	H	Mature	20,205	655	3·24	350
" "	H	"	13,887	442	3·19	311
Ott. March Ormsby	H	3 yr. old	10,017	347	3·47	278
Korndyke Canary Butter Maid	H	2 yr. old	10,328	371	3·59	294
Ormsby Rhoda Maud	H	2 yr. old	10,250	361	3·52	291
Ott. Pietertje Ormsby	H	3 yr. old	10,291	422	4·1	333
Topsy Keyes	H	Mature	10,907	381	3·5	285
Conway Posch Butter Girl	H	Mature	12,155	433	3·56	317
Culcaigrie Dot*	A	Mature	10,637	473	4·46	365
Flavia 2nd D*	A	3 yr. old	6,714	294	4·38	313
Marjorie 8th of Ottawa	A	Mature	10,420	401	3·84	283
Marjorie 9th of Ottawa	A	2 yr. old	6,178	271	4·39	313
Ottawa Kate	A	Mature	10,511	416	3·95	323
Sybil of Fieldhouse	A	Mature	11,387	447	3·92	342

*These two cows were in the Bang herd for the last 215 days only.

It will be noted that some very creditable records have been made by cows from this Bang herd. This table shows eight records from mature cows averaging 461 pounds of butter fat, nearly all of which were made in less than 365 days. This goes to prove that, even if affected by tuberculosis, some individuals may still be ranked as first-class producers. A number of cows were very good producers before reacting and continued producing well after they were sent to the reacting herd. The Holstein cow, Helena Keyes Posch, which made R.O.M. and R.O.P. records after she reacted, is one of them. Another one is the Ayrshire cow, Ottawa Kate, which, before reacting, had three R.O.P. records. The one she made at twelve years of age, after reacting, was equal to the one she made at eight years of age, and, when slaughtered six months after completing her last record, her post mortem showed such a bad infection that the carcass was condemned, proving that she probably was well advanced while making her record.

Still another very good producer while in the Bang herd was the Ayrshire cow, Marjorie 8th of Ottawa. This cow made a R.O.P. record which can be seen from the table. During the four years she has been quarantined she has produced 32,987 pounds of milk and 1,214·74 pounds of fat. When she was slaughtered, she proved to be badly infected in the lungs and bronchials.

Many others have been good producers up until they were slaughtered.

Animal	Breed	Months in herd	Milk	Fat
			lbs.	lbs.
Sybil of Fieldhouse	A	44	29,155	1,131
Topsy Keyes	H	33	27,917	956
Brampton Beulah	J	27	15,113	693
Ottawa March Ormsby	H	43	30,173	1,060
Ottawa Bessie Ann	H	8	8,249	345
Greenbank Rilla 6th	A	33	20,125	724

Therefore tuberculosis up to a certain stage does not seem to reduce the productive power of some cows; as a matter of fact, the production of any of the cows that were sent to the tubercular herd has not been greatly affected.

DIFFICULTIES ENCOUNTERED

The main object in establishing and operating a Bang herd is to secure the progeny of the cows in the herd. Any factor that defeats this object must be classed as one of the difficulties of operation. A few such factors have been met

with. First, the calves being removed immediately from the Bang herd to the main herd, were denied their mother's milk and, in many cases, did not receive colostrum or new milk of any kind. As a result, indigestion and constipation often set in, which sometimes ended fatally, but more often gave the calf a set back for a few weeks or even months. Scours in the calves was typical of this trouble and was much more evident in the calves from the Bang herd than in those from the main herd.

Pneumonia was also one of the difficulties encountered. In some cases, it was the initial trouble brought on by the cold trip from the Bang barn to the calf barn at the Farm. In others, the pneumonia developed later on when the calf was in a weakened condition owing to the debilitating effects of indigestion and scours.

Diseases and troubles common to large herds of dairy cattle, such as abortion, retention of afterbirth, udder affections, etc., were not found any more numerous in the Bang herd than in the main herd. One difficulty, which, in this case, was readily solved, but which might trouble the average breeder, was the pasteurization of the milk. Milk from a Bang herd is a menace alike to man and beast and should not be used in any form until pasteurized. No thinking person would allow such milk to go off the farm unpasteurized, unless it was definitely known that it was to be pasteurized before manufacture or consumption. If assurance of subsequent pasteurization was not forthcoming, then the milk should be retained on the farm and be subjected to some form of pasteurization and then fed to pigs rather than to calves. If any living germs remained and infected the pigs, the results would not be so far reaching as they would in calves, as the pigs are usually pretty well isolated on most farms, and the majority of them are slaughtered at an early age and usually in an abattoir, where the carcasses are inspected. If steam is available, it may be turned directly into the milk and thus heat the milk up to 150° F. and hold it there for 20 to 30 minutes. Failing steam, the milk should be heated over a fire, preferably in a water-jacketed vessel, until the above-mentioned temperature is reached, then held for the prescribed time.

Conclusions

In the light of the experience as outlined in the foregoing, it is considered that the establishment of a Bang herd is both feasible and practical where circumstances warrant such a herd. What then are the circumstances that would warrant the establishment of a Bang herd?

First.—A herd or herds of pure-bred cattle of sufficient size and high quality to make the isolation of reactors and the reclaiming of their progeny profitable.

Second.—A sufficient number of reactors of high quality within the herd to ensure returns on the overhead charges that must be met in running a Bang herd, which overhead charges might swamp the returns were only a few reactors found.

With the Accredited Herd System of the Health of Animals Branch making the rapid strides that it is there are undoubtedly many herds in the country in which the circumstances are such that they would fulfil the above conditions. In some cases, where the individual herds are not sufficiently large or the reactors within the herds not so numerous as to warrant a private Bang herd, a group of breeders might very well operate a joint one.

One feature of this work that should not escape attention is that if a Bang herd is to justify its existence at all, *it must be established simultaneously with the entry of a herd into the Accredited Herd System;* for it is at this time that the greatest number and often the highest quality reactors will be found. As each test goes by the number of reactors naturally decreases, so that in the course of a few years at the most the herd should have a clean sheet and the Bang herd can then be gradually eliminated. It is when the herd has this clean bill of health that the owner who has neglected establishing a Bang herd will wish that he had done so and thus been able to have retained some of his favourite blood lines.

MILKING MACHINES

Project 85.—During the year the practical trials of various milking machines against one another and against hand milking have been continued. One entirely new type of machine has been tried out, viz, the Mehring Foot Power milker.

In this machine the power is obtained by the operator sitting on a seat and operating a treadle which in turn works a vacuum pump which draws the milk from the cows. The teat cups are made of hard rubber with a soft rubber mouthpiece. Intermittent suction is used on the teats, that is, suction and then a release but no pressure. However, the release is not complete and there being no application of pressure to the teats congestion in the points of the latter often took place. This was particularly noticeable in cows with fleshy teats and others that were the least bit hard to milk. This machine was designed to milk two cows at once.

In actual practice it was cumbersome to handle. The operator had to work the treadle with his feet at the same time that he was applying the teat cups. If the cows were fairly close together in the stalls this was not so difficult. If, however, the cows had fair-sized stalls and they crowded away from the machine, which they invariably did, it became almost impossible for the operator to keep up the vacuum and attach the teat cups both. Then, as the power was supplied by the operator, the machine was necessarily idle while he emptied the milk. Still another objectionable feature was that the milk had to pass through the pump which supplied the vacuum, which was far from being sanitary.

There are other makes of man-power machines on the market to which the same criticisms as regards being cumbersome and unpractical would apply though some of the others might be built in a more sanitary manner.

It would seem that if a farmer has not got sufficient cows to warrant putting in a power machine he would be better off milking by hand than with a man-power machine. At least that was the conclusion reached as a result of this trial.

In January, 1922, the De Laval machine was installed. This machine has only been on the market a short time, but has been on the way for some time, the manufacturers not being desirous of putting it out until they had every detail worked out to as near perfection as they could get it.

In general principle this machine is not unlike the Empire, McCartney and such machines in its action. It has, however, some important deviations from the type of these machines so that a short description of it may not be out of place.

The power is supplied by means of a rotary pump which creates the necessary vacuum in the vacuum tank and pipe line. At the same time, this pump, through a geared device, acts as the pulsator and regulates the timing of the application of the vacuum and atmospheric pressure to the teats. Two lines of pipe are used throughout the stable, one being the vacuum line and the other the pressure line through which are transmitted the air pulsations which operate the udder pulsator placed close to the udder of the cow. This system of handling the suction and pressure lines ensures a positive and uniform action of the teat cups for each and every cow in the herd. Unless something goes wrong with the pump or the power, the latter being the more likely to happen, there is little danger of the machine going out of order and certainly the timing of the pulsator is as near fool-proof as it could be made.

The machine is exceptionally well made of good materials and backed as it is by De Laval service should prove durable.

In practical experience with the machine to date (March 31, 1922), it has proved most satisfactory. Practically no difficulties have been experienced in the operation of the machine; the cows take to it readily; it milks quickly and thoroughly and it is easily kept clean.

DAIRY HERD RECORDS

The following are the dairy cow milk records for all cows and heifers which have finished a lactation period during the fiscal year ending March 31, 1922. Others of the cows and heifers have started lactation periods, but, as they are not completed, they will be reported on later.

In the case of heifers with their first calves, charges for feed include the consumption from a date two months prior to parturition to the time of being dried off preparatory to their second calving. In the case of heifers and cows three years old or over, charges for feed include the period in which they were dry prior to the lactation period herein reported.

In estimating the cost of feeds the following values were used:—

Pasture per month	per cow	$ 2 00
Meal mixture	per ton	40 00
Hay	"	9 00
Roots	"	4 75
Silage	"	3 90
Green feed	"	9 00

These values represent the cost of raising in the case of feeds which are or can be home grown, and the actual cost price in the case of mill feeds, factory by-products, etc., that were purchased.

In calculating the value of products the actual cash value was used, which amounted to 40 cents per pound for butter, and 30 cents per 100 pounds for skim-milk.

The cost of caring for the cattle, other than feeding, the manufacture of the butter, etc., have not been accounted for. On the other hand, the value of the manure made and the value of the calves at birth will effectually counterbalance the above-mentioned items, though not sufficiently to cover other overhead charges such as interest, depreciation, etc.

Name and Breed of Cow	Age at beginning of lactation period	Date of dropping calf	Number days in the lactation period	Total pounds of milk for period	Daily average yield of milk	Average p.c. fat in milk	Pounds of butter produced in period	Value of butter at 40c. per pound
				lbs.	lbs.	p.c.	lbs.	$ cts.
Grace Fayne Aaggie.....H.	5	Dec. 1, 1920..	321	15,610	48·63	3·95	728·2	291 28
Grace Allen Ormsby.....H.	9	July 1, 1920..	405	15·386	37·99	3·5	639·72	255 89
Zorra De Kol.....H.	8	Mar. 16, 1920..	441	15,083	34·2	3·7	627·33	250 93
Leila Posch Mechthilde.....H.	6	Mar. 19, 1920..	341	14,387[5]	42·19	3·62	601·89	240 76
Culcaigrie Dot.....A.	7	June 10, 1920..	388	10,596	27·31	4·35	533·17	213 27
Hairshaw Tibbie.....A.	6	April 18, 1920..	355	9,679	27·26	4·35	474·08	189 63
Flora De Kol Korndyke.....H.	6	April 26, 1921..	321	11,281	35·11	3·5	555·29	222 12
Springbank Posch Canary.....H.	5	Mar. 21, 1920..	365	12,759	34·96	3·53	527·81	211 12
Auchenbay Mina 5th.....A.	3	April 12, 1920..	461	10,654	23·11	4·44	501·82	200 73
Leoni of Pinehurst.....J.	4	Nov. 19, 1920..	302	7,804	25·83	4·94	452·44	180 98
Queen Colantha Dewdrop.....H.	5	April —, 1920..	381	10,760	28·24	3·78	469·16	187 66
Allancroft Pansy.....A.	7	May 9, 1921..	306	8,157	26·66	4·9	446·86	178 74
Brampton Vinnie Beth.....J.	3	———, 1920..	379	5,963[5]	15·73	6·11	429·11	171 64
Wayne Butter Maid Boon.....H.	6	April 6, 1920..	360	10,100	30·83	4·02	467·98	187 19
Beauty Tensen.....H.	11	Feb. 4, 1921..	272	9,492	34·9	3·12	345·18	148 07
Allancroft Ada.....A.	6	Dec. 1, 1920..	284	8,127	28·62	4·29	410·09	164 04
Starlight of Fredericton.....A.	4	Dec. 16, 1920..	260	6,898	26·53	4·68	377·3	150 92
Korndyke Canary Butter Maid.H.	3	Aug. 25, 1920..	378	10,038	26·55	3·56	427·68	171 07
Midnight Jewel De Kol.....H.	4	Mar. —, 1920..	640	12,143[5]	18·97	3·7	522·81	209 12
Helena Keyes Posch.....H.	9	April 8, 1921..	275	11,911	43·31	3·2	428·84	171 54
Old Hall Maggie 9th.....A.	8	April 26, 1920..	355	8,448	23·79	4·06	373·31	149 32
Evergreen March 3rd.....H.	11	April 8, 1920..	356	10,343[5]	29·05	3·43	406·6	162 64
Colantha Fayne Hengerveld....H.	6	July 23, 1920..	616	12,999[5]	21·1	3·2	489·39	195 76
Auchlochan Emerald.....A.	8	July 12, 1920..	277	8,102	29·25	4·01	374·7	149 88
Wayne Butter Maid Boon.....H.	7	June 9, 1921..	284	10,158[5]	38·48	3·7	382·53	153 01
Bess Hengerveld.....H.	2	Sept. 18, 1920..	392	9,973[5]	25·44	3·42	399·86	159 94
Maud of Fernbrook.....A.	9	Aug. 24, 1920..	470	9,849[5]	20·96	3·27	417·35	166 94
Brampton Triumph 2nd.....J.	2	———, 1920..	377	5,061[5]	13·43	5·84	344·42	137 77
Hardcroft Dewdrop 3rd.....A.	5	April 14, 1920..	335	7,539	22·50	4·15	353·65	141 46
Belle of Oban.....A.	9	Aug. 31, 1920..	336	7,836	23·32	3·84	369·75	147 90
Allancroft Betsy 2nd.....A.	3	———, 1920..	333	6,937	20·84	4·1	337·28	134 91
Lulu Posch Regina.....H.	3	Sept. 8, 1920..	418	10,149	24·28	3·29	382·52	153 00
Primrose of Athens.....A.	4	Mar. 24, 1921..	250	4,968	19·87	4·6	268·85	107 54
Ottawa Woodcrest Lyn.....H.	4	June 4, 1920..	305	8,527	27·97	3·43	338·16	135 26
Milly of Wishtonwish.....J.	3	Dec. 22, 1920..	345	4,857[5]	14·08	6·0	341·18	136 47
Trilby.....A.	7	Feb. —, 1921..	336	6,211	18·48	4·13	306·32	122 53
Ottawa March Posch.....H.	2	Dec. 25, 1920..	327	7,524[5]	23·01	3·91	320·57	128 23
Ottawa Pistertje Ormsby.....H.	5	Mar. 23, 1921...	283	7,116[5]	25·14	3·7	306·8	122 72
Merry Christmas.....A.	7	May 30, 1921..	261	6,091[5]	23·34	3·87	272·47	108 99
Lillian of Oban.....A.	3	April 8, 1921..	292	5,482[5]	18·78	4·2	261·6	104 64
Dalwhatswood Blossom 2nd....A.	6	May 17, 1921..	228	4,709	20·65	3·8	225·96	90 38
Carston Dollar.....A.	9	May 5, 1920..	452	7,000[5]	15·47	3·98	323·4	129 36
Duchess.....A.	9	Mar. 19, 1921..	246	4,346	17·67	4·22	212·64	85 06
Maud of Fernbrook 4th.....A.	7	———, 1920..	365	4,716	12·92	4·08	217·01	86 80
Total for herd (44 cows).....	256	.....	15,454	395,777	1146·74	177·47	17,993·08	7,207 21
Average for herd (44 cows).....	6·4	.....	351·23	8,994·93	26·06	4·03	409·08	163·8
								HOL
Grace Fayne Aaggie.....	5	Dec. 1, 1920..	321	15,610	48·63	3·95	728·2	291 28
Grace Allen Ormsby.....	9	July 1, 1920..	405	15·386	37·99	3·5	639·72	255 89
Zorra deKol.....	8	Mar. 16, 1920..	441	15,083	34·2	3·7	627·33	250 93
Leila Posch Mechthilde.....	6	Mar. 19, 1921..	341	14,387[5]	42·19	3·62	601·89	240 76
Flora DeKol Korndyke.....	6	April 26, 1921..	321	11,281	35·11	3·5	555·29	222 12
Average of best 5 cows.....	6·8	.....	365·8	14,349·5	39·62	3·65	630·49	252·2
Average of herd (20 cows).....	5·85	.....	373·0	11,287·2	31·52	3·57	468·42	187 87
								AYR
Culcaigrie Dot.....	7	June 10, 1920..	388	10,596	27·31	4·35	533·17	213 27
Hairshaw Tibbie.....	6	April 18, 1920..	355	9,679	27·26	4·35	474·08	189 63
Auchenbay Mina 5th.....	3	April 12, 1920..	461	10,654	23·11	4·44	501·82	200 73
Allancroft Pansy.....	7	May 9, 1921..	306	8,157	26·66	4·9	446·86	178 74
Allancroft Ada.....	6	Dec. 1, 1920..	284	8,127	28·62	4·29	410·09	164 04
Average of best 5 cows.....	5·8	.....	358·8	9,442·6	26·59	4·47	473·2	189 28
Average of herd (20 cows).....	6·35	.....	329·5	7,317·4	22·37	4·17	352·88	141·15
								JER
Leoni of Pinehurst.....	4	Nov. 19, 1920..	302	7,804	25·83	4·94	452·44	180 98
Brampton Vinnie Beth.....	3	———, 1920..	379	5,963[5]	15·73	6·11	429·11	171 64
Brampton Triumph 2nd.....	2	.....	377	5,061[5]	13·43	5·84	344·42	137 77
Milly of Wishtonwish.....	3	Dec. 22, 1920..	345	4,857[5]	14·08	6·0	341·18	136 47
Average for herd (4 cows).....	3	.....	350·8	5,921[6]	17·27	5·72	391·79	156 72

Value of skim-milk at 30c. per cwt.	Total value of product	Amount of meal eaten at 2c. per pound	Amount of roots at $4.75 per ton and ensilage at $3.90 per ton	Amount of hay eaten at $9.00 per ton	Amount of green feed eaten at $9.00 per ton	Months on pasture at $2.00 per month	Total cost of feed between calvings	Cost to produce 100 lbs. of milk	Cost to produce one pound of butter skim-milk neglected	Profit on one pound of butter skim-milk neglected	Profit on cow between calvings, labour and calf neglected
$ cts.	$ cts.	lbs.	lbs.	lbs.	lbs.	mos.	$ cts.	$ cts.	cts.	cts.	$ cts.
44 97	336 25	4,773	24,860	2,376	.....	2	163 40	1·04	22·4	17·6	172 85
44 53	300 42	4,361	19,430	2,802	3,350	2	142 66	0·927	22·3	17·7	157 76
43 65	294 58	4,934	17,000	2,646	900	1	150 69	0·998	24·0	16·0	143 89
41 63	282 39	4,419	17,970	2,544	.....	2	140 20	0·97	23·3	16·7	142 19
30 43	243 70	3,674	12,125	2,634	900	2	117 02	1·10	21·9	18·1	126 68
27 83	217 46	2,886	9,365	1,902	900	2	92 58	0·96	19·5	20·5	124 88
32 43	254 55	4,085	18,060	2,730	.....	2	134 10	1·19	24·1	15·9	120 45
36 93	248 05	4,173	13,690	2,100	900	2	128 55	1·01	24·3	15·7	119 50
30 68	231 41	3,517	15,155	2,730	900	2	121 13	1·137	24·1	15·9	110 28
22 26	203 24	2,725	12,515	2,004	.....	2	93 04	1·19	20·6	19·4	110 20
31 08	218 74	3,366	14,250	2,196	900	2	113 93	1·06	24·2	15·8	104 81
23 33	202 07	3,066	12,100	2,190	.....	2	98 78	1·21	22·1	17·9	103 29
16 80	188 44	2,334	12,740	2,334	.....	2	86 92	1·46	20·3	19·7	101 52
29 11	216 30	3,534	13,540	2,100	900	2	115 48	1·14	24·6	15·4	100 82
27 60	175 67	3,429	15,625	2,312	.....	2	79 37	·836	23·0	17·0	96 30
23 34	187 38	2,748	12,610	1,782	.....	2	93 13	1·146	23·0	17·0	94 25
19 73	170 65	2,356	9,630	1,746	.....	2	77 76	1·13	20·6	19·4	92 89
29 02	200 09	3,280	13,675	2,552	.....	2	107 75	1·07	25·2	14·8	92 34
35 10	244 22	4,268	21,680	3,782	.....	4	152 66	1·26	29·2	10·8	91 56
34 64	206 18	4,056	12,925	2,312	.....	2	120 72	1·01	28·1	11·9	85 46
24 39	173 71	2,826	9,365	1,992	900	2	91 79	1·09	24·6	15·4	81 92
29 99	192 63	3,408	13,690	2,100	900	2	113 25	1·10	27·8	12·2	79 38
37 75	233 51	4,150	23,315	3,744	900	2	154 26	1·19	31·5	8·5	79 25
23 35	173 23	2,776	11,015	1,902	900	2	94 50	1·166	25·2	14·8	78 73
29 50	182 51	3,580	11,700	2,004	.....	2	107 49	1·06	28·1	11·9	75 02
28 90	188 84	3,566	14,070	2,355	.....	2	114 45	1·15	28·6	11·4	74 39
28 48	195 42	3,550	16,920	3,108	.....	2	122 88	1·25	29·4	10·6	72 54
14 31	152 08	2,029	12,740	2,334	.....	2	80 82	1·59	23·4	16·6	71 26
21 72	163 18	2,724	11,465	2,032	900	2	94 92	1·26	26·8	13·2	68 26
22 57	170 47	2,918	13,700	2,466	900	2	104 12	1·33	28·0	12·0	66 35
19 95	154 86	2,486	12,740	1,968	.....	2	88 66	1·28	26·0	14·0	66 20
29 47	182 47	3,384	14,455	2,498	.....	5	117 11	1·15	30·6	9·4	65 31
14 23	121 77	1,708	6,570	1,464	.....	2	57 56	1·16	21·4	18·6	64 21
24 72	159 98	3,106	10,700	2,010	.....	2	96 04	1·13	28·4	11·6	63 94
13 70	150 17	2,315	14,190	2,556	.....	2	90 33	1·86	26·5	13·5	59 84
16 95	139 48	2,364	11,656	2,078	.....	2	83 84	1·35	27·4	12·6	55 64
21 76	149 99	2,792	13,500	2,312	.....	2	96 69	1·28	20·8	19·2	53 30
20 57	143 29	2,760	13,080	2,132	.....	2	94 30	1·33	30·7	9·3	48 99
17 58	126 57	2,238	10,325	2,004	.....	2	77 91	1·28	28·6	11·4	48 66
15 78	120 42	2,189	9,180	1,836	.....	2	73 94	1·35	28·3	11·7	46 48
13 55	103 93	1,846	7,920	1,470	.....	2	62 98	1·34	27·9	12·1	40 95
20 18	149 54	2,804	16,305	2,742	1,830	2	113 35	1·62	35·0	5·0	36 19
12 50	97 56	1,844	10,200	1,818	.....	2	69 45	1·59	32·6	7·4	28 11
13 59	100 39	2,128	11,870	1,980	900	2	83 56	1·71	38·5	1·5	16 83
1,140 58	8,347 79	137,475	599,616	100,679	17,780	92	4,614 07	53·460	1,142·9	617·1	3,733 72
25 92	189 72	3,124·4	13,627·5	2,288·16	404·09	2·09	104 87	1·215	25·975	14·025	84 85
STEINS											
44 97	336 25	4,773	24,860	2,376	.....	2	163 40	1·04	22·4	17·6	172 85
44 53	300 42	4,361	19,430	2,802	3,350	2	142 66	0·927	22·3	17·7	157 76
43 65	294 58	4,934	17,000	2,646	900	1	150 69	0·998	24·0	16·0	143 89
41 63	282 39	4,419	17,970	2,544	.....	2	140 20	0·97	23·3	16·7	142 19
32 43	254 55	4,085	18,060	2,730	.....	2	134 10	1·19	24·1	15·9	120 45
41 44	293 64	4,514·4	19,464	2,619·6	850	1·8	146 41	1·025	23·22	16·78	147 43
32 66	220 53	3,771·2	15,860·8	2,480·4	437·5	.....	122 16	1·095	26·06	13·94	98 38
SHIRES											
30 43	243 70	3,674	12,125	2,634	900	2	117 02	1·10	21·9	18·1	126 68
27 83	217 46	2,886	9,365	1,902	900	2	92 58	0·96	19·5	20·5	124 88
30 68	231 41	3,517	15,155	2,730	900	2	121 13	1·137	24·1	15·9	110 28
22 33	202 07	3,066	12,100	2,190	.....	2	98 78	1·21	22·1	17·9	103 29
23 34	187 38	2,748	12,610	1,782	.....	2	93 13	1·146	23·0	17·0	94 25
27 12	216 40	3,178	12,271	2,247·6	540	2	104 53	1·111	22·12	17·88	111 88
21 01	162 16	2,632·4	11,510·8	2,092·2	451·5	2	90 99	1·273	26·55	13·45	71 17
AYRS											
22 26	203 24	2,725	12,515	2,004	.....	2	93 04	1·19	20·6	19·4	110 20
16 80	188 44	2,334	12,740	2,334	.....	2	86 92	1·46	20·3	19·7	101 52
14 31	152 08	2,029	12,740	2,334	.....	2	80 82	1·59	23·4	16·6	71 26
13 70	150 17	2,315	14,190	2,556	.....	2	90 33	1·86	26·5	13·5	59 84
16 76	173 48	2,350·7	13,046	2,307	.....	2	87 78	1·53	22·7	17·3	85 71

OFFICIAL RECORDS

In addition to the records kept by this division, a number of the dairy cattle of the different breeds are entered in the Record of Performance for Pure-bred Dairy Cattle conducted by the Live Stock Branch of this department. In addition, many Holstein cows have been put through the Holstein Record of Merit test. The following tables give the list of cows qualifying under each of these tests for the year:—

HOLSTEIN RECORD OF MERIT TESTS ON CENTRAL FARM, APRIL 1, 1921, TO MARCH 31, 1922

—	Age at commencement of test			Number of days on test	Pounds milk	Pounds fat	Pounds 80% butter
	Years	Months	Days				
Grace Fayne Aaggie, 48612	6	3	27	7	668·0	27·29	34·12
	6	3	27	30	2,828·0	114·14	142·68
Grace Allen Ormsby, 22333	9	9	25	7	474·5	20·13	25·17
	9	9	25	30	2,318·0	83·80	104·77
Flora DeKol Korndyke, 41737	6	1	6	7	505·5	18·41	23·02
	6	1	6	30	2,107·0	75·87	94·84
Helena Keyes Plus, 44067	5	7	20	7	492·0	18·70	23·39
	5	7	20	30	2,049·0	75·04	93·80
Wayne Butter Maid Boon, 37989	6	7	29	7	473·5	18·32	22·90
	6	7	29	30	1,953·5	70·97	88·71
Queen Colantha Dewdrop, 40768	6	1	23	7	502·0	14·81	18·51

CANADIAN RECORD OF PERFORMANCE TESTS ON CENTRAL FARM, APRIL 1, 1921, TO MARCH 31, 1922

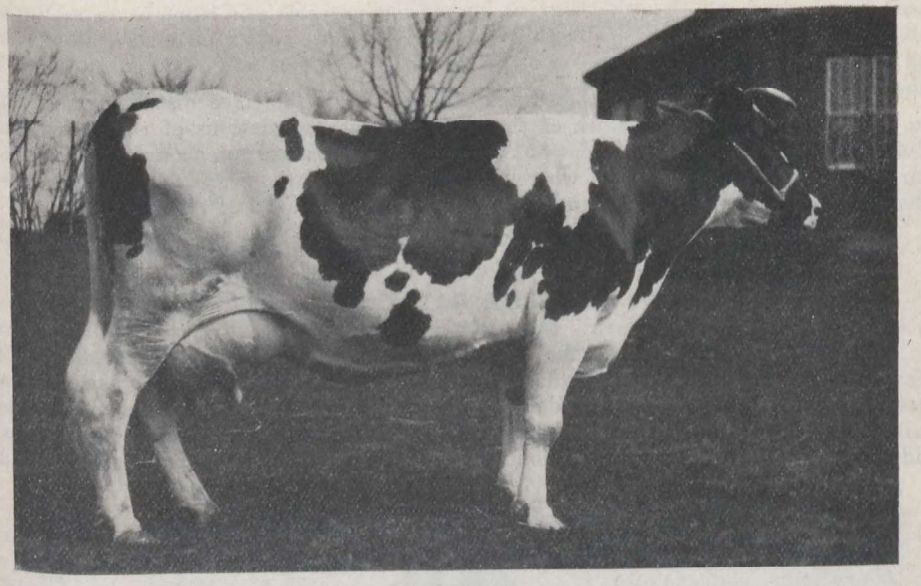
Name and number of cow	Breed	Age at commencement of test	Number days milking	Pounds of milk produced	Pounds of fat produced	Average per cent fat
Grace Fayne Aaggie, 48612	Holstein	5	305	15,542	630	4·05
	"	5	321	15,610	633	4·05
Grace Allen Ormsby, 22333	"	8	365	14,857	490	3·30
Helena Keyes Posch, 21376	"	7	311	13,887	442	3·19
Zorra DeKol, 22593	"	7	365	14,483	497	3·43
Leila Posch Mechthilde, 39673	"	5	342	14,383	506	3·52
Springbank Posch Canary, 39598	"	4	364	13,210	453	3·43
Culcaigrie Dot, 70081	Ayrshire	7	365	10,637	473	4·46
Auchinbay Mina 5th, 70080	"	3	365	9,522	388	4·07
Isabel of Maplehurst, 28728	"	10	336	8,576	371	4·32
Leoni of Pinehurst, 8631	Jersey	4	3 4	7,876	384	4·88
Fairy's Fern, 12328	"	3	289	6,233	325	5·21

CO-OPERATIVE MILK RECORDS

During the past year an increasing number of applications were received for milk and feed record forms—which are distributed free of charge upon application to this division. This is a gratifying indication of the rapidly improving methods being adopted by the dairy farmers in keeping records for the individual cows of their herds. Apparently, however, there are still many farmers who are not aware of this free distribution of record forms. The following is a list of the forms for distribution:—

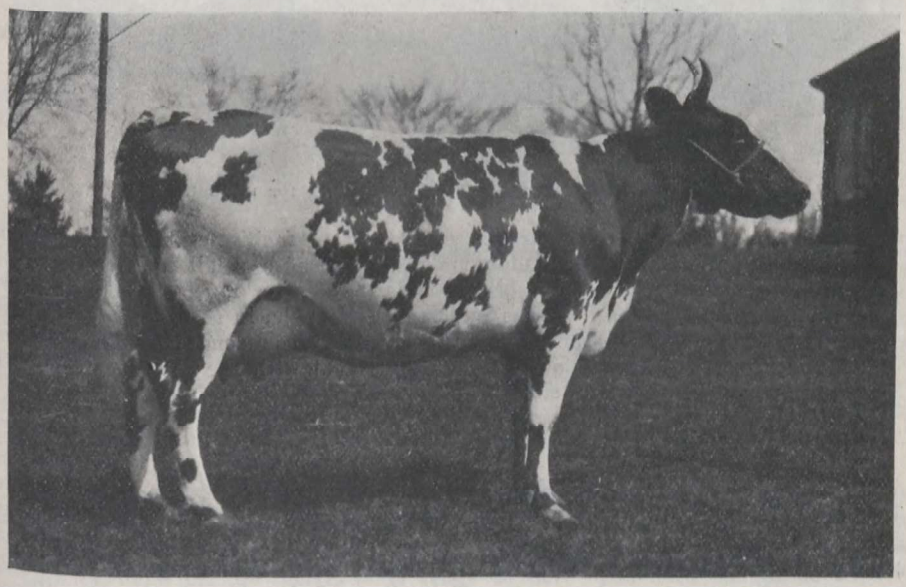
Month long.—Daily milk records suitable for herds numbering up to twenty-two cows.

Week long.—Daily milk records suitable for herds numbering up to sixteen cows.



Grace Fayne Aaggie—48612.

R.O.M.— 7-day 668 pounds milk, 34.12 pounds butter.
30 " 2,828 " 412.68 "



Auchinbay Mina 5th (Imp.)—70080
Just finishing a highly creditable record in R.O.P.

Week long.—Daily milk records suitable for herds numbering up to twenty-four cows.

Monthly summary records.

Yearly summary records.

Feed record forms.

It should be clearly understood that the object of this free distribution is not in any way to overlap the work of the Cow Testing Associations of the Dairy and Cold Storage Branch, Department of Agriculture; but rather to encourage individual farmers, especially in districts where cow-testing associations are not developed, so that these individuals may in turn eventually form the nuclei of record centres.

THE DAIRY

The milk as produced at the Central Experimental Farm is handled by the Farm Dairy and disposed of in a variety of ways. During the past year, besides handling the regular routine of dairy work in connection with the distribution of milk and the manufacture of butter, Cheddar, cream and Coulommier cheese, considerable experimental work was done toward the origination of new varieties. A

Meilleur cheese, properly cured and ready for market.

new curing cellar has been added to the equipment to facilitate this work. As a result, one new product has been added in the form of a small, medium to full flavoured cheese. This product has been standardized after much experimentation and named "Meilleur" cheese. It has met with ready sale, in so far as the limited manufacture possible would permit, and has been highly commended by connoisseurs of this type of cheese. The following paragraphs deal with the methods employed in the manufacture of this product:—

MEILLEUR CHEESE

When properly ripened, this cheese presents an attractive bright yellow colour and possesses a fine texture. It does not, however, possess the firmness of Cheddar and similar cheeses, being more open in texture and resembling to some extent the Emmenthaler or "Swiss-hole" cheese. The characteristic odour and flavour, while being more or less pronounced, are not sufficiently marked to be objectionable, differing materially in this respect from the great majority of cheeses representing this class.

Considering the possibilities for a liberal remuneration which the manufacture of this cheese seems to offer when conditions and circumstances are favourable, the manufacture of milk into this product should be profitable. It has been found that one hundred pounds of whole milk testing 4 per cent butter fat will give 10 pounds of Meilleur cheese. The sale of this cheese at 35 cents per pound (which might be termed the minimum price to be expected) would realize $3.50 per hundred pounds of milk.

In the manufacture of this cheese there are no factors more important than the conditions under which it is cured. If the curing room or cellar is not suitable, it is next to impossible to obtain a desirable product. The room temperature should be about 60 degrees F. and the optimum humidity should be 90 per cent or more. This is an important consideration in view of the fact that cheese cured in a relatively dry atmosphere develops a thick hard crust which generally checks or cracks. The result is that an abnormal bacterial growth develops in these openings, and such is capable of imparting undesirable and inferior flavours to the cheese. When cured under satisfactory conditions and given the required attention, this cheese develops a very thin and smooth crust which presents an unbroken surface to all outside influences, the cheese thus being permitted to develop its own particular flavour to the exclusion of all others.

MANUFACTURING AND EQUIPMENT

1. *The Milk.*—To make a desirable quality of Meilleur cheese, it is very important to have fresh, clean milk. If the milk is to be kept overnight, it should be cooled to a temperature of 60 degrees F. or lower and held at that temperature until used. The milk should not be held more than twelve hours as it is very essential that it be perfectly sweet.

2. *The Cheese Vat.*—A wash boiler, large kettle, or tub may be used, but if cheese is to be made frequently or on a fairly large scale, a regular cheese vat is much more satisfactory. A cheese vat so constructed that hot and cold water may be circulated around the milk for regulating the temperature.

The control of the temperature throughout the manufacturing process is essential to its successful making. A good thermometer therefore should be used.

3. *Heating the Milk and Adding Rennet.*—The milk is heated in the vat to a temperature of 90 degrees F. at which it is held until after the curd has been cut. Before adding the rennet the acidity of the milk should be about ·20 to ·21 per cent. To attain this point of acidity, the starter is required when only the morning's milk is used. When both morning's and evening's milk is used, no starter is needed. One ounce of good buttermilk or sour milk of good flavour, per 100 pounds of milk, would make an excellent starter.

Rennet extract, which is used to coagulate the milk, may be obtained from any dairy supply house. Rennet should be added at the rate of one-half of an ounce for each 100 pounds of milk or enough to coagulate the milk in from thirty to thirty-five minutes, according to the strength of the rennet used. The rennet should first be mixed with 8 ounces of lukewarm water and then stirred into the milk very thoroughly for five minutes. Then let the milk stand undisturbed until the curd is ready to cut which should take about thirty to thirty-five minutes after the addition of the rennet. The vat should be covered to keep a more uniform temperature and especially to prevent the surface of the milk from cooling.

4. *Cutting the Curd.*—One method of determining the proper stage for cutting is to insert the forefinger in the curd at an angle of 45 degrees and about half-an-inch under the surface. If, when the finger is raised, the curd splits smoothly without leaving particles on the finger, it is ready to cut. The curd should be first cut lengthwise of the vat with a horizontal curd knife, then cut crosswise with a vertical knife, and finally lengthwise with the vertical knife, thus leaving the curd in small cubes.

If curd knives are not available, the curd may be cut with a large butcher knife, cutting both lengthwise and crosswise of the vat, and then, after carefully giving the curd a quarter turn so that one side is now on top, cutting lengthwise again. When the cutting is completed, the pieces of curd should form a cube about three-eights of an inch in thickness.

5. *Heating the Curd and Removing the Whey.*—Heat the curd slowly to 115 degrees F., taking about ten minutes to raise the temperature to that point. The curd should be stirred gently while heating, in order to prevent the pieces from sticking together and forming large lumps. The whey is then immediately removed.

6. *Moulds and Moulding.*—Very suitable moulds can be made by any good tinsmith. They should be made of strong, heavy tin. Those used at the Experimental Farm are tin cylinders or hoops of two sizes. The small ones are 2¾ inches high by 5¾ inches in diameter, making a cheese 1½ inches high by 5¾ inches, and varying in weight from 1 pound to 18 ounces. The larger size measures 3½ inches high by 8 inches in diameter. These hold a cheese that weighs about 3 pounds.

Before putting in the curd the hoop is lined with a heavy cotton cloth.

A wooden top is made to fit inside the hoop to press on the cheese. A grooved board or a board perforated with small holes may be used as a bottom. (In order to let the whey off it is necessary to have openings in the bottom of the moulds.)

These moulds are filled with the curd and then put in the press. After five minutes of gentle pressing they should be taken out and dressed.

7. *Dressing the Cheese.*—In order to prevent the cheese from sticking to the cotton cloth, it should not be pressed too long before dressing. Dressing is done in the following manner: The cheese is taken out of the moulds and the cloth removed. It is then rewrapped first in a very damp parchment and next in the same cotton cloths and put back into the moulds.

The parchment paper is used to prevent the cheese from sticking to the cotton cloth. If this paper were not used, the cotton would cling to the cheese the same as in the case of cheddar cheese.

The cheese is then pressed for twenty-four hours.

8. *Salting.*—After twenty-four hours, the cheese is removed from the moulds and salted. The salting process requires two days. Cover the cheese with about an eighth of an inch of salt and after one day reverse and apply a similar amount to the opposite side and allow to stand for another twenty-four hours.

The cheese is then removed to the curing room.

CURING THE CHEESE

Curing is the most important part in the making of Meilleur cheese.

1. *The Curing Room.*—The curing room should be clean, cool and humid. The most suitable temperature seems to be 60 degrees F. When permitted to rise much above 60 degrees F. great difficulty will be experienced in retaining sufficient atmospheric moisture for the proper curing of the cheese.

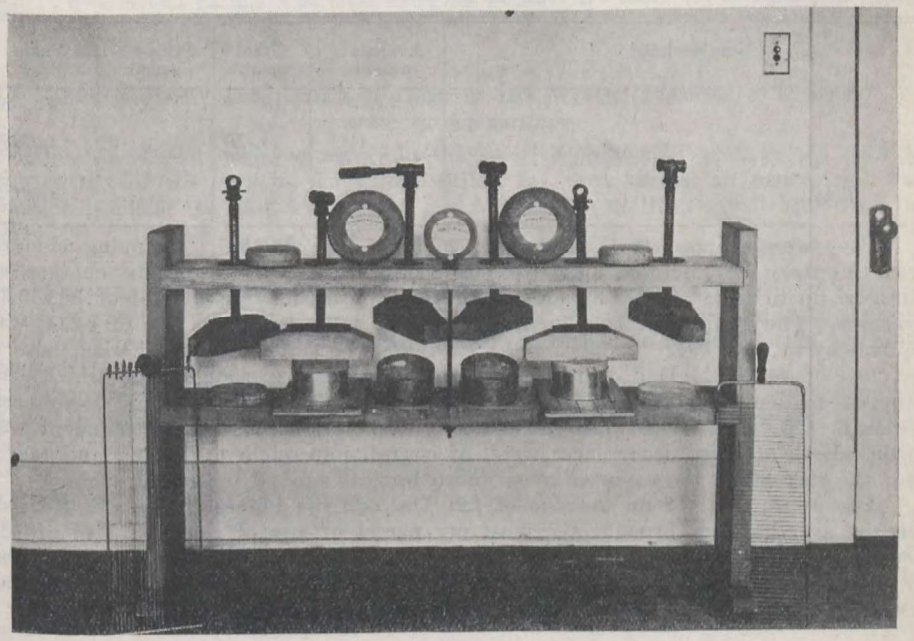
The retention of sufficient humidity in the atmosphere of the curing room is of paramount importance. At no time should it be permitted to drop below 85 per cent for any considerable length of time, and a much superior product would result if a humidity of 90 per cent or even 95 per cent were retained. Under optimum conditions, the cheese should develop a thin, smooth crust free from checks or cracks. When cured in a room in which the humidity is too low, the cheese develops a thick crust which is liable to check.

2. *Washing the Cheese.*—Before the crust develops, the cheese is washed with a strong brine solution and kept on damp shelves. The brine is made of two ounces

of salt dissolved in two quarts of water. This is sufficient as a wash for a considerable quantity of the cheese. From time to time as the brine is taken from the container for use in washing the cheese the same quantity which has been removed should be replaced by a fresh supply.

This brine will, of course, develop quite a strong odour after a few days, but such has no detrimental effect on the cheese.

The brine wash is applied to the cheeses in order to keep these moist while the cheese is curing. The wash may be applied to the cheese on shelves with a sponge or soft cloth. The washing must be continued daily for about a month or until the



A home-made cheese press used in the manufacture of Meilleur cheese.
Note also the moulds, blocks and drain board.

bright yellow crust has formed. When such has developed satisfactorily the cheese may be removed to dry shelves. The washing must be continued, however, until the cheese is cured, which generally requires two and a half to three months from the time of manufacture. At this particular stage it is important to have the brine fresh and it should be made up daily or at most every other day, mixing the water and salt in the same proportions as before.

When cured in such a manner the cheese should present an attractive bright yellow colour, should have a thin, smooth crust and should not be hard, but at the same time, possess a reasonable amount of firmness.

MISCELLANEOUS WORK

Aside from routine and experimental work, considerable time has been spent in the testing of samples of milk, cream, skim-milk, etc., as forwarded by dairymen and farmers. Assistance has been given to commercial concerns in the manufacture of soft cheese, such as Cream and Coulommier varieties, and to farmers in the production of farm dairy products.

BEEF CATTLE

The only beef cattle work taken up during the year was the sale of a group of export steers on the British market through the firm of H. P. Kennedy, Limited, Toronto, Ont., by whose courtesy full returns as to cost of export, prices received, etc., were received. These returns have, of course, a limited value, as the figures apply only to conditions obtaining at the time that this shipment was made. However, a statement as to the results may be of interest.

There were thirty-three cattle in all in the shipment, consisting, for the most part, of three-year-old steers, though there were a few two-year-olds. They were valued at Montreal on June 21, 1921, as follows:—

Number head	Average weight	Total weight	Price per pound	Value
	lbs.	lbs.	c.	$ cts.
17	1,444	24,550	9¼	2,270 87
16	1,264	20,230	9	1,820 70
Total				4,091 57

They were shipped to Glasgow and sold on July 8, 1921. Shipping charges from Montreal to Glasgow amounted to $60.13 per head. Handling charges at Glasgow up to time of sale amounted to $7 per head, making a total of $2,215.29 expenses. The cattle were sold for £1,471, which, at an exchange rate of $4.14, was equivalent to $6,089.94. Deducting the expenses, the shipment was charged with a net loss of $116.92. Had it not been for the adverse exchange rate, which had dropped suddenly just at the time of shipment, a small profit would have been realized. The market had also fallen about $1 per hundred just as shipment was made. Both of these occurrences were, of course, impossible to foretell and represent the risk which the exporter must guard himself against by buying right.

The cattle sold for an average of £44 11s. 6d., the highest being £52 10s. 3d. On the average, they brought the most per pound of any of the boat load of 185 head. While they would have classed as choice heavy butcher cattle on the Montreal or Toronto markets, they were not considered sufficiently finished for the British trade, showing the high degree of finish necessary for the export market.

HORSES

There are now 30 head of horses at the Central Experimental Farm, made up of 14 draught geldings and mares, 2 general purpose horses, 3 drivers, and 11 registered Clydesdales.

During the year 6,908 hours of work have been accounted for in the various divisions on the Central Farm. With a stock of horses, such as this, experimental work is difficult, although during the past winter one experiment has been carried on as reported.

An analysis of maintenance costs as afforded by 23 draught horses:—

Feed		$3,320 81	or 83.8%
Labour		1,150 00	or 18.6%
Interest (6% on $5,750)		345 00	or 9.3%
Shelter (estimated at $25 per horse)		575 00	
Harness repairs, etc.		315 00	
Miscellaneous—			
Shoeing	$386 60		
Veterinary service	46 00		
Sundries	23 00		
	$455 60	455 60	
Total yearly cost		$6,161 41	
Cost per horse		$ 267 88	

The average yearly feed requirement per horse has been as follows:—

Hay	6,512 lbs.
Oats	4,919.3 "
Corn	156.5 "
Bran	378.2 "

The average cost of rearing foals from weaning to one year of age has been as follows:—

Oats, 816 lbs. at 50 cents per bushel	$12 00
Bran, 498 lbs. at $30 per ton	7 47
Hay, 996 lbs. at $9 per ton	4 48
Roots, 540 lbs. at $3 per ton	54
Five months pasture with mare at $1 per month	$ 5 00
	$29 49

The Economy and Effect of Corn in the Winter Feeding of Horses

OBJECT OF EXPERIMENT

Project 86.—In order to ascertain the relative value and economy of corn to replace part of the oats in the winter ration for work-horses, an experiment was conducted during the past winter with our work-horses at the Central Experimental Farm.

ROUTINE

Fourteen horses were used in the experiment. The horses were fed for a period of twelve weeks, being fed for two consecutive weeks on each ration and then changed to the other ration. When one horse of a team received the regular ration his mate received that containing corn and vice versa.

Accurate figures were kept during the whole experiment—horses were weighed at the beginning and the end of each feeding period, the feed being carefully weighed also.

RATIONS

Ration No. 1.—Oats, 5 parts.
Corn, 8 parts.
Bran, 2 parts.
Hay (timothy and alsike).

Ration No. 2.—Oats, 13 parts.
Bran, 2 parts.
Hay (timothy and alsike).

The following table gives the averages only:—

Name of Horse	Ration No. 1—Six weeks			Ration No. 2—Six weeks		
	Grain fed	Cost grain	Gain or loss	Grain fed	Cost grain	Gain or loss
	lbs.	$ cts.		lbs.	$ cts.	
Ben	698	10 54	−15	698	11 31	50
Maude	655	9 89	15	672	10 88	10
Nigger	737	11 13	−25	729	11 81	60
Sam	698	10 54	−75	693	11 23	75
Harry	698	10 54	5	698	11 31	−15
Mack	698	10 54	10	698	11 31	−20
Diamond	493	7 44	−10	504	8 16	−15
Billy	505	7 63	35	518	8 39	−40
Walter	703	10 61	−45	698	11 31	−15
Sam	698	10 54	−30	703	11 39	25
Pony	693	10 46	70	693	11 23	20
Prince	570	8 61	20	572	9 27	−30
Darling	498	7 42	90	504	8 16	0
Fred	693	10 46	25	698	11 31	25
Total for six weeks	9,037	136 45	70	9,078	147 06	130
Average "	645	9 74	5	648	10 50	9·2

The following table gives the averages of the above table per day, with the rations fed, kinds and amounts of feed, and also the cost of feed per day:—

CORN vs. OATS

Rations fed	Amount fed per day	Initial weight horse	Gain	Daily cost of feed
Ration No. 1—				
Grain {Oats.....5 parts; Cracked corn.....8 "; Bran.....2 "}	15·3	1,658	0·12	·288c.
Mixed hay	16·5			
Ration No. 2—				
Grain {Oats.....13 parts; Bran.....2 "}	15·4	1,658	0·21	·306c.
Mixed hay	16·5			

FEED PRICES

The meal ration was charged at the ruling market prices, which were: Corn, $30 per ton; bran, $20 per ton; oats, 59 cents per bushel.

Hay was charged at actual cost of production, or $7 per ton.

RESULTS

Both rations proved to be very good, horses not only keeping up their weight, but gaining slightly. The losses or gains in weights of individual horses or teams that appeared in the table were due to an increase or decrease in the amount of work done and not to the change of the ration. During certain weeks, on account of inclement weather, etc., horses were necessarily idle for varying lengths of time Further, the nature of the work ranged from light and intermittent to heavy and continuous hauling, all of which introduction of a variable factor affected gains or losses.

No. 1 ration, containing corn, was cheaper, a saving of 2 cents per day per horse being made, and this without any detriment to the health or condition of the horses.

CONCLUSIONS

1. Corn is a palatable feed for horses and it can safely replace part of the oats in the winter ration of working horses, and this without reducing the endurance or energy of the horses in any way.

2. Under the then existing prices of corn and oats, the substituting of corn for a part of the oat ration resulted in a saving in cost of feed.

These conclusions are sound when corn is fed during winter. In summer, in very warm weather, the feeding of a heavy ration of corn may result in a lack of vigour, loss of weight, and cause the horses to sweat more readily—corn being too heating a food for use in hot weather. Further, heavy feeding of corn is likely to cause trouble with horses' legs—scurf, itch, swelling, etc.

PREVENTION OF JOINT ILL IN FOALS

Project 87.—Five mares were treated by the pre-inoculation method with the product of the Lederle Antitoxin Laboratories. This vaccine is not prepared specifically for the prevention of joint ill, but is of mixed origin and known as mixed Bacterial Vaccine. Each mare was inoculated three times previous to foaling, and

the foal inoculated with a prophylactic or preventative dose, when delivered. Further, the navel cord was given the customary dressing with tincture of iodine at the same time.

Five healthy foals were dropped, there being no sign of joint ill. At twenty-four days of age the strongest and most promising foal of the five suddenly developed unmistakeable symptoms of joint ill. Curative treatment of repeated and increasing doses (both as to quantity and strength of dilution) was begun. The disease manifested itself in both hocks, both stifles, and the muscling of both forelegs. Despite the virulence of the attack, the disease was controlled, and the foal apparently on a fair way to recovery, when intense swelling developed in the throat below the jaws. The foal died from suffocation shortly after.

The infection, in the above case, was undoubtedly of post-natal origin, the activity and general good health of this foal up until the age mentioned being specially commented upon. Later foaling mares were placed in a specially disinfected box stall in a new building bedded with shavings, and where no horses had been previously.

Conclusions are: (1) previous evidence toward the efficacy of joint ill vaccines in preventing this disease are borne out; (2) the indications would point toward the fact that in this case infection in the one case reported was of post-natal origin; (3) the fact that no cases were noted at or immediately following foaling would indicate the possibility that such infection was controlled by treatment, particularly in view of the trouble existing on these premises some years before.

Practical suggestions afforded further are that, where joint ill infection is present, every precaution should be taken as follows: first, to select clean, well-lighted foaling quarters, preferably, it would appear, in a building not regularly occupied by horses; second, to see that such quarters are limewashed thoroughly, floor, walls and ceiling, with a wash containing carbolic or other efficient creolin disinfectant, and finally the floors liberally covered with slaked lime; third, to make use of clean, fresh sawdust or, better, planer shavings as bedding. With the foregoing procedure, of course, must be included the practice of disinfection of the navel cord with tincture of iodine.

SHEEP

The flocks of Leicester and Shropshire sheep maintained on the Farm can be reported as doing very favourably. The flock now numbers 246 head, made up as follows:—

Leicesters—Breeding stock, 83 head; spring lambs, 59 head.

Shropshires—Breeding stock, 67 head; spring lambs, 37 head.

As was reported last year the Leicester flock was augmented by the importation of twelve yearling ewes. These gave excellent promise at the start but have since proved an expensive lot in that some died off for no apparent reason and others proved shy breeders. Only one ewe lamb was reared from the first crop of lambs from these imported ewes. The second crop of lambs gives promise of being a little better.

The Shropshire flock is improving steadily through the use of high-class sires. In the fall of 1921 an imported ram of Buttar breeding, "Buttar 223"—32759—, was used on the flock. He is a ram of exceptionally good type and is leaving his mark on this spring's crop of lambs.

The Connaught rifle ranges were again used for sheep-grazing purposes. The dry summer affected the pasture so that it was not as good as the previous year, but the wide range available offset this and the sheep kept in good condition. This year again little trouble was experienced with worms or kindred diseases owing to the

fresh pasture conditions and the wide range available as compared to the limited range available when they were pastured at the farm.

The poor markets, as compared with war years, again affected the sheep-breeding industry adversely and as a consequence there was a still further dropping off in the demand for pure-bred breeding stock, particularly rams. This was more noticeable with the Leicesters than with the Shropshires, owing to the low prices obtained for the grade of wool that even the best Leicesters will shear. They would need to be extra good for lamb and mutton production to offset their handicap in wool. Since they do not excel in these points, they must be scored down accordingly.

The lambing season of 1922 was quite early, so that most of the ewes were lambed by March 31. The returns were very gratifying indeed. In Shropshires, 29 ewes lambed 47 lambs, the majority of which were healthy. In Leicesters, 43 ewes lambed 77 lambs. However, a greater percentage of the Leicesters were weaklings.

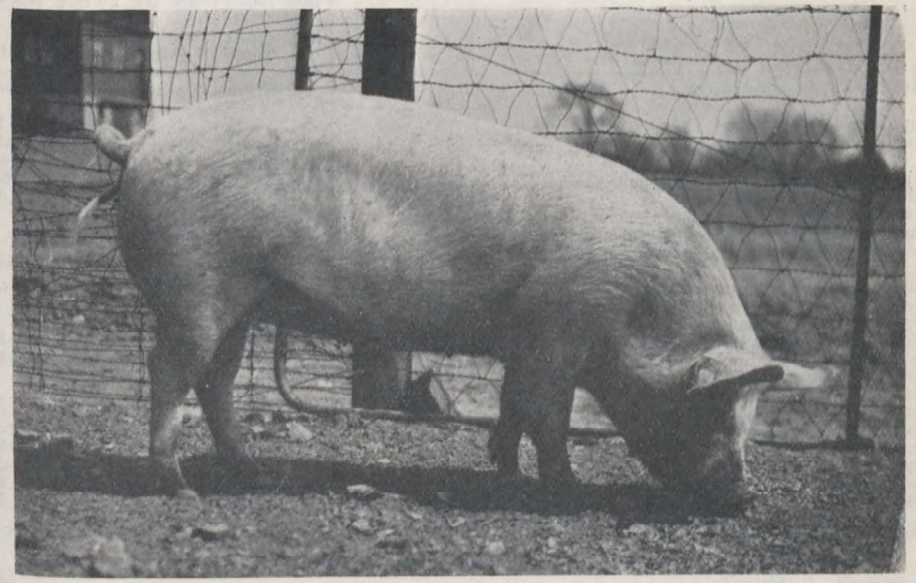
Waiting for the grass.
Ewes and lambs at the Central Experimental Farm

The 1921 wool clip yielded 1,151 pounds. This was sold on a graded basis and brought from 10 cents to 21 cents per pound, the former price being that received for the majority of the Leicester wool and the latter price being that received for a good part of the Shropshire wool. These figures serve to show the advantage the short-wooled sheep have over the long-wooled ones on a graded wool basis.

SWINE

The herd at the Central Experimental Farm now numbers 194 head in all, being made up of 137 Yorkshires and 57 Berkshires. Much careful selection and culling has been carried on during the past year. With Yorkshires new blood has been introduced through the use of boars sired by the boar Dalmeny Marengo (Imp.) from the celebrated herd of Lord Rosebery, Dalmeny Park, Scotland. Two or three distinct strains of merit have been developed. With Berkshires, boars have been selected from the Ontario herds. With the latter breed the characteristics sought have been (1) length of side, (2) depth of side, (3) smoothness of shoulder, (4) lack

of any pronounced tendency toward thickness generally; in general a strict adherence to bacon type with the retention of Berkshire breed characteristic. In the latter regard, while the result of matings has been entirely satisfactory from the bacon standpoint, the heads of the majority of the pigs have been slightly long. In fact a longer, leaner head has apparently developed relative to a longer, leaner body. Throughout the report of experiments following will be found reference, from time to time, to the two breeds. Particularly would the student of swine husbandry be referred to experiment No. 10, an analysis of Yorkshire and Berkshire hogs, live and dressed.



The required type.
An eight-months Yorkshire sow at the Central Experimental Farm.

Projects 76 and 77.

Feed Cost of Rearing Young Pigs

OBJECTS OF EXPERIMENT

1. To obtain information on the cost of rearing young pigs from farrowing to seven weeks of age.

2. To determine the respective value of skim-milk, buttermilk and water as supplements to the meal ration of brood sows while suckling pigs.

OUTLINE OF EXPERIMENT

Sow	Breed	Number of pigs farrowed	Number of pigs at seven weeks	Meal ration		Other feeds
No. 1	Yorkshire	12	10	Shorts Oats Barley	Equal parts	Buttermilk
No. 2	Yorkshire	11	9	Shorts Oats Barley	Equal parts	Skim-milk
No. 3	Yorkshire	11	4	Shorts Oats Barley	Equal parts	Water

WEIGHTS

All the feeds consumed by the sows were carefully weighed. The young pigs were weighed at birth and again at seven weeks of age.

PRICES CHARGED FOR FEEDS

Shorts, per ton	$23 00
Oats, per ton	30 00
Barley, per ton	31 00
Skim-milk or buttermilk, per cwt	25

TABLE No. I—RAISING PIGS FROM FARROWING TO SEVEN WEEKS OF AGE

—	Sow No. 1 (833B) Buttermilk and Meal	Sow No. 2 (74) Skim-milk and Meal	Sow No. 3 (805) Water and Meal
Breed	Yorkshire	Yorkshire	Yorkshire
Number of pigs in litter at birth	12	11	11
Condition of pigs	11 good, 1 small	all good	10 good, 1 small
Initial weight, gross (lbs.)	31	25	29
Initial weight, average	2·58	2·27	2·63
Number of pigs in litter at seven weeks (hogs)	10	9	4
Number of pigs dying or killed during seven weeks	2	2	7
Condition of live pigs at 7 weeks	good, dry in hair	good	good
Gross weight of litter at 7 weeks (lbs.)	195	222	88
Average weight of litter at 7 weeks "	19·5	24·6	22
Number of days in experiment (dys.)	49	49	49
Total pounds gained by live pigs (lbs.)	169·2	201·68	77·5
Average gain per animal "	16·9	22·4	19·4
Quantity of meal eaten for period "	330	289	344
Quantity of milk eaten for period "	1,370	1,260	.....
Quantity of meal consumed per lb. gain of pigs "	1·94	1·43	4·43
Quantity of milk consumed per lb. gain of pigs "	8·09	6·24	.....
Total cost of feed ($)	8·05	7·20	4·81
Cost of feed per head ($)	·805	·80	1·20
Cost of feed per head per day (c.)	1·64	1·63	2·44
Cost of feed to produce 1 lb. gain (c.)	4·7	3·5	6·2

Conclusions

The results from this experiment as found in the above table would seem to indicate that skim-milk is superior to buttermilk or water as a supplement to the sow's ration while nursing pigs. The poor showing of sow No. 3 was the result of the pigs being destroyed by the sow, and not because of ill health among the pigs. Because of the abnormally small number of pigs raised to seven weeks by No. 3 sow the water ration, as a result, shows to a disadvantage. From a further study of this table we find that the water and meal fed sow consumed only 3 pounds of meal more daily than the buttermilk and meal fed sow and 1·1 pounds more than the skim-milk and meal fed sow. The figures serve to demonstrate the material saving that seems possible from the feeding of a water and meal ration for the nursing sow. In view of the very limited number of sows under test, however, and also the small number of pigs raised by No. 3 sow, no very conclusive deductions are possible until more convincing results have been obtained.

Project 32.

PASTURE VS. GREEN FOOD IN PIGGERY

OBJECTS OF EXPERIMENT

1. To compare the feeding of hogs on alfalfa and clover pasture vs. green feed in piggery.

2. To compare the feed cost of hogs on pasture vs. hogs fed green feed in piggery.

3. To determine the most economical method of feeding hogs in summer.

4. To determine the feeding method conducive to the maximum gains.

PLAN OF EXPERIMENT

Lot No.	Breed	Number of Pigs	Days on Experiment	Meal Ration		Other Rations
I	Yorkshire	12	60	Shorts Corn Oats Oat flour Oil meal	4 parts 2 parts 2 parts 1 part 5%	Milk Clover pasture
II	Yorkshire	10	60	Shorts Corn Oats Oat flour Oil meal,	4 parts 2 parts 2 parts 1 part 5%	Milk Green feed

WEIGHTS

All feeds consumed were accurately weighed, except in the case of the green feed fed to the hogs on pasture.

Hogs were weighed at the commencement of the experiment, at the end of each thirty days, and on the completion of the experiment.

PRICES CHARGED FOR FEEDS

Oat flour	per ton	$35 00
Shorts	"	23 00
Corn	"	30 00
Oats	"	30 00
Oil meal	"	56 00
Milk	per cwt	0 25
Pasture	per mo	3 00
Clover hay	per ton	9 00

TABLE No. 2—PASTURE vs. GREEN FOOD IN PIGGERY

—		Lot 1, Pasture	Lot 2, Piggery
Number of hogs on experiment		12	10
Initial weight gross	(lbs.)	609	357
Initial weight average	(lbs.)	50·7	35·7
Finished weight gross	(lbs.)	1,602	1,020
Finished weight average	(lbs.)	133·5	102
Number of days in experiment	(dys)	60	60
Total gain for period	(lbs.)	993	663
Average daily gain per animal	(lbs.)	1·38	1·10
Quantity of meal eaten by groups for period	(lbs.)	1,820	1,220
Quantity of skim-milk eaten	(lbs.)	5,300	3,275
Quantity of clover eaten	(lbs.)	.....	950
Months on pasture	(mo.)	2	.....
Quantity of meal eaten per lb. gain	(lbs.)	1·83	1·85
Quantity of milk eaten per lb. gain	(lbs.)	5·33	4·75
Total cost of feed	($)	45·91	30·32
Cost of feed per head	($)	3·82	3·03
Cost of feed per head per day	(cts.)	6·36	5·05
Feed cost to produce 1 lb. gain	(cts.)	4·6	4·57

Conclusions

A comparison of these two lots of hogs leads to the observation that the hogs on pasture made greater gains than the lot fed inside. The reverse of this is generally true. The fact that lot No. I made greater gains may be explained in part at least when we note that these hogs were somewhat older than those in lot II and would therefore be likelier to make greater daily gains. One point which is

brought out by this experiment and which substantiates previous findings is the fact that more economical gains are possible when hogs are fed inside than when more or less range is available. It will be realised when we observe the average daily gains made by lot I, which showed an average of 1·38 pounds daily, that the opportunity of making maximum daily gains is not necessarily reduced when hogs are encouraged to take exercise such as is available on limited range or pasture, and it would further seem that the increased vigour of the hogs resulting from the following of such a practice enables the hogs to handle profitably larger quantities of feed with equally good if not better results.

Project 43.—Mineral and Molasses Experiment

OBJECTS OF EXPERIMENT

1. To compare the feeding of a mineral and meal ration with a meal ration.
2. To compare a molasses and meal ration with a meal ration.
3. To determine whether the addition of mineral matter to the ration in liberal quantities is beneficial for the growing pigs.
4. To determine if such is instrumental in encouraging increased growth.
5. To determine if molasses is beneficial for the growing pig.
6. To determine if the addition of molasses to a well-balanced meal ration is justified when judged on the basis of economy of gains.

PLAN OF EXPERIMENT

Four lots of pigs were fed on a standard meal ration for a period of 120 days.

The meal was fed in the nature of a slop.

In addition to the meal ration, No. I lot was supplied with mineral matter.

Lots III and IV were fed molasses to the amount of about 7 per cent of the meal ration.

Plan of Experiment

Lot	Breed	Number of Pigs	Meal Ration		Other Feeds	
I	Berkshire	5	Middlings	4 parts	Skim-milk	
			Corn	2 parts		
			Oats	2 parts	*Minerals*	
			Oat flour	1 part	Charcoal	44 lbs.
			Hominy	1 part	Ashes	2 lbs.
			Oil meal	5%	Bone meal	28 lbs.
					Blood meal	31 lbs.
					Rock phosphate	14 lbs.
					Soft coal	36 lbs.
II	Berkshire	9	Middlings.	4 parts		
			Corn	2 parts	Skim-milk	
			Oats	2 parts		
			Oat flour	1 part		
			Hominy	1 part		
			Oil meal	5%		
III	Berkshire	8	Middlings	4 parts	Molasses	
			Corn	2 parts		
			Oats	2 parts	Skim-milk	
			Oat flour	1 part		
			Hominy	1 part		
			Oil meal	5%		
IV	Yorkshire	8	Middlings	4 parts		
			Corn	2 parts	Molasses	
			Oats	2 parts		
			Oat flour	1 part	Skim-milk	
			Hominy	1 part		
			Oil meal	5%		

WEIGHTS

All feeds consumed were carefully and accurately weighed.

Hogs were weighed at the commencement of the experiment, at the end of each thirty-day period, and at the termination of the experiment.

PRICES CHARGED FOR FEEDS

Middlings	per ton	$31 00
Corn	"	30 00
Oats	"	30 00
Oat flour	"	37 00
Hominy	"	36 00
Oil meal	"	56 00
Bran	"	24 00
Shorts	"	23 00
Skim-milk	per cwt	0 25
Molasses	per gal	0 30

TABLE No. 3—MINERAL AND MOLASSES EXPERIMENT

—		Lot I Mineral and Meal	Lot II Meal	Lot III Molasses and Meal	Lot IV Molasses and Meal
Number of hogs in experiment	(hogs)	5	9	8	8
Initial weight gross	(lbs.)	157	184	151	363
Initial weight average	"	31·4	20·4	18·8	45·3
Finished weight gross	"	719	1,130	1,032	1,551
Finished weight average	"	143·8	125·5	129	193·9
Number of days in experiment	(dys.)	120	120	120	120
Total gains for period	(lbs.)	562	946	881	1,188
Average daily gain per animal	"	·935	·875	·917	1·23
Quantity of meal eaten by groups	"	1,074	1,754	1,688	2,934
Quantity of milk eaten by groups	"	3,357	5,116	5,076	6,670
Quantity of molasses eaten by groups	"	.....	.....	325	424
Quantity of mineral matter eaten by groups	"	155	.....	.....	.....
Pounds of meal eaten per lb. gain	"	1·91	1·85	1·91	2·46
Pounds of milk eaten per lb. gain	"	5·97	5·40	5·76	5·61
Pounds of molasses eaten per lb. gain	"	.....	.....	·36	·35
Pounds of mineral matter eaten per lb. gain	($)	·27	.....	.....	.....
Total cost of feed	($)	29·41	41 56	50 95	77 68
Cost of feed per head	($)	5 88	4 61	6 36	9 71
Cost of feed per head per day	(cts.)	4·9	3·84	5·30	8·25
Cost of feed to produce 1 lb. gain	(cts.)	5·23	4·39	5·78	6·53

Conclusions

In comparing lots I and II we find that the lot receiving minerals made slightly greater daily gains with the consumption of more meal and milk per pound gain and the feed cost is, therefore, also higher with the mineral-fed lot. The extra cost of the additional mineral ration would not seem to be warranted in view of the comparatively slight increased gains since these were obtained at a somewhat greater cost. Lots III and IV made greater daily gains than lot II, this being particularly true of lot IV which showed an average gain of one-third more than lot II. This may in part at least be attributed to the fact that the pigs in lot IV were more than double the weight of the pigs in lot II at the commencement of the experiment. As with lot I the amount of feed required per pound of gain in live weight was greater. The amount of food eaten per pound of gain is greater in the molasses fed lots as is also the feed cost per pound gain. This result is in agreement with former findings, which show that the addition of molasses to the ration results in an increased daily gain, but since this is accomplished by an increased amount of food consumption this use of molasses would not seem to be justified at its present cost except as a conditioner, in view of the fact that the increased gains are not sufficiently large to counterbalance the additional feed cost of the ration.

As with other experiments which have been conducted, the outstanding factor in this experiment is the economy of gains which it is possible to make when the meal ration is supplemented with milk products.

It will be noted from this table that the Yorkshires (lot IV) made greater daily gains, than the Berkshires (lot III), but these were made at a considerably greater feed cost.

Throughout the course of this experiment there was no trouble among the hogs that could be traced to the rations supplied. The molasses fed lots if anything possessed more gloss in hair and a somewhat higher finish than the other lots.

Yorkshires vs. Berkshires on Self-Feeders

OBJECTS OF EXPERIMENT

1. To compare Yorkshires and Berkshires fed on self-feeders.
2. To determine the adaptability of the self-feeder for raising Yorkshires and Berkshires for bacon purposes.
3. To determine the feed cost of feeding young pigs on self-feeders.

Plan of Experiment

Lot	Breed	Number of Pigs	Days on Experiment	Meal Ration	Parts	Other Rations
I	Yorkshire	18	90	Middlings Oats Corn Bran Oil meal	4 2 2 1 5%	Skim-milk
II	Berkshire	15	90	Middlings Oats Corn Bran Oil meal	4 2 2 1 5%	Skim-milk

WEIGHTS

Accurate weights were taken of all feeds consumed.

Hogs were weighed individually at the commencement of the experiment, at the termination of each 30 days, and at the completion of the experiment.

Prices Charged for Feeds

Middlings	per ton	$31 00
Oats	"	30 00
Corn	"	30 00
Bran	"	24 00
Oil meal	"	56 00
Skim-milk	per cwt	0 25

Project 33.

TABLE No. 4—SELF-FEEDERS FOR YOUNG PIGS

—		Lot I, Yorkshires	Lot II, Berkshires
Number of hogs in experiment	hogs	18	15
Initial weight gross	lbs	463	357
Initial weight average	"	25·7	23·8
Finished weight gross	"	1,904	1,675
Finished weight average	"	105·8	111·6
Number of days in experiment	dys	90	90
Total gain for period	lbs	1,441	1,318
Average daily gain per animal	"	·89	·97
Amount of meal eaten by group	"	3,205	3,161
Amount of skim-milk eaten by group	"	5,873	5,576
Amount of meal eaten per pound gain	"	2·22	2·44
Amount of milk eaten per pound gain	"	4·07	4·23
Total cost of feed	$	$64 48	$63 04
Cost of feed per head	"	$ 3 58	$ 4 20
Cost of feed per head per day	cts	3·97	4·66
Cost to produce 1 lb. gain	cts	4·46	4·77

Conclusions

The original number of pigs placed on this experiment when it commenced was considerably decreased before its completion, a number of the better individuals being taken out for show purposes when the experiment was partially completed. For this reason the lots do not appear so advantageously as would otherwise have been the case.

In the comparison of these two lots we find that the Berkshire lot made greater daily gains but required slightly greater amounts of both meal and milk per pound of gain. The increased gain, however, is not sufficiently great to show an advantage over the Yorkshire lot when we compare them in the final analysis of cost per pound gain. We therefore find that the Yorkshire lot gave the most economical gains which heretofore generally proved the exception rather than the rule with these two breeds of swine.

It will also be observed on comparing the amounts of meal consumed by these lots on the self-feeders with that consumed by pigs of a similar age fed by the trough feeding method, that the consumption in this instance is slightly greater than the average of trough fed hogs. This fact, that hogs on the self-feeder consume more feed per pound of gain than trough-fed hogs, is generally accepted.

Project 88.—Feeding Pure-Bred Yorkshire vs. Berkshire Swine vs. Cross-Bred.

OBJECTS OF EXPERIMENT

1. To compare pure-bred Yorkshires, Berkshires, and cross-breds from these two breeds (Berkshire boar: Yorkshire sow), as economical producers of bacon.
2. To determine the adaptability of these lots of swine for the production of Wiltshire sides, when judged as dressed carcasses.
3. To compare oat flour with ground oats as a feed for finishing swine.

PLAN OF EXPERIMENT

Each separate lot of hogs was fed for a period of sufficient duration to bring them up to the desired weight of bacon carcasses. (The most desirable size for a bacon hog when ready for market ranges between 175 and 215 pounds liveweight.)

The meal ration was fed in troughs, and was mixed with milk.

PLAN OF EXPERIMENT

Lot	Breed	Number of Pigs	Meal Ration Fed	Other Feeds
I	Cross-breds	8	Oat flour 2 parts Bran 1 part Shorts 1 part Corn 1 part Flax 6 per cent Tankage 3 per cent	Milk
II	Cross-breds	8	Ground oats 2 parts Shorts 2 parts Corn 1 part Flax 6 per cent Tankage 3 per cent	Milk
III	Berkshire	6	Ground oats 2 parts Shorts 2 parts Corn 1 part Flax 6 per cent Tankage 3 per cent	Milk
IV	Yorkshire	7	Ground oats 2 parts Shorts 2 parts Corn 1 part Flax 6 per cent Tankage 3 per cent	Milk

With the object of obtaining information relating to the comparative merits of pure-bred and cross-bred hogs of the Yorkshire and Berkshire breeds, two lots of cross-breds and one lot each of Yorkshires and Berkshires were fed from shortly after weaning to the time of finishing. The hogs were then slaughtered and comparisons were drawn between the different lots, with the chief object in view of determining the respective merits or demerits of these types of hogs from the standpoint of their qualifications for manufacture into Wiltshire sides. Table No. 5 gives the detailed results obtained in this feeding test.

WEIGHTS

All feeds consumed were accurately weighed and records kept. Individual weights of pigs were taken at the commencement of the experiment, at the end of each thirty-day period, and at the end of the experiment.

PRICES CHARGED FOR FEEDS

Oat flour	per ton	$ 35 00
Bran	"	24 00
Shorts	"	23 00
Cornmeal	"	30 00
Ground oats	"	30 00
Flax	"	56 00
Tankage	"	55 00
Milk	per cwt.	0 25

TABLE No. 5—PURE-BREDS VS. CROSS-BREDS

		Cross-Breds	Cross-Breds	Berkshires	Yorkshires
		Lot I	Lot II	Lot III	Lot IV
Number of hogs in experiment	hogs	8	8	6	7
Intial weight gross	lbs	342	361	237	246
Initial weight average	"	42·7	45·1	39·5	35·1
Finished weight gross	"	1,576	1,581	1,034	1,551
Finished weight average	"	197	198·9	172·3	221·5
Number of days in experiment	dys	119	119	119	133
Total gain for period	lbs	1,234	1,220	797	1,305
Average daily gain per animal	"	1·29	1·28	1·11	0·9800
Amount meal eaten by group	"	3,115	3,050	2,000	3,159
Amount skim milk eaten by group	"	6,990	7,130	4,857	7,178
Amount meal eaten per pound gain	"	2·52	2·50	2·51	2·42
Amount milk eaten per pound gain	"	5·66	5·83	6·08	5·5
Total cost of feed	$	63·43	59·63	39·50	61·24
Cost of feed per head	$	7·93	7·45	6·58	8·75
Cost of feed per head per day	cts.	6·74	6·26	5·52	6·57
Feed cost to produce 1 pound gain	"	5·14	4·88	4·95	4·69

Conclusions

A study of the above table leads to the following conclusions:—

That cross-bred swine are capable of making the maximum daily gains with the minimum of feed consumed as compared with the Berkshire lot. While, however, making greater daily gains than the Yorkshire, these last made somewhat more economical gains. One point that is worthy of note is, the fact that the Yorkshire lot of swine made considerably more economical gains than the Berkshire lot. This fact is more particularly of interest since it has generally been conceded that the Berkshires are more economical feeders than Yorkshires.

In comparing oat flour with ground oats we find that Lot I which was fed oat flour made slightly greater daily gains, but these were made at a higher feed cost. On slaughtering the hogs from the Berkshire lot it was found that while they

would grade up to the required weight demanded in the Wiltshire trade, averaging between 50 and 55 pounds to a side, they did not possess sufficient length of side or uniformity of fleshing, being thick on the shoulder and not carrying a uniform layer of fat along the back. All the pigs of this lot were open to criticism on these points.

The cross-bred lots possessed less uniformity of type than the Berkshire lot but averaged considerably longer in side and possessed more even distribution of flesh over the back, this last being particularly true in the case of some individual carcasses. The chief criticism that could be directed to these carcasses was their lack of uniformity in length of side, and uniformity of fat carried on the back. These carcasses on the average graded well up to weight, averaging between 60 and 65 pounds to a side, and were superior to the Berkshire carcasses for manufacture into Wiltshire sides.

The Yorkshire lot on being slaughtered showed a marked superiority both in quality of fleshing and the uniformity with which this fat was distributed along the back and sides. The heaviness at the shoulder as well as the tendency to run thin on the back which was particularly noticeable in the Berkshire lot and to a lesser extent in the cross-bred lots was lacking in these carcasses.

While the cross-bred carcasses would not give as desirable a Wiltshire side as the Yorkshire carcasses when averaging them as a lot, there were, however, carcasses in this lot that graded very favourably when judged by the standards required by the Wiltshire trade.

It would seem from this experiment that there is an opportunity offered for the production of the desired type of bacon hogs from a Berkshire-boar, Yorkshire-sow cross when boars of the required type are used, as this cross is an improvement on the ordinary Berkshire type for bacon purposes. This field is limited, however, in view of the fact that the Yorkshire carcass is superior, judging from the limited data on hand.

This experiment would also seem to indicate that the best grade of bacon cannot be obtained by forced feeding, since the Yorkshire lot consumed the lowest amount of meal and milk per pound gain and made the lowest daily gains but produced the higher grade of carcasses for the bacon trade.

Project 39.

Oat Feeding Experiment

OBJECTS OF EXPERIMENT

1. To determine the value of hulless oats as a feed for the growing hogs when compared with ordinary oats.
2. To compare skim-milk and buttermilk as supplements to the meal ration.

PLAN OF EXPERIMENT

Lots	Breeds	Number of Pigs	Meal Ration Fed	Other Feeds
I	Berkshire	5	Hulless oats 2 parts Shorts 1 part Middlings 1 part Flax 5 per cent Tankage 3 per cent	Buttermilk
II	Yorkshire	5	Ground oats 2 parts Shorts 1 part Middlings 1 part Flax 5 per cent Tankage 3 per cent	Buttermilk
III	Berkshire	4	Hulless oats 2 parts Shorts 1 part Middlings 1 part Flax 5 per cent Tankage 3 per cent	Skim-milk
IV	Yorkshire	5	Ground oats 2 parts Shorts 1 part Middlings 1 part Flax 5 per cent Tankage 3 per cent	Skim-milk
V	Yorkshire	5	Hulless oats 2 parts Shorts 1 part Middlings 1 part Flax 5 per cent Tankage 3 per cent	Buttermilk

WEIGHTS

All feeds that were utilized during this experiment were carefully weighed. Weights of the pigs were taken immediately before starting the experiment, on the termination of each thirty-day period, and at the end of the experiment.

PRICES CHARGED FOR FEEDS

Oats	per ton	$30 00
Shorts	"	23 00
Middlings	"	30 00
Flax	"	56 00
Tankage	"	55 00
Skim-milk or buttermilk	"	0 25

TABLE No. 6—OAT FEEDING EXPERIMENT

	Berkshire	Yorkshire	Berkshire	Yorkshire	Yorkshire
	Hulless oats buttermilk	Ground oats buttermilk	Hulless oats Skim-milk	Ground oats Skim-milk	Hulless oats buttermilk
	Lot I	Lot II	Lot III	Lot IV	Lot V
Number of hogs in experiment	5	5	4	5	5
Initial weight gross lbs.	206	235	140	248	222
Initial weight average "	41·2	47·0	35·0	49·6	44·4
Finished weight gross "	532	556	274	568	396
Finished weight average "	106·4	111·2	68·5	113·8	79·2
Number of days in experiment	60	60	53	53	47
Total gains for period lbs.	326	321	134	321	174
Average gain per animal "	65·2	64·2	33·5	64·2	34·8
Average daily gain per animal "	1·08	1·07	0·63	1·21	0·74
Quantity meal eaten by groups for period "	590	720	267	640	450
Quantity skim-milk eaten "	1,695	2,180	990	1,970	1,030
Quantity meal eaten per pound gain "	1·8	2·24	1·99	1·99	2·58
Quantity of milk eaten per pound gain "	5·19	6·8	7·38	6·13	5·92
Total cost of feed $	12·60	16·54	6·03	13·68	8·95
Cost of feed per head $	2·52	3·31	1·50	2·73	1·79
Cost of feed per head per day cts.	0·042	0·055	0·028	0·051	0·038
Feed cost to produce 1 pound gain "	3·8	5·15	4·5	4·26	5·00

Conclusions

This experiment was originally intended to cover a period of sixty days, but as the supply of hulless oats was not sufficient and no more was available, the feeding period of some of these lots was necessarily decreased. For this reason the results that have been obtained are not as conclusive nor do they convey as full information as would otherwise have been the case. Nevertheless certain conclusions may be drawn that are of value.

In comparing lots I and II we find that the lot fed hulless oats made slightly greater daily gains with a considerably lower feed cost.

In comparing lots III and IV we find the reverse to be the case, the lot fed hulless oats in this case making considerably lower daily gains while consuming a similar amount of meal per pound of gain and a greater amount of skim-milk.

Lot V, which was fed hulless oats, in some ways made the poorest showing of the five lots, making the second lowest average daily gains and requiring considerably more meal to make these gains than any of the other lots.

The greatest daily gain was made by lot IV, which was fed ground oats and skim-milk, while the lowest average daily gain was made by lot III, fed hulless oats and skim-milk.

The lowest meal consumption per pound of gain is found in lot I, fed hulless oats and buttermilk, while the highest meal consumption is found in lot V, fed hulless oats and buttermilk.

In view of the contradictory nature of these results, further feeding tests will have to be conducted to make accurate deductions possible.

The outstanding fact, however, that this experiment seems emphatically to prove is the remarkable economy of gains which the feeding of oats makes possible when added to a well-balanced meal ration supplemented with milk by-products.

Further, in view of the higher percentage of feed units possessed by hulless oats as compared to ordinary oats, it would seem that this feed pound for pound should be the most economical source of nutrition, but such has not been proven in this experiment.

Project 33a.

Finishing of Bacon Hogs

Free Choice Feeding and Self Watering vs. Trough Feeding

OBJECTS OF EXPERIMENT

1. To compare self-feeding and self-watering vs. trough feeding.
2. To determine the respective merits of these two systems of feeding as indicated by the finished hogs.
3. To determine which of these methods is most economical for pork production when compared on the basis of feed costs.

Plan of Experiment

Lot	Breed	Number of Pigs	Method of Feeding	Rations Fed
I	Yorkshire	6	Free choice self-feeder and watering device.	Whole corn Ground oats } Equal Shorts } parts Flax 5% Tankage (Fed dry)
II	Yorkshire	6	Trough	Ground corn } Equal Ground oats } parts Ground shorts } Flax 5% Tankage 3% (Fed as slop)

Lot II received skim-milk after 60 days.

Lot I was given free access to a self-feeder which contained whole corn, tankage and a mixture of oats and shorts mixed in equal proportion with 5 per cent of flax. The corn, tankage and meal mixture were supplied in three separate compartments. Water was supplied by the automatic watering device, and this was heated by three oil burners to prevent freezing, during the severe weather. Lot II were fed a ration consisting of equal parts of ground corn, oats and shorts with the addition of 5 per cent flax and 3 per cent tankage. This was mixed with water until the hogs were sixty days on experiment, after which date skim-milk was supplied. The trough-feeding method was used for this lot throughout the duration of the experiment.

WEIGHTS

Accurate weights of all feeds consumed by the separate lots were taken.

Hogs were weighed at the commencement of the experiment, at the end of each thirty-day period, and on the completion of the experiment.

PRICES CHARGED FOR FEEDS

Shorts	per ton	$23 00
Oats	"	30 00
Corn	"	30 00
Tankage	"	55 00
Flax	"	56 00
Oil (fuel)	per gal.	24½
Milk	per cwt.	25

TABLE No. 7—FINISHING BACON HOGS

FREE CHOICE FEEDER AND WATERING VS. TROUGH FEEDING

—		Lot I (60 days)	Lot II (90 days)
		Whole corn, oats, shorts (equal parts) Tankage Flax	Corn, oats, shorts (equal parts) Tankage, 3%, Flax, 5%
Number of hogs in experiment	hogs	6	6
Initial weight gross	lbs	823	727
Initial weight average	"	133·8	121·1
Finished weight gross	"	1,307	1,331
Finished weight average	"	217·8	221·8
Number of days in Exper	days	60	90
Total gain for period	lbs	484	604
Average daily gain per animal	"	1·34	1·12
Amount of whole corn eaten by group	"	2,145	.....
Amount of meal eaten by group	"	525	2,540
Amount of milk eaten by group	"	.....	1,950
Amount of corn eaten per lb. gain	"	4·41	.....
Amount of meal eaten per lb. gain	"	1·08	4·20
Amount of milk eaten per lb. gain	"	.....	3·23
Cost of operating watering device	($)	4·41	.....
Total cost of feed	($)	45·99	44 05
Cost of feed per head	($)	7·66	7 34
Cost of feed per head per day	(c.)	·126	·081
Feed cost to produce 1 lb. gain	(c.)	9·5	7·29

Conclusions

The above experiment had a number of points of particular interest that are well worth noting.

In the first place it is a comparison between the self-feeding method and the trough or hand-feeding method. The results which have been obtained indicate that with a satisfactory self-feeding device the possible daily gain is materially greater than with trough feeding. The possibility of preparing hogs for market at a much earlier date when such a device is used seems to be proven conclusively. Another factor which enters into the consideration and which is equally important from the production standpoint is that of economy of gain. When comparing these two lots on this basis we find the self-fed lot to be considerably more expensive to feed. One reason for this materially greater cost of production may be laid to the fact that under this system of a free-choice ration where the hogs were at liberty to consume the portion of the ration which proved most appetizing to them they selected the whole corn and consumed large quantities. Another fact which was proven on the completion of the experiment, was that the self-fed hogs did not dress into as desirable carcasses for bacon purposes, these being somewhat shorter in length of side and carrying an excess of fat in proportion to lean meat. For this reason it would seem that for the production of the most desirable bacon carcass the free-choice system is not satisfactory, more particularly when whole corn is supplied. It might further be observed that the self-feeding method is less desirable than that of trough feeding for the production of bacon carcasses. This is more particularly true in the earlier stages of the pig's life after weaning when much better results are obtainable where it is possible to regulate the feeding of the ration to meet the varying requirement of the growing pigs.

It should be observed in connection with the trough-fed pigs, that no milk was supplied until the last thirty days and for this reason the amount of meal required to produce one pound of gain is greater. As No. 1 lot was self-watered as well as

self-fed, full credit of gains made during the test cannot be laid to the advantages of using the self-feeding device but that part of the credit must be given to the watering device is undoubtedly true. In view of the relatively high cost of operating this watering device, it is doubtful if the use of such is profitable in cold weather.

The self-feeder and also the self-watering device used on this experiment were manufactured by the James Manufacturing Company. Both these appliances are constructed entirely of galvanized sheet-iron. The agitator and wheel for bringing the feed forward into the feeding trough both operated satisfactorily with the exception that when such heavy feed as whole corn was fed the weight of the feed on this wheel made the revolving of it somewhat difficult. This, however, did not prevent the hogs obtaining sufficient corn, as there was always an abundance in the trough. One revolving wheel and agitator supplied feed to each compartment.

Another device which proved very satisfactory and which is a feature of decided value on the feeder is the hinged door that completely closes the feeder when the hogs are not feeding. This door is hinged at the top and by simply pressing on this with its snout, the hog is enabled to obtain access to the feed trough. When the hog finishes feeding this door drops shut and prevents the loss of feed through such agencies as rats, mice, or birds. Feed is easily placed in the various compartments by raising the hinged top which opens the entire width of the feeder.

The salient features in favour of this feeder are: It is water and rain proof. It is long-lived. It is vermin proof and prevents loss of feed through the agency of rats, mice, and birds. It is comparatively easy to operate and automatic in action.

The watering device is automatic, supplying fresh water as it is consumed from the supply basins, one of which is located on each side of the tank. These are placed sufficiently high to prevent litter gaining access to them, but not so high that the pigs are inconvenienced when drinking.

Because of the fact that this watering device is of steel construction it is more subject to frost. Through the course of the experiment it was found that the heat supplied would keep the temperature of the water at a sufficiently high temperature to prevent its freezing when the thermometer did not fall lower than ten degrees above zero. Throughout the greater part of the time this experiment was in operation two lamps were necessary to prevent freezing, the coldest weather being about eighteen degrees below zero. The additional lamp was of two-burner type.

The parts of this waterer that were most subject to freezing were the watering basins where the water is exposed to the air and also the supply pipes to these basins.

The oil consumed by the lamps for the period of sixty days in which the experiment was in operation totalled eighteen gallons. It will be realized from this that the cost of finishing the hogs would be quite appreciably increased through this additional expense.

In order to gain more conclusive information of the practicability of such a device for supplying water to the hogs throughout the extreme weather such as is encountered in this country further experiments will be required.

Project 42.

Pulped Roots vs. Beet Pulp for Brood Sows

OBJECTS OF EXPERIMENT

1. To compare beet pulp with mangels as a source of succulence for the brood sow.

2. To compare beet pulp vs. mangels from the standpoint of the influence, beneficial or otherwise, that may be exerted by these feeds, on the pregnant sow and also on the litter.

PLAN OF EXPERIMENT

In order to obtain experimental data on the feeding of beet pulp to pregnant sows, five Yorkshire sows were supplied with a ration of meal and beet pulp. The daily ration of these sows averaged seven pounds of meal and one pound of beet pulp per sow.

In order to obtain a basis of comparison, five Yorkshire sows were selected from those farrowing during the same period as the sows receiving beet pulp. This was done with the object of having conditions under which the experiment was conducted as uniform as possible. This latter lot of sows was given an average daily ration of five pounds of meal and five pounds of pulped mangels per sow.

Water was supplied to both lots of sows. One of the sows on the beet pulp ration had not farrowed to date so has been eliminated from the table.

The meal ration supplied consisted of the following feeds: shorts, 1 part; bran, 1 part; screenings, 2 parts; tankage, 5 per cent.

TABLE No. 8—PULPED ROOTS vs. BEET PULP

FEEDING YORKSHIRE BROOD SOWS DURING THE GESTATION PERIOD

—		Beet Pulp, meal and Water	Pulped roots, Meal and Water
Number of sows in experiment		4	5
Number of days in experiment (average)	(dys)	114	114
Quantity of meal eaten by group for period	(lbs.)	3,192	2,850
Quantity of meal eaten per animal	(lbs.)	798	570
Quantity of roots or beet pulp eaten by group	(lbs.)	456	2,850
Quantity of roots or beet pulp eaten per animal	(lbs.)	114	570
Condition of individuals		good	good
Total cost of feed	($)	45·47	43·48
Cost of feed per head	($)	11·37	8·69
Results of Farrowing		Lot I, Beet Pulp, Meal and Water	Lot II, Pulped Mangels, Meal and Water
Number of sows in experiment	No.	4	5
Total number of pigs farrowed	"	36	60
Average number of pigs farrowed per litter	"	9	12
Total number of good pigs	"	29	49
Average number of good pigs per litter	"	7·25	9·8
Total number of small and weak pigs	"	4	10
Average number of small and weak pigs	"	1	2
Total number of dead pigs	"	3	1
Average number of dead pigs		·75	·2
Total weight of litters at birth	(lbs.)	102	165
Average weight of litters at birth	(lbs.)	25·5	33
Average weight of pigs at birth	(lbs.)	2·83	2·91

Conclusions

This experiment has resulted in supplying some interesting information. While the number of sows which were carried on this experiment are small the results nevertheless seem to be fairly conclusive.

While the factor of individuality will of course influence the size of the litters it does not seem probable that this factor alone would be responsible for the relatively poorer showing of the sows fed on the beet pulp. As to whether the succulence supplied in the ration of the pregnant sow will vary the number of

pigs in the litter or the condition of the pigs at farrowing, is an open question. It would seem from this experiment, however, that the sows fed on beet pulp and meal suffered a deleterious influence, resulting both in fewer pigs in the litters and also in smaller pigs at birth. The percentage of normal and healthy pigs at the time of farrowing is practically the same, the slight difference being in favour of the root fed sows. The mangel fed sows, however, farrowed an average of 2·5 more pigs per litter than those fed beet pulp.

The fact that the litters from the beet pulp fed lot averaged smaller, may have been because of hereditary influence, or it may have been the result of some deficiency in the ration which they received and it would seem probable under the circumstances that the latter was the case. The comparatively small number of individuals entering into this experiment coupled with the fact that this small number would be liable to show greater variation than a larger number make it unsatisfactory to draw any conclusive deductions.

Project 40.—Water Experiment

Object of Experiment

To determine if water kept before the pigs at all times in addition to the regular ration of meal and milk is instrumental in the production of increased gains.

Plan of Experiment

Lot	Breed	Number of Pigs	Days in Experiment	Meal Ration		Other Rations
I	Yorkshire	5	60	Shorts Middlings Corn Oats Tankage	1 part 1 part 1 part 1 part 5%	Buttermilk Water before pigs continually
II	Yorkshire	5	60	Shorts Middlings Corn Oats Tankage	1 part 1 part 1 part 1 part 5%	Buttermilk

Weights

Accurate weights of all feeds consumed were carefully kept for the period. Hogs were weighed individually at the commencement of the experiment, at the end of thirty days and on completion of the experiment.

Prices Charged for Feeds

Shorts	per ton	$23 00
Middlings	"	31 00
Oats	"	30 00
Corn	"	30 00
Tankage	"	55 00
Buttermilk	per cwt	0 25

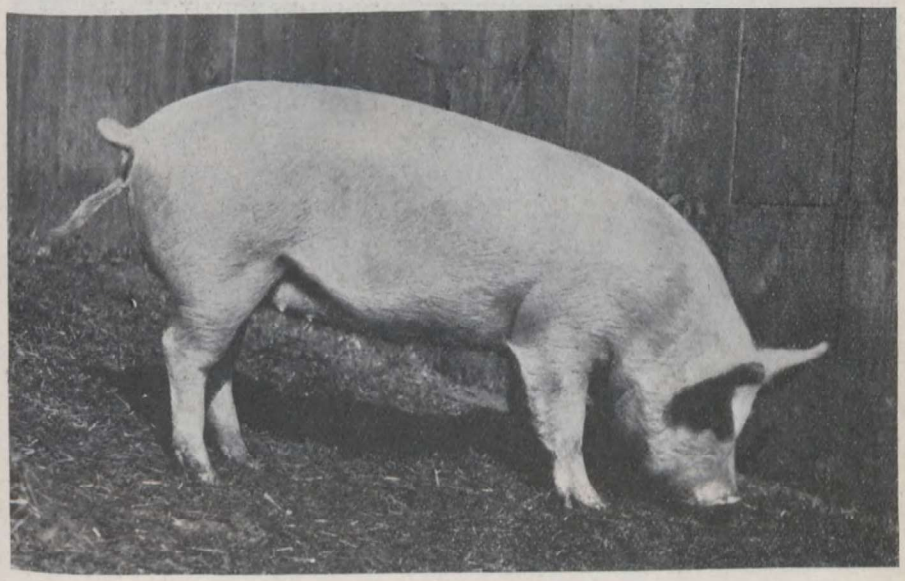
TABLE No. 9—WATER EXPERIMENT

—		Lot No. 1, Water	Lot No. 2, No water
Number of pigs in experiment		5	5
Initial weight gross	(lbs.)	681	597
Initial weight average		136·2	119·4
Finished weight gross		1,178	992
Finished weight average		235·6	198·4
Number of days in experiment	(dys)	60	60
Total gains for period	(lbs.)	497	395
Average daily gains per animal	"	1·65	1·31
Quantity of meal eaten by group	"	1,730	1,465
Quantity of skim-milk eaten by group	"	3,535	3,020
Pounds of meal eaten per lb. gain	"	3·48	3·7
Pounds of skim-milk eaten per lb. gain	"	7·11	7·64
Total cost of feed	($)	34 15	29 20
Cost of feed per head	($)	6·83	5·84
Cost of feed per head per day	(c.)	11·3	9·7
Cost of feed to produce 1 lb. gain	(c.)	6·8	7·3

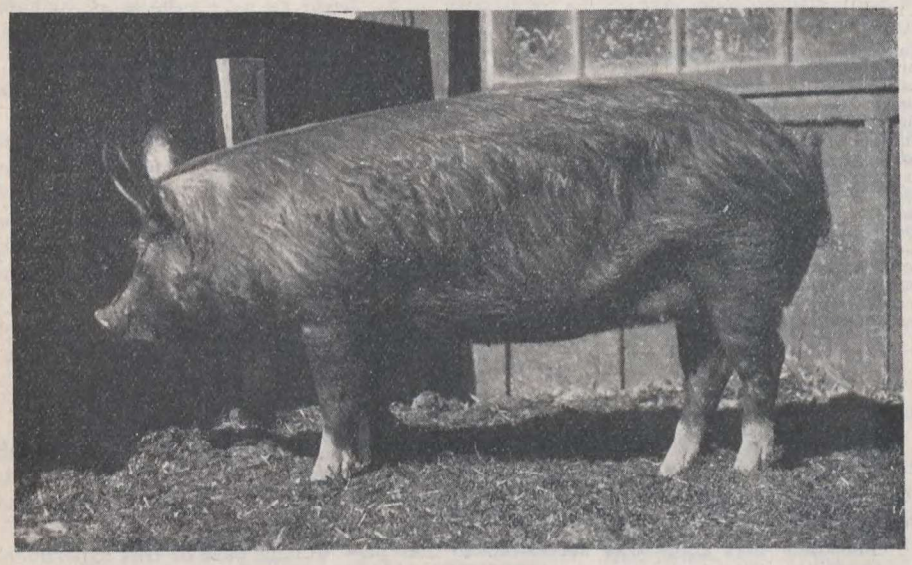
Conclusions

This experiment would indicate that the presence of water where it is available at all times for the use of the pigs, results both in greater daily gains and also in more economical gains. Further experimental work will have to be undertaken, however, in order to obtain confirmation of this observation.

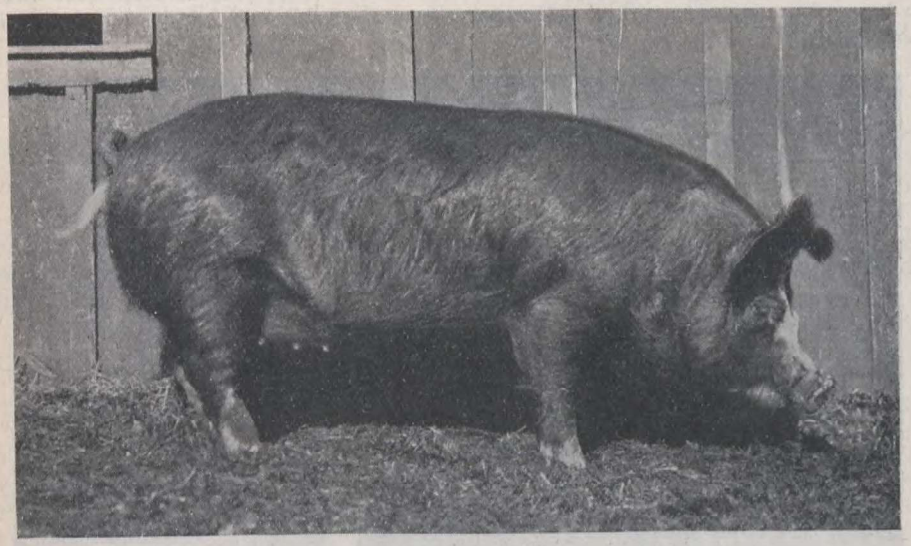
The fact that snow was accessible to the pigs during part of this experiment detracts somewhat from the accuracy of these results. Apart from this, however. the fact that the lot receiving the water made a materially better showing than the lot receiving no water would seem to indicate that the availability of slightly warmed water in cold weather where it is freely accessible to the pigs is decidedly beneficial. In this connection it seems reasonable to add that the supplying of fresh cool water to hogs while on pasture in the summer is very desirable and has proven decidedly beneficial.



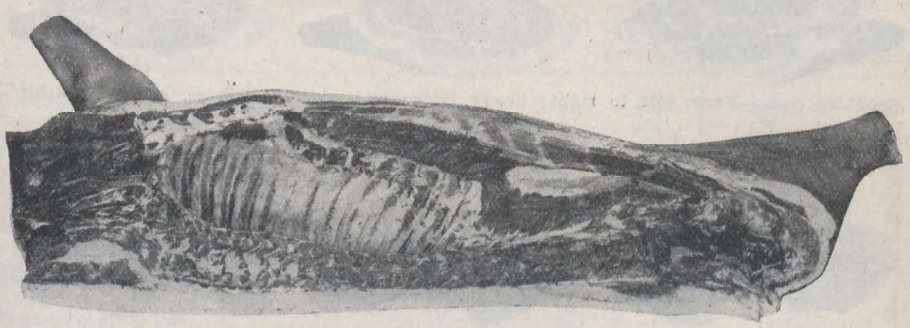
Select Yorkshire.



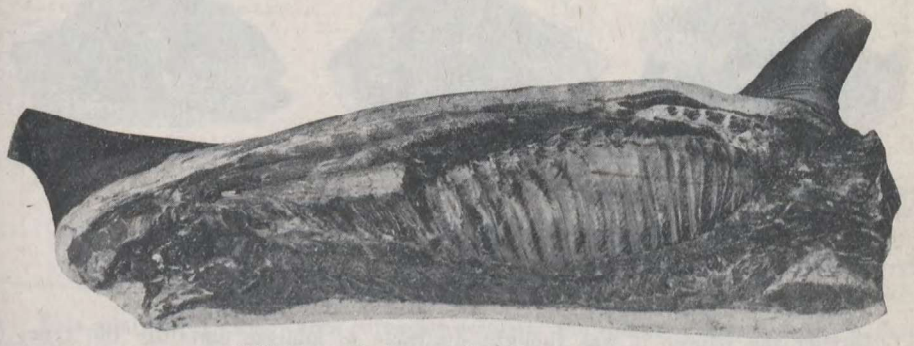
Select Berkshire.



Heavy Berkshire.



Wiltshire side from select Yorkshire carcass.



Wiltshire side from select Berkshire carcass.

Wiltshire side from heavy Berkshire carcass.

Shoulder cuts.—From left to right; heavy Berkshire, select Berkshire, select Yorkshire.

Loin cuts.—From left to right: select Berkshire, heavy Berkshire, select Yorkshire.

Hams.—From left to right: heavy Berkshire, select Berkshire, select Yorkshire.

Project 90.

OBJECT OF EXPERIMENT

During the winter it was thought desirable to analyze carefully the types of bacon hogs being raised (*a*) as a class, (*b*) comparatively as regards Yorkshires and Berkshires, (*c*) comparatively as regards the leaner and heavier types of Berkshires.

OUTLINE OF TEST

Three hogs were chosen, a select Yorkshire, a select Berkshire, and a Berkshire of the heavier and thicker type very commonly marketed. All were slightly heavier than desirable, but the two former, at least, would have graded as select hogs. These hogs were slaughtered and dressed by an official of the department with much experience in the packing business both here and in Denmark and with the full knowledge of the bacon requirements of the British market. As much light may be thrown on the subject, in report form, by photographs, a number of illustrations are shown: (1) the live hogs, (2) the sides, (3) the Wiltshire sides, (4) shoulder loin and ham cuts, (5) groups of Yorkshire and Berkshire hogs as representing the type sought after in the herd at Ottawa.

The following table gives an accurate comparison of the three carcasses which were selected:—

TABLE No. 10—COMPARISON OF YORKSHIRE AND BERKSHIRE CARCASSES

—		Select Yorkshire	Select Berkshire	Heavy Berkshire
Live weight	Lbs.	213	213	240
Dressed weight	"	168	176	197
Yield	P.C.	78·4	82·63	82·08
Wiltshire sides	Lbs.	138	146	158
Yield of Wiltshire from dressed weight	P.C.	82·14	83·0	80·2
Yield of Wiltshire from live weight	P.C.	64·78	68·54	65·83
Length of side from ham bone to neck joint	In.	40·0	39·5	39·0
Width of side at shoulder	In.	15·0	15·5	16·0
Width of side at loin	In.	14·0	13·5	14·0
Length of middle	In.	28·5	28·0	27·0
Thickness of fat at shoulder	In.	1·75	1·5	1·75
Thickness of fat at back	In.	1·25	1·25	1·25
Thickness of fat at loin	In.	1·5	1·5	1·25
X cut of middle, back fat	In.	1·25	1·25	1·25
X cut of middle, back fat and lean	In.	3·0	3·5	3·75
Width of steak	In.	2·0	2·25	2·25
Weight of middle (one)	Lbs.	32·0	35·0	38·0
Weight of shoulder (one)	Lbs.	20·0	21·5	22·5
Weight of gammon (one)	Lbs.	16·5	16·0	17·5
Weight of back (one)	Lbs.	19·5	21·0	21·0
Weight of steak (one)	Lbs.	12·5	13·5	17·0
Weight of whole side of Wiltshire	Lbs.	69·0	73·0	79·0
Total weight of trimmings	Lbs.	15·0	16·0	18·0
Yield of middle	P.C.	46·38	47·95	48·1
Yield of fore cut	P.C.	29·0	29·45	28·49
Yield of gammon	P.C.	23·92	21·92	22·15
Yield of back	P.C.	28·27	28·77	26·58
Yield of steak	P.C.	18·12	18·5	21·52
Remarks:	Quality Grade	A 1 Leanest	Excellent Leanest	Good Lean
		Owing to good length will pass for best price.	A shade too heavy for choice price.	Discounted for weight.

This analysis of these three carcasses presents the different cuts in such a form that these can be accurately compared. Of the three, the carcass from the Yorkshire hog fulfils most closely the requirements of the packers. This carcass carried less waste, and while not as uniform in the thickness of fat along the back, shoulder and loin as desired, it still graded as a carcass of the first quality. The select Berkshire carcass while running a trifle heavier than is desired by the most exacting trade, produced, nevertheless, an excellent bacon side, being excelled by the Yorkshire carcass chiefly because of the slightly greater length of the latter. The heavy Berkshire was open to criticism chiefly because of its being somewhat heavier than is desirable, producing a side somewhat thicker and heavier than is desirable. Both these Berkshire carcasses were from hogs of the lengthier type and tended to resemble the Yorkshire type of bacon hogs in this respect.

Project 76.

COST OF RAISING PIGS TO TEN WEEKS

(*a*) Service of boar	$1 00	$1 00
(*b*) Feed cost of dam during generation—		
625 lbs. meal at $23.50 per ton (bran and shorts)	7 35	
700 lbs. roots at $3 per ton	1 05	
50 lbs. mixed clover hay at $7	17	
		8 57
(*c*) Farrowing to weaning—		
210 lbs. of meal at $28 per ton (shorts, oats and middlings)	$2 94	
500 lbs. skim-milk at 20 cents per cwt	1 00	
		3 94
(*d*) Feed cost of weaned litter (7) from 7 to 10 weeks of age (including meal eaten by pigs while with sow)—		
92 lbs. meal at $30 per ton (middlings, oat flour and oil meal)	$1 38	
760 lbs. skim-milk at 20 cents per cwt	1 52	
		2 90

SUMMARY

Feed cost of sow from breeding to weaning	$12 51
Boar service	1 00
Cost of seven pigs weaning to 10 weeks	2 90
Total cost of seven pigs	$16 41
Feed cost per pig at 10 weeks	$ 2 35

Project 19.—YORKSHIRES VS. BERKSHIRES

COMPARISON OF FARROWING AND WEANING RECORDS

An analysis of the results indicated by the following table points to the fact that while the results obtained from the two breeds of swine are characteristic, both breeds made a somewhat poorer showing than for the previous year. One of the outstanding facts borne out by this table is the heavy mortality between birth and eight weeks of age, among the young pigs.

Definite figures are not available for the actual number of pigs fit for breeding purposes for the reason that all such pigs are not disposed of for this purpose. The figures submitted, however, are sufficiently accurate to indicate very closely the total number of pigs which would develop into desirable breeding stock.

TABLE No. II—COMPARISON OF YORKSHIRE AND BERKSHIRE FARROWING AND WEANING RECORDS FOR 1921-22

Breed	Total number of sows	Total number of pigs farrowed	Average number of pigs per litter	Total number of pigs dead at birth	Per cent of dead pigs at birth	Total number of small and weak pigs at birth	Per cent of small and weak pigs	Total number of normal and living pigs at birth	Per cent of normal and living pigs at birth	Total number of living pigs at eight weeks	Total losses during the 1st eight weeks	Per cent losses during the first eight weeks	Average litter at birth	Average number of pigs in litter at eight weeks	Per cent of pigs raised to eight weeks	Total number fit for breeding purposes	Per cent fit for breeding purposes	Total number fit for feeding purposes only	Per cent fit for feeders only
Yorkshire	29	335	11·55	28	8·38	54	16·11	253	75·51	195	104	41·7	11·55	6·72	58·2	141	72·3	54	27·6
Berkshire	15	138	9·2	3	2·1	18	13·04	117	84·78	95	43	31·15	9·20	6·3	68·4	64	67·3	31	32·6

VENTILATION

The following tests were undertaken with the object of obtaining an insight into the efficiency with which the ventilation systems in a number of the barns were operating at the Central Experimental Farm. The ideal ventilation system should be automatic and should so adjust itself that varying climatic conditions would not affect or vary the conditions within the stable. Such a system has as yet not been perfected, so adjustments must be made as the operator thinks necessary.

It was the desire throughout these tests to maintain the stable temperature between 50 and 55 degrees Fahrenheit and the humidity about 75 per cent. Accurate data were obtained on the temperature by the use of recording thermometers. Readings of the humidity were taken from time to time by the use of hydrometers or wet and dry bulb thermometers.

This series of tests was conducted in the main cow barn, in the calf barn and in the horse stable.

THE MAIN COW BARN

This barn is placed east and west; has a cubic air space of 68,400 cubic feet; and accommodates 88 head of stock, all of which are two years of age or older. This gives an average air space, per head, of approximately 777 cubic feet.

Ventilation System.—The system of ventilation installed in this barn is the Rutherford. The fresh air intakes, which are ten in number, are located on the northern and eastern sides of the barn. The inner openings of these intakes are situated on the floor of the building. The dimensions of each of these intakes are eight by thirty-six inches, giving a total intake area of twenty square feet or approximately 82·7 square inches per head. The three outlets are placed along the centre line of the building, the lower opening of each being on a level with the ceiling. These outlet shafts each measure two by four (2 by 4) feet, giving a total area of twenty-four (24) square feet or an average of thirty-nine square inches of outlet area per head. These shafts are vertical except for a bend of a few feet near the peak of the roof, and may be closed entirely if desired. The intakes do not completely close and only permit of a maximum reduction of about 75 per cent of the volume of air that is entering through them.

Ventilation Test.—This test was instituted with the purpose of determining, if possible, the most satisfactory adjustments of the intakes and outlet air flues, the object being to maintain the temperature between 50 and 55 degrees F. and the stable reasonably free from moisture. It was commenced on December 15 and continued for the remainder of the winter. The temperature of the stable was obtained by the use of a recording thermometer, while the humidity was recorded by a wet and dry bulb thermometer, readings of which were taken six times daily at regular intervals. The prevailing temperature was also recorded.

The following results were obtained from different adjustments of the intakes and outlets:—

TABLE I

Day	Outside temperature	Inside temperature	Inside moisture	Inlets	Outlets	Remarks
			p.c.			
Dec. 16— 5 a.m.	0·3	48·0	73·0	Closed....	Middle one closed, other two open.	
11 a.m.	7·0	47·0	73·0	" ...		
5 p.m.	4·00	50·0	74·0	" ...	Middle one closed, other two one-half closed.	Decrease of air circulation in closing part of outlet area.
10 p.m.	2·0	55·0	81·0	" ...		

NOTE.—Inlets: closed from outside only.

It will be seen by the above table that while the intakes were not entirely closed, the temperature and humidity of the stable could be maintained at the desired points by adjusting the outlets.

TABLE II

Day	Outside temperature	Inside temperature	Inside moisture	Inlets	Outlets	Remarks
			p.c.			
Dec. 21— 5 a.m.	8·8	50	85	Closed....	Middle closed, other two open.	
9 a.m.	2·1	46	73	All open..		North wind blowing.
5 p.m.	−3·0	44	70	" ..	" "	Too cold and draughty.
10 p.m.	−5·0	41	64	" ..	" "	

The above table indicates that with the intakes all open, the stable temperature was much lower than was desirable. There was a low humidity, but too great a draught was set up, resulting in the stock near the intakes becoming chilled. It was then decided to close all intakes to their limit (about 75 per cent) and only permit an average flow of air of about six to eight square inches per animal. All adjustments were then made on the outlets. The stable was always after this about the right temperature, and dry without any sign of moisture collecting in the more remote corners. The partial closing of the outlets during very severe weather conditions and opening in milder weather gave very satisfactory results. At times when the stable doors were frequently opened the temperature dropped as low as 44, but only for brief periods. The maximum temperature recorded for the period was 60. This was during the first week of February when the weather became mild. As the weather became milder throughout the months of March and April, it was found necessary to open the intakes fully for the greater part of the day.

The average humidity in the stable for the latter part of December and the month of January was approximately 75 per cent. The maximum humitity recorded was 85 per cent, which was taken on a rainy night, while the minimum was 64 per cent on December 21, on which day all ventilators were open.

For the greater part of the winter it would seem that the proper adjustment would consist of the closing of the intakes to 25 per cent of full capacity and maintaining the temperature of the stable by the regulation of the outlets.

THE CALF BARN

This barn has a cubic air space of 26,500 cubic feet and contains on the average about forty calves, which approximates 662 cubic feet of air space per head. This would seem to be considerably in excess of their requirements.

Ventilation System.—The ventilation system in this barn is a combination of the King and Rutherford systems. The construction of the intakes and outlets are so arranged that either system may be put into operation at will. The three intakes have a total area of 730 square inches, while the total area of the two outlets is 450 square inches. These supply an average intake area of 18 square inches and an average outlet of 11 square inches per head.

Because of the relatively large cubic air space and the small amount of heat generated by the calves, difficulty has been experienced from time to time in this stable to keep a uniform temperature. For this reason artificial heat has been supplied by means of a coal stove situated about the centre of the barn and operating continually during the winter months. This device developed sufficient heat in addition to that produced by the calves to promote satisfactory ventilation under most conditions.

Ventilation Test.—The initial part of this test was conducted under the King system of ventilation, this being the system in operation in the stable for the past few years. To commence with, all ventilators were opened to full capacity with the exception of the intake at the southern end, this being closed at all times reducing its capacity by about 60 per cent, it being necessary to do this because of the fact that the newly dropped calves were stabled in that section of the barn. This system has never given entire satisfaction in this stable, the air often being foul and damp and the ceiling at the northern end being damp and occasionally dripping moisture. This condition was relieved to some extent by fully opening the ventilators.

For purposes of comparison, the King and Rutherford systems were alternated for periods of one, two and three days, respectively, the purpose of these brief periods being to obtain data from both systems when the weather conditions were more or less similar.

The following tables show the results obtained under each system for a period of six days:—

KING SYSTEM

Day	Outside lowest temperature	Inside temperature	Moisture	Remarks
	degrees F	degrees F	p.c.	
Feb 7— 8 p.m.	.....	58·0	72	
11 p.m.	.....	56·0	77	
8— 4 a.m.	.....	50·0	70	South end outlet three-quarters closed for forenoon; temperature too low.
9 a.m.	−4·0	51·0	72	
8 p.m.	−3·0	54·0	76	Outlets all open.
11 p.m.	.....	54·0	76	
9— 4 a.m.	.....	52·0	75	
9 a.m.	8·8	59·0	78	
4 p.m.	10·0	56·5	79	
8 p.m.	.....	56·0	82	
11 p.m.	.....	58·0	77	
10— 4 a.m.	.....	58·0	77	Conditions fair at all times, no dripping from ceiling, but little moisture in spots, northwest corner especially being damp.
9 a.m.	13·0	55·0	78	
4 p.m.	14·0	60·0	78	
Average 3 days	6·4	55·5	76·2	

RUTHERFORD SYSTEM

Day	Outside lowest temperature	Inside temperature	Moisture	Remarks
	degrees F	degrees F	p.c.	
Feb. 10— 8 p.m.	.....	60	78	
11 p.m.	.....	58	77	
11— 4 a.m.	.....	56	80	
9 a.m.	14·0	57	78	
8 p.m.	21·0	58	77	
11 p.m.	.....	55	76	
12— 4 a.m.	.....	51	70	
9 a.m.	−9·4	53	75	
8 p.m.	−9·0	54	76	
11 p.m.	.....	54	76	
13— 4 a.m.	.....	52	75	Fair condition at all times, about same as under King System.
9 a.m.	−2·0	54	76	
4 p.m.	−2·0	54	76	
Average 3 days	2·1	55	76·1	

Data from this test would seem to indicate that either one of these systems will operate equally well in this stable when artificial heat is supplied. It would seem, however, that the King system is better adapted to meet the requirements, this being more particularly true in cold weather. With the cold air entering at the floor, as is the case with the Rutherford, some trouble may result from the calves becoming

chilled and contracting colds or pneumonia. When fresh air is permitted to enter at the ceiling it has a greater opportunity to become warmed before coming in contact with the calves.

As in the main barn, the best results were obtained from partially closing the intakes and adjusting the outlets to suit varying climatic conditions.

It would seem particularly difficult to install a ventilation system in a barn of this nature that would operate successfully. When calves were the only occupants and the heat thrown off from their bodies was the only source of heat, it was found necessary to install artificial heat.

HORSE BARN

The tests conducted in this barn were undertaken with the object of determining the efficiency with which the ventilating system was operating. It was necessary to make these tests during the night when all the horses were stabled, it being impossible to obtain accurate or reliable information during working hours when many of the horses were at work. This barn has a cubic air space of 24,000 cubic feet. With its full capacity of twenty horses this allows about 1,200 cubic feet of air space per animal.

Ventilation System.—The ventilation system installed in this barn is the Rutherford. It comprises three intakes, each of which measures 15 by 30 inches, with a total area of 1,350 square inches or an average per horse of 67 square inches. The two outlets are 24 inches square, with a total area of 1,152 square inches or an average per horse of 57 square inches.

Results.—Records were kept during the month of February. The intakes were closed part way at the commencement of the test and not again moved, while any regulating that was found necessary was done by adjusting the outlets. Conditions in this stable were satisfactory at all times with no condensation of moisture on the walls or ceiling while the temperature was kept in the proximity of 50 degrees irrespective of the prevailing outside temperature, even when this dropped as low as 20 degrees below zero. This was found possible by operating the outlets without any trouble being experienced from draughts. The following table is indicative of these results:—

—	Temperature		Moisture
	Outside	Inside	
			p.c.
Average	6·0	50·2	74·5
Highest	38·8	58·0	79·0
Lowest	−22·0	46·0	68·0

General Conclusions and Summary

With our long Canadian winters when stock must be housed for a more or less prolonged period of the year and in order to be kept in a good healthy condition, some provision must be made for the liberal supply of fresh air at all times. A good ventilating system is the only satisfactory way to provide this in the stable.

The number of cattle or live stock housed in a given space is an important factor and one that directly influences the efficiency of any system. Too much crowding makes it difficult to avoid draughts and at the same time allow sufficient fresh air to enter; too few individuals will not generate sufficient heat to promote sufficient air movement or circulation to carry off foul air and the excess moisture. For the larger domestic animals, such as horses and cattle, a good rule to follow is to allow 600 to 800 cubic feet of air space for each animal two years of age or over.

As a rule it is advocated that each animal be allowed an area of 15 square inches of controlled outlet, and about 8 square inches of controlled inlet. It would seem that this should be the minimum and that twice or even more than this area

would be preferable. This would permit of sufficient ventilation in the warmer weather and it would also be possible to adjust to meet the requirements of colder weather. The inlet and outlet area of the ventilation system in the main barn is about three times that mentioned above and is not any too large for the successful ventilation of the stable throughout the warmer weather when the difference in temperature inside and outside is slight. Such a condition results in a decrease of the volume of air that circulates through the air flues. In very cold weather the proportionally greater difference in temperature of the air in the stable and that outside results in a vastly greater pressure of air from the outside because of the fact that this cold air is considerably heavier than the warmed air within the stable. It is this factor that makes the ventilation of a barn possible. With these forces in operation, it is obvious that some system of control must be introduced into the ventilating system. No one of our present systems is automatic and until such a system is perfected the prevailing method of regulating the flow of air, by means of an adjustable damper, must be followed.

Such factors as changes in temperature, humidity, direction and velocity of the wind, and many others must be provided for. It has been observed that even should the intakes be of insufficient size or entirely closed, for that matter, the installation of properly constructed outlets, which are operated with reasonable care and intelligence, will give fairly satisfactory results. This is explained, in part at least, by the fact that air can gain access around doors and windows in most stables. While this may be the case, such a source of fresh air inlet is by no means reliable. Properly constructed intakes and outlets of sufficient size to accommodate the needs of the particular building which they are to serve form the only satisfactory methods of controlling the ventilation.

Repeated observations during the past winter would tend to strengthen the assumption that the outlet is the most important end of the ventilating system. With an outtake shaft or shafts of correct size and proper construction, successful ventilation is assured, provided there is a sufficient and well distributed inlet area. The provision of excess inlet area need have no detrimental effect on proper air circulation, provided the individual inlets may be controlled. Indeed, during very mild weather, excess inlet area is a decided advantage.

Correct construction of the outtake shaft means that it must have airtight walls, of double construction, with building paper and an air space between; that it ascend perpendicularly until the roof of the building is reached, deflecting thence to the cowl at the peak; that each individual shaft be of proper size—not too large, with the danger of down flow, nor too small with excess friction retarding air flow; that it be *controlled* by a damper close to the lower end. Readers are further referred to Bulletin 78, "The Ventilation of Farm Buildings."

MISCELLANEOUS

The Dominion Animal Husbandman has visited all Farms and Stations in the system, at least once during the past year, those Farms in the east having been visited several times. Aside from this, the members of the staff of the Animal Husbandry Division have visited large numbers of exhibitions, live stock shows, meetings, short courses, conventions, etc., in various capacities. Judging has been undertaken, in an increased way, at a number of fall fairs and exhibitions.

BUILDING AND BUILDING PLANS

Cattle barns are under construction at three points on the Branch Farm system: Cap Rouge, Que.; Rosthern, Sask.; and Scott, Sask., and will fill much needed requirements.

The distribution of plans and blue-prints has been continued. Owing to the depression generally affecting farm matters, however, the call for information relative to buildings has been greatly lessened.