KANSAS STATE AGRICULTURAL COLLEGE.

Agricultural Experiment Station.

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HOG FEEDING.

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SUMMARY.

PART I.

1. Two tests in this series (Experiments Nos. I and III) compared corn meal and kafir meal for fattening hogs, both being supplemented with soy bean meal. In one the gains made on the kafir meal-soy bean ration were 11.4 per cent less than on the corn meal-soy bean ration and the cost was 9.1 per cent more. In the other the gain on the kafir meal-soy bean ration was 5.4 per cent greater than on the corn meal-soy bean ration. The lot on corn meal-soy bean meal required 5.7 per cent more grain to produce one pound of gain.

2. A sorghum seed meal and soy bean meal ration (Experiment No. III) gave less daily gain than a ration of clear corn meal. In the same experiment the corn meal lot required 28 per cent more grain to produce one pound of increase than the lot receiving kafir meal-soy bean meal and 22 per cent more than a lot receiving corn meal and soy bean meal.

3. An average of three lots (Experiment No. VII) receiving different brands of condimental stock foods with corn, in comparison with a lot on corn meal, shorts and meat meal, showed an average daily gain of .76 pound with stock food rations and 1.69 pounds daily gain on the corn, shorts and meat meal ration.

4. A comparison of wet and dry mixtures of corn, shorts and meat meal (Experiment No. VIII) showed an average daily gain per hog of 1.95 pounds on the dry ration and 2.31 pounds on the wet ration.

5. The average daily gain of five lots fed corn meal alone was .94 pound per head, costing $6.34 per 100 pounds of increase.

6. The average daily gain of four lots receiving alfalfa hay as a supplement to corn was 1.09 pounds per head, costing $5.82 per 100 pounds of gain.

7. The average daily gain of three lots receiving alfalfa meal as a supplement to corn was 1.01 pounds per head, costing $5.97 per 100 pounds of gain.

8. The average daily gain of seven lots fed tankage or meat meal as a supplement to corn was 1.58 pounds per head, costing $5.06 per 100 pounds of gain.

9. The average daily gain of four lots receiving a ration of corn, shorts and meat meal or tankage was 1.88 pounds per head, costing $4.58 per 100 pounds of gain.

10. In seven trials where corn was supplemented with tankage or meat meal an average value of .80 cents per bushel was returned for corn fed, giving pork a valuation of $7 per cwt.

11. In four tests where corn was supplemented with shorts and meat meal or tankage, corn returned a value of $1.07 per bushel, giving pork a valuation of $7 per cwt.

12. Averaging four tests where corn alone was fed, corn returned a value of 59 cents per bushel, giving pork a valuation of $7 per cwt.

PART II.

1. Hogs fattened on alfalfa and rape pastures made cheaper and more rapid gains than hogs fattened in dry lots.

2. Hogs fattened on rape pasture made gains as cheaply as those fattened on alfalfa pasture.

3. It was more expensive (Experiment No. XV) to grow young hogs in a dry lot on corn, shorts and tankage than on corn or corn, shorts and tankage on alfalfa pasture.

4. A comparison of Lot 75 with Lot 72a (Table No. XXXII) shows that it is advisable to feed some protein supplement, such as shorts and tankage, with corn, even to stock shoats that are being grown on alfalfa pasture.

5. The gain made at the given prices of feed and pasture cost $5.30 in Lot 72a and $4.58 in Lot 75, a difference of 72 cents a hundred pounds in favor of the protein-fed lot (Table No. XXXII).

6. Sorghum seed, as is shown in Experiment No. XIII, can be used for fattening hogs, but it does not make a very desirable feed.

7. Kafir and milo, when fed to fattening hogs, each gave results about 10 per cent lower than results obtained from feeding corn (Experiment No. XIII).

8. Kafir, milo and sorghum seed, when supplemented with some other feeds, such as shorts and tankage, that are more palatable and contain more protein, gave better returns than supplemented with alfalfa hay (Experiment No. XIII).

9. When spring shoats were full fed through the summer on alfalfa or rape pasture and finished in the fall in dry lots, those fed a grain ration of corn, shorts and tankage finished 45 days sooner, averaged 48 pounds a hog heavier, made gains at a cost of 15 to 20 cents a hundred pounds less, and sold on the market for from 10 to 20 cents a hundred pounds more than those fed on corn or corn and alfalfa hay (Table No. XXXIII).

10. When spring shoats were grown with a limited amount of grain on alfalfa pasture during the summer and finished in dry lots in the fall and early winter, those finished on corn, shorts and tankage were ready for market 15 days earlier, weighed 55 pounds a hog more, required 15 cents less to produce each 100 pounds of gain, and sold for 20 cents a hundred pounds more than those finished on corn or corn and hay.

11. Spring shoats that were full fed through the summer and thus pushed for an early market, not considering interest and risk, made gains at an average cost of from 15 to 20 cents a hundred more than similar shoats grown through the summer on pasture and a small amount of grain and finished in the fall and winter in dry lots.

12. An average of all the comparable lots fed in the experiments reported in Part II of this bulletin shows that when hogs were finished in dry lots 41 hogs fed on corn alone required 5.96 pounds of corn to produce each pound of gain; 33 hogs fed on corn and alfalfa hay required 5.29 pounds of corn and .5 of a pound of hay to produce each pound of gain; 86 hogs fed corn and tankage required 4.77 pounds of feed to make 1 pound of gain; and 134 hogs fed corn, shorts and tankage required 4.62 pounds of feed to make each pound of gain.

INTRODUCTION.

G. C. WHEELER, Assistant Animal Husbandman.

HOGS are raised on nearly every live-stock farm in the state. More farmers are interested in the growing and marketing of swine than in the production of any other class of meat-making animals. With the hog occupying such an important place in the farm practice of the state, it is to be expected that investigations in pork production should be one of the important lines of research work engaged in by the Experiment Station. Swine feeding tests of various kinds have been in almost continuous progress since the organization of the Station and much valuable information has been secured.

Corn must ever be the basis of profitable pork production throughout the greater part of the state. Through the western section kafir and milo, to a large extent, must be substituted for corn. When corn was low in price little attention was given to economizing its use. Corn has now reached a high level on the market and will probably never again be cheap. It can no longer be looked upon as the sole feed even for fattening hogs. Under these conditions the problem of so supplementing this great pork producer as to secure the largest return from the corn fed is a most important one.

Careful observers have long noted the results following unwise methods of feeding. While corn is the great fat producer of the farm, a train of bad results have followed its injudicious use as a feed for swine. It is lacking in both protein and mineral matter. Swine fed on corn alone do not grow to full size, are weak in bone, and lacking in vigor and reproductive powers. It is a well established fact that corn alone is not a satisfactory or profitable feed for pork production.

The first three experiments of this series were planned and authorized by Oscar Erf, Dairy and Animal Husbandman from September 1, 1903, to September 1, 1905. The remaining experiments of the series were planned and authorized by R. J. Kinzer, Animal Husbandman, beginning September 1, 1905. The author of Part I of this bulletin, G. C. Wheeler, was assistant in feeding experiments in 1904 and 1905, and Assistant Animal Husbandman from September 1, 1905, to September 1, 1909, and had direct charge of the feeding and other details of the experiments. The experiments reported in Part II were planned and authorized by Professor Kinzer and Pres. H. J. Waters. Turner R. H. Wright, author of Part II, and F. G. King, Assistants in Animal Husbandry, looked after the details of the experiments.

Swine by nature are adapted to a diet of great variety. Under natural conditions green forage combined with a varied assortment of more concentrated feeds formed the diet of the hog. The data secured by the various Experiment Stations have all pointed to the necessity for growing and fattening swine under more natural conditions, if the most profitable, returns are to be made for the feed consumed.

Corn, kafir and milo all contain large amounts of digestible carbohydrates and fat but are very deficient in both protein and mineral matter. There are many concentrated feeds containing larger amounts of protein and mineral matter than these. Proper combinations of these various feeds with corn, kafir or milo in order to produce the most profitable results are of the greatest importance in pork production. Inquiries are being received constantly by the Kansas Experimental Station as to the relative value of these various supplemental feeds, and the proper combinations to make in order to secure the most profitable returns. The desire to supply accurate information in response to these numerous inquiries inspired the planning and the carrying out of the series of swine feeding experiments reported in this bulletin.

GENERAL PLAN OF EXPERIMENTS.

HOGS USED. Eight experiments are reported in Part I of this bulletin, involving the use of three hundred and sixty-four hogs. These hogs were all bred and raised by the Animal Husbandry Department of the College. In connection with the instruction work in this department it is necessary to have representative animals of several different breeds. The maintenance of these breeding herds made it possible to have a large number of hogs each year suitable for experimental purposes. In all the feeding trials made the number of hogs per lot has been large enough to overcome influences which might be due to the different breeding of the animals used. In making the division into lots special attention has been given to this point in each experiment of the series.

METHODS USED IN FEEDING. The yards and houses used in these experiments were planned and constructed in a manner especially suitable for experimental feeding. The yards have a southern exposure and are well drained. The houses are cheaply constructed and designed as sleeping quarters only,

They are divided into two parts 8 ft. by 10 ft., each division having an outside yard 30 ft. by 150 ft. The feeding was done out in the open yard in all the experiments. All grain fed was ground, a Bowsher mill being used.

The rations were carefully mixed in the proper proportions and accurately weighed. These rations were wet at the time of feeding so as to form a thick slop, and were fed in troughs. The hogs were given such amounts as they would clean up without waste. Scales were convenient to the feeding yards, and each lot was carefully weighed every seven days.

SUPPLEMENTAL FEEDS USED. The main object of the experiments of this series was to study the use of the various nitrogenous supplements available for properly balancing corn in fattening rations. As has been pointed out, the nutritive ratio of corn is too wide to give the most profitable returns when it is used as the sole ration.

Tankage, meat meal, soy beans, shorts, alfalfa hay and alfalfa meal were all used as supplements to corn and kafir in these various experiments. In order to permit a comparative study of the feeds used, from the standpoint of the nutrients supplied by each, the following figures are given:

AVERAGE COMPOSITION OF FEEDING STUFFS.

	Water, per cent.	Ash, per cent.	Crude protein, per cent.	Carbohydrates.		Fat, per cent.
				Fiber, per cent.	Nitrogen-free extract, per cent.	
Corn	10.6	1.5	10.3	2.2	70.4	5.0
Milo	9.	2.3	10.7	3.0	72.2	2.8
Kafir	9.9	1.6	11.2	2.7	71.5	3.1
Shorts	11.2	4.4	16.9	6.2	56.2	5.1
*Swift's digester tankage	.....	.....	60.	0.0	00.0	8.0
*Swift's meat meal	.....	.....	46.	0.0	00 0	10.0
*Armour's deodorized meat meal	.....	.....	60.	1.5	00.0	10.0
Soy beans	11.7	4.8	33.5	4.5	28.3	17.2
Alfalfa hay	6.8	10.6	15.4	33.3	32.5	1.4
Sorghum seed	12.8	2.1	9.1	2.6	69.8	3.6

* Guaranteed composition. Inspection samples analyzed by the chemical department show that manufacturers are living up to guarantee.

PRICE OF FEEDS.

While the efficiency of the ration is the important point to study, from an experimental standpoint, it is necessary to make financial comparison between various rations. In order

that all the experiments of this series may be comparable from a financial standpoint the following scale of prices has been used in calculating the cost of gains in all the tests reported:

TABLE I.—Prices of feeds used in computing cost of gains.

Corn meal	$0.95 per cwt.
Kafir meal	.95 "
Milo meal	.95 "
Sorghum seed meal	.95 "
Soy bean meal	1.70 "
Shorts	1.20 "
Armour's deodorized meat meal	2.25 "
Swift's digester tankage	2.25 "
Swift's meat meal	2.05 "
International stock food	5.00 "
Pratt's stock food	5.00 "
Hercules stock food	7.00 "
Alfalfa hay	8.00 per ton.
Green alfalfa	2.40 "
Alfalfa meal	12.00 "
Cottonseed meal	29.00 "
Shelled corn	.50 per bu.

Pasture:

10 cents per head per month where hogs are full fed on corn 62 per cent, shorts 30 per cent, tankage 8 per cent.

10½ cents per head per month where hogs were full fed on corn alone.

12½ cents per head per month where hogs are limited fed on corn 62 per cent, shorts 30 per cent, tankage 8 per cent.

18 cents limited fed on corn alone.

20-30 cents per head per month when on alfalfa pasture alone.

TANKAGE AND MEAT MEAL. At the time this series of tests was started the use of these packing-house by-products for feeding purposes had just begun. No data were available as to their value, except their chemical composition. They were being sold on the market for feeding purposes, and farmers using them were getting good results. Armour's deodorized meat meal, according to the manufacturers, consists of cooked meat scraps dried down in the water in which the meat was cooked. This is then ground and put through a screen in order to secure uniformity of product. It is sold in Kansas under the following guarantee as to composition:

Protein	60.0	per cent minimum.
Fat	10.0	" "
Crude fiber	1.5	" maximum.

Swift's digester tankage is described by the Animal Food Department of Swift & Company as follows: "The trimmings and other materials used are placed in steam pressure tanks, where a temperature of around 245° F. is maintained for several hours. This high temperature releases most of the fats, which are then drawn off. The meat residues and small pieces of bone remaining in the tank are then run through a steam jacketed dryer and the tankage dried to a point where it can be handled and stored for an indefinite time. After going through the dryer the tankage is run over a mill, ground and screened to a proper mechanical condition; in other words, to about the mechanical texture of ordinary corn meal." It is sold in Kansas under the following guarantee:

Protein	60.0 per cent	minimum.
Phosphates	6.0 "	"
Fat	8.0 "	"
Crude fiber	0.0 "	maximum.

Swift's meat meal, which was fed in some of the tests, resembles the Swift's digester tankage in appearance, but is a lower grade product. It is sold in Kansas under the following guarantee:

Protein	46.0 per cent	minimum.
Fat	10.0 "	"
Phosphates	6.0 "	"
Crude fiber	0.0 "	maximum.

The composition of these packing-house by-products may vary somewhat from the guaranteed analysis. Samples containing as high as 67 per cent crude protein have been analyzed by the chemistry department of the Experiment Station.

The possibility of introducing hog cholera or other diseases into a herd of healthy hogs is often suggested by those not familiar with processes used in preparing these products for use. The high temperature to which they are subjected effectually destroys any disease germs which might be present. Government inspection does not permit any diseased animals to be used in preparing feeding tankage or meat meal, but even if such animals were used all danger of transmitting diseases would be overcome by the sterilizing process which this material undergoes.

CONDIMENTAL STOCK FOODS. Three common brands of stock foods were used in one experiment of this series of tests, being purchased on the open market and fed in connection with corn according to the printed instructions found in the packages.

ALFALFA MEAL. The fact that alfalfa is so high in feeding value has naturally stimulated a desire to reduce all waste to a minimum.

Within the past few years a number of companies have been organized for grinding alfalfa hay into meal and placing it on the market, either as a pure meal or some prepared mixture of the meal and other feed. The grinding of the hay into meal has greatly increased its cost, and to those having alfalfa hay available it becomes an important question as to whether the digestibility is sufficiently increased or the amount of waste sufficiently reduced to pay returns on the increased cost.

In order to solve some of these problems as applied to the fattening of hogs, and thus enable the Experiment Station to answer the numerous inquiries constantly being received concerning alfalfa meal, its use as a supplement was introduced into several of the experiments of this series.

SOY BEAN MEAL. Previous experimental work with soy beans has shown them to have great value in supplementing corn and kafir for profitable pork production. Their use in these experiments was for the purpose of introducing supplemental feed of known value for comparison with the tankage and meat meal as supplements to corn and kafir.

SHORTS. Shorts have long been recognized as of great value in pork production. The use of shorts in these tests has been for direct comparison with tankage as a supplement, or as an additional supplement to the tankage or meat meal.

Experiment I.

A COMPARISON OF TANKAGE AND SOY BEAN MEAL AS A SUPPLEMENT TO CORN FOR FATTENING HOGS.

January 5, 1904, to February 1, 1904.

At the time this experiment began, January 5, 1904, little was known concerning tankage as a feed for hogs. Practically no information was available as to the best methods of feeding it or the proper quantities to use. It had been used for three or four years by a few individuals, and two experiment stations had published the results of experiments which showed it to have great value as a supplement to corn. This first test at the Kansas Station was, through force of circumstances, of rather short duration, but long enough to bring out marked differences as result of the different rations used.

PLAN OF EXPERIMENT.

Since corn alone constitutes the ration of a great many hogs being finished for market, one lot in the experiment received corn meal as the sole ration. This lot was used as a check on the lots receiving supplemental feeds. Previous tests having demonstrated the great value of soy beans in balancing corn and kafir rations, a lot was introduced using soy bean meal as a supplement to corn. The principal object of this experiment was to make direct comparisons between tankage and soy bean meal as supplements to corn, using a ration of corn alone as a check upon the two lots receiving supplemental feeds. The rations fed were as follows:

Lot 1.	Corn meal	5 parts	by weight.
	Tankage	1 part	" "
Lot 2.	Kafir meal	4 parts	" "
	Soy bean meal	1 part	" "
Lot 3.	Corn meal	4 parts	" "
	Soy bean meal	1 part	" "
Lot 4.	Corn meal.		

These rations were mixed with water into a thick slop at the time of feeding, and only such quantities were given as would be cleaned up with a relish by the hogs.

THE HOGS USED.

The hogs used were good, thrifty shoats and were in fairly good condition when the experiment began. All had been fed alike during the first part of the winter. Forty-eight hogs were carefully divided into four lots of twelve each.

RESULTS OF EXPERIMENT.

Table II gives in condensed form the essential facts of this experiment.

TABLE II.—Fattening hogs with Swift's digester tankage and soy bean meal as supplements to corn and kafir meal.
Experiment began January 5, 1904 and closed February 1, 1904.

	Lot 1. Corn meal 5 parts, tankage 1 part.	Lot 2. Kafir meal 4 parts, soy bean meal 1 part.	Lot 3. Corn meal 4 parts, soy bean meal 1 part.	Lot 4. Corn meal.
Number of hogs in lot	12	12	12	12
Number of days fed	27	27	27	27
Initial weight per hog, lbs.	168	178	173	168
Final weight per hog, lbs.	209.6	207.4	206.2	193.6
Total gain per hog, lbs.	41.6	29.4	33.2	25.6
Av. daily gain per hog, lbs.	1.54	1 09	1.23	.95
Av. feed consumed daily per hog, lbs.	6.54	6 25	6 47	6.58
Av. feed consumed daily per 100 lbs. of hog, lbs.	3 46	3.24	3.41	3.64
Feed per pound of gain, lbs	4.25	5.74	5.26	7.28
Cost of feed per 100 lbs. of gain	$4.95	$6.32	$5.76	$6.92

The greater efficiency of the tankage ration as compared with corn alone was apparent within the first week of the test. The hogs fed corn alone required 3.03 pounds more feed for each pound of gain produced than the lot receiving the tankage ration. Each pound of tankage fed had taken the place of or saved, 5.3 pounds of corn. At the rate of 95 cents per cwt. this amount of corn was worth 5 cents. A pound of tankage cost 2¼ cents, leaving a net gain of 2¾ cents for every pound of tankage fed. Two dollars and twenty-five cents per hundred seems a high price to pay for a feed, but if its use would save $2.75 for every hundred pounds of it fed a farmer would certainly be justified in using it as a means of economizing in the production of pork. The value of soy beans as a hog feed was also demonstrated by this

test. The ration of corn and soy bean meal was not so efficient as the ration of corn meal and tankage, but far superior to corn meal alone. It is interesting to note the efficiency of the kafir and soy bean ration. The gain made by the hogs in this lot was only 11.4 per cent less than that of the lot receiving corn and soy bean meal. The feed cost per pound of gain was 9.1 per cent greater.

Experiment II.

A COMPARISON OF TANKAGE AND SHORTS AS SUPPLEMENTS TO CORN FOR FATTENING HOGS.

November 1, 1904, to December 15, 1904.

PLAN OF EXPERIMENT.

Here the comparison between the two supplemental feeds was direct, there not being a sufficient number of hogs available to introduce a check lot receiving corn alone without making the lots too small in numbers. This comparison was suggested by the fact that shorts had so long been recognized as one of our most valuable feeds for swine. The hogs used were good, thrifty shoats of spring farrow. They had run on pasture through the summer, receiving a moderate ration of corn and shorts. Alfalfa hay of fine quality had been kept before them at all times when not on pasture. There were ten hogs in each lot. The rations fed were as follows:

LOT 5.	Corn meal	5 parts
	Tankage	1 part.
LOT 6.	Corn meal	2 parts
	Shorts	1 part.

RESULTS OF EXPERIMENT.

These two lots were carefully fed forty-five days, and at the end of that period were fairly well finished for light hogs. The important facts of the experiment are shown in Table III. Good gains were made by both lots. It will be noticed that the average daily gains made by the tankage lot are almost identical with those made by the tankage lot in Experiment I. From the standpoint of efficiency the corn and tankage ration was slightly superior to the corn and shorts ration, 9.6 per

cent more of the latter being required to produce a pound of gain. The cost, however, per hundred pounds of gain was only 2.9 cents more with the shorts ration.

TABLE III.—Fattening hogs with tankage and shorts as supplements to corn meal.

Experiment began November 1, 1904, and closed December 15, 1904.

	Lot 5. Corn meal 5 parts, tankage 1 part.	Lot 6. Corn meal 2 parts, shorts 1 part.
Number hogs in lot		10
Number of days fed	45	45
Initial weight per hog, lbs	128	127 5
Final weight per hog, lbs	200	195
Total gain per hog, lbs	72	67.5
Average daily gain per hog, lbs	1 6	1.5
Average feed consumed daily per hog, lbs	6 99	7.19
Average feed consumed daily per 100 lbs. live weight of hog, lbs	4 26	4.45
Feed per pound of gain, lbs	4.37	4.79
Cost of feed per 100 lbs. of gain	$4 925	$4 954

Experiment III.

A COMPARISON OF SORGHUM SEED MEAL, KAFIR MEAL AND CORN MEAL FOR FATTENING HOGS.

April 4, 1905, to May 5, 1905.

PLAN OF EXPERIMENT.

This experiment is somewhat out of place in this series, since it was not a comparison of supplementary feeds. The experiment was short and was planned for the purpose of finding out to what extent sorghum seed could be used as a grain for fattening hogs. The value of kafir when properly supplemented had been fairly well established by previous experimental work, but no data were available on sorghum seed other than its chemical composition, which very closely resembled that of kafir. A bunch of fall and winter shoats were available, and they were divided into four lots of twelve hogs each. The rations fed were as follows:

LOT 7. Sorghum seed meal ..... 4 parts by weight.
Soy bean meal..... 1 part

LOT 8. Kafir meal ..... 4 parts by weight.
Soy bean meal., ... 1 part "
LOT 9. Corn meal ..... 4 parts "
Soy bean meal.. ..... 1 part "
LOT 10. Corn meal.

RESULTS OF EXPERIMENT.

It became apparent during the first week of the experiment that the sorghum seed ration would not prove of much value. The hogs did not relish it and would not eat large enough rations to produce good gains. The other lots would have consumed larger amounts of feed, but were held to the amount Lot 10 consumed. The test was closed at the end of the fourth week. Table IV shows the results in figures.

TABLE IV.—Fattening hogs with sorghum seed meal, kafir meal and corn meal, supplemented with soy bean meal.
Experiment began April 4, 1905, and closed May 2, 1905.

	Lot 7. Sorghum seed meal, 4 parts; soy bean meal, 1 part.	Lot 8. Kafir meal, 4 parts; soy bean meal, 1 part.	Lot 9. Corn meal, 4 parts; soy bean meal, 1 part.	Lot 10. Corn meal.
Number of hogs in lot	12	12	12	12
Number of days fed	28	28	28	28
Initial weight per hog, lbs.	139.16	140 00	136 66	138.33
Final weight per hog, lbs	167.91	178 33	172.91	168 33
Total gain per hog, lbs.	28 75	38 33	36.25	30 00
Average daily gain per hog, lbs.	1.02	1.37	1.29	1.07
Av. daily feed consumed per hog, lbs.	6.00	6 00	6 00	6 00
Average feed consumed daily per 100 lbs. of hog, lbs.	3 90	3.77	3 86	3.91
Feed consumed per lb. of gain, lbs.	5.84	4 38	4.63	5.60
Cost of feed per 100 lbs. of gain	$6 42	$4.81	$5.09	$5.32

It will be noted that the sorghum seed lot, even though the sorghum seed meal was supplemented with the rich and palatable soy bean meal, did not make as great daily gains as the check lot on corn meal alone. Lots 8 and 9 made very good gains considering the fact that if allowed to they would have consumed somewhat larger rations than were given. In this test the kafir meal exceeded the corn meal in efficiency, as will be seen by referring to the figures under Lots 8 and 9 in the table above. Making comparison between these two lots, we find that the lot receiving the corn-soy bean combination required 5.7 per cent more grain to produce a pound of gain than the lot receiving kafir meal and soy bean meal. These results

were a complete reversal of those secured in making comparison between similar rations in Experiment 1. The check lot receiving corn alone required 1.22 pounds or almost 28 per cent more grain to produce a pound of increase than the lot receiving kafir and soy bean meal, and 22 per cent more than the lot receiving corn and soy bean meal.

Experiment IV.

A COMPARISON OF ARMOUR'S MEAT MEAL AND ALFALFA HAY AS SUPPLEMENTS TO CORN FOR FATTENING HOGS.

October 9, 1905, to January 29, 1906.

PLAN AND PURPOSE OF EXPERIMENT.

Inquiries concerning the use of meat meal and tankage for hog feeding were becoming more and more numerous at this time. The two previous tests were of such short duration that they could not be used as a basis for authoritative information regarding the use of these packing-house by-products for feeding purposes. In order to secure more comprehensive data on the subject this experiment was planned. The hogs were taken at an earlier age and carried through a longer period of feeding.

It was planned to have a check lot on corn alone, since that method of feeding is so largely followed after hogs come off the pasture in the fall.

It had been noticed that mature hogs when fed light grain rations made considerable use of alfalfa hay during the winter season. It had also been commonly observed that hogs being fattened for market on corn alone were more thrifty and made better gains where they have had free access to alfalfa hay. In order to secure accurate data as to the value of alfalfa hay as a supplement to corn in the fattening pen its use for that purpose was introduced into this experiment. The rations fed were as follows:

LOT 11. Corn meal.
LOT 12. Corn meal ..... 5 parts.
Armour's deodorized meat meal ..... 1 part.
LOT 13. Corn meal, and all the alfalfa hay they would consume.

The alfalfa hay was fed in a rack especially made for the purpose. A rack of this kind is shown in Fig. 8. This method of feeding alfalfa hay to hogs keeps it before them at all times and prevents much waste. Such racks are in use constantly during the winter season at the Experiment Station in feeding brood sows and other breeding stock.

HOGS USED.

Thirty thrifty, vigorous shoats were available for this experiment. They were all cross-bred, three different crosses being represented. In the division care was taken to have an equal number of each different cross in each of the three lots, so as to overcome any possible influence due to the breeding of the animals. They had been grown on pasture, with a moderate allowance of grain, and were in splendid condition to make profitable returns in the fattening pens. Alfalfa hay of good quality was very difficult to obtain at this season of the year, and after twenty days feeding it was found necessary to discontinue the use of the hay. For the remainder of the experiment green alfalfa was cut daily and given to the hogs in this lot.

TABLE V.—Fattening hogs with Armour's meat meal and alfalfa hay as supplements to corn meal.
Experiment began October 9, 1905, and closed January 29, 1906.

	Lot 11. Corn meal.	Lot 12. Corn meal 5 parts, meat meal 1 part.	Lot 13. Corn meal, alfalfa hay.
Number of hogs in lot	10	10	10
Number of days fed	112	112	112
Initial weight per hog, lbs	129	127 5	131
Final weight per hog, lbs	240	325	263
Total gain per hog, lbs.	111	197.5	132
Average daily gain per hog, lbs.	.99	1.76	1 18
Average feed consumed daily per hog, lbs.	6.866	8.392	7.03 corn meal. 1.2 alfalfa.
Average feed consumed daily, per 100 lbs. of hog, lbs.	3.72	3.71	3 57 corn. .61 alf. hay.
Feed per pound of gain, lbs	6 93	4.76	5.96 corn meal. 1 01 alf. hay.
Cost of feed per 100 lbs. of gain	$6.58	$5 54	$6.07.

RESULTS OF EXPERIMENT.

The hogs receiving the meat meal ration outstripped the check lot fed on corn meal alone from the start. They consumed their feed with a much keener appetite and appeared

more healthy and thrifty throughout the test than Lot 11. This lot consumed on an average 1.43 pounds more feed daily than Lot 11. Their average daily gains were also much greater. The real efficiency of the meat meal ration is shown in the greatly reduced quantity of feed required per pound of gain by the hogs in this lot. By reference to the table it will be seen that the hogs in the corn meal lot required 2.17 pounds, or over 45 per cent, more of feed to produce a pound of increase than those in the meat meal lot; or, in other words for each pound of meat meal fed 3.75 pounds of corn had been saved. This would make 100 pounds of the meat meal worth $3.56 in terms of corn at 95 cents per 100 pounds.

The lot receiving the alfalfa hay as a supplement consumed somewhat larger amounts of grain daily, and also made 20 per cent greater gains than Lot 11. The hay substituted for corn pound for pound, as will be noted by making comparison as to the amounts of feed required to produce each pound of increase, or, in other words, a pound of hay saved a pound of corn. Lots 11 and 13 could profitably have been fed longer, as they were not fully finished at the close of the test. Figures 1, 2 and 3 show the general appearance of the three lots of hogs the day the test was ended.

SLAUGHTER TEST.

In order to study the effects of the different rations upon the carcasses of these hogs, they were followed through the packing house. They were shipped direct to the Chas. Wolff packing house, Topeka, Kan., and each lot was tagged and slaughtered separately. A typical carcass was selected from each lot. After these were cut up the various cuts were grouped and photographed. Figures 4, 5 and 6 show the appearance of the various cuts from these carcasses. The greater thickness of the cuts from the Lot 12 carcass is easily noted. Although Lot 12 seemed much fatter and heavier on foot, the weight of the leaf lard was only slightly greater than that from the other two lots. The alfalfa lot, No. 13, produced a fine carcass, as will be noted. Mr. J. B. Nicholson, superintendent of the packing house, stated that the carcasses from Lot 12 seemed more firm in the warm condition than those of the other two lots. Doctor De Wolf, the government inspector,

pronounced the whole bunch unusually healthy. The lymphatic glands were all large and soft, and only one case of parasitic infection of the liver was found.

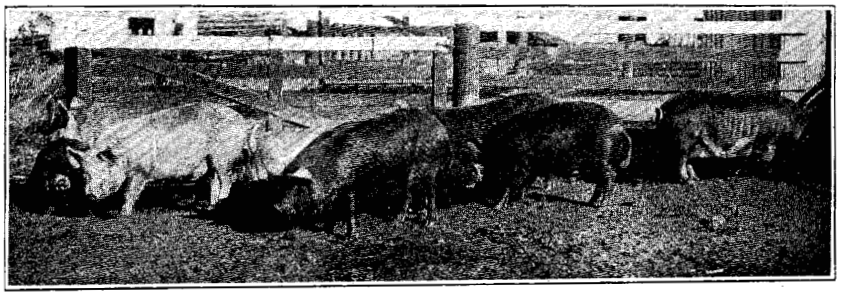

FIG 1. Showing hogs fed in Lot 11; ration, corn alone.

FIG. 2. Showing hogs fed in Lot 12; ration, corn and meat meal.

FIG. 3. Showing hogs fed in Lot 13; ration, corn and alfalfa hay.

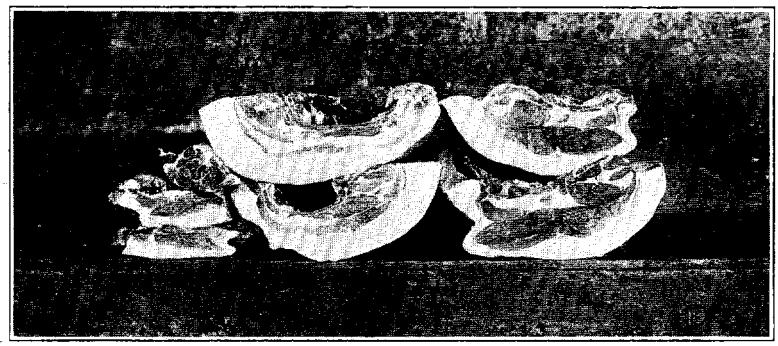

FIG. 4. Showing cuts of representative carcass from hogs finished in Lot 11, on corn alone.

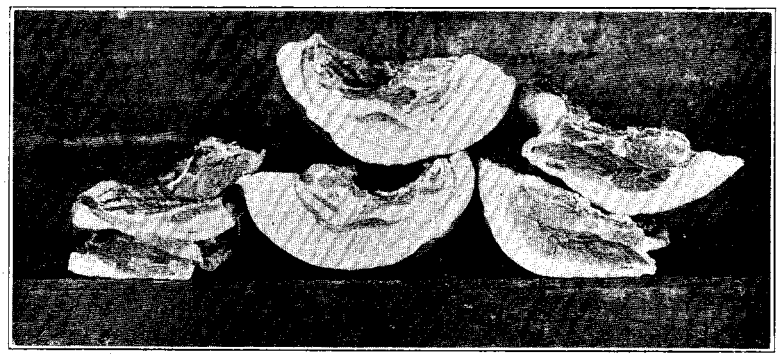

FIG. 5. Showing cuts of representative carcass from hogs finished in Lot 12, on corn and meat meal.

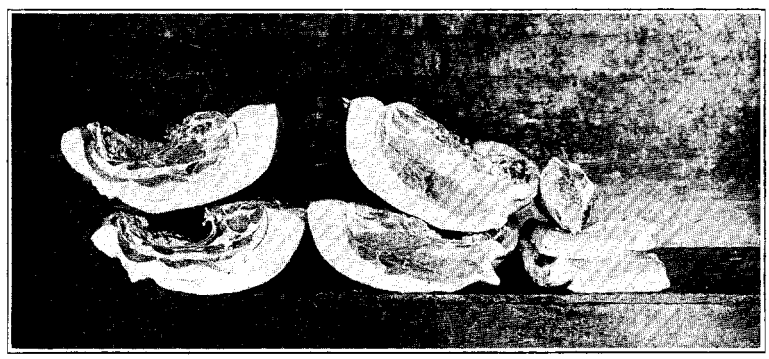

FIG. 6. Showing cuts of representative carcass from hogs finished in Lot 13, on corn and alfalfa hay.

Experiment V.

A COMPARISON OF TANKAGE, MEAT MEAL, COTTONSEED MEAL AND ALFALFA HAY, AS SUPPLEMENTS TO CORN FOR FATTENING HOGS.

April 11, 1906, to June 16, 1906.

PLAN AND PURPOSE OF EXPERIMENT.

This experiment was practically a duplication of No. IV. Since there were two packing-house by-products being sold under different names, it was decided to feed both in the same experiment. A lot on corn meal alone was again introduced as a check, and in order to more fully test the use of alfalfa hay in finishing hogs, one lot was fed corn meal, with free access to alfalfa hay of good quality. The use of cottonseed meal as a supplement to corn was also introduced in this test. Much experimental work has been done with this by-product. It usually gives splendid results for a short period of time, but can not be fed safely to hogs in large quantities or through too long a feeding period. The nutritive ratio of the tankage and meat meal rations used was about 1 to 6, and the corn meal and cottonseed meal were used in such proportions as would give a similar nutritive ratio.

The primary object of this experiment was to study more fully the use of packing-house by-products in pork production. In studying the results of the previous tests it seemed that smaller quantities of tankage might be more profitable. Where tankage constituted one-sixth or $16^2/_3$ per cent of the total ration, as in previous tests, it was evident that more protein was supplied than was necessary to properly balance the rations. In this test tankage and meat meal constituted but 8. per cent of the total ration. This combination gave a nutritive. ratio of about 1 to 6. The rations fed were as follows:

LOT 14.	Corn meal.	
	Alfalfa hay before hogs at all times.	
LOT 15.	Corn meal.	
LOT 16.	Corn meal	92 per cent.
	Swift's digester tankage.....	8 "
LOT 17.	Corn meal	85 "
	Cottonseed meal.....	15 "
LOT 18.	Corn meal	92 "
	Armour's deodorized meat meal.....	8 "

HOGS USED.

The hogs used in this test represented several breeds. They were all pure-bred. In making the division, the different breeds were divided as equally as possible among the different lots. After culling out such as were undesirable for experimental purposes, one hundred head were available for the experiment.

The hogs were from fall litters, and had been handled and fed alike during the winter season. They were in splendid condition for experimental work.

RESULTS OF EXPERIMENT.

The results of feeding corn meal alone in this experiment were almost identical with those of previous trials where corn was the sole ration. By reference to Table VI, it will be seen that the average daily gain per hog was one pound only, cost-

TABLE VI.—Fattening hogs with Swift's digester tankage, Armour's deodorized meat meal, cottonseed meal and alfalfa hay as supplements to corn meal.

Experiment began April 11, 1906, and closed June 15, 1906.

	Lot 14. Corn meal, alfalfa hay ad. lib.	Lot 15. Corn meal.	Lot 16. Corn meal, 92 per cent; Swift's digester tankage, 8 per cent.	Lot 17. Corn meal, 85 per cent; Cottonseed meal, 15 per cent.	Lot 18. Corn meal, 92 per cent; Armour's meat meal, 8 per cent.
Number of hogs in lot	20	20	20	20	20
Number of days fed	65	65	65	65	65
Initial weight per hog, lbs.	138.25	131	131.75	137.50	132.5
Final weight per hog, lbs.	215.5	196	239	235.25	235.25
Total gain per hog, lbs.	77.25	65	107.25	97.75	102.75
Av. daily gain per hog, lbs.	1.18	1	1.65	1.5	1.58
Av. feed consumed daily per hog:					
Corn meal, lbs.	5.95	5.95	7.51	6.97	7.51
Alfalfa hay, lbs.	1	.....	.....	.....	.....
*Green alfalfa, lbs.	1.82	.....	.....	.....	.....
Av. feed consumed daily per 100 lbs. of hog:					
Corn meal, lbs.	3.37	3.64	4.05	3.74	4.08
Alfalfa hay, lbs.	.57	.....	.....	.....	.....
Green alfalfa, lbs.	1.03	.....	.....	.....	.....
Feed consumed per lb. of gain:					
Corn meal, lbs.	5	5.95	4.55	4.63	4.75
Alfalfa hay, lbs.	.26	.....	.....	.....	.....
Green alfalfa, lbs.	1.62	.....	.....	.....	.....
Cost of feed per 100 lbs. of gain	$4.98	$5.65	$4.80	$4.74	$5.01

*Alfalfa hay was fed for 20 days, and green alfalfa was fed for the balance of the period.

ing in feed almost six pounds of corn. At this rate a bushel of corn would produce only 9.4 pounds of pork. The three rations in which the corn meal was supplemented with a rich nitrogenous concentrate were all far more efficient than corn

meal alone. The average daily gain per hog ranged from 1.5 pounds to 1.65 pounds and the feed per pound from 4.55 pounds to 4.75.

Making a direct comparison between Lot 15, fed corn only, and Lot 16, fed corn and tankage, we find that the tankage lot produced a pound of gain for 1.4 pounds less feed than the corn lot. Each pound of gain in Lot 16 required 4.19 pounds of corn and .38 pound of tankage, while the hogs in Lot 11 consumed 5.95 pounds of corn for every pound of pork produced. The addition of each pound of tankage has saved 4.84 pounds of corn, or for each 100 pounds of tankage fed 484 pounds of corn had been saved, worth $4.60 at 95 cents per 100 pounds.

The ration in which cottonseed meal supplemented corn produced gains at slightly less cost than where tankage or meat meal was used. The result with this lot should not be taken, however, as indication that this by-product is a safe feed for hogs. While it has occasionally been fed in small quantities through short feeding periods with excellent results, in the main all experimental work with cottonseed meal as a hog feed has shown that it is not a safe feed for that purpose.

The results with alfalfa were especially good in this test. No effort was made, however, to get at the cost of cutting the green alfalfa and getting it to the hogs. It was charged to them on the basis of the amount of hay it would have made when properly cured.

Experiment VI.

A COMPARISON OF STOCK FOODS, MEAT MEAL, SHORTS, ALFALFA HAY AND ALFALFA AS SUPPLEMENTS TO CORN FOR FATTENING HOGS.

February 17, 1908, to April 13, 1908.

PLAN AND PURPOSE OF EXPERIMENT.

The purpose of this test was to continue the study of the packing-house by-products as supplements to corn for fattening hogs. The by-product used was known as Swift's meat meal. It was sold at 20 cents per hundred pounds less than the digester tankage, and was guaranteed to contain a min-

imum of 46 per cent crude protein, this being 14 per cent less than the protein guarantee of digester tankage.

In order to introduce a little variety into the ration, one lot received both shorts and meat meal as supplementary feeds to corn meal.

A check lot on corn meal alone was used as in previous tests with supplemental feeds.

Great claims were being made about this time for alfalfa meal as a feed. It was argued by many that this meal could take the place of expensive supplements in hog feeding. In order to make a direct comparison between the alfalfa meal and alfalfa hay as fed in previous tests, two lots were introduced for this purpose.

Many extravagant claims were being made for the various condimental stock foods, and three brands of these foods were purchased and fed as directed. Corn was the only grain fed with these stock foods.

The rations fed were as follows:

Lot 19.	Corn meal.		
Lot 20.	Corn meal and International stock food.		
Lot 21.	Corn meal and Pratt's stock food.		
Lot 22.	Corn meal and Hercules stock food.		
Lot 23.	Corn meal and alfalfa hay.		
Lot 24.	Corn meal	14 parts by weight.	
	Shorts	5 parts	" "
	Swift's meat meal	1 part	" "
Lot 25.	Corn meal	6 parts	" "
	Alfalfa meal	1 part	" "
Lot 26.	Corn meal	9 parts	" "
	Swift's meat meal	1 part	" "

HOGS USED.

The hogs used for this test were all raised by the Station. They were from late spring and summer litters and had been grown largely on alfalfa pasture. All were pure in breeding, representing the several breeds kept on the college farm. As usual, the division into lots was made so as to overcome any breed difference which might be present. After culling out undesirable hogs a sufficient number of uniform individuals remained to allow eight hogs per lot to be used in the experiment.

RESULTS OF EXPERIMENT.

The tabulated results of this test are given in Table VII. The two lots receiving the meat meal were the only lots in the test making satisfactory gains. Lot 24, which received both

shorts and meat meal in addition to corn, consumed the largest daily ration of any lot in the experiment, and likewise made the largest average daily gain per hog. From the standpoint of feed consumed per pound of gain this ration was slightly more efficient than the one in which meat meal alone was used as a supplement.

With the prices on feeds used in making these calculations Lot 24 not only made the largest gains but the most economical. From the standpoint of both economy and efficiency this ration surpassed any ration previously fed in this series of experiments.

When compared with the check lot in this test, which received corn only, the efficiency of these meat meal rations stands out most prominently. The hogs in Lot 19, the corn meal lot, made average daily gains of only .67 pound. Seven and fifty-eight hundredths pounds of corn, costing 7.21 cents, was required for every pound of pork produced. For every 100 pounds of supplementary feed consumed 353 pounds of corn was saved. This corn was worth, at 95 cents per 100 pounds, $3.35 for the total corn saved. With shorts at $1.20 per 100 pounds and meat meal at $2.05 per 100 pounds, a hundred pounds of the shorts and meat meal mixture cost $1.35. This means that a net saving of $2 was made for every 100 pounds of supplementary feed consumed. It is very evident that it does not pay to feed 50-cent corn to hogs as the sole ration when such returns can be secured by the addition of proper supplemental feeds.

A careful study of the results secured with Lot V and Lot VII does not show that any great advantage was derived from reducing the alfalfa hay to the meal form.

In Table VIII the three stock food lots have been averaged and compared with Lot 24 in the same test. Advocates of stock food can get little encouragement from these figures. A condimental stock food has little value in increasing the efficiency of corn when compared with a proper use of supplemental feeds in balancing the corn ration.

TABLE VII.—Fattening hogs with various stock foods as supplements to corn meal in comparison with Swift's meat meal, alfalfa hay and alfalfa meal as supplements. Experiment began February 17, 1908, and closed April 13, 1908.

	Lot 19. Corn meal.	Lot 20. Corn meal. International stock food	Lot 21. Corn meal, Pratt's stock food.	Lot 22. Corn meal, Hercules stock food	Lot 23. Corn meal, alfalfa hay.	Lot 24. Corn-meal, 70 per ct.; shorts, 25 per ct.; Swift's meat meal, 5 per ct.	Lot 25. Corn-meal, 6 parts; alfalfa meal, 1 part	Lot 26. Corn-meal, 90 per ct.; Swift's meat meal, 10 per ct.
Number of hogs in lot	8	8	8	8	8	8	8	8
Number of days fed	56	56	56	56	56	56	56	56
Initial weight per hog, lbs.	170.625	166.25	171.87	165.6	166.25	166.25	168.75	166.25
Final weight per hog, lbs.	208	212	213.37	206.62	213.375	261	212.5	246.62
Total gain per hog, lbs.	37.375	45.75	41.5	41.	47.125	94.75	43.75	80.37
Average daily gain per hog, lbs.	.67	.82	.74	.73	.84	1.69	.78	1.44
Average feed consumed daily per hog, lbs.	5.06	5.09	4.91	5.11	Corn meal, 5.22 Alfalfa hay, .84	7.29	Corn meal, 4.57 Alfalfa meal, .76	6.43
Av. feed consumed daily per 100 lbs. of hog lbs.	2.67	2.70	2.55	2.74	2.75 .44	3.41	Corn meal, 2.39 Alfalfa meal, .40	3.10
Feed per pound of gain, lbs.	7.58	6.23	6.63	6.99	6.21 .99	4.31	Corn meal, 5.88 Alfalfa meal, .98	4.48
Cost of feed per 100 lbs. gain	$7.21	$6.06	$6.39	$7.01	$6.29	$4.60	$6.17	$4.75

TABLE VIII.—Average of stock food lots in comparison with Lot 24, which was fed a well-balanced ration.

	Lots 20, 21 and 22. Corn meal and stock foods.	Lot 24. Corn meal, 70 per cent; shorts, 25 per cent; Swift's meat meal, 5 per cent.
Number of hogs	24	8
Number of days fed	56	56
Initial weight per hog lbs.	167.90	166.25
Final weight per hog lbs.	210.66	261.00
Total gain per hog lbs.	42.76	94.75
Average daily gain per hog lbs.	.76	1.69
Average feed consumed daily per hog lbs.	5.03	7.29
Average feed consumed daily per 100 lbs. of hog, lbs.	2.65	3.41
Feed per lb. of gain lbs.	6.61	4.31
Cost of feed per 100 lbs. of gain	$6.48	$4.60

Experiment VII.

A COMPARISON OF SWIFT'S MEAT MEAL, SHORTS, ALFALFA HAY AND ALFALFA MEAL AS SUPPLEMENTS TO CORN FOR FATTENING HOGS.

April 16, 1908, to June 11, 1908.

PLAN OF EXPERIMENT.

The following rations were fed in this test:

LOT 27.	Corn meal	6 parts.
	Alfalfa meal	1 part.
LOT 28.	Corn meal	6 parts.
	Alfalfa meal	1 part.
	(Soaked 12 hours before feeding.)	
LOT 29.	Corn meal	9 parts.
	Swift's meat meal	1 part.
LOT 30.	Corn meal	14 parts.
	Shorts	5 parts.
	Swift's meat meal	1 part.
LOT 31.	Corn meal.	
	Alfalfa hay.	

It will be seen that Lots 29 and 30 were exact duplicates of Lots 26 and 24 in Experiment VI, which had just been completed. It was desired to study more fully the use of alfalfa meal as a supplement to corn, and two lots were included in the test for this purpose. In one of these lots the mixture, consisting of 6 parts corn meal and 1 part alfalfa meal, was

soaked 12 hours before feeding. The relative proportions of corn and alfalfa meal to use in these rations were determined by observing the amounts of corn and alfalfa hay consumed daily by hogs having free access to both. A lot receiving alfalfa hay in racks was again used as a check on the alfalfa meal lots. No corn meal was included in this test. It was considered unnecessary, since the tests with corn meal alone in the preceding tests have shown such uniform results.

HOGS USED.

Forty hogs, all from fall litters, were available for this experiment. Seven were pure-bred Yorkshires. The remainder, 33 head, were cross-bred, being the produce of pure-bred Tamworth sows and a Hampshire boar. They were younger and somewhat lighter than the hogs used in Experiment VI, and as a result of their breeding were somewhat more rangey in type. They were good, thrifty shoats, however, and made a very uniform lot for experimental purposes. They were divided into five lots, each containing eight hogs.

RESULTS OF EXPERIMENT.

After eight weeks of feeding the experiment closed. The results of the test in tabular form appear in Table IX. It will be noted that Lots 3 and 4 consumed very large amounts of

TABLE IX.—Fattening hogs with alfalfa meal, alfalfa hay, shorts and Swift's meat meal as supplements to corn meal.
Experiment began April 16, 1908, and closed June 11, 1908.

	Lot No. 27. Corn meal 6 parts, alfalfa meal 1 part.	Lot No. 28. Corn meal 6 parts, alfalfa meal 1 part, soaked 12 hours.	Lot No. 29. Corn meal 90 per cent, Swift's meat meal 10 per cent.	Lot No. 30. Corn meal 70 per cent, shorts 25 per cent. Swift's meat meal 5 per cent.	Lot No. 31. Corn meal, alfalfa hay.
Number of hogs in lot	8	8	8	8	8
Number of days fed	56	56	56	56	56
Initial weight per hog, lbs.	142.5	139.37	140.6	141.8	139.37
Final weight per hog, lbs.	209.37	199.37	227.5	230	205
Total gain per hog, lbs.	66.87	60	86.9	88.2	65.63
Average daily gain per hog, lbs.	1.19	1.07	1.55	1.57	1.17
Av. feed consumed daily, per hog:					
Corn meal, lbs.	6.31	6.31	7.98	7.96	6.57
Alfalfa, lbs.	1.05	1.05	.....	.....	1.55
Av. feed consumed daily per 100 lbs. of hog:					
Corn meal, lbs.	3.58	3.72	4.33	4.28	3.81
Alfalfa, lbs.	.59	.62	.....	.....	.84
Feed consumed per pound of gain:					
Corn meal, lbs.	5.28	5.89	5.13	5.06	5.8
Alfalfa lbs.	.88	.98	.....	.....	1.05
Cost of feed per 100 lbs. of gain	$5.55	$6.18	$5.44	$5.40	$5.98

feed daily and also made good gains. The rations did not produce such economical results, however, as followed the feeding of similar rations in Experiment VI. No advantage was derived from soaking the alfalfa meal rations; in fact the gains in that lot were more expensive than in Lot 27, which was fed corn meal and alfalfa meal without soaking. In this experiment Lot 27 made slightly larger and more economical gains than Lot 31, which received alfalfa hay in racks.

Experiment VIII.

A COMPARISON OF WET AND DRY FEEDING.

April 27, 1909, to June 8, 1909.

OBJECT OF EXPERIMENT.

The primary object of this experiment was to make comparisons between the feeding of mixed rations in dry form and in the usual or wet form. The same mixtures were fed each lot.

The rations were as follows:

Corn meal	6 parts,	by weight.
Shorts	3 parts,	" "
Swift's meat meal	1 part,	" "

Lot 32 received the grain mixture in dry form. The mixture was wet sufficiently with water to form a thick slop for Lot 33. Both were fed only such amounts as would be cleaned up within an hour after feeding.

HOGS USED.

Fourteen shoats were available for this test. They were from fall litters and were pure in breeding, They were carefully divided into lots as nearly alike in breeding and weight as possible.

RESULTS OF EXPERIMENT.

The average daily gains made per hog by these two lots were greater than the gains made in any other experiment of the series. Less feed was required per pound of increase than in any previous test. The results in tabular form are shown in Table X. The amount of feed required per pound of gain

was practically the same in each lot the only noticeable difference in results was the larger daily consumption of feed by Lot 33 and the larger daily gain per hog. If the labor of feeding the two lots was equal in amount, Lot 33 might be considered the more profitable lot, since the same expenditure of labor converted a larger amount of feed into pork. The results of these tests would seem to indicate that as much pork can be made from a given amount of feed in the dry form as when fed wet. During the winter season the feeding of wet feed is often impracticable. A plentiful supply of fresh water is an important factor in successful feeding, however, and should always be supplied in abundance.

TABLE X.—Fattening hogs with shorts and meat meal as supplements to corn meal. Wet and dry feeding compared.
Experiment began April 27, 1909, and closed June 8, 1909.

	Lot 32. Corn meal, 60 per cent; shorts, 30 per cent; tankage, 10 per cent. Fed dry.	Lot 33. Corn meal, 60 per cent; shorts, 30 per cent; tankage, 10 per cent. Fed wet.
Number of hogs in lot	7	7
Number of days fed	42	42
Initial weight per hog, lbs	117.14	117 14
Final weight per hog, lbs	199 28	211.42
Total gain per hog, lbs.	82.14	94.28
Average daily gain per hog, lbs.	1.95	2.31
Average feed consumed daily per hog, lbs.	7.04	8.11
Average feed consumed daily per 100 lbs. of hog, lbs.	4.45	4 93
Feed consumed per lb. of gain, lbs	3 6	3 61
Cost of feed per 100 lbs. of gain	4.16	4 17

SUMMARY OF THE RESULTS OF THE SERIES CORN ALONE AS A FATTENING RATION.

During this series of feeding experiments five different lots of hogs, ranging in initial weight per hog from 129 pounds to 170 pounds, were fed rations of corn alone during fattening periods varying from 27 days to 112 days. The largest average daily gain per hog made during these tests on corn alone was 1.07 pounds and the smallest .67 pound. With corn meal costing 95 cents per hundred, or 50 cents per bushel, plus the cost of shelling and grinding, the cost of gains per 100 pounds ranged from $5.32 to $7.21. In Table XI the essential facts of

TABLE XI.—Summary of lots fed corn meal only.

	Number of hogs.	Number of days fed.	Average daily grain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. gain.
Lot 4, corn meal	12	27	.95	7.28	$6.92
Lot 10, "	12	28	1.07	5.6	5.32
Lot 11, "	10	112	99	6.93	6.58
Lot 15, "	20	65	1.00	5.95	5.65
Lot 19, "	8	56	.67	7.58	7.21
Average	62	58	.94	6.66	$6 34

these five tests have been brought together and the results averaged. The unsatisfactory results following such a system of feeding are apparent at a glance. With corn worth but 50 cents per bushel, hogs would have to sell for over $6 per hundred in order to even pay for the feed consumed. There could be no profit in producing pork with such a system of feeding.

CORN AND ALFALFA HAY.

The results secured in the fattening pen when alfalfa hay was supplied as a supplement are somewhat better than where corn alone was fed. Four different lots were fed alfalfa hay and corn during this series of experiments. In Table XII the results of these various experiments are brought together and

TABLE XII.—Summary of lots fed alfalfa hay as a supplement to corn meal.

	No. of hogs in lot.	No. of days fed.	Av. daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. of gain.
Corn meal with alfalfa hay in rack, lot No. 13,	10	112	1.18	Corn meal 5.96 Alf. 1.01	$6.07
Lot No. 14 (as above)	20	65	1.18	Corn meal 5.0 Alf. hay .26 Gr. alf. 1.06	4.98
Lot No. 23 (as above)	8	56	.84	Corn meal 6.21 Alf. hay .99	6.29
Lot No. 31 (as above)	8	56	1.17	Corn meal 5.80 Alf. hay 1.05	5.93
Average	46	72	1.09	Corn meal 5.74 Alf. hay .91*	$5.82

* Green alfalfa fed in second test reduced to basis of dry hay in making average.

averaged. The average daily gains per hog for the series were 1.09 pounds. The feed cost per 100 pounds of gain was $6.82, or 8.2 per cent less than where corn meal alone was fed. It is evident that the fattening pen is not the place to look for most profitable returns from the use of alfalfa in pork production, although it is advisable to have a rack of alfalfa hay in every lot where hogs are being fed. As a factor in the growing of hogs and in the maintenance of the mature breeding stock alfalfa is in a class by itself. During the fattening period the hog requires concentrated feeds if large and profitable gains are to be made.

CORN AND ALFALFA MEAL.

The essential facts of the alfalfa meal tests are brought together and averaged in Table XIII. A glance at these figures

TABLE XIII.—Summary of lots fed alfalfa meal as a supplement to corn meal.

	Number of hogs.	Number of days fed.	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. of gain.
Lot No. 25: Corn meal, 6 parts; alfalfa meal, 1 part	8	56	0.78	Corn meal, 5.88 Alf. meal, 0.98	$6.17
Lot No. 27: Corn meal, 6 parts; alfalfa meal, 1 part	8	56	1.19	Corn meal, 5.29 Alf. meal, 0.88	5.55
Lot No. 28: Corn meal, 6 parts; alfalfa meal, 1 part; soaked 12 hours	8	56	1.07	Corn meal, 5.89 Alf. meal, 0.98	6.18
Average	24	59	1.01	Corn meal, 5.68 Alf. meal, 0.95	5.97

is sufficient to show that for use in the fattening pen grinding alfalfa hay into meal does not increase its value sufficiently to pay for the extra expense. Even smaller daily gains were made than in the lots receiving hay and the cost per 100 pounds of gain was greater.

CORN SUPPLEMENTED WITH TANKAGE OR MEAT MEAL.

During these experiments seven different lots of hogs were fed on rations containing varying amounts of tankage or meat meal in connection with corn. The amounts fed ranged from 8 to 16⅔ per cent of the total ration. Eighty-eight hogs were involved in these seven tests, the length of the feeding periods ranging from 27 days to 112 days. In Table XIV the results of the tests have been brought together, so that comparisons

TABLE XIV.—Summary of lots fed tankage or meat meal as a supplement to corn meal.

	Number of hogs.	Number of days fed.	Average daily gain per hog, lbs.	Feed per pound of gain.	Cost of feed per 100 lbs. of gain.
Lot No. 1. Corn meal 5 parts, Swift's tankage 1 part.....	12	27	1.54	4.25	$4.95
Lot No. 5. Corn meal 5 parts, Swift's tankage 1 part.....	10	45	60	4 37	4 92
Lot No. 12. Corn meal 5 parts, Armour's meat meal 1 part.....	10	112	1 76	4.76	5.54
Lot No. 16. Corn meal 92 per cent, Swift's tankage 8 per cent..	20	65	1 65	4.55	4.80
Lot No. 18. Corn meal 92 per cent, Armour's meat meal 8 per cent..	20	65	1.58	4.75	5.01
Lot No. 26. Corn meal 90 per cent, Swift's meat meal 10 per cent...	8	56	1 44	4.48	4.75
Lot No. 29. Corn meal 90 per cent, Swift's meat meal 10 per cent...	8	56	1.55	5.13	5.44
Average.....	88	61	1.58	4.61	$5 06

may be made of the different lots. The average of the seven tests is given in the last line of the table. It is interesting to note the uniformity of the average daily gains made by the hogs in the various lots. The largest average daily gain of the test was 1.76 pounds and the smallest 1.44 pounds, the average of all being 1.58 pounds. A study of the figures given in the

TABLE XV.—Summary of lots fed meat meal and shorts as supplements to corn meal.

	Number of hogs.	Number of days fed.	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs of gain.
Lot No. 24: Corn meal 70 per cent, shorts 25 per cent, Swift's meat meal 5 per cent.....	8	56	1.69	4.31	$4.60
Lot No. 30: Corn meal 70 per cent, shorts 25 per cent, Swift's meat meal 5 per cent.....	8	56	1.57	5.06	5.40
Lot No. 32: Corn meal 60 per cent, shorts 30 per cent, Swift's meat meal 10 per cent.....	7	42	1.95	3.60	4.16
Lot No. 33: Corn meal 60 per cent, shorts 30 per cent, Swift's meat meal 10 per cent.....	7	42	2.31	3.61	4.17
Average	30	49	1.88	4.14	4.58

column headed "Feed per pound of gain" likewise shows very uniform results. As compared with corn alone, these rations were not only much more efficient but also more economical.

CORN SUPPLEMENTED WITH SHORTS AND SWIFT'S MEAT MEAL.

There were four tests made in which shorts and Swift's meat meal were used in the same ration as supplements to corn. These tests, while not so numerous as the ones in which only the tankage or meat meal was used, gave results well worthy of careful study. From the standpoint of gains made, efficiency of feed consumed and economy they were superior to any rations previously fed. The results secured in these four tests in feeding the various combinations of corn, shorts and meat meal were so suggestive that this line of experimentation was continued. The data secured in the later experiments appear in Part II of this bulletin.

A COMPARISON OF AVERAGE RESULTS SECURED WITH VARIOUS SUPPLEMENTS TO CORN.

In order that careful comparative studies may be made of the results secured in the experiments reported in Part 1 of this bulletin Table XVI has been prepared. This table con-

TABLE XVI.—Averages of various tests of supplements to corn meal compared.

	Number of tests.	Number of hogs.	Average number of days fed.	Average daily gain per hog.	Average feed per pound of gain.	Average cost of feed per 100 lbs. of gain.
Corn meal	5	62	58	.94	6 66	$6.34
Corn meal and alfalfa meal	3	24	56	1.01	Corn meal, 5.68 Alf. M., .95	5.97
Corn meal and alfalfa hay	4	46	72	1.09	Corn meal, 5.74 Alf. H., .91	5.82
Corn meal and meat meal or tankage	7	88	61	1.58	4 61	5.06
Corn meal, meat meal, or tankage and shorts	4	30	49	1.88	4.14	4.58

Prices of feeds used:

Corn meal	$0 95 per cwt.
Swift's digester tankage	2.25 "
Swift's meat meal	2.05 "
Armour's deodorized meat meal	2 25 "
Alfalfa hay	8.00 per ton.
Alfalfa meal	12.00 "

tains the average results secured with the various rations fed. The number of tests from which the averages have been made are given in the first column and the number of hogs involved in the second column. The average results are arranged in the order of their efficiency and economy, the most efficient and economical ration coming last in the table. In studying these figures it will be noted that the average daily gains per hog, beginning with .94 pound as the average of the corn meal rations, increases as we go down the columns, the gains reaching the maximum of 1.88 pounds per hog as the average from the feeding of the corn, shorts and meat meal rations. The feed required per pound of gain decreases, reaching the minimum of 4.14 pounds as the average from the same rations. The cost per 100 pounds of gain likewise decreases from $6.34 as the average cost of the gains where corn alone was fed to $4.85 as the average cost of the rations of corn, shorts and meat meal.

It required 61 per cent more feed to produce a hundred pounds of pork on corn alone than where shorts and meat meal formed a part of the ration. In cost the gains produced on corn alone were 38 per cent greater than those produced as a result of feeding corn supplemented with shorts and meat meal.

VALUE RETURNED PER BUSHEL FOR CORN.

The hog may be looked upon as a convenient means of profitably marketing corn in a condensed form.

When corn is high in price on the market it often becomes important to know what value is being returned for the corn sold in the form of pork. Tables XVII, XVIII and XIX have been compiled for the purpose of showing what value was returned for the corn fed in the various tests reported in Part I of this bulletin. The value on the market of the total gains produced by each lot during the progress of the experiment is taken as the value returned for the feed consumed during the period of the test. In Table XVII corn meal lots are brought together and the value returned per bushel of corn fed is calculated by dividing the total value of the gains produced by the number of bushels of corn fed. With pork worth $5 per 100 pounds the average value returned per bushel for corn was $0.423; with pork worth $6 per 100 pounds it was $0.51; and with pork worth $7 per 100 pounds it was $0.593.

TABLE XVII.—Value returned per bushel for corn in tests where corn meal alone was fed.

RATIONS FED.	Corn meal.	Corn meal.	Corn meal.	Corn meal.	Corn meal.	Average.
Number of hogs in lot	10	20	8	12	12	.....
Number of days fed	112	65	56	28	27	.....
Total pork produced by lot, lbs	1,110	1,300	299	360	307	.....
Value received per bushel for corn:						
With pork at $5 per cwt.	$0.404	$0.470	$0.369	$0.50	$0.38	$0.423
With pork at $6 per cwt.	.485	.564	.443	.60	.46	.510
With pork at $7 per cwt.	.565	.658	.516	.70	.53	.593

TABLE XVIII.—Value returned per bushel for corn in tests where meat meal or tankage was used as a supplement.

	Corn, 5 parts; tankage, 1 part	Corn, 5 parts; Armour's meat meal, 1 part	Corn, 92 per cent; Swift's tankage, 8 per cent.	Corn, 92 per cent; Armour's meat meal, 8 per cent.	Corn, 90 per cent; Swift's meat meal, 10 per cent.	Corn, 90 per cent; Swift's meat meal, 10 per cent.	Corn meal, 5 parts; tankage, 1 part	Average.
Number of hogs in lot	10	10	20	20	8	8	12	.....
Number of days fed	45	112	65	65	56	56	27	.....
Pork produced, lbs.	720	1,975	2,145	2,055	643	695	499	.....
Cost of supplementary feed	$9.65	$34.92	$17.77	$17.77	$5 91	$7.31	$7.95	.....
Value returned per bu. for corn fed, with pork at $5 per cwt.	.54	.45	.56	.53	.57	.48	.54	$0.524
With pork at $6 per cwt	.69	.60	.69	.66	.70	.60	.70	.663
With pork at $7 per cwt	.84	.74	.83	.79	.84	.72	.85	.801

Prices of supplementary feeds used:

Swift's digester tankage	$2.25	per cwt.
Armour's deodorized meat meal	2.25	" "
Swift's meat meal	2.05	" "

TABLE XIX.—Value returned per bushel for corn in tests where meat meal or tankage and shorts were used as supplements.

	Corn, 70 per cent; shorts, 25 per cent; Swift's M. M., 5 per cent.	Corn, 70 per cent; shorts, 25 per cent; Swift's M. M., 5 per cent.	Corn, 60 per cent; shorts, 30 per cent; Swift's M. M., 10 per cent.	Corn, 60 per cent; Shorts, 30 per cent, Swift's M. M., 10 per cent.	Average.
Number of hogs in lot	8	8	7	7	.....
Number of days fed	56	56	42	42	.....
Pork produced, lbs.	758	705	575	660	.....
Total cost of supplementary feed	$13.145	$14.369	$12.109	$13.95	.....
Value returned per bu. for corn fed:					
With pork at $5 per cwt.	.60	.47	.75	.74	$0.640
With pork at $6 per cwt.	.79	.68	1.01	1.00	.867
With pork at $7 per cwt.	.98	.78	1.27	1.26	1.070

Prices of supplementary feeds used:

Swift's digester tankage	$2.25	per cwt.
Armour's deodorized meat meal	2.25	" "
Swift's meat meal	2.05	" "
Shorts	1.20	" "

In Tables XVIII and XIX are shown the values returned per bushel for corn in the lots where supplementary feeds were used." In making these calculations the actual cost of the supplementary feed was deducted from the market value of the pork produced during the period. The remainder was then divided by the number of bushels of corn fed during the progress of the experiment, giving the value per bushel returned for corn. The average value returned per bushel for corn in the seven tests in which tankage or meat meal was fed with corn was $0.524 when pork was worth $5 per 100 pounds, $0.663 when pork was worth $6 per 100 pounds, and $0.801 when pork was worth $7 per 100 pounds.

In similar manner Table XIX shows the value returned per bushel of corn fed for the four tests where shorts and meat meal were used as supplements to corn.

CONCLUSION.

The enhancement of the value of corn for pork production by the use of highly nitrogenous supplementary feeds is most strikingly brought out through the comparisons made possible in these three tables. In the light of the results secured from feeding rations of corn alone it is apparent that such a system of fattening hogs for market can not be profitably followed under present conditions.

The use of alfalfa hay in the feed lot is certainly a valuable practice, although the addition of small amounts of a highly nitrogenous concentrated feed to the corn rations is necessary in order to secure the largest and most profitable returns in the fattening of hogs.

Meat meal and tankage are the most valuable feeds on the market for supplementing the corn ration. This fact is most strikingly brought out as a result of the various experiments. When shorts does not cost to exceed 20 to 25 per cent more than the market value of corn it can undoubtedly be used profitably as a portion of the ration.

The high value of kafir in pork production is again brought out in these experiments. In one case it even exceeded corn in efficiency. Farmers in the western section of the state should by all means make more effort to grow these grain sorghums, since their value in pork production, when properly supplemented, is practically the same as corn.

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PART II

By T. R. H. WRIGHT, Assistant Animal Husbandman.

THE general method of feeding in the series of experiments reported in Part II of this bulletin was the same as for those reported in Part I.

All the grain fed, except shelled corn, was wet enough at each feed to pour easily from the pail into troughs and was then fed immediately. The shelled corn was fed on hard ground, and the alfalfa hay was fed in racks of the type shown in Figure 8. The feeding was done twice daily—morning and evening. All feed fed was accurately weighed, and all feed refused was weighed (after being dried) and deducted from the amount fed. All the hogs used in this series were carefully and accurately weighed at the beginning and close of each experiment, and also at the end of each thirty-day period.

FEED YARDS.

The hogs fed on pasture were fed in yards containing from one-half to two and one-half acres each. These yards furnished all the pasture the hogs would eat at all times. Good water and shade were provided.

The yards used for dry-lot feeding were 10 by 12 feet. Each yard was provided with a sleeping shed 10 by 12 feet. The hogs had access to no shade other than that furnished by the sleeping sheds.

Experiment IX.

A COMPARISON OF DRY-LOT AND PASTURE FEEDING AND LIMITED FEEDING OF GROWING PIGS.

Experiment began July 26, 1909, and closed November 19, 1909.

OBJECT OF EXPERIMENT.

The object of this experiment was, first, to show the relative value of alfalfa pasture for fattening growing hogs as compared with hogs fed in a dry lot; and second, to show the relative economy of growing pigs on a limited grain ration and pasture during the summer and then finishing on a heavy grain ration in the fall, after a cheap growth has been secured, as compared with full feeding from the time the pigs are put on pasture in the spring until they are ready for the market.

PLAN OF THE EXPERIMENT.

Thirty pigs averaging ninety pounds each were available for this experiment. On July 26, they were divided into three lots of ten pigs each and fed as follows:

LOT 34. Full fed on alfalfa pasture.
LOT 35. Half fed on alfalfa pasture.
LOT 36. Full fed in dry lot.

From July 26 to October 8 the grain ration fed to all the lots was,

Corn meal	46 per cent.
Shorts	46 per cent.
Tankage	8 per cent.

On October 8 Lot 35 was put on full feed, and the ration of all the lots was changed to,

Corn meal	62 per cent.
Shorts	30 per cent.
Tankage	8 per cent.

On November 8 Lots 34 and 35 were taken from pasture and fed in dry lots until the close of the experiment on November 19.

RESULTS OF THE EXPERIMENT.

A summary of the results obtained in this experiment is shown in Table No. XX.

TABLE XX.—Comparison of dry-lot and pasture feeding and limited and full feeding of growing pigs.

Experiment conducted from July 26, 1909, to November 18, 1909.

	Lot 34. Full fed on alfalfa pasture 104 days, in dry lot 11 days.	Lot 35. Half fed on alfalfa pasture 104 days, in dry lot 11 days.	Lot 36. Full fed in dry lot.
Number of hogs in lot	10	10	10
Number of days fed	115	115	115
Average weight of each at beginning, lbs.	90	90	90
Average weight of each at close, lbs.	272	248	260
Average daily gain per hog, lbs.	1 58	1 37	1.48
Average daily feed eaten per hog, lbs	6.55	4 87	6.97
Av. daily feed eaten per 100 lbs. live weight, lbs.	3.61	2 88	3.98
Pounds of feed required to produce one pound of gain.	4.14	3.543	4.71
Cost per 100 pounds gain	$4 96	$4 36	$5 48

A comparison of Lots 34 and 35 shows that the hogs that were grown for a while on a limited grain ration and alfalfa pasture, and then full fed, made slower but cheaper gains than did the hogs that were full fed from the start. The hogs in Lot 34, however, were 34 pounds heavier at the close of the experiment than those in Lot 35, and had they been sold on November 8, when they averaged 255 pounds each, it would have taken 4.03 pounds of grain to produce one pound of gain, and each hundred pounds of gain would have cost $4.81. These figures, however, still leave a difference of 45 cents per hundred in, favor of the limited-fed hogs

When Lot 34 is compared with Lot 36, it will be seen that the hogs fed on, pasture made a much more rapid and more economical gain than the hogs fed in the dry lot. The hogs fed on pasture gained 182 pounds more than the hogs fed in the dry lot. In addition, the total cost of the feed eaten by the hogs on pasture, was $3,90 less than the total cost of the feed eaten by the hogs in the dry lot. These figures show and emphasize the economy of feeding hogs, and especially young growing hogs, on pasture.

Experiment X.

A COMPARISON OF A RATION OF CORN, SHORTS AND TANKAGE WITH ONE OF CORN AND TANKAGE, AND A COMPARISON OF LARGE AND MEDIUM TYPE POLAND CHINAS.

OBJECT OF EXPERIMENT.

This experiment was undertaken with a view of determining the relative feeding value of a ration of corn meal 6 parts, shorts 3 parts, and tankage 1 part as compared with a ration of corn 9 parts and tankage 1 part, and at the same time to determine, if possible, the relative value for feeders of the large and medium types of the Poland China hog.

HOGS USED.

Twenty Poland China pigs were secured for this experiment. Ten pigs (eight barrows and two sows) of the large type were furnished by Mr. B. M. Bell, Beattie, Kan., and ten pigs (all barrows) of medium type were furnished by Mr. F. A. Dawley, Waldo, Kan.

PLAN OF EXPERIMENT.

On September 18 the pigs of each type were divided, as nearly equally as possible as to size, quality and condition, into two lots of five pigs each. Each lot was fed as follows:

LOT 38. Large type—Corn meal 60 per cent, shorts 30 per cent, tankage 10 per cent.

LOT 39. Large type—Corn meal 90 per cent, tankage 10 per cent.

LOT 40. Medium type—Corn meal 60 per cent, shorts 30 per cent, tankage 10 per cent.

LOT 41. Medium type—Corn meal 90 per cent, tankage 10 per cent.

On September 27 one hog in Lot 38 had developed a hernia and was taken out of the experiment. Another hog in Lot 38 also developed a slight case of hernia, but was left in the experiment. The four lots of hogs were fed for ninety-one days. Lots 40 and 41 were then sold as finished hogs, at $8 per cwt. The same value was placed on Lots 38 and 39, but these two lots were not quite finished, so they were thrown together and fed two weeks longer, and sold as finished hogs.

RESULTS OF THE EXPERIMENT.

A summary of the results of the experiment is shown in Table No. XXI.

TABLE XXI.—Relative value of corn, shorts and tankage as compared with corn and tankage. Small- and large-boned Poland Chinas.

	No. of hogs in lot	No. of days fed	Av. weight of each at beginning	Av. weight of each at close	Av. daily gain per hog	Av. daily feed eaten per hog	Av. daily feed eaten per 100 lbs. live wt.	Feed required per lb. gain	Cost per 100 lbs. gain
			lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	
Lot 38.—Large type. Corn meal 60%, shorts 30%, tankage 10%	4	91	124	286	1.78	8.10	4.02	4.58	$5.25
Lot 39.—Large type. Corn meal 90%, tankage 10%	5	91	119.2	257.8	1.52	7.04	3.73	4.62	4.99
Lot 40.—Medium type. Corn meal 60%, shorts 30%, tankage 10%	5	91	110.4	260	1.64	7.83	4.23	4.76	5 50
Lot 41.—Medium type. Corn meal 90%, tankage 10%	5	91	109.4	232	1.35	6.80	3.98	5.04	5.45
Average lots 38 and 40	9	91	116.4	271.6	1.70	7.95	4.09	4.66	5.49
Average lots 39 and 41	10	91	114 3	244.9	1.44	6.92	3.85	4.82	5.21

A comparison of the average of Lots 38 and 40 with the average of Lots 39 and 41 shows that the ration of corn, shorts and tankage proved the most efficient and produced the most rapid gains, but at the prices given it did not prove as economical as the ration of corn and tankage. With any increase in the price of corn or decrease in the price of shorts, however, the relative economy of the two rations would change.

A comparison of Lots 38 and 39 with Lots 40 and 41 shows that the large type hogs made the most economical gains. The medium type hogs, however, finished more quickly and carried a finish that would command a higher price on the market. When the shorter feeding period and the higher finish of the medium type hogs is taken into consideration the data at hand is not sufficient to draw any conclusions as to which type will feed the more economically.

Experiment XI.

COOPERATIVE EXPERIMENT CONDUCTED AT JUANITA FARM IN WHICH A COMPARISON OF CORN, SHORTS AND TANKAGE, CORN AND TANKAGE, AND CORN AND ALFALFA HAY FOR FATTENING HOGS, IS MADE.

The Experiment began March 2, 1910, and closed April 7, 1910.

OBJECT OF EXPERIMENT.

The object of this experiment was to make a comparison under farm conditions of the following rations for fattening hogs.

1st. Corn meal 90 per cent and tankage 10 per cent.
2d. Corn meal 62 per cent, shorts 30 per cent, and tankage 8 per cent.
3d. Corn meal and alfalfa hay.

Mr. Dan D. Casement, proprietor of the Juanita Farm, kindly offered to cooperate with the College in the carrying out of this experiment.

HOGS USED.

Two hundred and ten high-grade Poland China hogs, were available. They had been following cattle for several, months and were a very uniform lot and in good thrifty condition.

PLAN OF THE EXPERIMENT.

On March 2 the 210 hogs were divided into three equal lots of seventy each and fed as follows:

LOT 42. Corn meal 90 per cent, tankage 10 per cent.
LOT 43. Corn meal 62 per cent, shorts 30 per cent and tankage 8 per cent.
LOT 44. Corn meal and alfalfa hay.
(The alfalfa hay was fed in racks.)

Ali the lots were fed in dry yards 75 by 100 feet in area. Lots 42 and 43 had access to a wallow, but Lot 44 had access to no water except that which was given in the water troughs.

The feeding was done twice daily by mixing the feed into a thick slop and then feeding it in troughs. After March 19, 56 pounds of shelled corn was fed to each lot at noon each day.

RESULTS OF THE EXPERIMENT.

Table No. XXII shows the summary of the results of the experiment.

TABLE XXII.—Value of tankage, shorts and tankage, and alfalfa hay as supplements to corn for fattening hogs.

Summary of experiment conducted at the Casement Ranch, March 2 to April 7, 1910.

	Lot 42. Corn meal, 90 per ct.; tankage, 10 per ct.	Lot 43. Corn meal, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.	Lot 44. Corn meal and alfalfa hay.
Number of hogs in lot	70	70	70
Number of days fed	36	36	36
Av. weight per hog at beginning, lbs.	177.14	167.86	180.86
Av. weight per hog at close, lbs.	233.36	234.64	228.86
Av. daily gain per hog, lbs	1.56	1.86	1.33
Av. daily feed consumed per hog, lbs	7.36	8.03	Grain, 7.36 Hay, 1.00
Av. daily feed consumed per 100 lbs. live weight of hog, lbs.	3.58	3.99	Grain, 3.59 Hay, .49
Feed required per lb. of gain, lbs.	4.71	4.33	Grain, 5.52 Hay, .75
Cost per 100 lbs. gain	$4.91	$4.94	$5.33

A comparison of Lot 42 with Lot 43 shows that the ration of corn, shorts and tankage and the ration of corn and tankage proved just about equal as to cost of gains; however, the ration of corn, shorts and tankage was more efficient and produced more rapid gains than the ration of corn and tankage.

When the results obtained from Lots 42 and 43 are compared with those obtained from Lot 44 it will be seen that the corn and hay ration did not prove so efficient as the other two, and that at the same time the costof feed required to produce 100 pounds of gain was greater.

NOTE.—From March 21 to March 28 no tankage was available, and during this time Lot 42 was fed corn meal alone and Lot 43 was fed corn meal 70 per cent and shorts 30 per cent. No accurate data was kept of the amount of hay consumed by the hogs fed corn and hay, but from the amount of hay hauled and fed to the fattening and breeding hogs, it was estimated that this lot consumed about 2520 pounds.

Experiment XII.

A COMPARISON OF LIMITED AND FULL FEEDING OF GROWING PIGS.

June 25, 1910, to January 1, 1911.

OBJECT OF EXPERIMENT.

As was stated in Part I of this bulletin, a good pasture of some kind must always be relied upon as a factor in cheap pork production. The man who raises hogs and subsequently fits them for market must manage his feeding operations so as to secure the greatest returns from pasture crops. By far the greater per cent of hogs that go to fill the larders of the country are farrowed in the spring. By the time, or even before, the spring pigs are ready to wean, pastures are available. These spring pigs can either be grown on pasture, with a limited amount of grain, and finished in the fall after a cheap growth has been secured and they are in a condition to make rapid gains in the feed lot; or they can be full fed, or pushed on a heavy grain ration, from the time they go on pasture in the spring until they are ready for market in the fall or winter.

The object of this experiment was, primarily, to determine the relative economy of feeding growing pigs a limited grain ration on alfalfa pasture during the pasture season and finishing in the dry lot in the fall, as compared with full feeding from the time the pigs go on pasture until they are ready for market. In addition, the experiment was planned to determine the value of a protein supplement to corn for fattening hogs when fed on alfalfa pasture; the relative value of rape and alfalfa pasture, and to obtain a comparison of dry-lot and pasture feeding for full-fed hogs.

HOGS USED.

Sixty Duroc-Jersey pigs (all barrows) were available for this experiment. These pigs were bred and raised at the Hays Branch Experiment Station, and shipped to Manhattan as soon as they were weaned. They arrived in Manhattan June 11, averaging 23.9 pounds per head. They were a very uniform lot of pigs as to size, quality and condition.

PLAN OF EXPERIMENT.

On June 25 the sixty pigs were divided into five lots and fed as follows:

LOT 45. 10 hogs. Full fed a ration of corn meal 62 per cent, shorts 30 per cent, and tankage 8 per cent, by weight, on alfalfa pasture.

LOT 46. 10 hogs. Full fed corn meal on alfalfa pasture.

LOT 47. 20 hogs. Fed a limited amount of shelled corn (1.63 pounds of corn per hog per day) on alfalfa pasture.

LOT 48. 10 hogs. Full fed on a ration of corn meal 62 per cent, shorts 30 per cent, and tankage 8 per cent, by weight, on rape pasture.

LOT 49. 10 hogs. Full fed on a ration of corn meal 62 per cent, shorts 30 per cent, and tankage 8 per cent, by weight, in dry lot.

The experiment was divided into two periods, the summer or growing period, and the winter or finishing period. The eighteen hogs in Lot 47 were divided into two lots at the end of the growing period.

During the summer one pig in Lot 45 and two pigs in Lot 47 died, therefore the data for Lots 45 and 47 has been calculated on the basis of nine and eighteen individuals.

On September 23 all the hogs were taken from pasture and put in the dry lots for the finishing period. Table No. XXIII shows a summary of the summer period.

TABLE XXIII.—Limited vs. full feeding of growing pigs. Summer period—June 25 to September 23, 1910.

	Lot 45. Ground corn, 62 per cent; shorts, 30 per cent, and tankage, 8 per cent, alfalfa pasture. Full grain ration.	Lot 46. Ground corn and alfalfa pasture. Full grain ration.	Lot 47. Shelled corn and alfalfa pasture. Limited grain ration.	Lot 48. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, rape pasture. Full grain ration.	Lot 49. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot. Full grain ration.
Number of days in period	90	90	90	90	90
Number of hogs in lot	9	10	18	10	10
Average weight per hog at beginning, lbs.	32.00	32.50	32.25	33.50	32.80
Average weight per hog at close, lbs.	142.00	90.90	77.33	141.50	103.80
Average daily gain per hog, lbs.	1.222	.649	.500	1.200	1.088
Average daily grain consumed per hog, lbs.	4.29	2.486	1.632	3.826	3 882
Pounds of feed consumed daily per 100 lbs. live weight, lbs.	4.93	4.03	2.99	4.37	4.76
Feed per lb. of gain, lbs.	3.511	3.888	3.257	3.188	358 41
Cost per 100 lbs. gain	$4.182	$4 188	$3.90	$3.821	$4.036

At the close of the summer period none of the hogs were ready for market. The hogs in Lots 45, 48 and 49 had made more rapid gains and were more nearly finished than the hogs in Lot 46, the lot fed corn alone on pasture. The hogs in Lot 47 had made a good growth and were in good, thrifty, stocker condition.

On September 23 it was decided to divide the hogs in Lot 46 as well as those in Lot 47 into two lots. Five hogs were taken from Lot 46 and nine hogs from Lot 47. The new lots were called 46a and 47a respectively. The divisions were made as evenly as possible as to size, quality and condition of the hogs.

During the finishing period, from September 23 to January 1, all the lots were full fed, and all lots except Lots 46a, 47 and 47a received the same grain rations they had been getting while on pasture. Lot 47 was fed corn meal instead of shelled corn. Lot 47a was fed a ration of corn meal 62 per cent, shorts 30 per cent and tankage 8 per cent. Lot 46a was fed corn meal and alfalfa hay, the hay being fed in a rack. During the first part of the period the hay fed was coarse and of poor quality, consequently only a small amount was consumed. During the last half of the period hay of good quality was fed and the hogs ate it readily.

On January 1 the experiment was closed and the hogs shipped to Kansas City and sold at the top price for that market for the year. Table No. XXIV shows a summary of the finishing period.

The results as given in Table XXIV show that during the finishing period the hogs (Lot No. 47a) fed on a limited amount of corn on alfalfa pasture during the summer and then finished in the dry lot on a ration of corn, shorts and tankage made the most rapid gains and required the smallest amount of feed to produce a pound of gain. With the exception of the hogs (Lot No. 46a) full fed on corn and alfalfa pasture during the summer and on corn and alfalfa hay in the dry lot, the hogs in this lot (Lot No. 47a) made the cheapest gains of any of the hogs in the experiment. A comparison of the results obtained from Lot No. 47a with the results obtained from Lot No. 47, and also a comparison of the results obtained from Lot No. 46a with the results obtained from Lot No. 46, shows the value of supplementing corn with protein feeds when

TABLE XXIV.—Limited compared with full feeding of growing pigs. Fall and winter period—September 23, 1910, to January 1, 1911. Full feeding period.

	Lot No. 45. Ground corn, 60 per cent; shorts, 30 per ct.; tankage, 8 per cent.	Lot No. 46. Ground corn alone.	Lot No. 47. Ground corn.	Lot No. 47a. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent.	Lot No. 48. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent.	Lot No. 46a. Ground corn and alfalfa hay.	Lot No. 49. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent.
No. of days in period	100	100	100	100	100	100	100
No. of hogs in lot	9	5	9	9	10	5	10
Average weight per hog at beginning, lbs.	142.00	90.80	78.33	76.33	141.50	91.00	130.30
Average weight per hog at close, lbs.	283.39	159.50	151.44	224.70	269.80	197.00	265.90
Average daily gain per hog, lbs.	1.413	.687	.731	1.484	1.283	1.06	1.356
Average daily feed consumed per hog, lbs.	8.290	4.272	4.773	7.148	7.516	Gr. 5.466 H. 1.214	7.485
Average daily feed consumed per 100 lbs. live weight of hog, lbs.	3.90	3.41	4.15	4.71	3.65	Gr. 3.80 H. .84	3.78
Grain per pound of gain, lbs.	5.870	6.218	6.523	4.817	5.86	Gr. 5.157 H. 1.14	5.520
Cost per 100 lbs. of gain	$6.624	$5.96	$6.202	$5.438	$6.61	$5.356	$6.231

TABLE XXV.—Limited compared with full feeding of growing pigs. Summary of summer and winter periods—June 25, 1910, to January 1, 1911.

	Lot 45. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot 100 days; alfalfa pasture, 90 days.	Lot 46. Full fed—ground corn on alfalfa pasture, 90 days; in dry lot 100 days	Lot 46a. Full fed—ground corn on alfalfa pasture, 90 days. Full fed—ground corn and alfalfa hay in dry lot 100 days	Lot 47. Limited fed—shelled corn on alfalfa pasture, 90 days. Full fed—ground corn in dry lot 100 days	Lot 47a. Limited fed—shelled corn, alfalfa pasture, 90 days. Full fed—corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot 1 0 days	Lot 48. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on rape pasture 90 days, dry lot 100 days	Lot 49. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot 190 days
Number of days in period	190	190	190	190	190	190	190
Number of hogs in lot	9	5	5	9	9	10	10
Average weight per hog at beginning, lbs.	32 00	32.50	32.50	22.25	32 25	33.50	32.80
Average weight per hog at close, lbs.	283.39	159.50	197.00	151.44	224 70	269 80	265.90
Averege daily gain per hog, lbs	1.323	.668	.865	.627	1.013	1.243	1.226
Average daily grain consumed per hog, lbs.	6 399	3.426	G. 4.054 H. .64	3.285	4.533	5.77	5.778
Grain consumed daily per 100 lbs. live weight	4.06	3.57	G. 3.53 H. 56	3 57	3.53	3.74	3 87
Grain per pound of gain, lbs	4 837	5 127	G. 4.863 H. 74	5.237	4.477	4.64	4 71
Cost per 100 lbs. gain	$5.416	$4 869	$4.935	$4.903	$5 11	$5.331	$5 317

finishing hogs in dry lots, Each hundred pounds of gain made by the hogs fed corn alone cost from sixty to seventy-six cents more than the same amount of gain made by the hogs fed corn supplemented with the protein feeds. And in addition to the cheaper gains the hogs fed corn supplemented with shorts and tankage or alfalfa hay were nearer ready for market at the close of the experiment than the hogs fed corn alone.

As the results of the finishing period do not tell the whole story, the two periods, both summer and winter, should be combined as has been done in Table No. XXV.

In this table it will be seen that for the entire feeding period from June 25 to January 1 the hogs in Lot No. 45 made the most rapid gains and those in Lot No. 46 made the cheapest gains, while those in Lot No. 47a made the greatest gain for each pound of grain consumed. It should be noted, however, that at the close of the experiment the hogs in the different lots varied in weight from an average of 151.4 pounds for Lot 47 to 283.4 pounds for Lot 45. Since the cost of gain on a fattening hog increases as the hog increases in weight we would expect the gains made by a 283-pound hog to cost more than the gains made by a 151-pound hog. The hogs in Lot 47a required a third of a pound less feed than the hogs in Lot 45 to make a pound of gain. The question at once arises, had the hogs in Lot 45 required more grain to produce a pound of gain when they were at the same weight as Lot 47a when sold? In order to make a better comparison, Table No. XXVI has been prepared, as near as possible, on the basis of the same final weight for the hogs in each lot.

In this table comparisons of Lots 45 and 46 with Lots 47 and 47a show that the limited- and full-fed hogs required practically the same amount of grain to produce a pound of gain, and at the same time the cost of 100 pounds of gain was practically the same in each case.

A comparison of the lots fed on rape and alfalfa pastures shows that practically the same results were secured in each case. The rape pasture proved just as efficient as the alfalfa pasture in as far as gains were concerned. However, it took about twice the area of rape as of alfalfa to pasture the same number of hogs.

TABLE XXVI.—Limited vs. full feeding of growing pigs. 1910 experiment. Summary of gains made and cost of gains. Comparison made on basis of same final weight.

	Lot 45. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; alfalfa pasture, 90 days; in dry lot 63 days	Lot 46. Full fed—ground corn and alfalfa pasture, 90 days; dry lot, 100 days	Lot 46a. Full fed—ground corn and alfalfa pasure, 90 days. Full fed—ground corn and alfalfa hay, 100 days.	Lot 47. Limited fed—shelled corn and alfalfa pasture, 90 days. Full fed—ground corn, in dry lot 100 days.	Lot 47a. Limited fed—shelled corn; alfalfa pasture, 90 days. Full fed—corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot 100 days	Lot 48. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; rape pasture, 90 days; dry lot, 70 days	Lot 49. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot 159 days.
Number of days in period	153	190	190	190	190	160	159
Number of hogs in lot	9	5	5	9	9	10	10
Average weight per hog at beginning, lbs.	32 00	32.50	32 50	32 55	32 25	33 50	32.80
Average weight per hog at close, lbs.	224.85	159 50	197 00	151.44	224.70	224 86	225.30
Average daily gain per hog, lbs	1.26	.668	.865	.627	1 013	1.196	1.210
Average daily feed consumed per hog, lbs	5.627	3 426	G. 4 054 H. 1 21	3.285	4.533	5 418	5.295
Av. daily feed consumed per 100 lbs. live wt., lbs.	4.025	3.40	G. 3 664 H. 8 18	3 49	3.626	4.034	4.06
Feed per pound of gain, lbs	4.46	5 127	G. 4.683 H. .74	5.237	4.477	4.530	4 373
Cost per 100 lbs. of gain	$5 17	$4 869	$4.935	$4.903	$5.11	$5.240	$4 938

A comparison of the dry-lot and pasture-fed hogs shows that the hogs fed in dry lot made slightly cheaper gains than did the hogs on pasture. This is the only instance in this series of experiments where the hogs fed in a dry lot made more economical gains than hogs fed on pasture.

A comparison of Lots 46 and 46a shows the value of adding alfalfa hay to a straight corn ration. The hogs fed corn and alfalfa hay made 37.5 pounds more gain per hog and required .45 pound less corn to produce each pound of gain; or, in other words, one pound of alfalfa hay replaced 6 pound of corn when fed with corn in comparison with corn alone.

A comparison of Lots 45, 47a, 48 sand 49, the lots fed corn, shorts and tankage ration, with Lots 46, 46a and 47, the lots fed corn, shows that the corn, shorts and tankage ration produced the most rapid gains, and at the same time proved more efficient than the corn alone. When the price of feed is considered the corn-fed hogs made cheaper gains than those fed a ration of corn, shorts and tankage. The length of time required to fatten the corn-fed hogs, however, was much greater than that required to fatten the hogs fed the corn, shorts and tankage ration. The hogs fed corn alone weighed less at the close of the experiment and fed out more unevenly than did the hogs receiving the supplements. When the hogs were shipped six of the eighteen corn-fed hogs were culled out as not ready for market, while all the corn, shorts and tankage-fed hogs were graded as finished hogs. In addition, the twelve corn-fed hogs that were shipped were valued at from 15 to 20 cents per hundred less on the market than the hogs fed corn, shorts and tankage. Thus we have the shorter feeding period, and the heavier hogs more evenly finished, selling at a higher price, produced by the corn, shorts and tankage ration, to offset the cheaper gains produced by the corn and alfalfa, and corn alone.

Experiment XIII.

THE COMPARATIVE FEEDING VALUE OF KAFIR, MILO AND SORGHUM SEED WITH CORN FOR FATTENING HOGS.

January 23, 1911, to April 23, 1911.

HOGS USED.

One hundred Duroc-Jersey hogs (70 sows and 30 barrows) were available for this experiment. These hogs were bred and raised at the Hays Branch Experiment Station, and shipped to Manhattan just before the beginning of the experiment. They were of the same age and breeding as those used in Experiment XII. They had been grown during the summer on alfalfa pasture and a limited amount of grain, and had been wintered on alfalfa hay and a little grain. They were a very uniform lot of hogs in size, quality and condition; and were in good thrifty condition and averaged 125 pounds each when they arrived in Manhattan.

PLAN OF EXPERIMENT.

On January 23 the 100 hogs were divided as evenly as possible into ten lots of ten hogs each (seven sows and three barrows). The ten lots were fed as follows:

LOT 50. Corn meal and alfalfa hay.
LOT 51. Corn meal alone.
LOT 52. Corn meal 62 per cent, shorts 30 per cent, tankage 8 per cent and alfalfa hay.
LOT 53. Corn meal 62 per cent, shorts 30 per cent and tankage 8 per cent.
LOT 54. Sorghum meal and alfalfa hay.
LOT 55. Sorghum meal 62 per cent, shorts 30 per cent and tankage 8 per cent.
LOT 56. Milo meal and alfalfa hay.
LOT 57. Milo meal 62 per cent, shorts 30 per cent and tankage 8 per cent.
LOT 58. Kafir meal and alfalfa hay.
LOT 59. Kafir meal 62 per cent, shorts 30 per cent and tankage 8 per cent.

The hogs receiving the shorts and tankage supplements were ready for market in sixty days and were sold. The others were fed twenty days longer.

Table No. XXVII gives a summary of the results of the experiment.

TABLE XXVII.—Comparison of corn, milo, kafir and sorghum seed for fattening hogs. January 23, 1911, to April 23, 1911.

	Lot 50. Ground corn and alfalfa hay	Lot 51. Ground corn alone	Lot 52. Ground corn 62 per cent, shorts 30 per cent, tankage 8 per cent, and alfalfa hay.	Lot 53. Ground corn 62 per cent, shorts 30 per cent, tank. 8 per cent	Lot 54. Ground cane seed and alfalfa hay	Lot 55. Ground cane seed 62 per cent, shorts 30 per cent, tank. 8 per cent	Lot 56. Ground milo seed and alfalfa hay	Lot 57. Ground milo seed 62 per cent, shorts 30 per cent, tank. 8 per cent	Lot 58. Ground kafir seed and alfalfa hay	Lot 59. Ground kafir seed 62 per cent, shorts 30 per cent, tank. 8 per cent
Number of days in period	80	80	60	60	80	60	80	60	80	60
Number of hogs in lot	10	9	10	10	10	10	10	10	10	10
Average weight of each at beginning, lbs	124	126.1	124 5	124 9	125 8	125	125 2	124.1	124 1	125.1
Average weight of each at close, lbs	246.5	220.8	241.6	244 9	196 5	277 3	221 6	227.2	235.6	237
Average daily gain per hog, lbs	1.5 1	1.18	1 95	2 0	.88	1.7	1 2	1.7	1.3	1.8
Average daily grain consumed per hog, lbs	6.6	6.26	7.45	7.4	5.7	7.4	6 2	6 7	7 3	7.4
Av. daily grain consumed per 100 lbs. live weight, lbs	3.5	3.6	4.1	4.0	3 5	4 2	3.9	3.8	3 3	4.1
Average daily hay consumed per hog, lbs	.6	.0	5	.0	.9	.0	.9	0	.9	0
Av. daily hay consumed per 100 lbs. live weight of hog, lbs	.32	.0	.25	.0	57	0	.52	.0	.52	.0
Grain per pound of gain, lbs	4.32	5.3	3 8	3.7	6.5	4.4	5.1	3 9	5 2	3 9
Hay per pound of gain, lbs	.39	.0	.23	.0	1.03	.0	74	0	67	.0
Cost per 100 lbs. gain	$4 25	$5.03	$4.40	$4.20	$6 57	$4.95	$5 21	$4 45	$5.21	$4 50

A comparison of the lots fed the supplements (shorts and tankage) with the lots fed hay instead of shorts and tankage shows that the shorts and tankage-fed lots made more rapid gains and required less grain for each pound of gain produced than did the hay-fed lots.

Lot 50 compared with Lot 51 again shows the value of alfalfa hay for fattening hogs when added to a straight corn ration. The hogs fed in Lot 50 gained on the average 25.7 pounds more per hog than the hogs in Lot 51, and in addition they required .97 pound less grain to produce each pound of gain. In other words, the consumption of .39 pound of hay resulted in the saving of .97 pound of corn in the production of one pound of gain.

Lot 52 compared with Lot 53 shows that where corn had already been supplemented with shorts and tankage the adding of alfalfa hay to the ration did not give an added gain. Instead, the ration of corn, shorts, tankage and hay gave poorer results than the ration of corn, shorts and tankage alone. The amount of feed consumed daily by the hogs in each of these two lots indicates that the eating of the bulky hay caused the hogs to eat a smaller amount of the more concentrated feed.

Comparisons of Lots 54, 56 and 58 show that the milo and hay gave slightly better returns than the kafir and hay, and that both of these rations gave considerably better returns than the sorghum and hay. But when these three lots are compared with Lot 50 it is seen that the corn and hay proved more efficient than either of the other three rations.

Comparisons of Lots 55, 57 and 59 show that the milo, shorts and tankage proved slightly more efficient than the kafir, shorts and tankage, and that both of these rations were more efficient than the sorghum, shorts and tankage. But when we compare the results of these three lots with the results of Lot 53 it is seen that, as in the case of the hay-fed lots, the corn, shorts and tankage ration proved more efficient than either of the other three, though the difference is not so marked.

The hogs fed corn and hay produced a pound of gain with—

.85 lbs. less grain and .36 lbs. less hay than the hogs fed milo and hay.
.95 lbs. less grain and .28 lbs. less hay than the hogs fed kafir and hay.
2.17 lbs. less grain and .65 lbs. less hay than the hogs fed sorghum and hay.

The hogs fed corn, shorts and tankage produced a pound of gain with—

.23 lbs. less grain than the hogs fed milo, shorts and tankage.
.25 lbs. less grain than the hogs fed kafir, shorts and tankage.
.66 lbs. less grain than the hogs fed sorghum, shorts and tankage.

The figures above show that if corn is taken as the basis of comparison the milo, kafir and sorghum each have a higher feeding value when fed with protein supplements, such as shorts and tankage, than when fed with alfalfa hay. In addition, this experiment would indicate that for fattening hogs milo and kafir each have a feeding value slightly lower than corn, and that sorghum seed, while not especially desirable as a hog feed, because of its lack of palatability, has considerable feeding value.

Experiment XIV.

A COMPARISON OF DRY-LOT AND PASTURE FEEDING OF FATTENING HOGS.

Experiment began May 20, 1911, and closed July 3, 1911.

OBJECT OF THE EXPERIMENT.

The object of this experiment was to make a comparison of dry-lot and pasture feeding of fattening hogs, and also to make a comparison of a ration of corn 90 per cent and tankage 10 per cent with a ration of corn 62 per cent, shorts 30 per cent and tankage 8 per cent when fed to fattening hogs with and without pasture.

HOGS USED.

Forty-two Duroc-Jersey hogs of fall 1910 farrow were available for this experiment. The hogs were bred and raised at the Hays Branch Experiment Station, and were shipped to Manhattan just before the beginning of the experiment. They were a fairly uniform lot of hogs in good thrifty condition, averaging 160 poundseach when unloaded in Manhattan.

PLAN OF EXPERIMENT.

On May 20 the forty-two hogs were divided into seven lots of six hogs each. Four barrows and two sows were put in each lot. They were fed as follows:

LOT 65. Corn meal in dry lot.
LOT 66. Corn meal 90 per cent, tankage 10 per cent, in dry lot.
LOT 67. Corn meal 62 per cent, shorts 30 per cent and tankage 8 per cent, in dry lot.
LOT 68. *Corn meal and green alfalfa, in dry lot.*

TABLE XXVIII.—Comparison of dry-lot and pasture feeding. May 20, 1911, to July 3, 1911.

	Lot 65. Ground corn alone in dry lot.	Lot 66. Ground corn, 90 per ct.; tankage, 10 per ct., in dry lot.	Lot 67. Ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct., in dry lot.	Lot 68. Ground corn and green alfalfa in dry lot.	Lot 69. Ground corn on alfalfa pasture.	Lot 70. Ground corn, 90 per ct.; tankage, 10 per ct., on alfalfa pasture.	Lot 71. Ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct., on alfalfa pasture.	Average of three lots fed in dry lot.	Average of three lots fed on pasture.
Number of hogs in lot	6	6	6	6	6	6	6	18	18
Number of days in period	44	44	44	44	44	44	44	44	44
Average weight of each at beginning, lbs.	159.8	160.5	159.5	160.3	160.1	159.5	160.1	159.9	160
Average weight of each at close, lbs	201.8	218.7	224.2	202.3	214.1	232.5	240	214.9	228.9
Average daily gain per hog, lbs.	.95	1.32	1.46	.95	1.23	1.65	1.81	1.25	1.57
Average daily feed eaten per hog, lbs.	5.14	6.58	6.45	G., 5.11 A., 1.76	5.95	6.43	6.86	6.06	6.41
Average daily feed eaten per 100 lbs. live weight, lbs.	2.84	3.47	3.36	G., 2.82 A., .97	3.18	3.28	3 43	3.23	3.30
Feed required to produce 1 lb. of gain, lbs.	5.38	4.98	4.39	G., 5.36 A., 1.85	4.85	3.86	3.78	4.85	4.10
Cost of feed required to produce 1 lb. of gain, lbs.	$5.11	$5.38	$4.96	$5.31	$4.89	$4.38	$4.41	$5.14	$4.53

LOT 69. Corn meal and alfalfa pasture.
LOT 70. Corn meal 90 per cent, tankage 10 per cent, on alfalfa pasture.
LOT 71. Corn meal 62 per cent, shorts 30 per cent and tankage 8 per cent, on alfalfa pasture.

All the lots were fed 44 days, when the hogs were ready for market and the experiment closed.

Table XXVIII gives a summary of the results of the experiment.

A comparison of the three lots fed on pasture with the three lots fed in dry lot shows that .75 pound more grain was required to produce a pound of gain in the dry lot than on pasture. The hogs on pasture made 14 pounds more gain per hog during the experiment at a cost of 61 cents for each hundred pounds of gain made less than the hogs in dry lot.

Comparisons of Lots 66, 67, 70 and 71 show that when fed on alfalfa pasture the corn, shorts and tankage and the corn and tankage rations gave practically the same returns while in the dry lots. The corn, shorts and tankage proved more efficient than the corn and tankage.

The hogs fed on corn and green alfalfa did not give as economical returns as those fed on corn and alfalfa pasture.

Experiment XV.

Experiment began July 19, 1911, and closed January 16, 1912.

The object of this experiment was, primarily, the same as in Experiment XII. In addition the experiment was planned so as to obtain a comparison ,of dry-lot and pasture feeding of growing pigs. Also to determine the relative economy of supplementing corn with shorts and tankage when fed to pigs receiving a limited amount of grain and alfalfa pasture. In this experiment, too, one lot of pigs was run on alfalfa pasture without grain.

HOGS USED.

Ninety-nine spring pigs (fifty-two barrows and forty-seven sows) were available for this experiment. These pigs were very uniform in size, quality and condition. They were farrowed in March and April at the Hays Branch Experiment Station and were shipped to Manhattan in June, 1911. From

the time they arrived in Manhattan until the beginning of the experiment they were given the run of a four-acre lot and a limited amount of a grain ration, composed of corn 80 per cent and shorts 20 percent, morning and night. On July 19, when the experiment began, the ninety-nine pigs averaged 48.5 pounds each and were divided as evenly as possible; as to size, quality, sex and condition, into ten lots, and fed as follows:

Lot 72.	18 pigs.	Fed a limited amount of ground corn on alfalfa pasture.
Lot 73.	9 pigs.	Run on alfalfa pasture without grain.
Lot 74.	9 pigs.	Fed a limited amount of a grain ration composed of ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent in dry lot.
Lot 75.	9 pigs.	Fed a limited amount of a grain ration composed of ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent on alfalfa pasture.
Lot 76.	9 pigs.	Full fed on ground corn in dry lot.
Lot 77.	9 pigs.	Full fed on ground corn and alfalfa pasture.
Lot 78.	9 pigs.	Full fed on a grain ration composed of ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent in dry lot.
Lot 79.	9 pigs.	Full fed on a grain ration composed of ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent on rape pasture.
Lot 80.	9 pigs.	Full fed on ground corn and fresh cut green alfalfa in dry lot.
Lot 81.	9 pigs.	Full fed on a grain ration composed of ground corn 62 per cent, shorts 30 per cent on alfalfa pasture.

The experiment was started with the night feed of July 19, 1911. The hogs on pasture were given the run of yards, contaking approximately one-half acre each. The hogs fed in dry lot were put in yards 12 feet by 72 feet. Shade was provided for all the hogs. Individual weights were taken of the hogs at each weighing time and the feed for each lot was weighed at each feeding time. On September 9 two average hogs (one barrow and one sow) were taken from each lot for exhibition purposes at the Topeka and Hutchinson fairs, and on September 17 one hog in Lot 77 died from heat, consequently the results of the experiment for the summer period have been calculated on the basis of sixteen hogs in Lot 72, seven hogs in Lots 73, 76, 78, 81, and six hogs in Lot 77. The pigs on alfalfa pasture alone made some growth and a small amount of gain but became very thin. By September 9 one

of the pigs in this lot had become very weak. It was taken from the lot and fed a small amount of grain. On September 17 it was evident that the pigs in Lot 73 would soon starve unless fed some grain, consequently they were put on a full feed of a grain ration composed of ground corn 62 per cent, shorts 30 per cent and tankage 8 per cent.

The summer of 1911 was very dry and hot and pastures did not make a very satisfactory growth nor seem as succulent as in other years, The hogs in all the lots suffered more or less on account of the heat and those on pasture did not graze as much as they would have done had the weather been cooler, consequently none of the hogs on full feed made satisfactory gains. On October 7 the hogs were taken from pasture and put in the dry lots for the finishing period. The results of the summer period are shown in Table No. XXIX.

At the close of the summer period none of the hogs were ready for market. On October 7 the hogs in Lot 72 were divided into three lots, the division being made as evenly as possible as regards number, weight, quality, sex, and condition. The two new lots were called 72a and 72b. After October 7 all the hogs were full fed in dry lot, as follows:

LOT 72. Ground corn and alfalfa hay in rack.
LOT 73. Ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent.
LOT 74. Ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent.
LOT 75. Ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent.
LOT 76. Ground corn alone.
LOT 77. Ground corn and alfalfa hay in rack.
LOT 78. Ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent.
LOT 79. Ground corn 62 per cent, shorts 30 per cent, tankage 8 per cent, and alfalfa hay in rack.
LOT 80. Ground corn and alfalfa hay in rack.
LOT 81. Ground corn 62 per cent, shorts 30 per cent, tankage 8 per cent, and alfalfa hay in rack.
LOT 72a. Ground corn 62 per cent, shorts 30 per cent, and tankage 8 per cent.
LOT 72b. Ground corn alone.

After thirty-seven days' feeding the hogs in Lots 78, 79 and 81 were heavy enough for market, and were sold. All the other hogs were fed sixty-three days longer, or until January 15, 1912, when the experiment was closed. Table No. XXX shows the results of the winter feeding period.

TABLE XXIX.—Limited vs. full feeding of growing pigs. Summer period—July 19 to October 7, 1911.

	Lot 72. Limited fed—ground corn on alfalfa pasture.	Lot 73. Alfalfa pasture alone 60 days. Full fed—corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; alfalfa pasture, 20 days.	Lot 74. Limited fed—corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot.	Lot 75. Limited fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on alfalfa pasture.	Lot 76. Full fed—ground corn in dry lot.	Lot 77. Full fed—ground corn and alfalfa pasture.	Lot 78. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; in dry lot.	Lot 79. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on rape pasture.	Lot 80. Full fed—ground corn and fresh cut green alfalfa.	Lot 81. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on alfalfa pasture.
Number of days in period	80	80	80	80	80	80	80	80	80	80
Number of hogs in lot	16	7	7	7	7	7	7	7	7	7
Average weight per hog at beginning, lbs.	49.31	46.28	48.14	47.42	49.71	49.80	46.00	49.57	49.52	49.14
Average weight per hog at close, lbs.	77.93	90.57	62.14	93 42	67.42	102.33	126.30	161.85	99.14	164.57
Average daily gain per hog, lbs.	.357	20d. 1.893 60d. .107 80d. .553	.175	.575	.221	.656	1.003	1.403	.62	1.44
Average daily feed consumed per hog, lbs.	1.096	80d. 1.796 20d. 3.978	1.122	.987	2.50	2.933	4.183	5 166	G. 2.863 H. 2.06	5.00
Average daily feed consumed per 100 lbs. live weight, lbs.	1.81	80d. 1.45 20d. 5.81	2.034	1.402	4.26	3.85	4.86	4.89	G. 3.85 H. 2.78	4.68
Grain per lb. of gain, lbs.	3.065	2.101	6.412	1.717	11.27	4.469	4.168	3.68	G. 4.89 H. 3.32	3.46
Cost per 100 lbs. gain	$4.31	$3.119	$7.24	$2.663	$10.71	$4.779	$4.705	$4.345	G. $4.38 H. .40	$4.10

TABLE XXX.—Limited vs. full feeding of growing pigs. Winter period—October 7, 1911, to January 15, 1912.

	Lot 72. Ground corn and alfalfa hay	Lot 73. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot	Lot 74. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot	Lot 75. Corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot	Lot 76. Ground corn in dry lot	Lot 77. Ground corn and alfalfa hay in dry lot	Lot 78. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot	Lot 79. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; and alfalfa hay in dry lot	Lot 80. Ground corn and alfalfa hay in dry lot	Lot 81. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; and in alfalfa hay dry lot	Lot 72a. Ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent, in dry lot	Lot 72b. Ground corn in dry lot
No. of days in period	100	100	100	100	100	100	37	37	100	37	100	100
No. of hogs in lot	5	7	7	7	7	7	7	7	7	7	6	5
Average weight per hog at beginning, lbs.	77.4	90.57	62.14	93.42	67.40	102.30	126.30	161.85	99.14	164.5	77.	79.6
Average weight per hog at close, lbs.	193	262	221.1	264.7	74.71	184.83	188.57	233.42	186.57	235.3	236.16	170
Average daily gain per hog, lbs.	1.156	1.714	1.590	1.713	.729	.825	1.683	1.932	.874	1.911	1.591	.904
Average daily feed consumed per 100 lbs. live weight of hogs, lbs.	G. 4.53 H. .33	5.08	5.62	4.91	3.40	G. 3.98 H. .17	5.69	G. 5.57 H. .15	G. 3.76 H. .34	G. 4.96 H. .16	5.74	4.76
Average daily feed consumed per hog, lbs.	G. 6.122 H. .45	8.955	7.961	8.784	2.416	G. 5.716 H. .17	8.961	G. 11.00 H. .36	G. 5.367 H. .49	G. 9.917 H. .32	10.784	5.94
Feed consumed per pound of gain, lbs.	G. 5.295 H. .39	5.221	5.007	5.128	33.15	G. 6.929 H. .20	5.323	G. 5.688 H. .16	G. 6.138 H. .56	G. 5.187 H. .17	5.646	6.57
Cost per 100 lbs. of gain.	$5.192	$5.397	$5 653	$5.789	$31.49	$6.687	$6.01	$6.404	$6.077	$5.908	$6.374	$6.24

When the experiment closed, the average weight for each hog in the lots fed corn, shorts and tankage ranged from 221 to 265 pounds, and the average weight for each hog in the lots fed corn alone and alfalfa hay ranged from 75 to 193 pounds. It would have required sixty days more to have made the corn alone and corn and hay-fed hogs as heavy as the corn, shorts and tankage-fed hogs were at the close of the experiment. During the winter or finishing period, the hogs in Lot 74, fed corn, shorts and tankage, made the greatest gain for a pound of feed consumed, while at the prices used the hogs in Lot 72, fed corn and hay, made the cheapest gains. When, however, a summary of both feeding periods is made (Table No. XXXI) it is seen that for the entire feeding period the hogs in Lot 81, full fed on corn, shorts and tankage, on alfalfa pasture, and then on the same ration and alfalfa hay in the dry lot, made the greatest mount of gain for a pound of feed consumed, and at the same time the cheapest gains. It must be noted, however, that at the time the hogs in each of these two lots were sold, those in Lot 81 averaged 235 pounds each, while those in Lot 75, making the next cheapest gains, averaged 265 pounds each. Since the cost of gain increases as the hog increases in weight, if the hogs in Lot 75 had been sold when they averaged approximately 235 pounds the cost of each 100 pounds gain made would have been less. For the purpose of better comparison, Table No. XXXII, giving a summary based as nearly as possible on the same final weight per hog, has been prepared.

A comparison of Lot 75 with Lot 81 in this table shows that the hogs in Lot 75 made one hundred pounds of gain for each 390 pounds of feed consumed and at a cost of $4.58 per hundred pounds of gain, while the hogs in Lot 81 made one hundred pounds of gain for each 418 pounds of feed consumed and at a cost of $4.80 per hundred pounds of gain. This is a difference of 22 cents in the cost of each hundred pounds gain in favor of the hogs that were limited fed during the summer. A comparison of Lot 74 with Lot 75, the lots fed corn, shorts and tankage in dry lots during the summer, again shows a slight difference in favor of the limited feeding during the period of early growth. A comparison, however, of Lot 72a, the lot fed a limited amount of corn on alfalfa pasture during the summer and then finished on corn, shorts and tankage in

TABLE XXXI—*Limited vs. full feeding of growing pigs.* Summer and winter periods—July 19, 1911, to January 15, 1912.

	Lot 72. Limited fed: ground corn and alfalfa pasture, 80 days; full fed: ground corn and alfalfa hay, 100 days	Lot 73. Alfalfa pasture alone, 60 days; full fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; on alfalfa pasture, 20 days; dry lot, 100 days	Lot 74. Limited fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; 80 days; full fed: in dry lot, 100 days	Lot 75. Limited fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; alfalfa pasture; full fed: same grain; ration in dry lot, 100 days	Lot 76. Full fed: ground corn in dry lot 180 days	Lot 77. Full fed: ground corn and alfalfa pasture, 80 days; ground corn and alfalfa hay in dry lot, 100 days	Lot 78. Full fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; in dry lot, 117 days	Lot 79. Full fed: corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; on rape pasture, 80 days; same ration and alfalfa hay in dry lot, 37 days	Lot 80. Full fed: ground corn and alfalfa hay, 100 days	Lot 81. Full fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; on alfalfa pasture, 80 days; same ration in dry lot, 37 days	Lot 72a. Limited fed: ground corn and alfalfa pasture, 80 days; full fed: ground corn, 62 per ct.; shorts, 30 per ct.; tankage, 8 per ct.; in dry lot, 100 days	Lot 72b. Limited fed: ground corn and alfalfa pasture, 80 days; full fed: ground corn in dry lot, 100 days
Number of days in period	180	180	180	180	180	180	180	117	180	117	180	180
Number of hogs in lot	5	7	7	7	7	6	7	7	7	7	6	5
Average weight per hog at beginning, lbs	52.40	46.28	48.14	47.42	49.71	49.80	46	49.57	49.42	49.14	48.8	46.8
Average weight per hog at close, lbs	193	262	221.14	264.71	74.71	184.83	188 57	233.42	186.57	235.30	236.16	170
Average daily gain per hog, lbs	.781	1.198	.961	1.267	.14	.75	1.218	1.572	.762	1.509	1.040	.684
Aver. daily feed consumed per hog, lbs	G. 3.894 H. .25	5.417	4.921	5.319	2.466	G. 4.479 H. .09	5 694	G. 7.012 H. .10	G. 4.253 H. .27	G. 6.588 H. .10	5.480	3.787
Aver. daily feed consumed per 100 lbs liveweight, lbs.	G. 3.17 H. .20	3.51	3.66	3.41	3.96	G. 3.82 H. .08	4.85	G. 4.96 H. .07	G. 3.61 H. .23	G. 4.61 H. .07	3.32	3.49
Feed consumed per lb. gain, lbs	G. 4.985 H. .37	4.520	5.121	4.406	17.758	G. 5.972 H. .12	4.673	G. 4.462 H. .06	G. 5.574 H. .36	G. 4.122 H. .06	5.265	5.433
Cost per 100 lbs. gain	$5.16	$5.327	$5.782	$5.238	$16.87	$5.943	$5.275	$5.159	$5.636	$5.793	$6.074	$5.581

TABLE XXXII.—Comparison of limited vs. full feeding of growing pigs. Table showing summary of gains and cost of gain. Comparisons drawn on the basis of the same final weight. 1911 experiment.

	Lot 72. Limited fed—ground corn and alfalfa pasture 80 days. Full fed—corn and alfalfa hay 100 days.	Lot 72a. Limited fed—ground corn and alfalfa pasture 80 days. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent. In dry lot 75 days.	Lot 72b. Limited fed—ground corn and alfalfa pasture 80 days. Full fed—ground corn in dry lot 100 days.	Lot 73. Alfalfa pasture alone 60 days. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tank., 8 per cent; on alf. past. 20 days. In dry lot 75 days.	Lot 74. Limited fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent. 80 days. Full fed—in dry lot 75 days.	Lot 75. Limited fed—ground corn, 62 per cent; shorts, 30 per cent; tankage 8 per cent; alfalfa pasture. Full fed—same grain ration in dry lot 75 days.	Lot 77. Full fed—ground corn and alfalfa pasture 80 days; ground corn and alfalfa hay in dry lot 100 days.	Lot 78. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent. In dry lot 117 days.	Lot 79. Full fed—corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on rape pasture 80 days. Same ration and alfalfa hay in dry lot 87 days.	Lot 81. Full fed—ground corn, 62 per cent; shorts, 30 per cent; tankage, 8 per cent; on alfalfa pasture 80 days. Same grain ration in dry lot 87 days. Alfalfa hay
Number of days in period	180	155	180	155	155	155	180	117	117	117
Number of hogs in lot	5	6	5	7	7	7	6	7	7	7
Av. weight per hog at beginning, lbs.	52.40	48.8	46.8	46.28	48.14	47.42	49.8	46 00	49 57	49 14
Av. weight per hog at close, lbs.	193	218 83	170	245	199.28	244 57	184.83	188.57	233 42	235.30
Av. daily gain per hog, lbs.	.781	1.096	.684	1.281	.975	1.270	.750	1.218	1 572	1.509
Av. daily feed consumed per hog, lbs.	G. 3 894 H. .25	5.014	3 787	5.077	4.498	4.968	G. 4.479 H. .09	5 694	G. 7 102 H. .10	G. 6 588 H. .10
Av. daily feed consumed per 100 lbs. live weight, lbs.	G. 3.17 H. .20	3.75	3.49	3.49	3.63	3.408	G. 3.82 H. .08	4.854	G. 4 96 H. .07	G. 4.611 H. .07
Feed consumed per pound gain, lbs.	G. 4.985 H. .371	4.572	5.533	3.961	4 608	3.904	G. 5.972 H. .123	4.673	G. 4 462 H. .06	G. 4.122 H. .065
Cost per 100 lbs. of gain	$5.16	$5.30	$5.581	$4 70	$5.203	$4 577	$5.96	$5.275	$5.159	$4.80

the dry lot, with Lots 81 and 79 shows a difference of 50 and 15 cents per hundred, respectively, in favor of the full-fed lots. A study of the results obtained from the hogs in Lot 73, run on alfalfa pasture alone for sixty days, shows that each hundred pounds of gain made by these hogs cost $4.70 per hundred, thus ranking second from the standpoint of economy of gain.

A comparison of Lot 75 with Lot 72a shows a difference of 72 cents in the cost of each hundred pounds of gain in favor of the hogs receiving shorts and tankage while on limited feed during the summer. Thus this experiment indicates that it will pay to feed some protein in the form of shorts and tankage to hogs that are being grown during the summer on alfalfa pasture and a limited amount of corn; or, in other words, when pigs are being grown on pasture and a limited amount of grain, a ration of corn, shorts and tankage will give more economical returns than corn alone. This, however, is the result of only one experiment and should not be taken as conclusive. Again, a comparison of Lots 75 and 81 with Lots 72, 72b and 77 shows a difference of $0.58, $1 and $1.16, respectively, in the cost of one hundred pounds of gain in favor of the lots fed corn, shorts and tankage and alfalfa pasture instead of corn alone and alfalfa pasture, and corn alone and corn and hay. Then, further, there was not only a difference in cost of gain in favor of the corn, shorts and tankage ration but also a difference in condition. The corn, shorts and tankage-fed hogs weighed from 42 to 74 pounds more per hog at the close of the experiment, than the hogs fed corn alone and corn and hay, and all were in marketable condition, while two hogs from Lot 77, one hog from Lot 72 and three hogs from Lot 72b were culled as not being in marketable condition and the remainder valued at 20 cents per hundred less than the corn, shorts and tankage-fed hogs. Comparisons of Lot 72 with Lot 72b and Lot 77 with Lot 76 in Table No. 31 shows the value of adding alfalfa hay to the ration if the hogs are to be fed in a dry lot on corn. The comparison of Lot 76 with Lot 77 shows conclusively the value of alfalfa pasture in pork production. Figure 7 shows the carcass of an average hog from each of these two lots. The smaller hog shown in the cut was fed on corn alone in a dry lot from the beginning of the experiment until the close. The larger

FIG. 7. Showing representative carcasses from hogs fed on corn alone, as compared with corn and alfalfa hay.

hog was fed on corn and alfalfa pasture during the summer season and then on corn and alfalfa hay in a dry lot during the fall or finishing season. The two hogs were litter mates and weighed approximately the same at the beginning of the experiment.

A comparison of Lots 72 and 72b with Lot 77 shows that if the hogs are to be fed on corn alone and alfalfa pasture and then finished on corn alone or corn and hay in the dry lot the limited feeding for a period of growth is the most economical, while if the corn is supplemented with shorts and tankage we have a shorter feeding period for the full-fed hogs to offset a slightly cheaper gain by the limited-fed hogs.

SUMMARY OF RESULTS.

In Tables Nos. XXXIII, XXXIV, XXXV, XXXVI, XXXVIa and XXXVII the results obtained in the experiments reported in both Part I and Part II of this bulletin have been brought together and summarized.

CORN ALONE IN DRY LOT. For the hogs fed corn alone in dry lot the corn required to produce a pound of gain ranged from 5.29 pounds to 7.58 pounds, and with corn at 95 cents per cwt. the cost for 100 pounds of gain ranged from $5.11 to $7.21. These results show clearly that the feeding of corn alone in a dry lot is an expensive method of finishing hogs.

TABLE XXXIII.—Summary of lots fed corn alone in dry lot.

	Number of hogs.	Number of days.	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. gain.
Lot No. 11. Corn alone, in dry lot.....	10	112	0.99	6.93	$6.58
Lot No. 15. Corn alone, in dry lot.....	20	65	1.00	5.95	5.65
Lot No. 19. Corn alone, in dry lot.....	8	56	.67	7.58	7.21
Lot No. 47. Corn alone, in dry lot.....	9	100	.73	6.52	6.20
Lot No. 46. Corn alone, in dry lot.....	5	100	.687	6 22	5.96
Lot No. 51. Corn alone, in dry lot.....	9	80	1.19	5.29	5.03
Lot No. 65. Corn alone, in dry lot.....	6	44	.95	5.38	5.11
Lot No. 72. Corn alone, in dry lot.....	5	100	.90	6.57	6.24
Average.....	72	79.88	**914**	6.26	$6.94

CORN SUPPLEMENTED WITH ALFALFA HAY (FED IN DRY LOT).

Table No. XXXIV shows a summary of the results obtained from eight lots, comprising fifty-nine hogs, fed an average of 86.7 days. The amount of feed required to produce a pound of gain ranged from 4.71 pounds to 7.20 pounds, and the cost

of 100 pounds of gain ranged from $4.26 to $6.69. These figures show that the feeding of corn and alfalfa hay is more economical than the feeding of corn alone.

TABLE XXXIV.—Summary of lots fed corn and alfalfa hay in dry lot.

Number of lots and rations fed.	Number of hogs	Number of days	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs of gain
Lot No. 13. Corn and alfalfa hay fed in rack.	10	112	1.18	C. 5.96 H. 1.01	$6.07
Lot No. 23. Corn and alfalfa hay fed in rack.	8	56	.84	C. 6.21 H. .99	6.29
Lot No. 31. Corn and alfalfa hay fed in rack.	8	56	1.17	C. 5.8 H. 1.05	5.93
Lot No. 46a. Corn and alfalfa hay fed in rack.	5	100	1.06	C. 5.16 H. 1.14	5.37
Lot No. 50. Corn and alfalfa hay fed in rack.	10	80	1.53	C. 4.32 H. .39	4.26
Lot No. 80. Corn and alfalfa hay fed in rack.	7	100	.87	C. 6.14 H. .56	6.08
Lot No. 72. Corn and alfalfa hay fed in rack.	5	100	1.16	C. 5.30 H. .39	5.19
Lot No. 77. Corn and alfalfa hay fed in rack.	6	100	.83	C. 6.93 H. .20	6.69
Average	59	86.7	1.11	C. 5.56 H. .71	$5.57

CORN SUPPLEMENTED WITH MEAT MEAL OR TANKAGE IN DRY LOT.

Table No. XXXV shows a summary of the lots fed corn and meat meal or tankage. Nine lots comprising 162 hogs were fed corn and meat meal or tankage for an average of fifty-four days. The average daily gain secured in these hogs, ranging from 1.3 to 1.76 pounds, was considerably greater than that secured with the hogs fed corn alone, or corn and hay. The gains were much more uniform and the hogs were more evenly finished. The amount of feed required to produce one pound of gain averaged less, and the cost of each 100 pounds of gain was less than with the corn alone and corn and hay rations.

CORN SUPPLEMENTED WITH SHORTS AND TANKAGE OR MEAT MEAL FED IN DRY LOT.

Table No. XXXVI shows a summary of all the lots fed corn, shorts and tankage in dry lots. Eighteen lots comprising 207 hogs were fed an average of 75.4 days. The average daily gain ranged from .96 pound to 2.31 pounds. The cost of 100 pounds of gain ranged from $4.18 to $6.62, with an average

TABLE XXXV.—Summary of lots fed corn and meat meal or tankage in dry lot.

Number of lots. Rations fed.	Number of hogs.	Number of days.	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. gain.
Lot 1. Corn meal, 5 parts; Swift's digester tankage, 1 part	12	27	1.54	4.25	$4.95
Lot 5. Corn meal, 5 parts; Swift's digester tankage, 1 part	10	45	1.6	4.37	4.93
Lot 12. Corn meal, 5 parts; Armour's meat meal, 1 part	10	112	1.76	4.76	5.54
Lot 16. Corn, 92 per cent; Swift's digester tankage, 8 per cent	20	65	1.65	4.55	4.80
Lot 18. Corn, 92 per cent; Swift's meat meal, 8 per cent.	20	65	1.58	4.75	5.01
Lot 26. Corn meal, 90 per cent; Swift's meat meal, 10 per cent	8	56	1.44	4.48	4.75
Lot 29. Corn, 90 per cent; Swift's meat meal, 10 per cent.	8	56	1.55	5.13	5.44
Lot 66. Corn, 90 per cent; Swift's digester tankage, 10 per cent	6	44	1.32	4.98	5.38
Lot 42. Corn, 90 per cent; Swift's digester takage, 10 per cent	70	36	1.56	4.71	4.91
Average lots 39 and 41. Corn, 90 per cent; Swift's digester tankage, 10 per cent	10	91	1.44	4.82	5.21
Average	162	54	1.58	4.72	$5.27

TABLE XXXVI.—Summary of lots fed corn, shorts and meat meal or tankage in dry lot.

Rations fed.	Number of hogs.	Number of days.	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. gain.
Lot 24. Corn, 70 per cent; shorts, 25 per cent; Armour's meat meal, 5 per cent.	8	56	1.69	4.31	$4.60
Lot 30. Corn, 70 per cent; shorts, 25 per cent; Armour's meat meal, 5 yer cent.	8	56	1.57	5.06	5.40
Lot 32. Corn, 60 per cent; shorts, 30 per cent; Armour's meat meal, 10 per cent.	7	42	1.95	3.60	4.16
Lot 33. Corn, 60 per cent; shorts, 30 per cent; Armour's meat meal, 10 per cent.	7	42	2.31	3.61	4.17
Lot 36. Corn, 60 per cent; shorts, 30 per cent; Swift's digester tankage, 10 per cent.	10	115	1.48	4.71	5.48
Average lots 38 and 40. Corn, 60 per cent; shorts, 30 per cent; Swift's digester tankage, 10 per cent.	9	91	1.70	4.66	5.39
Lot 43. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	36	1.86	4.33	4.99
Lot 49. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	190	1.23	4.71	5.32
Lot 45. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	9	100	1.41	5.87	6.62
Lot 47a. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	9	100	1.48	4.82	5.44
Lot 48. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	100	1.28	5.86	6.61
Lot 53. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	60	2.00	3.72	4.20
Lot 67. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	6	44	1.46	4.39	4.96
Lot 74. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	7	180	0.96	5.12	5.78
Lot 78. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	7	117	1.22	4.67	5.28
Lot 73. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	7	100	1.71	5.22	5.90
Lot 75. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	7	100	1.71	5.13	5.79
Lot 72a. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	6	100	1.59	5.65	6.37
Average	207	75.4	1.53	4.75	$5.30

of $5.30, thus showing that for dry-lot feeding a ration of corn, shorts and tankage gave more economical results than corn alone or corn and alfalfa hay.

When compared with the average of the lots fed corn and tankage or meat meal, the results seem to show that the lots not fed shorts made the cheaper gains. It must be remembered, though, that several of the lots included in this average are not strictly comparable with those not fed shorts. For that reason Table No. XXXVIa has been prepared. In this table only those lots that are strictly comparable with the ones fed corn and tankage or meat meal have been used. The results here obtained show that the ration containing the shorts proved more efficient and more economical than the one without the shorts.

In Table No. XXXVII the averages of all the lots have been brought together for comparison. In the table it is seen that the feeding of alfalfa meal resulted in a saving of 32 cents for each hundred pounds gain over the feeding of corn alone; the feeding of alfalfa hay resulted in a saving of 72 cents for each hundred pounds gain as compared with corn alone; and the feeding of meat meal or tankage or shorts and meat meal or tankage resulted in a saving of approximately $1 on each hundred pounds gain as compared with corn alone. The

TABLE XXXVI*a*.—Summary of lots fed corn, shorts and meat meal or tankage in dry lot.

Rations fed.	Number of hogs	Number of days	Average daily gain per hog, lbs.	Feed per pound of gain, lbs.	Cost of feed per 100 lbs. gain
Lot 24. Corn, 70 per cent; shorts, 25 per cent; Armour's deodorized meat meal, 5 per cent.	8	56	1.69	4.31	$4.60
Lot 30. Corn, 70 per cent; shorts, 25 per cent; Armour's deodorized meat meal, 5 per cent.	8	56	1.57	5.06	5.40
Lot 32. Corn, 60 per cent; shorts, 30 per cent; Armour's deodorized meat meal, 10 per cent.	7	42	1.95	3.60	4.16
Lot 33. Corn, 60 per cent; shorts, 30 per cent, Armour's deodorized meat meal, 10 per cent.	7	42	2.31	3.61	4.17
Av. lots 38 and 40. Corn, 60 per cent; shorts, 30 per cent; Swift's digester tankage, 10 per cent.	9	91	1.70	4.66	5.39
Lot 43. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	70	36	1.70	4.33	4.99
Lot 45. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	9	100	1.41	5.87	6.62
Lot 48. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	100	1.28	5.86	6.61
Lot 53. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	10	60	2.00	3.72	4.20
Lot 67. Corn, 62 per cent; shorts, 30 per cent; Swift's digester tankage, 8 per cent.	6	44	1.46	4.39	4.96
Average.	144	52.68	1.70	4.58	$5.05

figures presented in this table show that when corn was supplemented with meat meal or tankage and shorts more efficient and more economical results were obtained than when supplemented with only meat meal or tankage.

TABLE XXXVII.

Ration.	Number of hogs.	Average number of days fed.....	Average daily gain per hog, lbs.....	Feed required to make one pound of gain, lbs.....	Cost of feed required to make 100 lbs. gain.....
Corn alone in dry lot.....	72	79.88	.914	6.25	$5.94
Corn and alfalfa hay in dry lot.....	59	86.7	1.11	C. 5.56 H. .71	5.57
Corn and meat meal or tankage in dry lot.....	162	54	1.58	4.72	5.27
Corn, shorts, and meat meal or tankage, in dry lot.....	144	52.68	1.70	4.58	5.05

VALUE RETURNED FOR A BUSHEL OF CORN.-As a rule the farmer or feeder is vitally interested in knowing what is the value returned for each bushel of corn raised and fed. Table No. XXXVIII has been prepared for the purpose of making this comparison. This table shows that at the prices used for supplemental feeds and with hogs selling as low as $5 per hundred the feeding of these feeds is more profitable than feeding corn alone. With any increase in the price of pork the greatest value to be secured from a bushel of corn will be obtained by the use of supplemental feeds rich in protein. This table shows conclusively the value of protein supplements as compared with corn alone.

TABLE XXXVIII.—Value returned per bushel of corn.

	Corn alone.	Corn and alfalfa hay.	Corn supplemented with meat meal or tankage.	Corn supplemented with shorts and tankage or meat meal.
Number of hogs in lot.....	72	59	162	144
Number of days fed.....	79.88	86.7	54	52.68
Average weight of each at beginning, lbs.....	123.83	120.9	153.1	151.40
Average weight of each at close, lbs.....	197.1	217.0	238.42	241.07
Pork produced, lbs.....	5,267.5	5,671.0	13,823.0	12,912.00
Value of supplementary feed.....	.....	16.08	153.29	313.21
Value returned per bushel for corn with—				
Pork at $5 per cwt.....	.447	.475	.517	.508
Pork at $6 per cwt.....	.536	.576	.65	.698
Pork at $7 per cwt.....	.626	.676	.73	.892
Pork at $8 per cwt.....	.716	.777	.916	1.089

CONCLUSION.

1. The feeding of corn alone in dry lot does not give satisfactory results.

2. A ration of corn and alfalfa hay is more economical than the feeding of corn alone.

3. The feeding of protein supplements, such as tankage or meat meal and shorts and tankage or meat meal, in connection with corn increased the efficiency of the ration and the rate of gain.

4. With a grain ration of corn, shorts and tankage on alfalfa pasture the profits were practically the same when the pigs were first grown on a limited amount of feed during the summer and then fattened in the fall as when full fed from the beginning until ready for market.

5. Hogs fed on pasture made cheaper and more rapid gains than those fed in dry lot.

6. Kafir and milo are good feeds for fattening hogs. These grains, however, should not be fed alone, but supplemented with feeds rich in protein, such as soy beans, shorts and tankage or meat meal, if best results are to be obtained.

7. Hogs can be profitably grown and fed when corn is supplemented with pasture crops and protein feeds, such as alfalfa hay, soy beans, shorts and meat meal or tankage.

TABLE NO. XXXIII.—Summary of (comparable) limited and full-fed lots.—1910 and 1911 experiments.

	Number of days fed.	Number of hogs fed.	Average weight of each at beginning, lbs.	Average weight of each at close, lbs.	Cost of 100 lbs. gain.
Average of all lots limited fed	173	48	42.5	199.0	$5.06
Average of all lots full fed	144	66	39.2	212.4	5.14
Average of lots full fed on corn on alfalfa pasture, and finished on corn or corn and alfalfa hay in dry lots	186	16	39.0	180.7	5.28
Average of lots full fed on corn, shorts and tankage on alfalfa or rape pasture, and finished on same feed in dry lots	139	33	39.8	228.8	5.11
Average of lots limited fed on alfalfa pasture, and finished on corn or corn and alfalfa hay in dry lots	185	19	41.4	163.5	5.13
Average of lots limited fed on alfalfa pasture, and finished on corn, shorts and tankage in dry lots	169	22	41.6	229.5	4.98

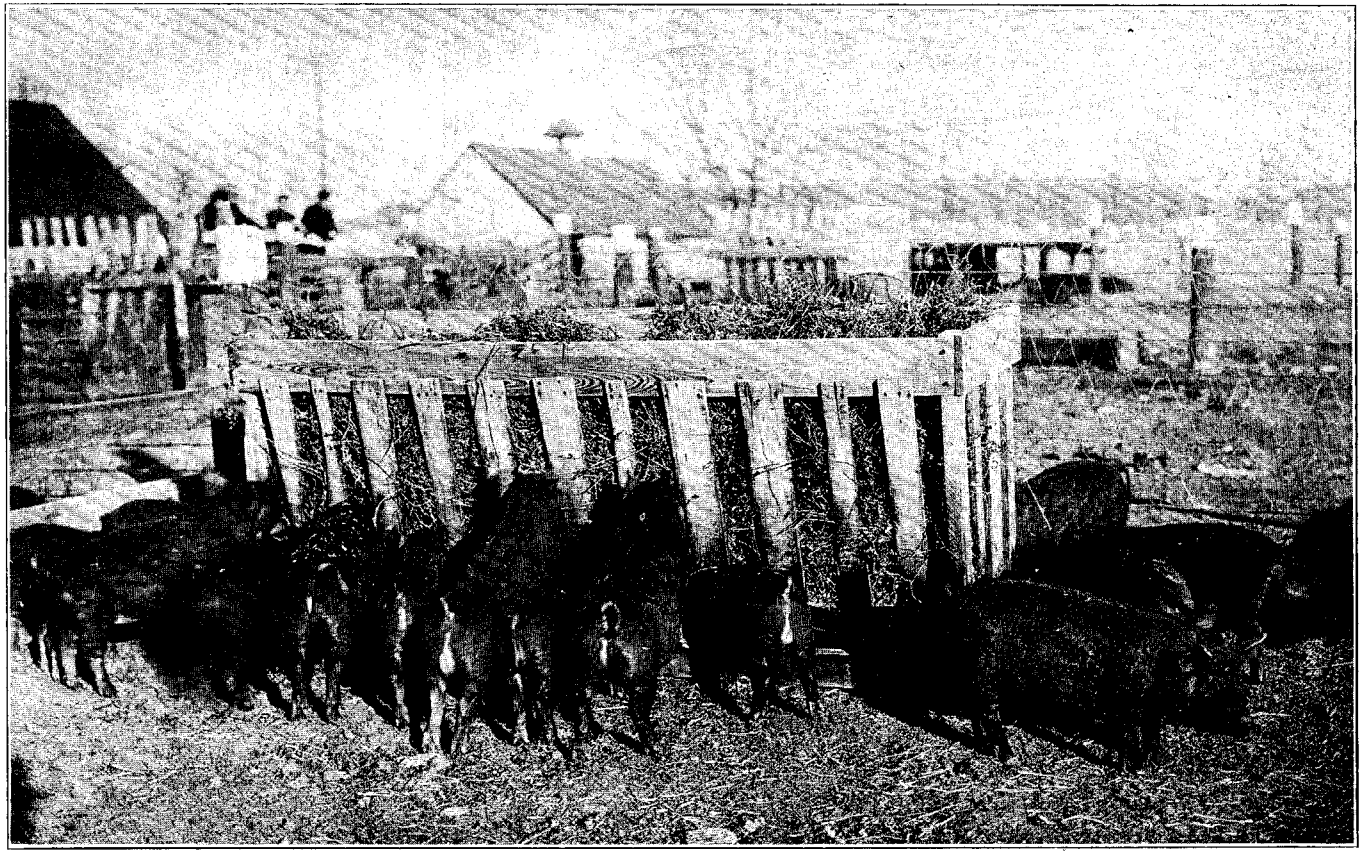

FIG. 8. Showing method of feeding alfalfa hay to hogs in dry lot.