

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

SOFT PORK

AN

INVESTIGATION INTO ITS CHARACTER AND CAUSES

BY

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Chemist, Dominion Experimental Farms

BULLETIN No. 38

OCTOBER, 1901

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE.

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OTTAWA, Octo

To the Honourable
The Minister of Agriculture.

SIR,—I herewith submit for your approval Bulletin No. 38, of the Experimental Farm series, which has been prepared under my direction by Mr. F. T. Shutt, chemist of the Dominion Experimental Farms, in which is given the results of a series of investigations into the character and causes of soft pork.

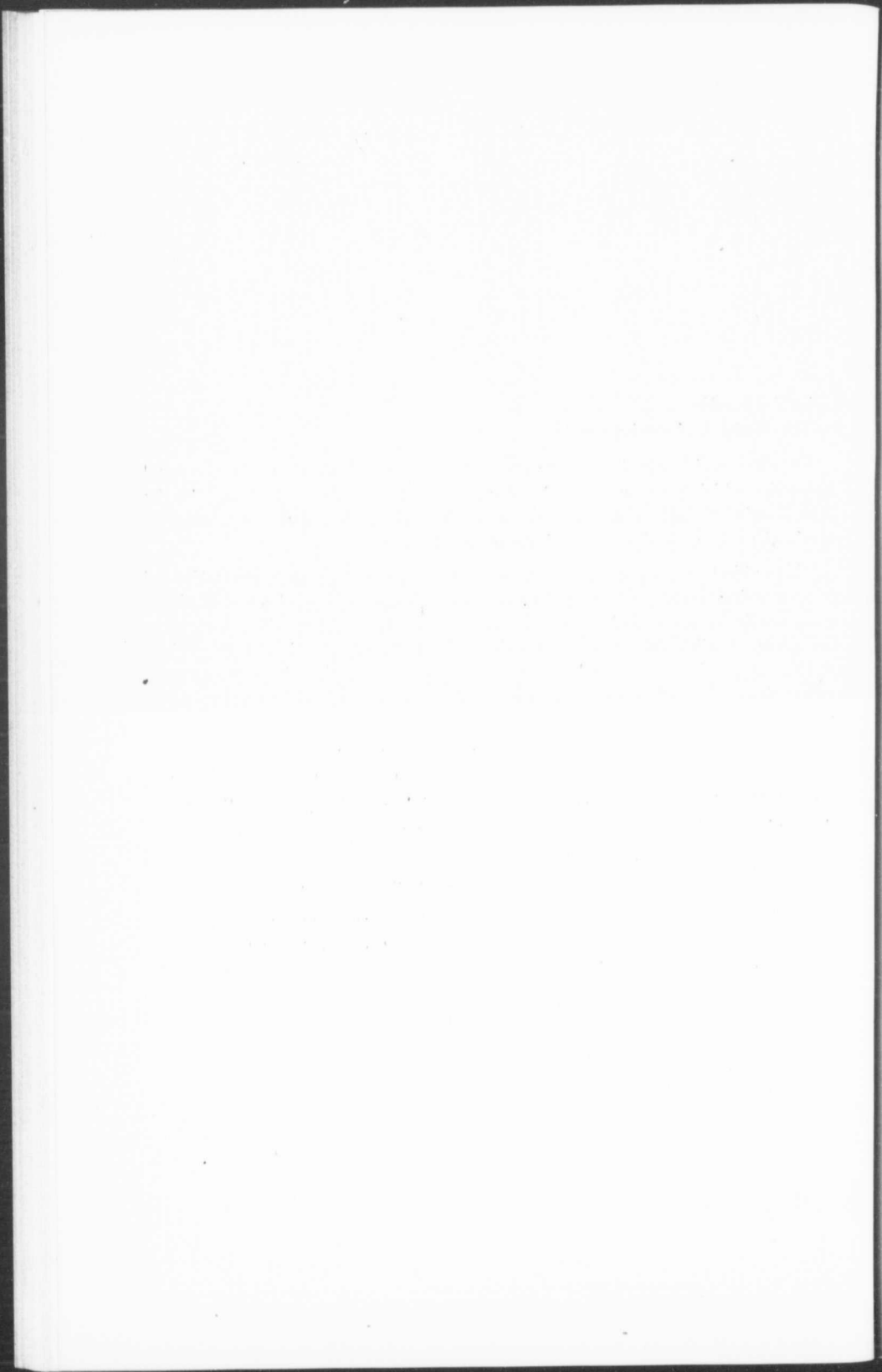
This subject is a most important one, bearing as it does on a profitable and rapidly growing branch of farm industry, one which can be carried on with advantage in nearly all the settled parts of the Dominion. From the results presented in this bulletin, it will be seen that much light has been thrown on this difficult subject, and that by persistent chemical research, based on the results obtained from the feeding of a variety of rations, the causes and conditions by which softness in the fat of pork is brought about are satisfactorily shown.

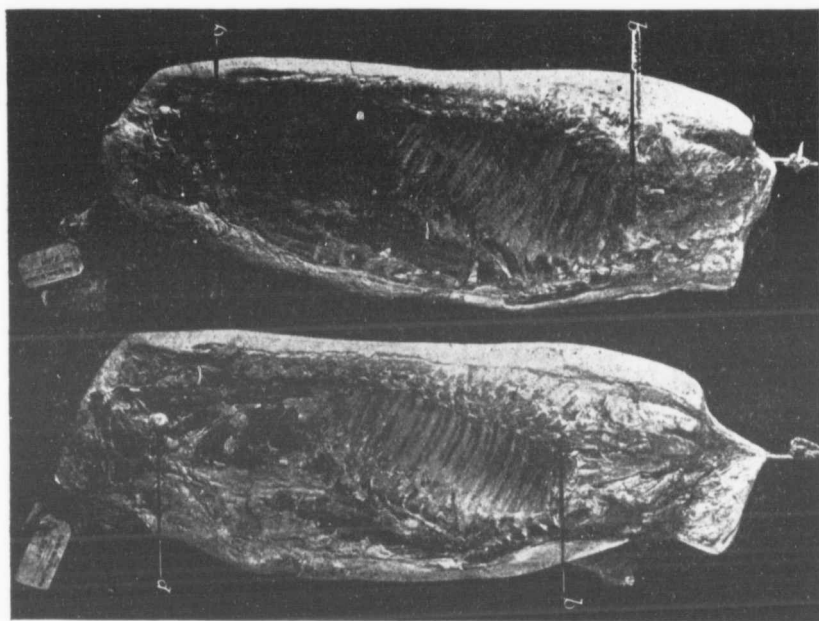
It is hoped that the information contained in this bulletin will be of much practical value to all who are engaged in the pork industry and that it will lead to greater uniformity of character and an average higher quality in Canadian bacon and stimulate further progress in this division of farm work.

I have the honour to be,
Your obedient servant,

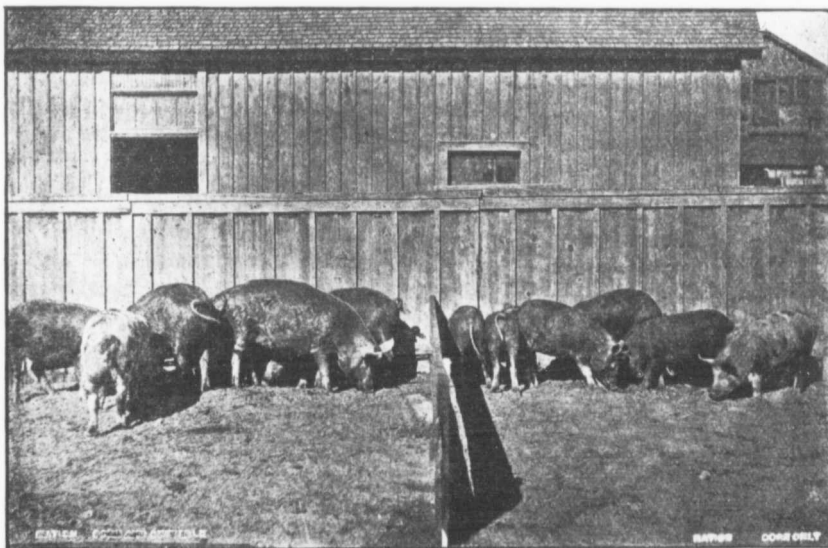
WM. SAUNDERS,
Director Experimental Farms.

OTTAWA, October 15, 1901.





FIRM AND SOFT SIDES OF PORK.



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SOFT PORK

AN INVESTIGATION INTO ITS CHARACTER AND CAUSES *

BY

FRANK T. SHUTT, M.A., F.C.S.,

Chemist, Dominion Experimental Farms.

INTRODUCTION.

That the export bacon trade is one of great importance to Canada is obvious from the fact that last year we received from England more than \$12,000,000 for this commodity alone. Moreover, the limit has not yet been reached; those engaged in the packing business assure us that the demand for first-class Canadian bacon will continue to increase for some years to come. It is, therefore, advisable that our farmers and dairymen should well understand the requirements of this large and remunerative market as regards size, shape, fatness and, above all, the character or quality of the bacon. These are matters which closely concern the raiser of pigs, for they are not under the control of the packer. Further, it is well to remember that the highest price will only be paid in England for that article which conforms with the demands of the consuming public, and that it is only first-class bacon that can be exported with profit.

Among the qualities necessary for first-class bacon in England, none is of greater importance than firmness. A tendency to softness or tenderness is quite sufficient to rate the bacon at second-class prices, and, if this softness is at all pronounced, to make it altogether unsaleable at a profit.

Since it was reported by our packers that a large, though varying, proportion of the pigs offered them produced soft bacon, and that this detrimental character specially characterized the produce of pigs from certain districts, it was held that an investigation to learn the nature and the cause or causes of 'soft' pork would, in all probability, furnish information of a most useful and valuable character.

*The feeding trials which this investigation necessitated were planned and conducted by Mr. J. H. Grisdale, Agriculturist, Central Experimental Farm. In addition to this most important part of the work, Mr. Grisdale, by his advice and assistance in the factory inspection and rating of the animals, has rendered most valuable aid, and I am much indebted to him for his hearty co-operation in bringing this research to a successful issue.

THE NATURE OF 'SOFTNESS.'

Naturally, the first step in undertaking the solution of this difficult problem was to ascertain the difference in composition of 'firm' and 'soft' pork, so that chemical analysis might be employed as an accurate discriminating agent in the examination of pork produced under varying conditions of food, exercise, &c., and that we might obtain standards that could serve as a basis for future work and comparison. Accordingly, we procured (February 1, 1899) from The Wm. Davies Co., Limited, Toronto, two (salted) Wiltshire sides, the one marked 'firm' and reported as of excellent quality; the other marked 'soft,' and stated as of very inferior quality. The former weighed 46 pounds; the latter, 44 pounds.

Both were frozen when received, but, nevertheless, there was a marked difference in the relative hardness of the two sides. As the sides thawed (at the temperature of the laboratory, about 70°F.) this difference—which was ascertained or measured by the resistance of the fatty portions to pressure by the finger—became still more pronounced. This was further evinced (February 2) in raising the ham by lifting as the sides lay on the table; the 'firm' remained fairly straight, whereas, the 'soft' doubled over. The relative softness is also shown in the accompanying photograph, the sides having been suspended the night previous. It illustrates the amount of 'drag' caused by the weight of the sides, similarly suspended by hooks. The extent of the 'drag' in the 'soft' side is much the greater.

The samples of the fat for examination were obtained by first cutting the sides (a) immediately in front of the thigh joint (socket of the femur in the pelvic arch), and (b) immediately in front of the first rib, and then taking the fatty tissue at each of these sections. Those taken at (a) are designated in the following tables as 'Loin'; those at (b) as 'Shoulder' (see photo). The precaution of confining the place or area from which the fat was taken was considered advisable from the fact that it has been stated that the fat varies considerably in composition, according to its position in the animal. Care was exercised in the preparation of the sample for analysis, to dissect out and reject all muscular tissue, blood vessels, &c.

The principal data obtained in this examination are presented in the following tables. Table I contains the percentages of the various constituents determined, in the fatty tissue of the two bacons:—

TABLE I.—Composition of Fatty Tissue in 'Firm' and 'Soft' Bacon.

	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Water.....	15.56	6.53	12.50	2.67
Salt.....	2.73	1.12	1.84	.48
Nitrogen.....	.504	.285	.243	.142
Fibre (nitrogenous tissue).....	3.15	1.78	1.52	.89
Fat.....	78.56	90.57	84.27	95.96
Olein in bacon.....	50.05	58.33	66.37	76.94
Palmitin and stearin in bacon.....	28.51	52.24	17.90	19.02

The fat proper consists essentially of olein, fluid at ordinary temperatures, and palmitin and stearin, solid at ordinary temperatures. It was hence conjectured that the percentage of olein would be found to be greater in the fat of the 'soft' than that

of the 'firm' and it is stearin in pure fats given in

Olein (calcul. Palmitin and Ratio of palmitin

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TABLE III.—

Melting point. Specific gravity. " " Sapon. equivalent Reichert number Iodine absorbed

*In addition the fat of soft investigation the composition, but its consistency linolein, which method of analysis rated and compared fats. From the sake of similarity used, it is interesting

of the 'firm' pork.* Accordingly, the olein in the dry, filtered fat was estimated, and it is from the figures so obtained that the percentages of olein and palmitin and stearin in the bacon, given above, were calculated. The detailed analyses of the pure fats and the ratio of the olein to palmitin and stearin contained therein are given in table II.

TABLE II.—Composition of Fat from 'Firm' and 'Soft' Bacon.

	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Olein (calculated).....	63.71	64.40	79.95	80.18
Palmitin and stearin.....	36.29	35.60	20.05	19.82
Ratio of palmitin and stearin to olein.....	1 : 1.76	1 : 1.80	1 : 3.99	1 : 4.02

These figures show very clearly that the fat of the 'soft' bacon contains a much larger proportion of olein than that of the 'firm' bacon, accompanied necessarily by a correspondingly decreased proportion of the solid fats, palmitin and stearin. We have in this fact—the large percentage of olein—the explanation of the peculiar and characteristic flabbiness of 'soft' pork. We also have afforded us in this discovery, through the estimation of olein, a ready means of tracing the effect of any particular food or condition on the pork produced.

Table III sets forth certain determinations made on the pure, filtered fat. Though of a strictly scientific character, they are of considerable importance, since they allow us to make deductions easily understood and of a practical character regarding the nature of the fats.

TABLE III.—Physical and Chemical Constants of Fat from 'Firm' and 'Soft' Bacon.

	Firm.		Soft.	
	Loin.	Shoulder.	Loin.	Shoulder.
	p. c.	p. c.	p. c.	p. c.
Melting point.....	37° 6' C.	37° 75' C.	27° 4' C.	28° 2' C.
Specific gravity at 96° C.....	.8668	.8859	.8678	.8740
" " 100° F.....	.9009	.8980	.8970	.8988
Sapon. equivalent.....	285.3	282.3	287.3	286.0
Reichert number.....	.408	.714	.408	.663
Iodine absorbed.....	55.3	55.9	69.4	69.6

*In addition to olein, no doubt a certain proportion of linolein—also a fluid fat—occurs in the fat of soft pork, and especially in that produced from corn. It will be seen from the present investigation that not only is there a close relationship between the consistency of a fat and its composition, but also that the food has a marked effect upon that composition, and hence upon its consistency or relative firmness. The oil of corn possesses more or less of this fluid fat linolein, which finds its way in part through the animal economy into the body fat. In the method of analysis employed, advantage was taken of the fact that these fluid fats are unsaturated and combine with iodine, and in this respect differ from palmitin and stearin, the solid fats. From the amount of iodine so absorbed, the fluid fat present was calculated, which, for the sake of simplicity, has been recorded in this bulletin as olein. Wherever the term olein is used, it is intended to include all fluid fats present.

No purpose will be served by discussing in detail the above data in this bulletin ; but the fact may be emphasized that they indicate the olein content and melting point, and especially the former, as data of great diagnostic value in this research. Indeed, to such a degree has subsequent work shown this to be the case that, although many other determinations, *e.g.*, nitrogen, non-fatty tissue, &c., were made on the larger number of pigs, we shall only present the figures for the olein and melting point estimations. We feel convinced that these data are reliable and in themselves sufficient to be used exclusively in pronouncing a judgment upon the relative firmness of the pork under investigation.

IMMATURE OR 'UNRIPE' PORK.

After the completion of the foregoing work and at the outset of the investigation about to be described, four very young pigs were examined in order to learn the nature of the fat of immature animals. Of these, two were from Western Ontario and two from Eastern Ontario. These pigs were slaughtered at the Geo. Matthews Co. Packing House, Hull, Que., June 27, and examined June 28, 1899. We adjudged Nos. 57 and 58 as decidedly soft, and Nos. 59 and 60 as only moderately firm.

An independent examination was made by Mr. W. E. Matthews, some two days later. His report is as follows :—'We have looked the little pigs over and think they are almost too small to secure anything definite from, but we find that Nos. 59 and 60 are by far the firmer pigs, No. 57 being a little soft, and No. 58 the softest of the lot. Not knowing where the pigs came from, we express the opinion that they are from what we would call a 'corn section,' as the fat on all shows signs of oil.'

It is to be noticed that this expert adjudged all the pigs soft (though varying in degree of softness), but considered them too small to draw definite conclusions from. It will now be shown that the laboratory data bear out in a marked manner Mr. Matthews's judgment. As already stated, only the data respecting the olein and melting point will be considered here, the other results being of minor importance for the purposes of this investigation.

TABLE IV.—Immature Pork ; Composition and Melting point.

No. of Pig.	Locality.	Dressed Weight.	Olein.		Ratio of Palmitin and Stearin to Olein.		Melting Point.	
			Shoulder.	Loin.	Shoulder.	Loin.	Shoulder.	Loin.
		Lbs.	p. c.	p. c.	p. c.	p. c.		
57	West.....	27	90.6	88.2	1:9.6	1:7.5	25.2° C.	24.4° C.
58	".....	23	86.9	85.9	1:6.5	1:6.1	24.5° C.	25.7° C.
59	East.....	42	83.3	82.2	1:4.9	1:4.6	27.6° C.	28.5° C.
60	".....	30	73.3	72.9	1:2.7	1:2.7	29.8° C.	32.0° C.

These pigs when killed had been recently weaned, hence the results furnish us with no information regarding the effect of feed ; it is significant, however, that the two softest were obtained from a so-called 'corn section' in Western Ontario.

If the above data are compared with those of table II. it will be observed that in all the fats the percentage of olein is considerably greater than that in the fat obtained from the 'firm' supplied by The Davies Co. Exceedingly instructive also is a comparison of the ratio of palmitin and stearin to olein. Thus, in the fat of the 'firm' pork of The Davies Co. we obtained 1 : 1.76 ; the ratio for the fat of the same part of the pig No. 60 (the firmest of the four) was 1 : 2.69.

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It seems probable that the fat of all young pigs contains a large amount of olein, and is consequently more or less soft. From this and subsequent work we are inclined to think that age and maturity or ripeness are factors of importance towards a 'firm' fat. In discussing the various rations used in this investigation, we shall place in each table the results obtained from certain immature or 'unripe' pigs (killed at about 100 lbs. live weight) taken from each pen, and it will be seen that the fat of these animals invariably possesses a larger percentage of olein than that of the remainder of the pigs on the same ration, which were not slaughtered until they had reached a live weight of 180 to 200 lbs.

STANDARDS OF FIRMNESS.

We are not as yet, perhaps, in a position to establish standards of firmness, that is, to say exactly what percentage of olein is to be considered as the limit for pork technically known as 'firm'; but for the purpose of comparing the various results here presented we shall be obliged to adopt provisional limits. These have been decided upon since the completion of the investigation, which has been in progress for the past two and a half years, from the chemical results and the ratings made at the packing house. In connection with the latter data, it should be stated that each dressed pig, after being thoroughly chilled, was critically examined at the packing house. In this investigation we adopted a scale of firmness ranging from 100 downwards. The cut surface of the fat along the back was felt and rubbed with the fingers, and that which was hardest and most resistant to pressure, rated at 100. The softest examined was placed at 20. Oiliness was also specially noted, and it is of interest to know there were but few cases in which the softness (slight resistance to pressure) was not accompanied by this quality. Thickness of fat, shape of carcase, &c., were also remarked.

It is to be pointed out as the result of our experience, that such an inspection, even when made by an expert, cannot furnish figures that will so closely differentiate as to relative softness as do the percentages of olein. In fact, in order to obtain comparative ratings, even of a fairly accurate character, it is essential that the carcasses should remain at least forty-eight hours after slaughtering in a refrigerating room of uniform temperature before inspection.

During several months of the winter, artificial refrigeration to chill the carcasses in the packing house is unnecessary at Ottawa, and it was noted not unfrequently that the temperatures to which the carcasses were exposed during these periods fell to many degrees below zero. As a natural result many of our ratings for individual pigs in the winter are too high. On the other hand, we have found that if owing to any cause the temperature of the refrigerating room in summer is allowed to rise, the ratings are too low.

For these and other obvious reasons, we believe that the olein content furnishes by far the more reliable indication of relative firmness; we are of the opinion that unless the very greatest care and judgment be exercised, the rating from inspection at the packing house is in a matter of close discrimination of little save corroborative value. It is for this reason that in the presentation of the subject we have arranged the ratings in the charts or tables according to percentages of olein rather than by the factory values. Further, to avoid as far as possible the introduction of error arising from such differences of temperature as we have alluded to, we have adopted certain terms and affixed values thereto, as indicated on the following page:—

ing Point.

der.	Loin.
° C.	24.4° C.
° C.	25.7° C.
° C.	28.5° C.
° C.	32.0° C.

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FACTORY OR INSPECTION RATINGS.*

Very firm	from 85 to 100 points.
Firm	" 75 " 85 "
Moderately firm	" 70 " 75 "
Soft	" 50 " 70 "
Very soft	Less than 50 "

The percentages of olein corresponding to the above classification we find to be approximately as follows :—

	Percentage of Olein.
Very firm	68 and less.
Firm	between 68 and 71
Moderately firm	" 71 " 73
Soft	" 73 " 75
Very soft	" 75 " above.

THEORIES REGARDING THE CAUSE OF 'SOFTNESS.'

Many theories have been advanced to account for softness in pork. Some have ascribed it to the character of the food, others to undue forcing of the pig in the earlier stages of growth, to killing the pig while in 'heat' or slaughtering while still immature or unripe, to the breed of the pig, to the locality or district in which the pig is grown, and even the phase of the moon when the pig is slaughtered has been assigned as a cause.

SCHEME AND OBJECTS OF THE INVESTIGATION.

On the completion of the preparatory work already recorded, the first series of feeding trials was instituted upon the Central Experimental Farm, Ottawa, followed by a laboratory examination of the pork produced. There were in all about one hundred and eighty pigs, and the experiment was commenced in the month of May, 1899, when the majority of them were between one and two months old.

They were either Tamworths or Tamworth grades.

The scheme of the trial was such that information would be gained as to the effect upon the quality of the pork of the following possible factors :—

1. Character of food (a) fed throughout life, and (b) fed during the initial and finishing periods, respectively.
2. Limited and unlimited supply of food.
3. Soaked or cooked grain as against dry or uncooked grain.
4. Age of animal when slaughtered.
5. Exercise and lack of exercise.
6. Locality or district where raised.

Details of the above may be briefly ascribed as follows :—

1. The character of the various foods used, together with particulars regarding its supply and treatment (*vide* 1, 2, and 3 above) are shown in the following scheme :—

*The pigs of both 1st and 2nd series were slaughtered and dressed at the packing house of The Geo. Matthews Co., Ltd., Hull, Que., where the inspection ratings were made. We are indebted to the Messrs. Matthews for much valuable advice and assistance in the grading of the carcasses.

RATIONS : FIRST SERIES OF FEEDING TRIALS, 1899.

- A. $\frac{1}{2}$ oats, pease and barley (in equal parts) } Boiled.
- B. $\frac{1}{2}$ oats, pease and barley (in equal parts) } Limited and unlimited.
- B. $\frac{1}{2}$ oats, pease and barley (in equal parts) } Dry.
- $\frac{1}{2}$ corn meal } Limited and unlimited.
- C. Corn meal exclusively Dry.
- Unlimited.
- D. Oats, pease and barley (in equal parts) Dry.
- Unlimited.
- E. Corn meal exclusively Soaked.
- Unlimited.
- F. Oats, pease and barley (in equal parts) Soaked.
- Unlimited.
- G. Beans, 1 part } Boiled.
- Shorts, $\frac{3}{4}$ part }
- H. FIRST PERIOD— $\frac{1}{2}$ corn meal } Boiled.
- $\frac{1}{2}$ oats, pease and barley (in } equal parts) }
- SECOND PERIOD—Corn meal Boiled.
- I. FIRST PERIOD— $\frac{1}{2}$ corn meal.
- $\frac{1}{2}$ oats, pease and barley (in } equal parts) } Dry.
- SECOND PERIOD—Corn meal Dry.
- J. FIRST PERIOD—Corn meal Dry.
- SECOND PERIOD—Oats, pease and barley (in equal } parts) } Dry.
- K. FIRST PERIOD—Oats, pease and barley (in equal } parts) } Dry.
- SECOND PERIOD—Corn meal Dry.
- L. FIRST PERIOD—Corn meal Soaker?
- SECOND PERIOD—Oats, pease and barley (in equal } parts) } Soaked.
- M. FIRST PERIOD—Oats, pease and barley (in equal } parts) } Soaked.
- SECOND PERIOD—Corn meal Soaked.
- N. $\frac{1}{2}$ corn meal.
- $\frac{1}{2}$ oats, pease and barley (in equal parts).
- O. $\frac{1}{2}$ corn meal.
- $\frac{1}{2}$ oats, pease and barley (in equal parts).
- Mangels.
- P. $\frac{1}{2}$ corn meal.
- $\frac{1}{2}$ oats, pease and barley (in equal parts).
- Pastured on clover.

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In pens H, I, J, K, L, M, it will be noticed that two rations were used; the first was fed until the pigs reached a live weight of 100 pounds, the second, from that weight until the pigs were finished. This method allowed us to ascertain the effect on the quality of the pork of the various rations at different periods of growth.

Where not otherwise stated, a sufficiency of green fodder, usually pease and oats, in addition to the grain ration was given to keep the animals in a thrifty condition.

2. As regards the supply of food, the pigs in one pen on each ration were given all they would eat, and this has been termed 'unlimited'; the pigs in the duplicate pen were fed with that quantity only that was thought necessary for normal growth; and this has been given in the tables as 'limited.'

It is very doubtful, however, if in experiments conducted with several pigs in a pen this classification is of any value, for we have found that, no matter what the supply may be, the larger animals practically get an unlimited quantity, while the smaller ones are sometimes on an extremely limited ration. We have accordingly grouped together in the tables of data the pigs on the 'limited' and 'unlimited' supplies of the same ration.

3. In two experiments, cooked as against a dry grain mixture was tried; in four cases, the effect of soaked as against dry grain was ascertained.

4. To ascertain what effect lack of maturity might have, two pigs from each pen were examined when they had reached the live weight of 100 pounds; the remainder were fed until they attained a live weight between 175 and 200 pounds.

5. To ascertain the result of exercise on the production of firm pork, an equal number of animals on each ration was placed (a) in small paddocks containing shanties or shelters, and, (b) in a pen of the piggery, each pen having a small yard attached. The pigs in the former are assumed to have had unlimited exercise, and are designated in the tables as 'outside' while those in the piggery are considered to have had limited exercise only. These latter are placed under the heading 'inside.'

6. Each pen, as a rule, consisted of sixteen pigs, eight of which had been obtained in Western Ontario (Essex and Kent counties) and eight in Eastern Ontario (Carleton County). This feature was adopted at the request of certain packers, who considered eastern bred pigs of better quality.

To render this account more concise, and consequently easier of comprehension, we purpose placing the detailed data in tabular form together at the end of the bulletin, simply discussing here the averages obtained from each pen. These data, although, as stated, are somewhat in detail, represent only a part of the estimations made. All the determinations which do not apparently throw any light on the object of this investigation have been omitted, for the reason that they might confuse the reader. On the same ground, the pigs on 'limited' and 'unlimited' rations are classed together and the averages of the results of the 'shoulder' and 'loin' fats are also given, the differences being too small to merit in this bulletin detailed discussion.

GENERAL RESULTS FROM FINISHED PIGS. FIRST SERIES, 1899.

In order to obtain at a glance the relative merits of the various rations in the production of firm pork, a table showing the average percentage of olein and the average melting point of each pen will be first presented. In this table the rations are arranged from above downwards in the order of 'firmness,' as indicated by the olein; that is, the ration giving least olein is placed at the head, and that producing most olein, at the bottom of the chart. We shall then discuss briefly these results and proceed to analyse more closely each ration separately, giving in chart form the figures for the olein content of the fat of the pigs obtained from the east and west respectively, and of those raised with and without exercise. In the appendix we shall place tables giving further details from each pen of pigs. These should be referred to in order to observe the effect of individuality among the animals similarly fed under the same conditions.

Ration
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TABLE V.—AVERAGES from determination of 1st Series, 1899.

Ration.	Composition of Ration.	Olein.	Melting Point.
F	Oats, pease and barley, $\frac{1}{3}$ each, soaked, unlimited	67.2	35.6
D	" " " dry, unlimited	67.5	34.2
B	$\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, dry, unlimited	71.1	34.4
A	" " " boiled, unlimited	72.7	33.6
B ¹	" " " dry, limited	73.1	33.1
M	1st Period: Oats, pease and barley, $\frac{1}{3}$ each, soaked. 2nd Period: Corn meal, soaked	73.4	32.5
N	$\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, dry, limited	73.7	30.5
K	1st Period: Oats, pease and barley, $\frac{1}{3}$ each, unlimited. 2nd Period: Corn meal, dry, unlimited	74.3	32.4
O	$\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, mangels	74.9	31.7
I	1st Period: $\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, dry, unlimited. 2nd Period: Corn meal, dry	75.4	32.4
A ¹	$\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, boiled, limited	75.9	33.6
P	$\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, steamed clover	76.1	32.1
L	1st Period: Corn meal, soaked. 2nd Period: Oats, pease and barley, $\frac{1}{3}$ each, soaked	76.4	32.3
I ¹	1st Period: $\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, dry, limited. 2nd Period: Corn meal, dry, limited	78.1	31.8
H	1st Period: $\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, boiled, unlimited. 2nd Period: Corn meal, boiled, unlimited	77.9	33.0
J	1st Period: Corn meal, dry, unlimited. 2nd Period: Oats, pease and barley, $\frac{1}{3}$ each, dry, unlimited	78.8	31.3
H ¹	1st Period: $\frac{1}{2}$ corn meal; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, boiled, limited. 2nd Period: Corn meal, boiled, limited	80.0	30.2
G	Beans 1 part, shorts $\frac{2}{3}$ part	84.7	31.0
C	Corn meal, dry, unlimited	92.0	30.9*
E	Corn meal, soaked, unlimited	92.4	27.7

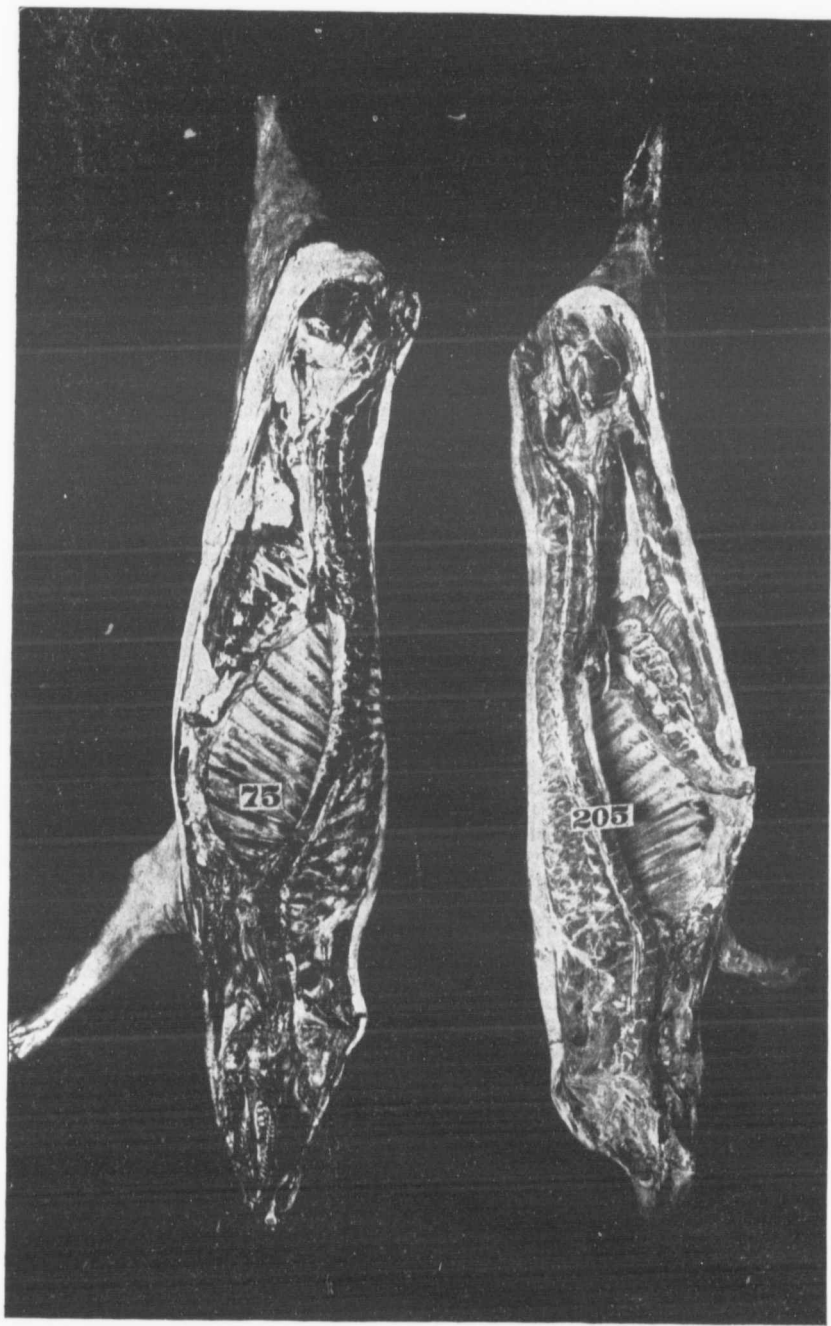
The more important inferences to be drawn from these data may be briefly stated as follow:—

1. That of all the grain rations employed, that consisting of equal parts of oats, pease and barley gave the firmest pork. It may further be added that the fat was deposited evenly and not too thickly, and that this ration gave a very thrifty growth.

2. That no difference could be observed in the firmness of the pork from the preceding ration whether fed soaked or dry.

3. That when half the grain ration (as in A and B) consists of corn meal, the resulting pork shows an increased percentage of olein; in other words, a tendency to softness.

* Melting point average on two pigs only, as the fat of the others was so soft that the melting point could not be determined.



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No. 205.—BEANS



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doubted proof of the 'soft' character of the fat of young pigs. Though all show a very large percentage of olein, the proportion of this constituent present varies with the character of the ration. The order of softness is practically identical with that found for the mature pigs, though that order has not been adopted in tabulating the results.

DETAILED DATA FROM THE GROUPS OF FIRST SERIES, 1899.

In the following tables we have given the results of the different rations fed under the varying conditions already enumerated, placing the figures side by side. We have, however, averaged the estimations from pigs under a limited and unlimited food supply, feeling assured that this distinction in pens containing a large number of pigs had little or no value. The data, therefore, set forth are the percentages of olein from the rations fed soaked or boiled and dry to eastern and western pigs, respectively, under conditions of limited and practically unlimited exercise, the latter being denoted in the tables as 'inside' and 'outside' respectively.

When comparing the rating by olein with those from inspection, it should be remembered that the former are averages from two or more animals, that may or may not differ materially, while the latter are from individuals. The ratings, therefore, are not strictly comparable. Further, owing to the fact that it was impossible to inspect and grade all the pigs at the same temperature, the inspection ratings cannot be considered so accurate an indication of relative firmness as the olein content, nor can it be expected, for the same reason, that this factory rating will always agree with the classification from the laboratory data.

RATION A AND B—ONE-HALF CORN MEAL; ONE-HALF OATS, PEASE AND BARLEY, IN EQUAL PARTS.

Considering first the finished pigs, we may bring together the olein content as follows:—

	Per cent Olein.
Boiled grain	74.3
Dry grain	72.1
Eastern pigs	73.4
Western pigs	73.0
Inside	71.9
Outside	74.5
Average of all	73.2

In connection with these data it will be instructive to note the ratings as to firmness obtained at the packing house:—

	V.F.	F.	M.F.	S.	V.S.
Boiled grain . . . . .	..	2	2	9	3
Dry grain	1	1	1	11	2
Eastern pigs . . . . .	..	2	2	11	1
Western pigs	1	1	1	9	4

The olein values place the majority of these pigs on the border line between 'moderately firm' and 'soft'; the inspection ratings adjudge twenty of the thirty-two animals as soft. It would seem, therefore, that when corn to the extent of half the ration is continued throughout life, and no corrective, as skim milk, is employed, the tendency will be towards the production of a soft or oily fat. In a number of the pigs the fat along the back was too thick and of uneven deposition.

The immature pigs of A and B (distinguished in the table by a dressed weight of less than 100 pounds) gave the following olein values :—

Boiled grain	82.7
Dry grain	81.7
Eastern pigs	78.6
Western pigs	86.7
Inside	83.6
Outside	80.1

The inspection ratings are as follows :—

		c.	v. s.
Eastern pigs		3	4
Western "		2	2

It is seen from these results that although the ration consisted of one-half of corn meal throughout the whole feeding period, the quality of the pork improved as the pigs reached maturity.

TABLE VII.

RATION A and B.—One-half Corn Meal ; one-half Oats, Pease and Barley.

No. of Pigs.	Dressed Weight.	PERCENTAGE OF OLEIN.							
		Boiled.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
1	Lbs. 67	77.2							
2	64			79.2					
1	66		91.6						
4	127	73.0							
4	136			75.6					
4	125		73.6						
4	121				75.0				
2	76					80.3			
2	65							77.8	
2	67						85.4		
1	60								83.2
4	140					70.5			
4	139							74.5	
4	133						70.6		
4	137								72.9

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RATION C AND E.—CORN MEAL EXCLUSIVELY.

The results from four pens fed upon corn meal only are given in Table VIII. The pigs with corn meal soaked and dry made very poor growth, very few of them reaching 100 pounds live weight before December (seven months) and several scarcely arriving at that weight by the following April, when the pigs would be eleven or twelve months old. Of the twenty-four animals in the two pens only five had exceeded 170 pounds live weight when the experiment was closed, May 28. Undoubtedly this lack of thrift is in a large measure due to the small proportion of nitrogenous or flesh-forming substances present in corn. Bone-forming material (mineral matter) is also deficient in this grain, and this fact no doubt still further accentuates its unsuitability when used alone, for young and growing stock.

As regards olein, the results show that the fat of all the pigs contain a very high percentage; the so-called finished pigs, in this instance, giving the larger figures. The data of each group are strikingly uniform, as will be noticed from the following tabulation :—

Finished Pigs.

	Per cent of Olein.
Soaked grain	92.5
Dry grain	92.1
Eastern pigs	91.2
Western pigs	93.4
Inside	92.3
Outside	92.3
Average of all	92.3

Immature Pigs.

Soaked grain	87.1
Dry grain	86.4
Eastern pigs	86.5
Western pigs	87.0
Inside	87.6
Outside	85.9
Average of all	86.8

By the olein standard, all fall into the class of 'very soft.' In many instances the melting point could not be taken owing to the fluidity of the fat.

Inspection at the packing house gave the rating of twenty-three very soft and one soft. In a large number of pigs the deposition of the fat was very meagre in amount and exceedingly soft in character, and the carcasses showed marked evidences of stunted or retarded growth. In every particular, corn meal as the exclusive grain showed itself unsuitable and unsatisfactory.

TABLE VIII.

RATION C and E.—Corn Meal.

No. of Pigs.	Dressed Weight.	PERCENTAGE OF OLEIN.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	
1	78	87.1							
1	88			84.5					
1	63		84.2						
1	71				92.6				
2	93	92.1							
2	93			92.3					
2	98		93.6						
2	110				91.9				
1	65					90.9			
1	69							83.6	
1	76						88.3		
1	72								82.9
2	90					87.9			
2	83							92.7	
2	88						95.5		
1	100								92.4

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RATIONS D AND F.—OATS, PEASE AND BARLEY IN EQUAL PARTS.

The percentages of olein of the twenty-four animals fed with the above ration will now be discussed. These pigs furnished the finest quality of pork of all those under experiment; the fat, for the most part, was exceedingly firm and even in thickness, about one and one-quarter inches in the finished animal. Growth was continuous and normal.

Notwithstanding the varying conditions of the trial, all the pigs on this most satisfactory ration gave a uniformly low olein content :

Finished Pigs.

	Percentage of Olein.
Soaked grain	67.2
Dry grain	67.7
Eastern pigs	67.9
Western pigs	67.0
Inside	67.0
Outside	67.9

The average, 67.5 per cent, places these pigs in the 'very firm' class.

The inspection ratings are as follow :—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	3	3	1	1	..
Dry grain	1	4	1	2	..
Eastern pigs	3	1	..	3	..
Western pigs	1	6	1	..	..

The immature pigs, as might be inferred from what has already been stated, gave a softer fat. The averages are subjoined :—

Immature Pigs.

	Percentage of Olein.
Soaked grain	74.5
Dry grain	81.8
Eastern pigs	76.4
Western pigs	79.2
Inside	82.6
Outside	70.9

Their inspection ratings are as follow :—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	2	..	..	1
Dry grain	3
Eastern pigs	1	..	1	2
Western pigs	1	..	1	1

TABLE IX.

RATION D and F.—Oats, Pease and Barley, one-third each.

No. of Pigs.	Dressed Weight. Lbs.	PERCENTAGE OF OLEIN.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
		p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
1	71	76.7							
1	60			67.2					
1	65		84.6						
1	67				69.4				
2	130	67.1							
2	131			68.7					
2	134		65.7						
2	125				67.4				
1	69					85.6			
1	67							76.2	
1	69						83.6		
2	133					68.8			
2	132							67.0	
2	125						66.4		
2	134								68.4

RATION G.—BEANS, ONE PART ; SHORTS, THREE-QUARTER PART.

This pen comprised ten pigs. They were all of eastern origin, and weighed at the time of slaughtering from 148 to 205 pounds. The lowest percentage of olein was 79.6; the highest, 92.6. It is thus evident that all would be classed, by olein, as 'very soft.' The inspection rating placed the majority as 'soft.' The growth of the pigs was much below normal, the carcass was meagre and showed very little fat, and that of an extremely oily nature. From every point of view this ration seems most undesirable.

RATION I AND H.—FIRST PERIOD—HALF CORN MEAL ; HALF OATS,
PEASE AND BARLEY, EQUAL PARTS.
SECOND PERIOD—CORN MEAL.

In this ration, half the grain of the first period and all the grain of the second period was corn meal. The effect of this is apparent upon the consistency of the fat. In ration A and B half the grain of the ration throughout life was corn meal, resulting in an average percentage of olein in the mature pigs of 73.2. In the ration

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RATION J. AND L.—FIRST PERIOD—CORN MEAL.

SECOND PERIOD—OATS, PEASE AND BARLEY,
EQUAL PARTS.

In planning this ration it was thought that any softening effect of the corn during the first period might be counteracted by using a grain feed not containing corn in the second or finishing period.

This has proved to be true to a large extent, as will be seen by comparing the average percentage of olein from the corn ration (Table VII.), namely, 92.3 with that obtained under consideration, 77.6. Nevertheless, our data show conclusively that when the animal is fed to a weight of 100 pounds on corn exclusively, the corrective action of such an excellent ration as oats, pease and barley is not sufficient to render the fat firm. Indeed, the olein values are very close to those obtained with ration I and H, just discussed.

	Percentage of Olein.
Soaked grain.....	76.4
Dry grain.....	78.8
Eastern pigs.....	76.4
Western pigs.....	78.9
Inside.....	76.5
Outside.....	78.7
Average of all	77.6

Inspection ratings—

	V.F	F.	M.F.	S.	V.S.
Soaked grain	3	1	4	..
Dry grain	1	1	5	1
Eastern pigs	4	2	2	..
Western pigs..	7	1
Inside	2	2	4	..
Outside	1	..	6	1

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TABLE XI.

RATION J and L.—1st Period, Corn Meal; 2nd Period, Oats, Pease and Barley, in equal parts.

No. of Pigs.	Dressed Weight.	PERCENTAGE OF OLEIN.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
	Lbs.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
2	135	70.7							
2	125			76.6					
2	127		80.5						
2	137				77.9				
2	149					77.4			
2	130							80.8	
2	125						77.4		
2	128								79.6

RATION K AND M.—FIRST PERIOD—OATS, PEASE AND BARLEY, IN EQUAL PARTS.

SECOND PERIOD—CORN MEAL.

This ration is the reverse of the preceding, corn meal being used as the finishing instead of the initial grain. The result was a firmer fat, containing 3.5 per cent (average) less olein. The fat of the greater number of the pigs, however, showed too much oiliness to allow the pork to be classed as of first quality.

	Percentage of Olein.
Soaked grain	73.5
Dry grain	74.4
Eastern pigs	74.4
Western pigs	73.4
Inside	73.0
Outside	74.8

Average of all 73.9

Inspection ratings—

	V.F.	F.	M.F.	S.	V.S.
Soaked grain	1	1	1	4	1
Dry grain		2	3	3	..
Eastern pigs	1	1	2	4	..
Western pigs		2	2	3	1
Inside		1	3	3	1
Outside		3	4	..	1

TABLE XII.

RATION K and M.—1st Period, Oats, Pease and Barley, in equal parts;
2nd period, Corn Meal.

No. of Pigs.	Dressed Weight. Lbs.	PERCENTAGE OF OLEIN.							
		Soaked.				Dry.			
		Inside.		Outside.		Inside.		Outside.	
		East.	West.	East.	West.	East.	West.	East.	West.
2	139	74.2							
2	137			76.2					
2	129		70.4						
2	134				73.0				
2	136					70.3			
2	130							76.8	
2	142						77.2		
2	135								73.1

CONDITIONS UNDER WHICH THE PIGS WERE FED CONSIDERED AS FACTORS.

Before discussing the three last rations of this series, N, O, and P, which were fed to eastern animals, we may consider to what extent the condition of the grain (soaked or dry), the locality or district in which the pigs were littered, and the amount of exercise obtainable, may have had upon the quality of the pork.

The inferences on these points are drawn from the olein content, that being undoubtedly the most reliable factor from which to make deductions. Finished animals only are considered.

Boiled as against dry grain.—In the sets of experiments A and B, half corn meal, half oats, pease and barley, boiled and dry, and I and H, first period, half corn meal, half oats, pease and barley, boiled and dry, we find that the fat produced from boiled grain in each case was the softer. In A and B the difference was 2.2 per cent olein, in I and H, the difference was 2.3 per cent olein.

Soaked as against dry grain.—This comparison was made with corn meal (C and E), a mixture of oats, pease and barley, (D and F), with rations employing during the first period corn meal, and second period oats, pease and barley (J and H), and lastly, first period, oats, pease and barley; second period, corn meal (K and M). The results are:

Percentages of olein—

	C & E	D & F.	J & H.	K & M.
Soaked.	92.5	67.2	76.4	73.5
Dry	92.1	67.7	78.8	74.4

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We scarcely feel justified, from these data, in drawing any conclusions as to the relative effect on firmness of the same grain ration, fed soaked or dry. A study of the individual results does not reveal any definite tendency, and most probably the condition of the grain in this respect has but little, if any, effect on the quality of the pork.

Eastern origin as against western.—This feature was allowed for under all the rations tested. The averages are in the order as discussed :—

	A & B.	C & E.	D & F.	I & H.	J & L.	K & M.
Eastern origin	73·4	91·2	67·9	78·6	76·4	74·4
Western origin	73·0	93·4	67·0	77·2	78·9	73·4

In four cases out of the six, the olein of the eastern pigs is somewhat the greater, and taken together the averages give a total excess of 3·7 per cent olein over the corresponding western groups. In two cases the western pigs show the larger olein per cent, amounting to 4·7 per cent olein over the corresponding eastern groups. These facts do not warrant us in supposing that there is any marked tendency towards softness in finished pigs due simply to western origin, as is thought by some packers. If finished pigs from the western part of Ontario are softer than those from the eastern, it must be due to the character of the feed they obtain.

Inside as against Outside.—As already explained, the pigs denoted as 'inside' are held to have had opportunities for limited exercise only, that is, in the small yards attached to the pens of the piggery; the 'outside' pigs had the run of an inclosure in which there was a movable sty or shelter for their accommodation at night.

The averages are as follow :—

Percentages of olein—

	A & B.	C & E.	D & F.	I & H.	J & L.	K & M.
Inside	71·9	92·3	67·0	77·8	76·5	73·0
Outside	74·5	92·3	67·9	77·9	78·7	74·8

In several of these instances, it will be seen, the results are practically identical (for differences of less than one per cent must not be considered as forming a sufficiently strong basis from which to draw conclusions); in the other cases, the larger amount of olein appears in the fat of the 'outside' pigs. There can be no doubt as to the value of a sufficiently large run for young and growing pigs; exercise to a limited extent in the earlier period of an animal's life is essential to a strong and thrifty growth, to good digestion and assimilation of the food.

We, therefore, do not think it wise, without further evidence, to draw the conclusion that the larger area for exercise had any injurious effect on the quality of the pork. Indeed, a survey of the two seasons' results makes it very clear that the character of the food is the one great influencing factor, and that the varying features or conditions, other than the ration, had very little to do with the relative firmness of the resulting fat.

RATION N, O AND P.—N.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY, EQUAL PARTS. DRY.

O.—GRAIN AS IN N. PLUS MANGELS.

P.—GRAIN AS IN N. PLUS STEAMED CLOVER.

This experiment comprising six pigs under each ration, was instituted to ascertain what the effect would be upon the relative firmness by adding (a) mangels, and (b) steamed clover to the grain ration, which, it will be noticed, is the same as under tests A and B. It is thus seen that B and N are duplicate tests in every particular. For this reason, it will be instructive to place the averages of A and B with those from the rations under discussion :

		Percentage of Olein.
Ration B, average of 12 pigs.....		73.1
“ N “ 6 pigs		73.7
“ O “ 6 pigs		74.9
“ P “ 6 pigs		76.1

By the olein test, B and N are practically identical. The addition of mangels somewhat raised the percentage of olein, but perhaps not to a degree sufficient to warrant any statement as to their effect upon the pork. The steamed clover, however, appeared to notably increase the olein. Very few of the carcasses from these rations fall into the classes of firm and moderately firm, the influences of the corn (forming half the grain ration) being apparent.

The inspection ratings are as follow :—

	V.F.	F.	M.F.	S.	V.S.
N.....	..	2	3	1	..
O.....	..	1	1	4	..
P.....	4	2	..

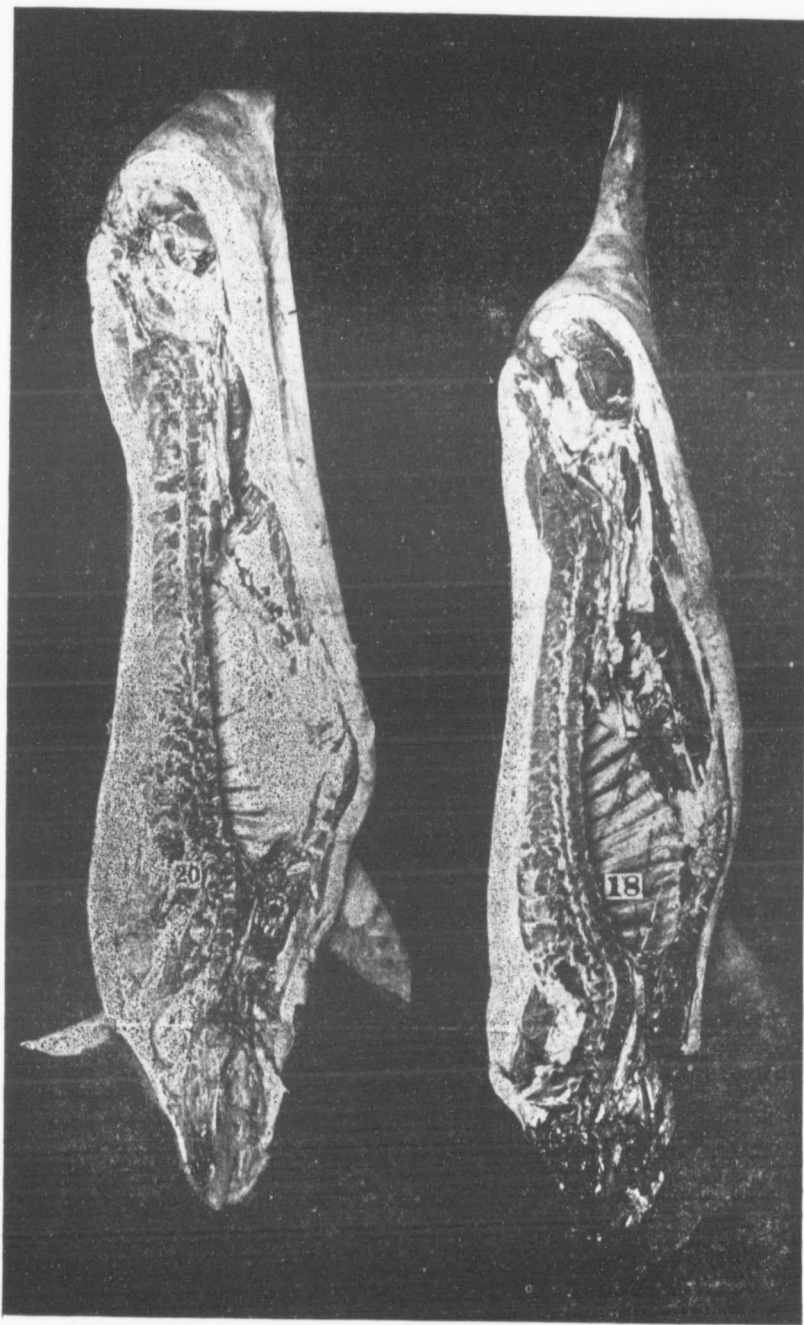
SECOND SERIES OF FEEDING TRIALS, 1900.

On the completion of the work of the first set of experiments, it was thought desirable to institute a further series to obtain corroboration of certain results, as well as to ascertain the influence of several modifications in the rations already employed. In this second series, the effect of the ration on the fat of the finished pig simply was determined. Further, it was considered unnecessary to repeat the details as regards eastern and western origin, limited and unlimited ration, exercise, &c., these factors, it having been shown, possessing little, if any, influence on the relative firmness of the resulting pork. It was also decided to examine chemically the fat taken from above the shoulder only, the difference in olein content between the shoulder and loin fat from the same carcass being, as a rule, extremely small. We have, therefore to consider in the trials about to be discussed the percentage of olein in the rendered shoulder fat, the melting point of the fat, and the inspection ratings taken at the packing house.

An improved and more accurate method of taking the melting points having been perfected in our laboratories during the winter of 1899-1900, it will be found that there is a closer agreement in this second series between the olein content and the melting point of the fat than is apparent in the data of the first series. The scheme of rations is detailed as follows :—

RATIONS.

1.Oats, pease and barley, $\frac{1}{2}$ each.
2.Corn meal.
3.Corn meal and skim-milk.
4.Pease.
5.Beans.
6. $\frac{1}{2}$ corn meal.
 $\frac{1}{2}$ oats, pease and barley, $\frac{1}{2}$ each.
7. $\frac{1}{2}$ corn meal.
 $\frac{1}{2}$ oats, pease and barley, $\frac{1}{2}$ each, plus skim milk.



No. 20 { HALF CORN MEAL,
HALF OATS, PEASE AND BARLEY

No. 18 { 1ST PERIOD, HALF CORN MEAL; HALF
OATS, PEASE AND BARLEY.
2ND PERIOD, CORN MEAL.

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8. FIRST PERIOD— $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each.
SECOND PERIOD—Corn meal.
9. FIRST PERIOD—Oats, pease and barley, $\frac{1}{3}$ each.
SECOND PERIOD—Corn meal.
10. $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each.
Pastured first on rape, finally on artichokes.
11. FIRST PERIOD— $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each.
Pastured on rape.
SECOND PERIOD—Same grain ration, plus raw pumpkins
12. $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, plus cooked pumpkins.
13. $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each. From October 16,
 $\frac{1}{2}$ corn meal, $\frac{1}{2}$ pease.
14. $\frac{2}{3}$ corn meal ; $\frac{1}{3}$ oats, pease and barley, plus artichokes.
15. FIRST PERIOD—Pastured on clover.
SECOND PERIOD—From October 30, fed clover, plus $\frac{1}{2}$ corn
meal, $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each.
16. FIRST PERIOD—Corn meal.
SECOND PERIOD—Oats, pease and barley, $\frac{1}{3}$ each.
17. A— $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, skim-milk and
turnips.
B— $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, skim-milk and
mangels.
C— $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each, skim-milk and
sugar beets.

Comparing the foregoing with the rations of the first series, it will be observed that the experiments with the following were duplicates : (a) the oats, pease and barley mixture, (b) corn only, (c) half corn, half oats, pease and barley mixture, (d) first period, corn meal ; second period, oats, pease and barley mixture ; (e) first period, oats, pease and barley mixture ; second period, corn meal ; (f) first period, half corn, half oats, pease and barley mixture ; second period, corn meal ; and (g) beans. In addition to these, the following rations found a place : (a) pease, (b) corn meal and skim-milk, (c) half corn meal, half oats, pease and barley mixture and skim milk, and several rations in which the grain was half corn meal, half oats, pease and barley with (a) pumpkins, (b) artichokes, (c) rape, (d) clover, and three pens with this same grain ration plus skim milk and mangels, turnips and sugar beets, respectively.

In Table XIII. we have arranged the rations in order of olein content, beginning with the firmest pork.

TABLE XIII.—AVERAGES from Determinations of 2nd Series, 1900.

No. of Ration.	Composition of Ration.	Olein.	Melting Point.
17 C	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley, $\frac{1}{3}$ each and skim milk, sugar beets.....	66.9	32.3
4	Pease.....	67.2	32.5
17 B	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley, $\frac{1}{3}$ each skim milk and mangels.....	68.2	32.7
1	Oats, pease and barley, $\frac{1}{3}$ each.....	68.7	32.4
17 A	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley, $\frac{1}{3}$ each and skim milk ; turnips.....	70.4	32.3
3	Corn meal and skim milk.....	70.9	33.3
7	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley, $\frac{1}{3}$ each and skim milk.....	72.3	31.1
13	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley $\frac{1}{3}$ each. From Oct. 16, $\frac{1}{2}$ corn meal, $\frac{1}{2}$ pease.	72.3	31.2
12	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley, $\frac{1}{3}$ each and cooked pumpkins.....	73.3	31.4
14	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease, barley and artichokes.....	73.4	31.5
9	1st period : oats, pease, barley $\frac{1}{3}$ each ; 2nd period, corn meal.....	73.9	31.1
11	1st period : pastured on rape, $\frac{1}{2}$ corn meal, $\frac{1}{2}$ oats, pease and barley $\frac{1}{3}$ each ; 2nd period, raw pumpkins and same grain.....	74.2	31.6
6	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats ; pease and barley, $\frac{1}{3}$ each.....	74.6	30.3
10	$\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each ; pastured first on rape, finally on artichokes.....	74.9	32.4
16	1st period : corn meal ; 2nd period, oats, pease and barley, $\frac{1}{3}$ each.....	76.1	30.9
15	Pastured on clover. From Oct 30, fed clover, $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each.....	76.1	30.3
8	1st period : $\frac{1}{2}$ corn meal ; $\frac{1}{2}$ oats, pease and barley, $\frac{1}{3}$ each ; 2nd period, corn meal.	77.9	30.8
2	Corn meal only.....	83.6	28.6
5	Beans.....	84.9	29.5

RATION No. 1.—OATS, PEASE AND BARLEY, IN EQUAL PARTS.

In all the pigs of this pen the fat was very firm, not too thick and of even deposition.

By inspection rating, all were classed as 'very firm'; by olein content, three would be 'very firm' and two 'firm.'

The average percentage of olein from the present ration indicates a very high quality of pork and is practically identical with that obtained in the first series. This is undoubtedly from every standpoint a most satisfactory ration.

RATION No. 2.—CORN MEAL.

The results with corn meal used exclusively are, as in the ration just considered, in close agreement with those of the same ration under the first series, though in the former test the average percentage of olein was somewhat higher, probably owing to the pigs being younger when the feeding was commenced. In the pen of the second series the animals when put upon the ration were about one month older than those of the first series, and this undoubtedly led to a better, quicker and more normal growth.

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We have, therefore, in this second test with corn meal ample corroboration for our conclusions as to the disastrous effect of this ration (see page 19) and its unsuitability in pig feeding. All the pigs, both by olein content and inspection rating, were classed as 'very soft.'

RATION No. 3.—CORN MEAL AND SKIM MILK.

This ration has afforded us some of the most striking results in the whole series. The effect of the skim milk in hardening the fat of these corn fed pigs has been most remarkable. Skim milk, it is seen, has placed these pigs well up on the list of averages. Corn meal without this corrective gave such an exceedingly soft pork that the pigs in the first series are last, and in the second series next to last in the order of merit. With skim milk, the growth was much more rapid and thrifty than with corn meal only (as will be seen from the illustration given of these pens), and this, no doubt, is largely due to the nitrogenous nutrients furnished by the milk, and which, as we have before remarked, are to a great extent lacking in corn, which supplies, essentially, starch and oil. This ration (No. 3) is not, however, so suitable as one of mixed grains (oats, pease and barley) for pork production, for in several of the pigs of this set, the fat along the back was too thick. From our experiments we conclude, then, that while a ration of corn exclusively resulted in a very meagre growth and only a slight deposition of fat—and that of an extremely soft and oily character—the addition of a sufficiency of skim milk to supply the necessary nitrogenous matter tended to a rapid growth and the production of a fairly firm fat, which, however, in many instances, was too thick for the bacon trade. The present results are most valuable and important in showing the beneficial effect of skim milk in promoting a thrifty growth and in counteracting the softening effect of the corn upon the pork, but looking to economy of production, thickness and quality of fat, a mixed grain ration, such as we have referred to above, will, we believe, give better returns.

It would probably be hard to overestimate the value of skim milk as part of every ration, especially for young pigs; the fact here brought out regarding its hardening effect upon the fat shows it to have an additional function of great importance.

The ratings by olein are: four firm, two moderately firm; by inspection we have: one very firm, one firm, two moderately firm, one soft, one very soft. The average percentage of olein for the set is 70.9, which gives it a rank of 'moderately firm.'

RATION No. 4.—PEASE.

Four of the six pigs in this group ranked 'very firm,' both by olein and inspection rating. Omitting one animal, regarding which we have some doubt, but the data of which have been allowed to stand in the table of details, the average percentage of olein for the group is 67.2, which places this ration practically at the head of our second series. The pigs made good growth, were well nourished, and the fat evenly deposited along the back (from 1½ to 1½ inches thick) and extremely firm. These results confirm the good opinion generally held with regard to pease, and furnish proof of their desirability in the ration for obtaining the finest quality of pork.

RATION No. 5.—BEANS.

As in the first series, all the pigs under this ration gave an extremely soft fat. The average percentage of olein was 84.9, that of the first series being 85.2—figures practically identical. Both by olein and inspection rating, the fat was classed as 'very soft.' We have in this pen, therefore, confirmatory evidence as to the unsuitableness of beans for fattening pigs. The deductions made from our first experiment with beans might be repeated for those of the second series (see page 22).

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RATION No. 6.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY,
IN EQUAL PARTS.

This is a repetition of ration A and B in the first series and the data obtained are in close accordance with those already recorded for this grain mixture. In the first series, the average percentage of olein was 73.2; in the second, 74.6, which places the group among those marked as 'soft.'

The present inspection ratings are:—One very firm, one firm, two moderately firm and two soft; by olein content we have five of the six pigs on the line between soft and moderately firm, and one moderately firm.

Our results in this second series, therefore, confirm the conclusions already drawn, namely, that this ration continued throughout life has the tendency towards the production of a soft, oily fat.

RATION No. 7.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY,
PLUS SKIM MILK.

This ration only differs from the preceding in the addition of skim milk. It had no counterpart in the first series. The skim milk here has had a corrective effect, though not in the same degree as when used with corn only. It lowered the average percentage of olein from 74.6 (see preceding ration) to 73.3, placing the group in 'moderately firm' instead of 'soft.' A study of the detailed data (see Table 7, page 44), reveals that the individuals of this pen varied considerably in olein content, and, further, that the agreement between olein ratings and inspection ratings is not so close as in most of the other groups. We can scarcely offer any good reason for this, but from a careful consideration of the whole matter, we feel confident in placing the greater weight upon the olein values. Very frequently examination after smoking the bacon has confirmed the lower olein values. By olein content we find practically four classed as 'firm,' one as 'soft,' and one as 'very soft.' By inspection rating we have three as very firm, one moderately firm and one soft.

RATION No. 8.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE
AND BARLEY.

SECOND PERIOD, CORN MEAL.

This is a duplicate of ration I and H of the first series, under which thirty-two animals were tested. It is perhaps a coincidence, though certainly one not to be lightly passed over, that the average percentage of olein in both series is the same, 77.9, and thus both groups, as such, are placed in the category of very soft.

Many of the pigs, as in the first series, had too thick a fat along the back. As with the preceding ration, considerable discrepancies are to be observed between the two classes of ratings of the individual animals, but the close accord of the olein values with those of the first series, leaves no doubt as to the character of the fat, and points unmistakably to the softening effect of this ration.

RATION No. 9.—FIRST PERIOD, OATS, PEASE AND BARLEY IN EQUAL
PARTS.

SECOND PERIOD, CORN MEAL.

The results from this ration may be compared with those of K and M of the first series, the rations being the same. Here, again, we find the average olein content for the group to be the same in both series, namely, 73.9, and consequently the deductions already made might be repeated. In the majority of cases the fat

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was too soft and oily to allow the pork to be classed as of first quality. It was also noticed, as in the first series, that most of the carcasses showed too thick a deposition of fat. We receive in these data corroboration of the statement made when discussing the first series, that this ration gives a fat containing less olein than one in which corn meal forms half of the first period food, and consequently forms a part or whole of the ration throughout life.

RATION No. 10.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY,
IN EQUAL PARTS. PASTURED FIRST ON RAPE AND FINALLY
ON ARTICHOKEs.

This is seen to be the same grain ration as No. 6 of this second series, the difference being in the addition of rape and artichokes. The average percentage of olein for the group is 74.9, being only three-tenths of a per cent more than that of the grain ration alone. It seems scarcely advisable, therefore, to make any inference as to the effect of the rape and artichokes, further than to say that these crops do not appear to correct in any degree the softening effect of the corn meal. The pigs of this group showed a tendency to develop too thick a shoulder fat.

RATION No. 11.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE
AND BARLEY MIXTURE, PASTURED ON RAPE.

SECOND PERIOD, SAME GRAIN RATION AND RAW
PUMPKINS.

This ration differs only from the preceding in the substitution of raw pumpkins for artichokes in the second period. The differences in the consistency of the fat of the individual pigs are not large. The average percentage of olein is 74.2. This is a fraction of a per cent less than in No. 6, in which the same grain ration was continued throughout without rape or pumpkins. While, therefore, it is impossible to say that these forage crops had any very marked effect in correcting the softening action of the corn meal, we can at least state they did not increase the softness of the pork.

RATION No. 12.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY
MIXTURE, AND COOKED PUMPKINS.

This group of pigs gave a somewhat lower percentage of olein—indicating a firmer fat—than most of the others on the same grain ration, the majority of them falling into the firm and moderately firm groups. The average percentage of olein for the group is 73.3, practically the provisional limit for the moderately firm class.

RATION No. 13.—FIRST PERIOD, HALF CORN MEAL, HALF OATS, PEASE
AND BARLEY.

SECOND PERIOD, HALF CORN MEAL, HALF PEASE.

Three of the five pigs of this group were classed by their olein content as 'firm,' one as moderately firm and one as soft. The average percentage of olein for the group was 72.3, placing the group equal in the scale of firmness with that from Ration No. 7. The inspection ratings gave three as 'very firm' and two as 'moderately firm.' If compared with No. 6 the good effect of the pease (forming half of the ration of the second period) is noticeable.

RATION No. 14.—HALF CORN MEAL, HALF OATS, PEASE AND BARLEY
IN EQUAL PARTS AND ARTICHOKEs.

The results of this ration are practically the same as those from No. 12, the average olein content for the two groups being 73.3 and 73.4 respectively. By the percentage of olein, one was classed 'firm,' two 'moderately firm,' and two 'soft.'

RATION No. 15.—FIRST PERIOD, PASTURED ON CLOVER.

SECOND PERIOD, HALF CORN MEAL, HALF OATS,
PEASE AND BARLEY AND CLOVER PASTURAGE.

As will be seen from the table of data, this is a very uneven group as regards olein content; three would be classed as very soft, one as moderately firm, and two as firm. The average olein content is 76.5, placing the group well down in the order of firmness. The olein average for the group (No. 6) on this grain ration without clover is 74.6. These data appear to indicate, therefore, that clover has a softening effect when continued throughout the whole feeding period. Comparing the olein content of this group with that of pen P of the first series, fed with the same grain mixture plus steamed clover, we find very little difference—the latter being 76.1 per cent—and this fact strengthens our opinion that clover increases the percentage of olein. Clover could possibly be used without detriment in more limited quantities, especially if used in conjunction with skim milk.

RATION No. 16.—FIRST PERIOD, CORN MEAL.

SECOND PERIOD, OATS, PEASE AND BARLEY, IN
EQUAL PARTS.

This ration is the reverse of No. 9 of the present series and a repetition of J and L of the first series.

As in the previous set of experiments, we find that corn meal fed during the first period (till the animal weighed 100 pounds) and finally oats, pease and barley, produced a somewhat softer fat than when corn is fed in the finishing period, preceded by oats, pease and barley.

Compared with the former data from the same ration, the present results show a somewhat firmer fat, the percentage of olein being 76.0 as against 77.6; the difference, however, is not sufficient to raise the group from the class of 'very soft,' in which the first set of pigs on this ration was placed.

RATION No. 17.—A.—HALF CORN MEAL, HALF OATS, PEASE AND
BARLEY, SKIM MILK AND TURNIPS.

B.—HALF CORN MEAL, HALF OATS, PEASE AND BAR-
LEY, SKIM MILK AND MANGELS.

C.—HALF CORN MEAL, HALF OATS, PEASE AND BAR-
LEY, SKIM MILK AND SUGAR BEETS.

The grain mixture for these groups, it will be observed, is the same as that which has been employed in a number of the experiments. Skim milk, however, has been fed to all the pigs throughout life and various roots—as indicated above—tried in the subdivisions, each of which comprised four animals. The results obtained have been satisfactory, the growth was good, the fat very firm and as a rule not too thick. From the table of averages (page 30) it will be observed that these three groups stand well at the head in the scale of firmness. The olein and inspection ratings are closely concordant, placing the animals in the classes of 'very firm' or 'firm.'

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Group 'B' is the same as ration 'O' of the first series, save that in the present trial skim milk was fed. The difference in the olein content—6.7 per cent—in favour of Ration 17, Group 'B,' may, I think, be fairly attributed to the effect of the skim milk. Of the three groups, that with sugar beets gave the firmest fat; that with turnips, the least firm.

In all three groups we have confirmed in the most marked manner the corrective and beneficial action of skim milk, which was more particularly referred to when discussing the corn and skim milk ration.

CONCLUSIONS FROM SECOND SERIES OF EXPERIMENTS.

On page 15 we have given the chief inferences to be drawn from the results of the first set of experiments. In all important features these deductions receive strong confirmation from the data of the second series. There are, however, from this latter series several additional and important features to be noted. The first is with regard to the use of skim milk in conjunction with the grain ration. **In every instance in which it has been tried, skim milk has produced a much firmer fat than resulted from the same grain ration, fed without skim milk.** The softening effect of corn, so repeatedly referred to, has in a very large measure been counteracted by this means. Therefore, while our results point to the injurious effects of a ration containing one-half or more corn without skim milk, we have to record that its use as a part of the grain ration in conjunction with skim milk has produced an excellent quality of pork. It will have been noticed, however, in the discussion of several of the rations, that a large proportion of corn in the ration tends to an increase in the deposition of fat, especially above the shoulder.

Clover has not been tried save in conjunction with a grain ration, half of which was corn meal. We are scarcely in a position, therefore, to speak positively as to its effect upon the relative firmness, but there are certainly strong indications that its influence is in the same direction as corn, increasing the percentage of olein.

It is quite evident that the root crops—turnips, mangels and sugar beets—can be used with benefit and with impunity in such a ration as we have in No. 17, the animals of which produced a first quality pork.

Further, we do not notice any softening effect due to the results of feeding rape, artichokes, or pumpkins, cooked or raw.

SUMMARY.

Among the more important conclusions to be drawn from this investigation are the following :—

1. That the one great controlling factor in the quality of the pork of finished pigs lies in the character of the food employed.

2. That Indian corn and beans tend to softness, *i.e.*, to increase the percentage of olein in the fat. If these grains are used they must be fed judiciously if first class firm pork is to be produced. If fed in conjunction with skim milk it has been shown that a considerable proportion of Indian corn may be used in the grain ration without injuring the quality of the pork.

3. That a grain ration consisting of a mixture of oats, pease and barley, in equal parts, gives a firm pork of excellent quality.

4. That skim milk not only tends to thriftiness and rapid growth, but counteracts in a very marked manner any tendency to softness.

5. That rape, pumpkins, artichokes, sugar beets, turnips and mangels can be fed in conjunction with a good ration without injuring the quality of the pork.

6. That the fat of very young pigs and animals of unthrifty growth is softer than that of finished pigs that have increased steadily to the finishing weight.

*As already indicated, there has been a very large amount of analytical work in connection with this investigation, and the writer is anxious to acknowledge with thanks his indebtedness to the assistant chemists, Mr. A. T. Charron and Mr. H. W. Charlton, by whom much of it was successfully undertaken. They rendered most efficient help in the prosecution of this research.

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APPENDIX

SERIES I.—RATION A.

$\frac{1}{2}$ Corn Meal } Boiled.
 $\frac{1}{2}$ Oats, Pease and Barley, in equal parts. }

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	68	East...	Oct. 26...	98	67	77.3	32.7	V. S.	V. S.
Outside.	104	"	Nov. 7....	102	67	77.1	31.6	V. S.	V. S.
"	106	"	" 14....	96	61	81.2	28.6	V. S.	V. S.
Inside..	2	West...	Sept. 26...	103	66	91.6	32.3	V. S.	V. S.
"	61	East...	Nov. 21....	181	129	71.5	34.0	S.	M. F.
"	65	"	Oct. 26....	180	127	73.9	34.6	S.	S.
"	66	"	Dec. 5....	191	126	74.8	33.7	S.	S.
"	69	"	Feb. 10....	181	125	71.8	34.5	S.	M. F.
Outside.	101	"	Jan. 5....	211	145	71.8	32.6	M. F.	M. F.
"	105	"	Feb. 3....	180	130	79.1	32.0	S.	V. S.
"	107	"	Jan. 13....	205	140	75.9	...	F.	S.
"	109	"	Feb. 3....	187	130	75.6	32.8	S.	S.
Inside..	1	West...	Nov. 14....	183	130	71.5	34.5	V. S.	M. F.
"	4	"	" 30....	180	118	71.5	32.8	S.	M. F.
"	8	"	Jan. 13....	188	...	78.9	33.9	S.	V. S.
"	10	"	Nov. 14....	183	128	72.6	33.9	V. S.	M. F.
Outside.	42	"	" 21....	190	126	69.7	34.6	S.	F.
"	45	"	Oct. 30...	183	124	72.5	33.5	M. F.	M. F.
"	48	"	Dec. 29....	190	120	77.1	34.8	F.	V. S.
"	50	"	" 29....	190	124	80.8	32.3	S.	V. S.

RATION B.

$\frac{1}{2}$ Corn Meal } Dry.
 $\frac{1}{2}$ Oats, Pease and Barley, in equal parts. }

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	71	East...	Sept. 19....	96	.....	88.1	32.6	V. S.	V. S.
"	78	"	Oct. 30....	106	76	72.6	34.1	S.	M. F.
Outside.	115	"	" 18....	106	65	77.9	32.5	S.	V. S.
"	119	"	Nov. 7....	97	64	77.5	32.3	S.	V. S.
Inside..	15	West...	Sept. 19....	100	.....	87.1	31.1	V. S.	V. S.
"	19	"	" 19....	102	.....	83.7	31.9	S.	V. S.
Outside.	59	"	" 19....	105	.....	83.2	32.2	S.	V. S.
Inside..	74	East...	Oct. 18....	188	134	74.0	35.9	S.	S.
"	75	"	Nov. 14....	204	146	67.8	33.5	S.	V. F.
"	77	"	Jan. 20....	180	139	69.4	32.4	S.	F.
"	79	"	" 20....	180	140	70.9	33.2	S.	F.
Outside.	113	"	" 5....	200	142	74.1	32.1	S.	S.
"	114	"	Nov. 30....	182	134	70.8	32.1	M. F.	F.
"	118	"	Jan. 5....	186	127	74.8	32.3	S.	S.
"	120	"	Dec. 29....	212	154	78.2	33.3	F. ?	V. S.
Inside..	14	West...	Oct. 18....	182	130	67.1	38.2	V. F.	V. F.
"	13	"	Nov. 14....	192	139	71.0	34.6	S. ?	F.
"	17	"	Oct. 5....	182	127	72.1	34.5	S.	M. F.
"	20	"	" 26....	184	135	72.5	34.4	S.	M. F.
Outside.	51	"	Nov. 7....	211	149	70.4	35.3	S.	F.
"	53	"	Oct. 18....	185	130	73.6	34.3	V. S.	S.
"	56	"	Nov. 21....	188	137	71.6	32.8	S.	M. F.
"	58	"	" 7....	186	133	75.1	32.4	V. S.	S.

RATION C.

Corn Meal—Dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	85	East...	Dec. 21....	107	.....	90.9	27.9	V. S.	V. S.
Outside.	124	"	" 8....	98	69	83.6	31.5	V. S.	V. S.
Inside..	21	West...	" 15....	108	76	88.3	29.3	V. S.	V. S.
Outside.	65	"	" 8....	102	72	82.9	29.7	V. S.	V. S.
Inside..	84	East....	April 18....	63	46	96.7	Too soft..	V. S.	V. S.
"	82	"	Feb. 16....	180	134	79.2	32.0	V. S.	V. S.
Outside.	122	"	May 7....	160	117	87.7	Too soft..	V. S.	V. S.
"	123	"	April 17....	63	49	97.7	"	V. S.	V. S.
Inside..	23	West...	" 30....	140	100	95.3	"	V. S.	V. S.
"	25	"	" 18....	111	76	94.6	"	V. S.	V. S.
Outside.	62	"	May 7....	127	100	92.4	"	V. S.	V. S.

RATION D.

Oats, Pease and Barley, in equal parts—Dry.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	87	East...	Sept. 19...	104	69	85.6	.....	V. S.	V. S.
Outside.	128	"	Oct. 30....	101	67	76.2	33.0	V. S.	V. S.
Inside..	26	West...	Sept. 19....	108	69	83.6	31.5	V. S.	V. S.
"	86	East....	Nov. 7....	182	134	69.3	36.5	M. F.	F.
"	89	"	" 14....	184	132	68.3	34.1	M. F.	V. F.
Outside.	129	"	" 30....	188	127	66.4	34.0	M. F.	V. F.
"	139	"	Jan. 20....	180	137	67.6	34.6	V. F.	V. F.
Inside..	29	West...	Nov. 21....	181	125	67.6	35.2	F.	V. F.
"	30	"	" 30....	179	126	65.2	34.4	F.	V. F.
Outside.	66	"	" 14....	195	134	66.7	33.3	F.	V. F.
"	68	"	" 14....	188	134	70.1	32.7	F.	F.

RATION E.

Corn Meal—Soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	95	East...	Dec. 21....	111	78	87.0	.....	V. S.	V. S.
Outside.	133	"	" 21....	115	83	84.5	30.2	V. S.	V. S.
Inside..	32	West...	Nov. 14....	95	63	84.2	31.0	V. S.	V. S.
Outside.	73	"	Dec. 8....	100	71	92.6	27.0	V. S.	V. S.
Inside..	93	East....	April 18....	64	45	97.3	24.5	V. S.	V. S.
"	94	"	Mar. 15....	178	140	87.0	28.7	V. S.	V. S.
Outside.	132	"	April 18....	80	55	98.9	Too soft.	V. S.	V. S.
"	134	"	May 7....	175	130	85.7	28.3	V. S.	V. S.
Inside..	31	West...	Feb. 16....	181	132	86.4	31.8	S.	V. S.
"	35	"	April 18....	91	63	100.2	Too soft.	V. S.	V. S.
Outside.	74	"	May 28....	194	148	90.0	26.3	V. S.	V. S.
"	75	"	April 18....	100	72	93.7	27.0	V. S.	V. S.

RATION F.

Oats, Pease and Barley in equal parts, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	100	East...	Oct. 10....	104	71	76.7	34.5	S.	V. S.
Outside.	139	"	Nov. 7....	96	60	67.1	38.4	F.	V. F.
Inside..	37	West...	Sept. 19....	100	67	84.6	30.5	V. S.	V. S.
Outside.	76	"	Oct. 5....	102	67	69.3	40.8	F.	F.
Inside..	96	East...	Nov. 21....	179	122	68.5	35.3	M. F.	V. F.
"	99	"	" 29....	195	138	65.7	37.1	V. F.	V. F.
Outside.	138	"	Jan. 5....	195	128	67.5	36.6	F.	V. F.
"	140	"	Dec. 29....	195	134	69.9	34.6	V. F.	F.
Inside..	36	West...	Oct. 30....	198	130	64.9	35.0	V. F.	V. F.
"	40	"	Nov. 14....	198	137	66.4	35.0	F.	V. F.
Outside.	77	"	" 30....	184	125	65.7	35.0	M. F.	V. F.
"	78	"	Dec. 15....	179	125	69.1	33.9	F.	F.

RATION G.

Beans, 1 part ; Shorts, $\frac{3}{4}$ part.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Outside.	145	East...	Oct. 30....	109	66	83.9	.....	V. S.	V. S.
"	148	"	Dec. 29....	205	142	82.5	32.5	S.	V. S.
"	147	"	Jan. 20....	180	130	81.0	32.9	S.	V. S.
"	150	"	" 20....	180	129	83.5	30.5	S.	V. S.
"	143	"	Feb. 3....	178	130	79.6	29.5	S.	V. S.
"	141	"	" 16....	151	102	92.6	Too soft.	V. S.	V. S.
"	142	"	" 16....	148	95	85.8	.....	V. S.	V. S.
"	144	"	" 16....	185	121	82.1	.....	S.	V. S.
"	149	"	" 16....	174	118	86.3	30.4	S.	V. S.
"	146	"	" 10....	188	133	88.8	30.5	M. F.	V. S.

RATION H.

1st Period { $\frac{1}{2}$ Corn Meal.
 $\frac{1}{2}$ Oats, Pease and Barley } Boiled.
 2nd " Corn Meal.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	62	East...	Jan. 13....	184	130	80.5	31.5	M.F.	V.S.
"	63	"	Dec. 5....	183	116	76.5	32.5	S.	V.S.
"	67	"	April 30....	182	127	87.5	27.5	V.S.	V.S.
"	70	"	Jan. 13....	180	125	78.7	33.0	F.	V.S.
Outside.	102	"	" 13....	190	135	73.2	34.0	M.F.	S.
"	103	"	Mar. 8....	183	136	77.0	33.0	F.	V.S.
"	108	"	May 7....	175	122	88.4	25.1	V.S.	V.S.
"	110	"	Mar. 15....	181	128	79.5	29.6	S.	V.S.
side..	3	West...	Dec. 5....	189	127	73.8	32.7	S.	S.
"	5	"	Mar. 8....	182	134	84.6	30.2	S.	V.S.
"	7	"	Feb. 10....	201	136	78.6	32.4	S.	V.S.
"	9	"	Dec. 5....	183	124	76.2	32.2	S.	V.S.
"	41	"	" 21....	190	140	74.3	?	S.	S.
"	43	"	April 30....	172	126	84.0	28.0	S.	V.S.
"	46	"	Jan. 13....	190	130	76.8	31.8	M.F.	V.S.
"	49	"	" 20....	180	127	74.8	31.3	S.	S.

RATION L.

1st Period Corn Meal, soaked.

2nd " Oats, Pease and Barley, in equal parts, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	91	East...	Mar. 30....	179	133	70.7	33.1	F.	F.
" ..	92	"	" 30....	187	138	70.7	31.5	F.	F.
Outside.	131	"	" 8....	202	134	74.1	33.9	F.	S.
" ..	135	"	" 8....	186	116	79.0	31.3	S.	V. S.
Inside..	33	West...	Dec. 29....	190	132	81.5	.....	S.	V. S.
" ..	34	"	Jan. 5....	190	123	79.6	.....	S.	V. S.
Outside.	71	"	Feb. 3....	182	134	78.3	32.6	S.	V. S.
" ..	72	"	" 3....	194	140	77.6	31.7	S.	V. S.

RATION M.

1st Period Oats, Pease and Barley, in equal parts, soaked.

2nd " Corn Meal, soaked.

Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
Inside..	97	East...	Dec. 8....	196	142	72.3	32.3	S.	M.F.
" ..	98	"	Jan. 20....	190	136	75.9	33.3	S.	S.
Outside.	136	"	Feb. 3....	184	140	73.3	32.0	M.F.	S.
" ..	137	"	" 23....	187	135	79.0	31.7	F.	V. S.
Inside..	38	West...	Nov. 30....	183	128	70.4	33.0	S.	F.
" ..	39	"	" 30....	180	130	70.4	32.8	V. S.	F.
Outside.	79	"	Dec. 8....	180	132	70.5	33.4	S.	F.
" ..	80	"	Mar. 15....	179	135	75.5	31.4	F.	S.

RATION 'N.' 'O.' 'P.'

'N.'—Half Corn Meal, half Oats, Pease and Barley in equal parts, dry.

'O.'—Grain as in 'N,' plus Mangels.

'P.'—Grain as in 'N,' plus steamed Clover.

Ration.	Inside or Outside.	No. of Pig.	East or West.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
N	Outside.	13	East.	Ap'l. 9....	197	142	73.1	32.2	M. F.	S.
	" ..	31	" ..	" 9....	170	123	72.7	32.0	M. F.	M. F.
	" ..	34	" ..	" 9....	173	125	72.8	31.9	F.	M. F.
	" ..	6	" ..	" 9....	181	132	72.9	30.0	F.	M. F.
	" ..	9	" ..	" 30....	189	130	74.1	31.0	M. F.	S.
	" ..	12	" ..	" 30....	180	125	76.4	32.0	S.	V. S.
O.	" ..	95	" ..	" 9....	196	136	72.9	31.3	S.	M. F.
	" ..	93	" ..	" 9....	186	125	76.6	31.2	S.	V. S.
	" ..	94	" ..	" 9....	188	126	76.9	31.0	S.	V. S.
	" ..	96	" ..	" 9....	173	115	73.3	31.2	S.	S.
	" ..	97	" ..	May 28....	185	137	73.8	32.3	M. F.	S.
	" ..	98	" ..	" 28....	161	117	75.9	33.4	F.	S.
P.	" ..	33	" ..	Ap'l. 9....	184	130	75.2	33.5	M. F.	S.
	" ..	4	" ..	" 9....	183	130	70.8	33.3	M. F.	F.
	" ..	100	" ..	" 30....	175	115	77.6	31.4	M. F.	V. S.
	" ..	2	" ..	May 28....	191	135	76.8	32.3	M. F.	V. S.
	" ..	3	" ..	" 28....	176	117	78.8	31.3	S.	V. S.
	" ..	32	" ..	" 28....	185	135	77.4	31.0	S.	V. S.

SERIES 2—RATION 1.

Oats, Pease and Barley, $\frac{1}{3}$ each, 1900.

No.	Sex.	Date of Slaughtering	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
243	B	Nov. 8.	192	134	68.2	32.0	V. F.	F.
244	B	Feb. 13.	168	122	69.6	32.2	V. F.	F.
245	B	Nov. 30.	189	137	67.6	33.0	V. F.	V. F.
246	S	Nov. 8.	179	124	71.6	30.0	V. F.	M. F.
247	S	Dec. 8.	180	126	66.7	33.8	V. F.	V. F.

No.

207
208
209
210
211
212

RATION 2.

Corn Meal.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
225	B.	Dec. 31.	187	144	75.8	30.6	F.	V.S.
227	B.	" 31.	179	135	82.4	29.0	S.	V.S.
228	S.	Feb. 13.	162	118	87.9	27.0	V.S.	V.S.
232	B.	Jan. 28.	181	133	82.7	29.0	V.S.	V.S.
233	B.	Feb. 13.	147	110	87.8	27.8	V.S.	V.S.
236	B.	" 13.	158	116	84.9	27.9	V.S.	V.S.

No.

201
202
203
204
205
206

RATION 3.

Corn Meal and Skim Milk.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
237	S.	Oct. 29.	198	140	69.9	34.0	F.	F.
238	S.	" 29.	184	130	73.6	30.5	S.	S.
239	S.	" 29.	190	135	69.8	35.3	M.F.	F.
240	S.	" 29.	187	131	70.6	34.6	S.	F.
241	S.	" 29.	208	150	69.7	34.0	V.F.	F.
242	S.	" 29.	185	132	72.1	31.3	M.F.	M.F.

No.

217
219
220
221
223
309

RATION 4.

Pease.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
207	B.	Nov. 23....	185	122	69·6	30·1	V. F.	F.
208	B.	Sept. 27....	206	145	81·7	29·7	S.	V. S.
209	S.	" 27....	198	128	73·2	31·0	S.	S.
210	B.	Nov. 23....	191	135	37·4	31·0	V. F.	V. F.
211	B.	Oct. 29....	220	155	62·2	35·9	V. F.	V. F.
212	S.	" 29....	201	145	63·4	36·5	V. F.	V. F.

RATION 5.

Beans.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
201	S.	Sept. 27....	193	127	83·2	30·0	S.	V. S.
202	B.	" 27....	183	123	89·9	28·5	V. S.	V. S.
203	B.	Oct. 29....	186	121	80·8	29·0	V. S.	V. S.
204	B.	Dec. 8....	188	121	84·6	30·7	S.	V. S.
205	S.	Feb. 13....	146	99	85·4	28·8	V. S.	V. S.
206	S.	Dec. 31....	180	121	85·9	30·0	V. S.	V. S.

RATION 6.

$\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Oats, Pease and Barley, $\frac{1}{3}$ each.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
217	S.	Nov. 8....	186	133	75·2	29·8	S.	V. S.
219	B.	" 23....	190	115	74·2	30·8	V. F.	S.
220	S.	" 8....	179	125	75·2	30·5	S.	V. S.
221	S.	" 23....	193	133	74·8	29·1	F.	S.
223	B.	" 30....	183	134	76·8	30·6	M. F.	V. S.
309	S.	" 8....	205	146	71·4	31·2	S.	M. F.

RATION 7.

$\frac{1}{2}$ Corn Meal, $\frac{1}{2}$ Oats, Pease and Barley + skim milk.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
286	S.	Nov. 23....	201	141	71.8	31.1	F.	M. F.
289	B.	" 30....	199	137	76.9	30.2?	M. F.	V. S.
291	B.	" 30....	184	131	75.1	31.3?	M. F.	V. S.
294	B.	Dec. 31....	203	154	69.0	31.4	V. F.	F.
297	B.	" 31....	205	155	71.3	31.3	V. F.	M. F.
308	S.	Nov. 23....	180	136	69.5	31.1	V. F.	F.

RATION 8.

1st Period..... $\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Oats, Pease and Barley.

2nd " Corn Meal.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
214	B.	Dec. 6....	205	143	77.5	31.1	S.	V.S.
215	B.	" 31....	178	130	82.6	29.8	M.F.	V.S.
216	S.	" 31....	194	144	76.6	31.1	V.F.	V.S.
218	B.	" 6....	210	152	75.0	31.0	F.	S.
222	B.	" 6....	190	139	78.7	31.1	S.	V.S.
224	S.	" 31....	195	145	77.2	30.4	F.	V.S.

RATION 9.

1st Period..... Oats, Peas and Barley, + skim-milk.

2nd " Corn Meal, commencing Oct. 17, 1900.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
250	B.	Jan. 28....	176	125	75.8	30.7	F.	V.S.
251	S.	" 28....	185	133	74.3	31.0	F.	S.
252	S.	" 14....	187	137	73.3	30.9	S.	S.
253	B.	Nov. 30....	181	135	71.7	32.2	V.F.	M.F.
254	S.	Jan. 14....	187	140	74.8	30.7	S.	S.

RATION 10.

$\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Oats, Pease and Barley ; pastured first on Rape, finally on Artichokes.

Rating by Olein.	No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
M. F.	279	S.	Dec. 6....	175	126	78.3	?	F.	V. S.
V. S.	280	S.	" 6....	195	138	65.4	?	F.	V. F.
V. S.	281	S.	" 6....	201	141	76.6	?	F.	V. S.
F.	282	S.	" 6....	171	127	74.9	?	V. F.	S.
M. F.	283	B.	" 6....	203	150	75.8	?	F.	V. S.
F.	284	S.	" 6....	182	131	78.5	31.4	F.	V. S.

RATION 11.

1st Period—Pastured on Rape ; $\frac{1}{2}$ Corn Meal, $\frac{1}{2}$ Oats, Pease and Barley.

2nd " Oct. 3—Same grain ration and Raw Pumpkins.

Rating by Olein.	No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
V.S.	261	B.	Nov. 30.....	181	135	73.2	29.3	V. F.	S.
V.S.	262	B.	Dec. 8.....	174	122	75.2	32.5	V. F.	V. S.
V.S.	265	B.	" 30.....	180	130	77.8	31.4	F.	V. S.
V.S.	266	S.	" 30.....	180	132	75.2	30.9	F.	V. S.
V.S.	272	S.	" 8.....	191	142	69.9	33.5	V. F.	F.
V.S.	305	S.	" 8.....	175	127	73.7	32.0 ?	V. F.	S.

RATION 12.

1st Period..... Corn Meal.

2nd " Oats, Pease and Barley and cooked Pumpkins.

Rating by Olein.	No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
V.S.	292	S.	Dec. 6....	185	139	78.1	30.8	F.	V. S.
S.	293	B.	Nov. 30....	190	142	70.8	31.2	V. F.	F.
S.	299	B.	" 8....	181	135	72.3	31.5	F.	M. F.
M.F.	300	B.	" 30....	190	140	73.2	30.9	V. F.	S.
S.	306	B.	" 8....	198	139	69.5	32.4	M. F.	F.
S.	307	S.	Dec. 6....	182	137	75.6	31.8	V. F.	V. S.

RATION 13.

1st Period..... $\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Oats, Pease and Barley.2nd " $\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Pease.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
287	S.	Dec. 8....	186	134	80.4	30.1	F.	V. S.
290	S.	Nov. 30....	190	139	73.7	31.1	F.	S.
298	S.	Dec. 31....	182	135	69.0	31.3	V. F.	F.
303	B.	Nov. 8....	180	124	68.5	31.8	F.	F.
310	S.	Dec. 31....	197	143	69.9	31.5	V. F.	F.

RATION 14.

 $\frac{1}{2}$ Corn Meal ; $\frac{1}{2}$ Oats, Pease and Barley and Artichokes.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
263	S.	Dec. 6....	191	137	75.9	31.0	F.	V. S.
264	S.	" 6....	201	147	70.9	31.1	V. F.	F.
267	B.	" 6....	182	137	73.2	31.3	V. F.	S.
269	S.	" 6....	191	140	75.1	31.8	V. F.	V. S.
271	B.	" 6....	182	131	72.0	32.2	V. F.	M. F.

RATION 15.

1st Period.....Pastured on Clover.

2nd "From Oct. 30, fed Clover— $\frac{1}{2}$ Corn Meal, $\frac{1}{2}$ Oats, Pease and Barley.

No.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
273.....	Nov. 23....	182	130	80.3	30.7	V. F.	V. S.
275.....	" 23....	179	120	83.4	28.8	S.	V. S.
276.....	" 23....	182	129	79.5	29.2	F.	V. S.
277.....	" 23....	192	137	72.6	30.2	F.	M. F.
278.....	" 23....	238	170	71.2	31.3	V. F.	M. F.
310.....	Dec. 31....	197	143	69.9	31.5	V. F.	F.

RATION 16.

1st Period Corn Meal.
 2nd " Oats, Pease and Barley.

No.	Sex.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
226	S.	Dec. 31....	180	134	78.9	.....	S.	V. S.
229	S.	" 31....	189	135	75.5	31.0	F.	V. S.
230	S.	Jan. 14....	193	136	74.9	30.9	S.	S.
231	B.	Dec. 31....	186	135	73.3	31.6	V. F.	S.
234	S.	" 31....	180	135	78.7	30.7	M. F.	V. S.
235	S.	Jan. 14....	194	140	75.2	30.6	S.	V. S.

RATION 17.

A— $\frac{1}{2}$ Corn Meal, $\frac{1}{2}$ Oats, Pease, Barley and Skim-milk + Turnips.
 B— " " " " Mangels.
 C— " " " " Sugar Beet.

	Number of Pig.	Date of Slaughtering.	Live Weight.	Dressed Weight.	Olein.	Melting Point.	Inspection Rating.	Rating by Olein.
A.	312	May 3.. .. .	197	133	71.8	32.0	V. F.	M. F.
	313	" 3.	197	135	70.2	32.5	V. F.	F.
	314	" 3.	189	126	69.6	32.0	F.	F.
	315	" 3.	185	121	70.1	32.7	V. F.	F.
B.	316	" 3.	195	135	65.9	33.0	V. F.	V. F.
	317	" 3.	195	138	68.0	32.3	V. F.	V. F.
	318	" 3.	182	125	69.1	32.7	F.	F.
	319	" 3.	194	131	69.6	32.9	V. F.	F.
C.	320	" 3.	175	118	66.0	32.5	F.	V. F.
	321	" 3.	218	155	66.1	32.5	V. F.	V. F.
	322	" 3.	187	130	69.1	31.9	F.	F.
	323	" 3.	227	157	66.3	32.2	V. F.	V. F.