

# TEXAS AGRICULTURAL EXPERIMENT STATION

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

W. B. BIZZELL, President

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BULLETIN NO. 305

FEBRUARY, 1923

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DIVISION OF ANIMAL INDUSTRY

## SWINE FEEDING EXPERIMENTS

AGRICULTURAL & MECHANICAL  
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B. YOUNGBLOOD, DIRECTOR,  
COLLEGE STATION, BRAZOS COUNTY, TEXAS

**TEXAS AGRICULTURAL EXPERIMENT STATION**  
**AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS**  
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**SWINE FEEDING EXPERIMENTS**

**PART I**

- Experiment I. Three Methods of Pig Raising**  
**Experiment II. Dried Buttermilk for Growing Pigs**

**PART II**

- Experiment III. Cottonseed and Cottonseed Meal for Fattening Pigs**  
**Experiment IV. Peanut Grazing and Self-Feeders for Fattening Pigs**  
**Experiment V. Protein Supplements in Fattening Rations for Pigs**



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†As of February 1, 1923.

\*In cooperation with School of Veterinary Medicine, A. and M. College of Texas.

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## SWINE FEEDING EXPERIMENTS

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### GENERAL INTRODUCTION

This Bulletin is divided into two parts. Part I is devoted to two tests in which young growing pigs were used. Part II deals with finishing rations in three different tests. A total of twenty-three different feed combinations, or rations, have been tried. Reference to the appropriate summary tables will show the results obtained with each ration. Tankage, cottonseed meal, peanut meal, wheat shorts, and dried buttermilk were the protein supplements used. The basal feeds used were corn chops, milo chops, rice bran, and rice polish. One lot was finished on peanut grazing alone, one lot was partly finished on peanuts and completed on a grain ration, and three lots were finished on free-choice self-feeders.

All experiments herein reported were conducted at the Feeding and Breeding Station, Substation No. 10, College Station, Texas. In most cases the lots have been fed at a profit over feed costs. It is thought advisable to submit the results in the form of tables showing the feed requirements per hundred pounds of gain, rather than the cost per hundred pounds of gain or profit or loss per lot. The cost of feeds varies greatly from year to year, but the number of pounds of any given ration required to produce a hundred pounds of gain is not subject to such varying fluctuations. Hence, this method of reporting the results is thought to be less misleading than would be the use of tables showing the profit or loss per lot or the cost per hundred pounds of gain. By noting the amount of feed required to produce a hundred pounds of pork, the pork producer can easily calculate the cost with prices prevalent at any particular time or place.

PART I

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FEEDING GROWING PIGS

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PART I

FEEDING GROWING PIGS



## EXPERIMENT I

### THREE METHODS OF PIG RAISING

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BY

G. R. WARREN

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#### INTRODUCTION

The feeding demonstration here reported was conducted to secure accurate data on an application of a well-known swine feeding principle, namely, that it pays to supplement the grain sorghums (or corn) with a protein concentrate and pasture. Accurate data were secured on the entire life of each of the three litters used and the following report of the results gives an impressive picture of the kind of pigs that might be expected from improper, as well as proper, methods of feeding. While this test was of necessity limited to three litters, it is nevertheless indicative of results generally arising from similar methods of feeding on farms. Pigs do not thrive on the grain sorghums alone, but the addition of a palatable protein concentrate and pasture is invariably followed by a liberal response in growth if the pigs are healthy. In connection with health, it is worth while to mention that the general stimulative effect of pasture, as well as its feeding value, is of primary importance to the pig. The general physical condition of pigs on good, clean pasture is highly favorable to rapid growth and economical use of the concentrates fed. The milo-tankage mixture used in this test is a good simple ration, but there are numerous others equally as good and many even better. Growing pigs should always receive some protein supplement along with their corn or the grain sorghums. Twenty-seven pounds at eight months of age was the greatest weight reached by any pig fed grain alone in this test.

#### TIME OF TEST

This test was begun on March 18, 1921, when the pigs were farrowed, and continued until November 17, 1921, when they were 245 days old.

#### PIGS USED

Three mature, purebred, Duroc-Jersey sows of similar size, type, and breeding and their respective litters, sired by the same herd boar, were selected for the test. The dams were fed together during the gestation period. At birth, there was no noticeable difference between the three litters as to type, but the Lot 1 pigs were slightly larger than the pigs in the other two litters. When the pigs were reduced to eight in each litter, they represented a comparison of as much fairness as might be expected from any three litters. One pig was mashed to death in Lot 2 on the fourth day, leaving only seven pigs in that litter.

## METHOD OF PROCEDURE

The pigs were divided into three lots, each lot containing one sow and her litter. The litters in Lots 1 and 3 were farrowed during the evening of March 17th and the litter in Lot 2 during the evening of March 19th. All pigs were given an individual ear number and weighed when twenty-four hours old. The dams were also weighed twenty-four hours after farrowing their litters. Individual weights were taken each fifteenth day throughout the test. All weighings were made just before the morning feed was given.

A record was kept of the feed consumed by each lot. A portion of the feed placed in each lot was put in the regular trough and the balance placed in a creep for the pigs, but since the pigs ate from both troughs a record of the amount consumed by the dam alone was not obtained. Lots 1 and 2 were in dry yards 20x50 feet and had access to shade and clear water in the barn at all times. Lot 3 was on a half-acre grass pasture and had access to a small house and clear water at all times. The feed was given twice daily to all lots as a fresh, thick slop. The two litters on dry yards were full fed at all times, while the litter on pasture was fed a somewhat limited concentrate ration. Since the pigs in Lot 1 fed grain alone were very irregular in the amount of feed that they would clean up, it was decided to feed their ration dry in a trough near their drinking water, in order to avoid waste from sour feed and inaccuracy from weighing back wet feed. Dry feed was kept in their trough at all times. Lots 2 and 3 were not difficult to keep on regular feed. The lots were fed as follows:

Lot 1. Milo chops alone on a dry yard.

Lot 2. Milo chops 90 per cent. and tankage 10 per cent., on a dry yard.

Lot 3. Milo chops 90 per cent. and tankage 10 per cent., on a half-acre grass pasture.

Lot 1A. Same as Lot 1 (after weaning only).

Lot 1B. Same as Lot 3 (after weaning only).

The boar pigs were castrated when they were thirty days old. Each litter was weaned when the pigs were seventy-five days old. At weaning time, the pigs in Lot 1 were so small and undeveloped it was decided to divide the lot and change the ration for half of them. Accordingly, the lot was equally divided into two lots and designated Lot 1A and Lot 1B. Lot 1A was a continuation of Lot 1, using only four of the pigs in the litter. Lot 1B contained the other four pigs in the litter and was given a ration and pasture identical with that of Lot 3.

## FEEDS AND PASTURE

Bright No. 2 milo grain of good quality was secured for the test. It was ground into medium fine chops as needed. Swift's Digester Tankage was used. Twenty-five dollars per ton for milo chops and seventy dollars per ton for tankage are considered average local prices for the period covered by the test, and these figures were used in calculating the feed costs.

The Lot 3 pigs were grazed on oats until weaning time. From wean-

ing time until September they were on Sudan grass. Owing to a scarcity of Sudan pasture, it was necessary to graze them on a half-acre plot of Bermuda grass after September 1st. The Lot 1B pigs were grazed on Sudan pasture from weaning time until the test closed. During the suckling period and for about two months after weaning, the pasture was excellent, but owing to dry, hot weather it was not very succulent after that time and furnished rather poor grazing during the last few months of the test. Since it was necessary to shift from pasture to pasture in order to have good grazing, it was impossible to determine the cost of the pasture used. However, forty cents per sow and litter per month prior to weaning time and ten cents per pig per month after weaning time were decided upon as fair charges for the quality of pasture utilized. These figures were used in calculating the total cost of pasture per lot.

The following table gives the percentage composition of the concentrates fed:

Table 1. Percentage composition of feeds used.

Feeds	Protein	Fat	Crude fiber	Nitrogen-free extract	Water	Ash	No. of analyses
Milo chops.....	10.62	2.76	2.50	71.15	11.05	1.92	2
Tankage.....	58.50	9.17	2.79	3.51	8.06	17.97	2

(Analyses by Dr. G. S. Fraps, Station Chemist.)

Table 2. Individual weights in Lots 1,\* 1A, and 1B.

(Milo chops—dry lot.)

Dates Weighed	Weight Mar. 18, pounds	Weight May 31, pounds (weaned)	Weight Aug. 14, pounds	Weight Nov. 17, pounds	Average daily gain, lbs.		
					To weaning	Since weaning	Since birth
Age of pigs in days.....	1	75	150	245			
Sow pig No. 65.....	3	22	78	215	.253	1.135	.869
Boar pig No. 66.....	3.25	16	62	187	.170	1.006	.750
Boar pig No. 67.....	3.25	24.50	86	231	.283	1.215	.929
Boar pig No. 68.....	3.25	20	60	175	.223	.912	.701
Boar pig No. 69.....	3	18.50	17	16	.220	(loss).015	.053
Boar pig No. 70**.....	3	17	16		.187		
Boar pig No. 71.....	3	25.50	25.50	27	.300	.009	.098
Sow pig No. 64.....	3	22	21	20.5	.253	(loss).009	.071
Average per pig....	3.09	20.69			.235		
Weight of dam.....	322	206			1.547 (loss)		

\*This lot was divided into two equal lots at weaning time and designated Lot 1A and Lot 1B. The ration for Lot 1B was changed to milo chops, tankage, and pasture. Lot 1B contained pigs numbered 65, 66, 67, and 68.

\*\*Pig No. 70 died September 14th, a few hours after weighing time, apparently of starvation, although it had access to milo chops at all times.

Table 3. Individual weights in Lot 2.  
(Milo chops—tankage—dry lot.)

Dates weighed	Weight Mar. 20, pounds	Weight June 2, pounds (weaned)	Weight Aug. 16, pounds	Weight Nov. 17, pounds	Average daily gain, lbs.		
					To weaning	Since weaning	Since birth
Age of pigs in days.....	1	75	150	243			
Sow pig No. 82.....	2.75	19	38	113	.217	.550	.454
Sow pig No. 83.....	3.25	26.50	63	152	.310	.747	.612
Sow pig No. 84.....	2.75	24.50	43	136	.290	.663	.548
Boar pig No. 85.....	3	29.50	74	172	.353	.848	.695
Boar pig No. 86.....	2.50	33.50	86	173	.413	.830	.701
Boar pig No. 87.....	2.50	21	70	168	.247	.875	.681
Boar pig No. 88.....	2.25	35.50	69	185	.417	.902	.752
Average per pig....	2.71	26.79	63.29	157	.321	.775	.635
Weight of dam.....	382	342			.533 (loss)		

Table 4. Individual weights in Lot 3.  
(Milo chops—tankage—pasture.)

Dates weighed	Weight Mar. 18, pounds	Weight May 31, pounds (weaned)	Weight Aug. 14, pounds	Weight Nov. 17, pounds	Average daily gain, lbs.		
					To weaning	Since weaning	Since birth
Age of pigs in days.....	1	75	150	245			
Sow pig No. 73.....	2.75	39	95	231	.483	1.129	.932
Sow pig No. 74.....	2.75	41	87	235	.510	1.141	.948
Sow pig No. 75*.....	2.25	42	100		.530		
Sow pig No. 76.....	3.25	45	103	265	.557	1.294	1.068
Sow pig No. 77*.....	2.50	40	101		.500		
Boar pig No. 78.....	2	35	92	222	.440	1.100	.898
Boar pig No. 79.....	3.25	46	113	282	.570	1.388	1.138
Boar pig No. 80.....	3	43	104	259	.533	1.271	1.045
Average per pig....	2.72	41.38	99.38	249	.515	1.221	1.005
Weight of dam.....	312	244			.907 (loss)		

\*Due to overheating, No. 75 died on August 20th, and No. 77 on September 23. Their records are discarded from the tables that report data on this litter after weaning.

#### INDIVIDUAL WEIGHTS

Tables 2, 3, and 4 show the individual weights of the pigs and dams. They also show the average daily gains made by the pigs to weaning time, after weaning time, and from birth to the close of the test. The dams were removed from the test when the pigs were weaned. Table 2 shows the weights of the pigs in Lot 1 until weaning time and the weights of the pigs in Lots 1A and 1B after weaning time. The first four pigs listed in the table were put in Lot 1B after weaning time. The last four pigs in the table constituted Lot 1A after weaning time. It is interesting to note that the pigs in this lot just about maintained their body weight during a period of 170 days after weaning time. Reference to the last line in each table shows considerable variation in the average daily loss per dam in the different lots. There is some difference, no doubt, due to the greater natural tendencies of some sows to lose more weight during the suckling period than do others. However, the exceptionally large loss made by the dam in Lot 1, fed grain alone, was due largely to the fact that she could not be induced to

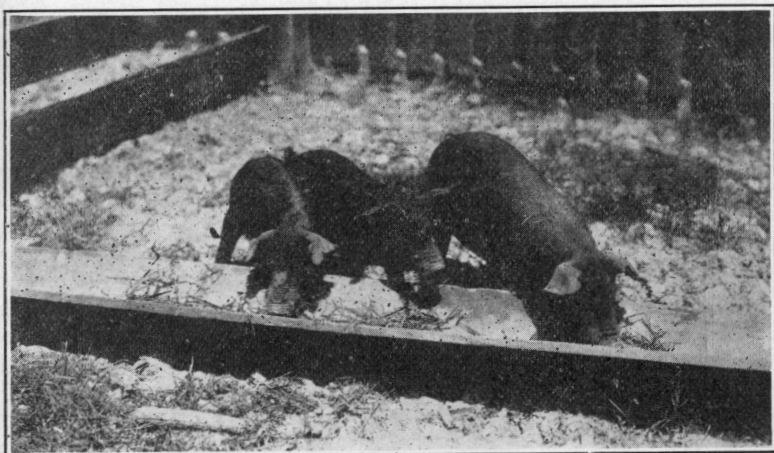


FIGURE 1.

Lot 1.	Lot 2.	Lot 3.
20 pounds.	26 pounds.	41 pounds.
Average pig from each lot at weaning time, 75 days old.		

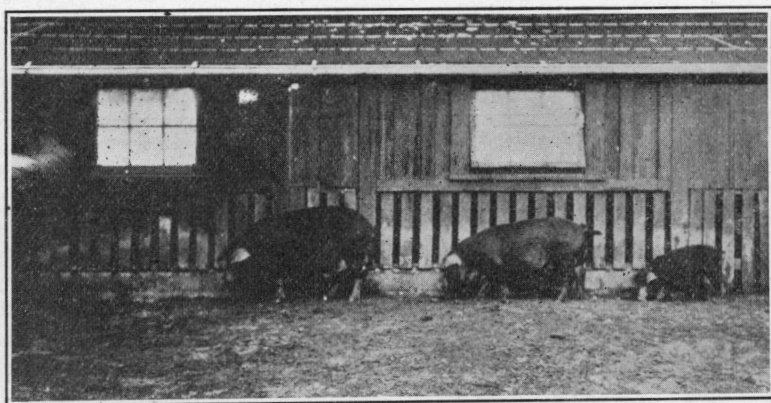


FIGURE 2.

Lot 3.	Lot 2.	Lot 1-A
249 pounds.	157 pounds.	21 pounds.
Average pig from each lot at close of test, 245 days old.		

consume as much grain as was consumed by the sow in Lot 2. The addition of tankage in Lot 2 made the ration more palatable and the sow consumed more feed and maintained better condition than did the sow in Lot 1. The concentrate ration for the Lot 3 sow was limited in order to force her to utilize more pasture. The tables show that her average daily loss was midway between the losses made by sows 1 and 2.

#### DEVELOPMENT OF THE PIGS

A fair idea of the development of the pigs in the several lots can be obtained by reference to the individual weights in Tables 2, 3, and 4. However, there are a few facts that these tables and the pictures do not show. At weaning time, Lot 1 contained a bunch of scrawny, long-nosed, pitiful looking pigs. They were fairly active and showed no swelling of the joints or abnormal developments, other than that they were weak and very thin. There was very little change in their appearance during the 170 days following weaning. The development made by the four pigs taken from this litter and placed in Lot 1B at weaning time is shown by their weights in the first part of Table 2. During the first two months that they were on pasture they were very "pot-bellied," but after they had been on pasture for some time they smoothed up and finished into a uniform lot. At the close of the test they had much the same appearance as did the pigs in Lot 3. The Lot 2 pigs presented the greatest variation in size and finish of any pigs in the test. At the close of the test, they ranged in weight from 113 to 185 pounds and varied in degree of finish from a medium stocker pig to a well fattened market pig. It seemed that no two of them carried a similar degree of finish. The Lot 3 pigs showed more uniformity of size and were remarkably uniform in degree of finish. At no period of the test was there any marked tendency for the pigs to put on finish at the expense of growth or to continue growth at the expense of finish.

Table 5. Summary of results from birth of pigs to weaning time.

Lot No.	No. pigs per litter	Age in days when weaned	Average initial weight per pig, pounds	Average weaning weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain by the litter	
							Kinds, pounds	Total, pounds
1	8	75	3.09	20.69	.235	.91	Milo chops (Dry lot) 388.8	388.8
2	7	75	2.71	26.79	.321	1.50	Milo chops 422.5 Tankage (Dry lot) 47.0	469.5
3	8	75	2.72	41.38	.515	1.10	Milo chops 190.9 Tankage (Pasture) 21.2	212.1

#### RESULTS TO WEANING TIME.

Perhaps the most important point brought out in the summary of the results to weaning time is the difference in the average weaning weight per pig in the different lots. The pigs in Lot 1 averaged 20.69 pounds in weight at a feed cost of \$0.86 per pig; those in Lot 2 averaged

26.79 pounds, at a feed cost of \$1.67 per pig; while those in Lot 3 averaged 41.38 pounds, at a feed and pasture cost of only \$1.34 per pig. The average cost per pig and the grain required for 100 pounds of gain by the litter are based on the total feed consumed by the dam and litter. No account is taken of the fact that there was a great difference in the loss of weight by the different dams. Lot 2 perhaps shows at a slight disadvantage, due to the death of one pig on the fourth day, which left only seven pigs in this lot. It should be especially noted that the average weight per pig in Lot 1, fed on milo chops alone on a dry lot, was only half the average weight per pig in Lot 3, which had access to pasture and received a protein supplement in the ration. Good, growthy pigs cannot be produced on a dry lot with grain alone.

Table 6. Summary of results from weaning time to close of test.

Lot No.	No. pigs per lot	No. days	Average weaning weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain by the lot	
							Kinds, pounds	Total, pounds
1A	3	170	22.00	21.2	.005 (loss)	.594	Milo chops (Dry lot) 303	Lost weight
1B	4	170	20.62	202.0	1.067	3.384	Milo chops Tankage (Pasture) 285.5 31.7	317.2
2	7	168	26.79	157.0	.775	2.825	Milo chops Tankage (Dry lot) 328.0 36.5	364.5
3	6	170	41.50	249.0	1.221	4.363	Milo chops Tankage (Pasture) 321.7 35.7	357.4

## RESULTS AFTER WEANING TIME

The data in Table 6 are based upon the number of live pigs per lot at the close of the test. As noted elsewhere, one pig died in Lot 1A and two in Lot 3. This table shows that the Lot 1A pigs consumed an average of only .594 pound of grain per pig daily. This was not sufficient to maintain their body weight, as is shown by the average daily loss of .005 pound per pig. Reference to Table 2 shows that in Lot 1A, one pig gained slightly and two lost slightly in body weight during this period. The largest average daily gain was made in Lot 3. The second largest daily gain was made by Lot 1B. The fact that Lot 1B made the second largest daily gain, exceeding by one-fourth pound per pig per day the gain made in Lot 2, fed on the same grain mixture but without pasture, is a strong argument in favor of the pasture furnished Lot 1B. The lowest feed requirement per 100 pounds of gain was in Lot 1B. That they surpassed Lot 3 in this respect is partly due to the fact that they consumed a relatively large amount of forage and a small amount of grain during the first month or so that they were on pasture.

Table 7. Summary of results from birth of pigs to close of test.

Lot No.	No. pigs per lot	Age in days	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain by the lot	
							Kinds, pounds	Total, pounds
1A	3	245	3	21.2	.074	.691	Milo chops (Dry lot) 930.6	930.6
1B	4	245	3.19	202.0	.812	2.627	Milo chops 294.8 Tankage 28.9 (Dry lot-pasture)*	323.7
2	7	243	2.71	157.0	.635	2.418	Milo chops 342.7 Tankage 38.1 (Dry lot)	380.8
3	6	245	2.83	249.0	1.005	3.362	Milo chops 301.1 Tankage 33.5 (Pasture]	334.6

\*Lot 1B contains four pigs from the litter that received milo chops alone on a dry lot until weaned. After weaning time, these four received a ration of 90 per cent. milo chops and 10 per cent. tankage on pasture.

### RESULTS OF ENTIRE PERIOD

Table 7 summarizes the results from the birth of the pigs to the close of the test. This table shows that the Lot 1A pigs attained a final average weight of only 21.2 pounds per pig on a feed requirement of 930 pounds of grain per 100 pounds of gain, as against a final average weight of 249 pounds per pig on a feed requirement of 334 pounds per 100 pounds of gain in Lot 3. Lot 1A was fed grain alone on a dry yard, while Lot 3 was fed a balanced ration on pasture. The results are too striking to be overlooked. Feeding grain alone on a dry yard is not a satisfactory method of pork production. Feeding a balanced ration on a dry yard in Lot 2 proved some better than the grain-alone method in Lot 1A. But the final average weight of 157 pounds per pig on a feed requirement of 380 pounds per 100 pounds of gain in Lot 2 does not compare favorably to the results obtained in Lot 3 on pasture in addition to the balanced ration. The pigs in Lot 1B, which were fed grain alone on a dry yard until weaning time and changed to a balanced ration on pasture after weaning, made a final average weight of 202 pounds per pig on a feed requirement of 323 pounds per 100 pounds of gain. They required about a month longer to reach the market weight of 200 pounds per pig than did the Lot 3 pigs. Thus, the Lot 3 method of utilizing a balanced ration and pasture from the birth of pigs to market size is superior to the other methods, in that it saves a month of labor and produces pigs ready for the earlier market, which is usually the best.



Table 8. Financial results.

Lot	1A	1B	2	3
Rations fed	Milo chops (dry lot)	Milo chops* (dry lot) milo-tankage (pasture)	Milo chops tankage (dry lot)	Milo chops tankage (pasture)
Average cost of feed per pig.....	\$ 2.12	\$ 9.34	\$ 8.67	\$ 12.15
Average cost of pasture per pig.....		0.57		0.69
Average cost of feed and pasture per pig.....	2.12	9.91	8.67	12.84
Average final value per pig.....	No value	13.64	10.21	17.43
Profit or loss per pig.....	2.12 (loss)	3.73	1.54	4.59

\*Lot 1B changed at weaning time from milo chops on dry lot to 90 per cent. milo chops and 10 per cent. tankage on pasture.

## FINANCIAL RESULTS

Table 8 gives a financial statement based upon prices prevalent during the period of the test. The profits shown are profits above feed and pasture costs alone. No account is taken of the value of the manure, cost of labor, interest, depreciation, marketing costs, etc. It is well to point out that the pigs in Lot 1A, which were eight months old and weighed an average of only 21.2 pounds each, had no sale value and that the entire cost of this lot was practically a loss. The final value per pig in each of the other three lots was calculated from the following prices per hundred pounds of live weight: Lot 1B, \$6.75; Lot 2, \$6.50; and Lot 3, \$7.00. It is recognized that the pigs in Lots 1B and 2, though lighter than those in Lot 3, would have sold for as much per pound on some markets as would have the Lot 3 pigs; yet it is thought fair to give the heavier pigs the higher value per hundred pounds of live weight, since they reached the best market weight much earlier than did the lighter ones. Under these conditions, the profit per pig was \$3.73 in Lot 1B, \$1.54 in Lot 2, and \$4.59 in Lot 3. Strange as it may at first appear, it is well to note that the profit per pig in the different lots was in the same order as the feed cost per pig, that is, the greater the cost per pig, the greater the profit per pig. This is not necessarily always true, but pork producers should not be misled by the false belief that pigs should be produced by the cheapest possible method. The method followed should be based upon both the cost of production and the value of the product produced. Lot 1A represents a comparatively inexpensive method of pig raising if the costs alone are considered, but when it is noted that the pigs produced have no sale value the method is clearly very uneconomical. Lot 3 represents a method involving greater expense; nevertheless, pigs produced by this method can ordinarily be sold at a fair profit rather than at a loss. If Table 8 is sufficient to generalize from, it shows that the pork producer who does not care to go to the expense of providing pasture and balanced rations for his pigs should not be disappointed if his profits are relatively low.

## THE PIGS IN LOT 1A

The three scrawny pigs alive in Lot 1A at the close of the test were continued under observation. No. 64, which weighed only 16 pounds, was continued on the dry lot with milo chops alone and died as a result of malnutrition on January 19th, at which time it was ten months old and weighed only 14 pounds. No. 69, which weighed 20.5 pounds, was put on oat pasture and fed the milo tankage ration of Lot 3. No. 71, which weighed 27 pounds (the only Lot 1A pig that had gained in weight since weaning time), was put on oat pasture and continued on milo chops alone. Ninety-two days later, the one receiving tankage in addition to milo chops had consumed 529 pounds of concentrates and weighed 162 pounds, while the one receiving milo chops without a supplement had consumed 552 pounds of grain and weighed only 154 pounds. By the use of the tankage supplement, No. 69, which weighed 24 per cent. less than No. 71 when the two were put on pasture, gained to a weight of nearly five per cent. heavier than No. 71, which received milo chops alone on pasture.

## SUMMARY AND CONCLUSIONS

This practical feeding demonstration brings out clearly, as have a great number of similar tests, the fact that pasture and balanced rations are essential factors in economical pork production.

At eight months of age, the average weight and profit per pig in the different lots were as follows:

Lot 1A. Milo-dry lot.....	21 lbs., no sale value
Lot 1B. Milo-dry lot to weaning time and milo-tankage-pasture after wean- ing .....	202 lbs., \$3.73 profit per pig
Lot 2. Milo-tankage-dry lot.....	157 lbs., \$1.54 profit per pig
Lot 3. Milo-tankage-pasture.....	249 lbs., \$4.59 profit per pig

## EXPERIMENT II

### DRIED BUTTERMILK FOR GROWING PIGS

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BY

D. W. WILLIAMS\* AND G. R. WARREN

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#### INTRODUCTION

Dried buttermilk is a feed of considerable importance at the present time, and while it seems to be used in greatest amounts by poultry raisers, yet there is a large amount being used by swine raisers also. There is very little known in regard to the feeding value of this feed for growing pigs, and it was with this fact in mind that this experiment was conducted.

#### OBJECTS

1. To study the relative value of dried buttermilk and tankage as supplements to milo chops and also as supplements to milo chops and wheat shorts, in feeding growing pigs and in finishing pigs for the market.

2. To study the value of additional variety in protein supplement by using both buttermilk and tankage with milo chops and shorts.

#### TIME

The experiment began on November 15, 1921, and ran for a period of 155 days, closing on April 19, 1922.

#### PIGS USED

Sixty pigs, representing three breeds, were used in this experiment. They were divided among the breeds as follows: Poland-China, six in each lot; Duroc-Jersey, two in each lot; and Tamworth, four in each lot. All of the pigs were farrowed during September and they were started in the experiment as soon as they were weaned. The handling of the litters previous to weaning had been as near the same as possible.

#### FEEDS USED

All the feeds used were of good quality. The percentage composition of the feeds used is shown in the following table.

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\*Professor of Animal Husbandry, in charge of swine, School of Agriculture, Agricultural and Mechanical College of Texas.

Table 9. Percentage composition of feeds used.\*

Feeds	Protein	Fat	Crude fiber	Nitrogen-free extract	Water	Ash
Milo chops . . . . .	12.40	2.44	2.39	71.28	9.96	1.53
Wheat shorts . . . . .	16.48	4.22	9.24	53.46	10.34	6.26
Dried buttermilk**	33.41	6.50	.50	33.42	12.45	13.72
Tankage . . . . .	63.10	8.38	2.61	.64	8.34	16.93

\*Analyses by Dr. G. S. Fraps, Station Chemist.

\*\*Furnished by Mistletoe Creameries, Fort Worth, Texas.

#### METHOD OF PROCEDURE.

The sixty pigs were weaned and started on the experiment at once. They were divided into five lots, consideration being taken of breed, weight, sex and breeding. Litter mates were distributed among the several lots.

Three individual weights were taken on successive days at the beginning and close of the experiment. An average of these three weights was considered the initial and final weights, respectively. The test was considered as starting with the evening feed of the third day of the initial weighings and closing with the morning feed of the third day of the final weighings. During the progress of the experiment individual weights were taken every fifteen days.

The pigs were fed in dry lots, having no access whatever to any pasture. They were fed all they would clean up twice daily, the feed being given as a thick slop.

The feeds used in the five lots were as follows:

- Lot 1. Milo chops and tankage.
- Lot 2. Milo chops and dried buttermilk.
- Lot 3. Milo chops, shorts, and tankage.
- Lot 4. Milo chops, shorts, and dried buttermilk.
- Lot 5. Milo chops, shorts, dried buttermilk, and tankage.

In determining the amount of the protein supplement to use in each of the lots the nutritive ratio of each ration was kept the same. The nutritive ratio used at the beginning of the test was 1:4.4. This was widened on January 29, 1922, to 1:4.8, and on March 30th again widened to 1:5.7. The amount of shorts in Lots 3, 4, and 5 was kept constant.

The following shows the ratio of milo chops to shorts, to dried buttermilk, and to tankage in pounds:

Table 10. Feed combinations used.

Periods	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Nov. 12 to Jan. 29..	7:0:0:1	7:0:2.75:0	7:2:0:.95	7:2:2.7:0	7:2:1.4:.48
Jan. 29 to Mar. 30..	9:0:0:1	9:0:2.75:0	9:2:0:.95	9:2:2.7:0	9:2:1.4:.48
Mar. 30 to April 19..	14:0:0:1	15:0:2.75:0	15.5:2:0:.95	17:2:2.7:0	17:2:1.4:.48

DEATHS AND REMOVALS

During the progress of this experiment there was a great deal of rain, which meant damp, cold concrete floors. This was probably the chief cause of the deaths and removals.

December 20, 1921, Tamworth barrow No. 40, Lot 5, died of pneumonia.

December 22, 1921, Poland-China gilt No. 57, Lot 3, died of pneumonia.

February 13, 1922, Poland-China barrow No. 32, Lot 3, removed because of rupture.

March 30, 1922, Duroc-Jersey barrow No. 60, Lot 3; Duroc-Jersey gilt No. 73, Lot 3; and Duroc-Jersey gilt No. 75, Lot 5, were removed on account of unthriftiness.

The following tables are a summary of the results:

Table 11. Summary of first period.  
(75 days)

Lot No.	No pigs	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain	
						Kinds, pounds	Total pounds
1	12	29.4	63.7	.46	1.63	Milo chops 311.8 Tankage 44.6	356.4
2	12	29.0	59.8	.41	1.34	Milo chops 234.3 Dried buttermilk 92.0	326.3
3	11	30.5	61.8	.42	1.64	Milo chops 276.7 Shorts 79.1 Tankage 37.5	393.3
4	12	29.7	62.2	.43	1.42	Milo chops 195.2 Shorts 55.8 Dried buttermilk 75.3	326.3
5	11	30.5	69.5	.52	1.71	Milo chops 212.6 Shorts 60.7 Tankage 14.6 Dried buttermilk 42.5	330.4

Table 12. Summary of second period.  
(80 days)

Lot No.	No. pigs	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain	
						Kinds, pounds	Total pounds
1	12	63.7	131.2	.84	3.37	Milo chops 363.1 Tankage 35.9	399.0
2	12	59.8	136.4	.96	3.16	Milo chops 216.4 Dried buttermilk 68.8	330.2
3	8	69.1	134.8	.82	3.27	Milo chops 311.4 Shorts 59.4 Tankage 28.2	399.0
4	12	62.2	136.0	.92	3.17	Milo chops 240.0 Shorts 44.3 Dried buttermilk 59.8	344.1
5	10	71.7	141.9	.88	3.39	Milo chops 283.5 Shorts 53.1 Tankage 12.7 D-ied buttermilk 37.2	386.5

Table 13. Summary of entire test.  
(155 days)

Lot No.	No. pigs	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain		
						Kinds, pounds		Total pounds
1	12	29.4	131.2	.66	2.53	Milo chops 345.9 Tankage 38.8		384.7
2	12	29.0	136.4	.69	2.28	Milo chops 253.6 Dried buttermilk 75.5		329.1
3	8	34.6	134.8	.65	2.49	Milo chops 290.8 Shorts 63.7 Tankage 30.3		384.8
4	12	29.7	136.0	.69	2.32	Milo chops 226.3 Shorts 47.8 Dried buttermilk 64.6		338.7
5	10	31.6	141.9	.71	2.58	Milo chops 255.4 Shorts 55.2 Tankage 13.3 Dried buttermilk 38.7		362.6

Table 14. Cost of producing 100 pounds of pork.

Period	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Milo chops, tankage	Milo chops, dried buttermilk	Milo chops, shorts, tankage	Milo chops, shorts, dried buttermilk	Milo chops, shorts, tankage, dried buttermilk
First period—75 days..	\$5.24	\$7.53	\$5.77	\$7.04	\$6.13
Second period—80 days	5.62	6.71	5.63	6.65	6.58
Entire period—155 days	5.49	6.94	5.50	6.78	6.35

Milo chops.....	\$ 25.00 per ton.
Gray wheat shorts.....	30.00 per ton.
Tankage.....	60.00 per ton.
Dried buttermilk.....	100.00 per ton.

## SUMMARY

It was noted from the first that lots receiving the larger percentages of dried buttermilk would not consume amounts of feed as large as those being fed tankage. Lot 2, receiving dried buttermilk and milo chops, was especially easily thrown off feed. This lot scoured some during the first month, but later there was no trouble of this nature.

There was no material difference in the appearance of the pigs on the several lots at the close of the experiment.

So far as the average daily gain was concerned, there was little difference from the rations used. The most striking difference shown in the test was in the amounts of feed required per 100 pounds of gain.

There was no advantage gained by adding shorts to the ration.

Very little importance should be attached to Table 14, which shows the cost of producing 100 pounds of pork in the various lots. The relative costs of feeds vary a great deal over comparatively short periods of time and the best ration to be used will depend on local feed prices. Actual feed costs as they prevailed during the experiment are given above.

**PART II**

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**RATIONS FOR FATTENING PIGS**

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## EXPERIMENT III

### COTTONSEED AND COTTONSEED MEAL AS SUPPLEMENTS TO MILO CHOPS FOR FATTENING PIGS

BY

G. R. WARREN AND D. W. WILLIAMS

#### TIME OF TEST

This experiment was begun January 16, 1921, and continued for a period of 120 days, closing May 15, 1921.

#### OBJECTS

The objects of this experiment were:

1. To study and compare the feeding values of cottonseed, cottonseed meal, and tankage as supplements to milo chops when fed to hogs in finishing rations.
2. To determine whether a ration one-fourth of which is cottonseed can be used for fattening hogs without fatal results.

#### PIGS USED AND THEIR PREVIOUS TREATMENT

Forty purebred Duroc-Jersey barrows and gilts raised by the Experiment Station were used in this test. Six barrows and four gilts were used in each lot. They were all farrowed in September, 1920. Until the beginning of the test, the feed and management of all pigs were the same. During the suckling period they were fed on milo chops and tankage. Shortly after weaning time, they became somewhat stunted by the use of ear corn without a proper protein supplement. This accounts for their light weight at the beginning of the test. Later, milo chops and tankage were secured and they were fed a ration of these feeds until the test began.

#### FEEDS USED

The feeds used were purchased as No. 2 red milo grain; Swift's Digester Tankage, 60 per cent. protein; and choice cottonseed meal, 43 per cent. protein. The feeds were all of good quality. The following table shows the percentage composition:

Table 15. Percentage composition of feeds used.

	Protein	Fat	Crude fiber	Nitrogen-free extract	Water	Ash
Milo chops.....	11.28	2.76	2.24	70.11	11.36	2.25
Cottonseed meal.....	41.39	8.42	10.56	25.81	7.50	6.32
Tankage.....	56.11	6.98	3.12	3.52	9.35	20.92

(Analyses by Dr. G. S. Fraps, Station Chemist.)

## METHOD OF PROCEDURE

The forty pigs were equally divided into four lots. An average of the weights of each lot taken about 1 p. m. each day for three successive days at the beginning and close of the test was considered the initial and final weights, respectively. The lots were also separately weighed each fifteenth day during the test. Each lot was fed in the hog barn and had access to a 20x50-foot dry lot. The feeds for each lot were thoroughly mixed and fed twice daily as a fresh, thick slop. All lots were full fed during the entire test. The following rations were planned to furnish approximately the same nutritive ratios, but with a different protein supplement for each lot:

Lot 1. Milo chops 8 parts, cottonseed meal 1 part.

Lot 2. Milo chops 8 parts, tankage .6 part.

Lot 3. Milo chops 8 parts, cottonseed meal .5 part, and tankage .3 part.

Lot 4. Milo chops 8 parts, whole cottonseed 2 parts, and tankage .3 part.

## COTTONSEED LOT DISCONTINUED

The pigs in Lot 4 would not eat fresh whole cottonseed. They continued to pick out the milo chops and tankage and leave the cottonseed in the trough. The daily ration was reduced and still they refused to eat the cottonseed. It is known that some pigs will eat cottonseed; but these would not. Since it was not possible to obtain an accurate record of the amount of feed that they were actually eating, and since they continued to lose weight, it was decided at the end of three weeks to make no further effort to force them to eat cottonseed, and the lot was discontinued.

Table 16. Results of the test.

Lot No.	No. pigs	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain		
						Kinds, pounds		Total, pounds
1	9	67.4	170.9	.86	4.14	Milo chops Cottonseed meal	427 53	480
2	10	65.1	200.5	1.13	4.79	Milo chops Tankage	395 30	425
3	10	67.2	186	.99	4.79	Milo chops Cottonseed meal Tankage	440 28 16	484

## DISCUSSION OF RESULTS

Table 16 shows that while the feed requirement for 100 pounds of gain was fairly satisfactory in each lot, the average daily gains were too low. The pigs were underweight for their age when the test was begun, which fact probably accounts for their low daily gains. Lot 2 made a fairly satisfactory gain. The addition of tankage to the cottonseed meal in Lot 3 increased the palatability of the ration and produced a larger gain than was obtained with the ration in Lot 1, but failed to

lower the amount of feed required per 100 pounds of gain. The Lot 1 pigs could not be induced to consume as much feed as the pigs in the other lots. One pig in Lot 1 died on the 70th day, apparently of cottonseed meal poisoning. This pig's sheath had been considerably swollen for about ten days when it died and it is possible that this might have brought on a complication that caused death. However, the carcass showed every symptom of cottonseed meal poisoning. Using cottonseed meal to the extent of eleven per cent. of the ration over a 120-day feeding period did not prove to be satisfactory. The smaller amount of cottonseed meal used in Lot 3, however, developed no objectionable features except that the daily gains were slightly low.

#### SHRINKAGE AND KILLING RESULTS

The pigs were shipped to Fort Worth, Texas, and sold to Armour & Company as test pigs at \$8 per cwt. All carcasses killed firm and were of good quality. The shrinkage in shipment was as follows for the different lots: Lot 1, 3.77 per cent.; Lot 2, 4.23 per cent.; and Lot 3, 4.30 per cent.

#### SUMMARY

1. The ration in which tankage was the source of protein produced the largest daily gain and produced 100 pounds of gain on the smallest amount of feed.
2. The ration in which cottonseed meal was the source of protein for the 120-day period produced the lowest daily gain. Lot 1 could be induced to consume only about 86 per cent. as much feed as was consumed by the other lots.
3. When approximately half of the protein was furnished by tankage and half by cottonseed meal in Lot 3, the ration was more palatable than in Lot 1 and the average daily gain was larger, but the amount of feed per 100 pounds of gain was not lowered.
4. Lot 4 was dropped from the test after the pigs refused for three weeks to eat whole cottonseed.
5. All carcasses killed firm and were of good quality.

## EXPERIMENT IV

### PEANUT GRAZING AND SELF-FEEDERS FOR FATTENING PIGS

BY

G. R. WARREN

#### TIME OF TEST

This experiment was begun September 24, 1921, and continued for a period of 57 days, closing November 20, 1921.

#### OBJECTS

The principal objects of this experiment were:

1. To determine the firmness of pork produced by finishing pigs sixty days on the rations herein given.
2. To determine whether cottonseed meal can be safely fed for sixty days with milo chops in a free-choice self-feeder.
3. To determine the proportion of cottonseed meal, tankage, or peanut meal that swine will consume when fed with milo chops or corn chops in a free-choice self-feeder.

#### PIGS USED AND THEIR PREVIOUS TREATMENT.

Fifty purebred Duroc-Jersey barrows and gilts raised by the Experiment Station were used in this test. Four barrows and six gilts were used in each lot. They were all farrowed during March, 1921. Previous to the beginning of the test, the feed and management of all pigs were practically the same. They were fed a balanced ration of milo chops and tankage. From birth until the test began they had access to pastures of Sudan grass, oats, or Bermuda grass.

#### FEEDS USED

The feeds used were all of excellent quality. The corn was No. 2 white, though several sacks contained some yellow corn. Good, clean No. 2 red milo was used. The corn and milo were ground into fine chops as needed. Table 17 shows the composition of the feeds used.

Table 17. Percentage composition of feeds used.

Feeds	Protein	Fat	Crude fiber	Nitrogen-free extract	Water	Ash
Corn chops.....	10.02	3.68	2.33	71.73	10.89	1.35
Milo chops.....	9.96	2.77	2.75	72.19	10.75	1.58
Tankage.....	60.88	11.36	2.45	3.51	6.78	15.02
Cottonseed meal.....	38.48	7.52	15.34	23.73	8.32	6.61
Peanut meal.....	42.85	5.98	8.75	28.56	7.87	5.99

(Analyses by Dr. G. S. Fraps, Station Chemist.)

## METHOD OF PROCEDURE

The fifty pigs were divided into five lots of ten pigs each, the lots being arranged as nearly equal in weight, sex, size, condition, and general appearance as possible. All pigs were individually weighed on three consecutive days at the beginning and close of the test, and the average of the three weights considered the initial and final weights, respectively. They were also weighed individually each fifteenth day during the test.

The lots were fed as follows:

Lot 1. Grazed on peanuts for 57 days.

Lot 2. Corn chops and tankage, free-choice self-feeder for 57 days in a dry lot.

Lot 3. Milo chops and cottonseed meal, free-choice self-feeder for 57 days in a dry lot.

Lot 4. Milo chops and peanut meal, free-choice self-feeder for 57 days in a dry lot.

Lot 5. Grazed on peanuts 30 days, followed with six parts milo chops and one part cottonseed meal by weight for 27 days, hand-fed, in a dry lot.

Each lot had access to shelter and fresh water at all times. The two lots that grazed peanuts ran together during the first 30 days, being separated only for individual weights on weighing dates. Spanish peanuts of average production were grazed. The quantity produced per acre was not determined. About five acres were grazed, the field being divided into two sections so the pigs could secure a full feed of peanuts without too much exercise. During the latter part of the test the peanuts were not as plentiful as they should have been for the production of the largest daily gains.

The self-fed pigs received their concentrates in separate compartments of free-choice self-feeders. A good supply of excellent quality dry feed was kept before them at all times. During the last 27 days of the test, the pigs in Lot 5 received a full feed of their concentrate mixture twice daily, fed as a thick slop.

Table 18. Individual weights in Lot 1, grazed on peanuts 57 days.

Pig number.....	9	97	102	51	92	3	26	48	2	58	Average
Sex*.....	B	B	B	B	S	S	S	S	S	S	
Initial weight, pounds.....	145	117	107	96	142	124	99	131	125	106	119.2
Final weight, pounds.....	234	200	184	176	254	212	200	234	214	204	211.2
Average daily gain, pounds.....	1.56	1.46	1.36	1.40	1.96	1.54	1.77	1.81	1.56	1.72	1.61

\*B—barrow; S—sow

Table 19. Individual weights in Lot 2, fed on corn chops and tankage in a free-choice self-feeder 57 days.

Pig number.....	1	38	52	98	10	37	57	107	96	49	
Sex.....	B	B	B	B	S	S	S	S	S	S	Average
Initial weight, pounds.....	127	138	109	104	130	145	90	109	112	128	119.2
Final weight, pounds.....	250	270	246	196	234	280	202	222	210	258	236.8
Average daily gain, pounds.....	2.16	2.32	2.40	1.61	1.82	2.36	1.96	1.98	1.72	2.28	2.06

Table 20. Individual weights in Lot 3, fed on milo chops and cottonseed meal in a free-choice self-feeder 57 days.

Pig number.....	101	100	59	41	16	29	30	40	93	11	
Sex.....	B	B	B	B	S	S	S	S	S	S	Average
Initial weight, pounds.....	127	120	118	128	127	112	103	138	114	103	119.0
Final weight, pounds.....	256	210	220	216	224	180	178	232	176	166	205.8
Average daily gain, pounds.....	2.26	1.58	1.79	1.54	1.70	1.19	1.32	1.65	1.09	1.11	1.52

Table 21. Individual weights in Lot 4, fed on milo chops and peanut meal in a free-choice self-feeder 57 days.

Pig number.....	36	44	99	31	4	45	55	32	17	106	
Sex.....	B	B	B	B	S	S	S	S	S	S	Average
Initial weight, pounds.....	134	134	103	125	116	109	98	133	125	114	119.1
Final weight, pounds.....	246	200	200	244	174	196	172	200	202	210	204.4
Average daily gain, pounds.....	1.96	1.16	1.70	2.10	1.02	1.53	1.30	1.18	1.35	1.68	1.50

Table 22. Individual weights in Lot 5, grazed 30 days on peanuts followed by 27 days on milo chops and cottonseed meal 6 to 1, hand fed.

Pig number.....	34	6	7	103	12	56	47	94	95	46	
Sex.....	B	B	B	B	S	S	S	S	S	S	Average
Initial weight, pounds.....	152	101	125	107	134	108	109	125	128	95	118.4
Final weight, pounds.....	232	186	218	186	228	200	210	216	214	178	206.8
Average daily gains, pounds (57 days).....	1.40	1.49	1.63	1.38	1.65	1.61	1.77	1.60	1.51	1.46	1.55
Average daily gains, pounds (30 days).....	1.53	1.57	1.70	1.43	1.47	1.60	1.83	1.63	1.47	1.63	1.59
Average daily gains, pounds (last 27 days).....	1.26	1.41	1.56	1.33	1.85	1.63	1.70	1.56	1.56	1.26	1.51

## INDIVIDUAL WEIGHTS

Tables 18 to 22, inclusive, give the individual weights and average daily gains of the pigs in the different lots. Individual weights have an advantage over lot weights in that it is made possible to eliminate any pig that is not making normal gains. These tables show that no pig made an average daily gain below one pound. Therefore, since the individual gains are all apparently normal, the average daily gain per lot is a fair basis of comparison between lots. A summary of the results is presented in Table 23.

Table 23. Summary of results.

Lot No.	No. of pigs per lot	Method of feeding	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 pounds gain		
							Kinds, pounds		Total, pounds
1	10	Grazed peanuts 57 days .....	119.2	211.2	1.61	.....	Grazed peanuts		.....
2	10	Corn chops and tankage, free-choice self-feeder, 57 days	119.2	236.8	2.06	9.31	Corn chops	425.9	451.3
						Tankage	25.4		
3	10	Milo chops and cottonseed meal, free-choice self-feeder, 57 days .....	119.0	205.8	1.52	7.04	Milo chops	457.7	462.4
						Cottonseed meal	4.7		
4	10	Milo chops and peanut meal, free-choice self-feeder, 57 days .....	119.1	204.4	1.50	7.04	Milo chops	463.7	470.6
						Peanut meal	6.9		
5	10	Grazed peanuts 30 days, followed by milo chops and cottonseed meal, 6:1, hand fed 27 days .....	118.4	206.8	1.55	*6.29	Milo chops	357.1	*416.6
						Cottonseed meal	59.5		

\*Based on the feed consumed and the gain made during the last 27 days. This should not be compared to the feed required per 100 pounds gain in Lots 2, 3, and 4, the results for these lots being calculated for the entire 57-day period.

## DISCUSSION OF RESULTS

Table 23 gives a summary of the results. It will be noted that Lots 3 and 4 consumed very small quantities of cottonseed meal or peanut meal. While the feeds were before them at all times, they consumed less than one-tenth pound per pig per day of cottonseed meal or peanut meal, respectively. Prior to the test, they received milo chops and tankage. They seemed to prefer milo chops alone to the cottonseed meal or peanut meal. They selected cottonseed meal or peanut meal in the proportion of about one per cent. of their ration. Since they were finished, therefore, practically on milo chops alone, the lowest daily gains were made by these two lots. It is a striking coincidence that while they were fed in free-choice self-feeders, the final calculation showed the average daily feed consumed by Lots 3 and 4 happened to be exactly the same, although the amount of cottonseed meal consumed in Lot 3 was slightly less than the amount of peanut meal consumed in Lot 4. The average daily gains in the two lots and the amounts of feed required per 100 pounds of gain are very close.

Perhaps the most interesting feature of Table 23 is found in the consideration of Lot 2. Of the three lots that were fed grain during the entire test, Lot 2 required the smallest amount of feed per 100 pounds of pork produced. Yet, under average conditions, the cost of 100 pounds of pork with this feed mixture would have been greater than with either of the other lots. Also, the greatest feed consumption per pig and the greatest total feed cost per pig were in Lot 2. But, on the other hand, the average daily gain was greatest in this lot. Therefore, under prevailing prices, Lot 2, though requiring the greatest feed bill, yielded the greatest profit per pig. They selected one part tankage to 16.8 parts corn, which gives a rather wide nutritive ratio. This test serves to emphasize the fact that it is not always the cheapest feed nor the lowest total feed bill that brings the greatest profit. It often costs more to get higher daily gains, and yet the greater cost is justifiable if the total profit per pig is increased. For example, if the profit per 100 pounds of pork is \$0.90 in Lot 2 and \$1.10 in Lot 3, the total profit per pig in Lot 2, which made a gain of 117 pounds per pig, will be \$1.05; while in Lot 3, which made a gain of 86 pounds per pig, the profit per pig will be only \$0.95. This, of course, does not take into consideration the "spread" between the value of feeders and finished pigs. In Lots 3 and 4, which consumed practically a milo-alone ration, the feed cost per pig was lower and the cost per 100 pounds of gain was lower than with the corn and tankage ration in Lot 2; yet the average daily gains were too low in the former lots to justify the use of the cheaper feed. It is seldom advisable to feed corn or the grain sorghums alone, despite the fact that most of the protein feeds usually available with which to balance a ration are higher in price than corn or the grain sorghums.

Fair daily gains were made by Lots 1 and 5, which grazed peanuts. In regard to daily gains, they ranked below Lot 2, which consumed a balanced ration of corn and tankage, and somewhat above Lots 3 and 4, which consumed a ration of practically milo alone. The five acres of peanuts grazed produced 1396 pounds of pork. The yield was estimated at 25 to 30 bushels of nuts per acre. All pigs in Lot 1 on



peanuts 57 days were graded "soft" by the packers and docked \$2 per hundred pounds live weight. Three pigs in Lot 5 on peanuts 30 days followed by 27 days on grain killed "soft" and were docked \$2 per hundred pounds live weight. The other seven pigs in Lot 5 killed firm and were not docked. With a carefully estimated value on the peanuts, it proved profitable in this instance to finish Lot 5 twenty-seven days on grain.

Table 24. Individual final weights, dressing percentages, carcass grades, and melting points of back fat and leaf fat samples.

Lot number and method of feeding	Pig No.	Final weight in feeding pen, pounds	Dressing per cent.	Carcass grade	Melting point C.°	
					Back fat	Leaf fat
Lot 1. Grazed on peanuts 57 days.	9	234	79.1	Soft	33.2	38.4
	97	200	76.0	Soft	28.2	39.9
	102	184	78.8	Med. soft	36.4	39.3
	51	176	75.0	Soft	30.3	36.3
	92	254	77.6	Soft	32.0	37.9
	3	212	76.4	Soft	30.7	39.2
	26	200	76.5	Soft	30.8	35.9
	48	234	76.1	Soft	30.9	37.9
	2	214	76.6	Soft	31.7	36.6
	58	204	76.5	Oily	27.6	36.0
Average.....		211	76.8		31.2	37.7
Lot 2. Corn chops and tankage in a free-choice self-feeder, 57 days.	1	250	80.8	Hard	38.3	43.8
	38	270	83.3	Hard	39.7	42.1
	52	246	80.5	Hard	39.3	43.0
	98	196	79.6	Hard	39.2	43.3
	10	234	79.5	Hard	37.5	41.4
	37	280	Not obtained			
	57	202	77.7	Hard	34.5	42.5
	107	222	77.9	Hard	37.1	42.2
	96	210	79.5	Hard	39.9	43.8
	49	258	79.8	Hard	36.0	42.6
Average.....		237	71.8		37.9	42.7
Lot 3. Milo chops and cottonseed meal in a free-choice self-feeder, 57 days.	101	256	78.1	Hard	42.8	45.0
	100	210	76.2	Hard	40.6	43.8
	59	220	79.1	Hard	38.7	42.0
	16	224	79.0	Hard	39.4	41.8
	29	180	76.1	Hard	36.3	42.3
	30	178	73.6	Hard	37.4	41.8
	40	232	75.9	Hard	40.9	44.4
	93	176	72.7	Hard	39.4	44.8
	11	166	75.9	Hard	37.4	42.5
	41	216	79.6	Hard	39.6	44.2
Average.....		206	76.6		39.2	43.3
Lot 4. Milo chops and peanut meal in a free-choice self-feeder, 57 days.	36	246	80.5	Hard	39.7	41.9
	44	200	77.0	Hard	40.7	43.2
	99	200	77.5	Hard	41.3	44.4
	31	244	78.3	Hard	38.7	41.5
	4	174	77.0	Hard	40.5	45.8
	45	196	77.0	Hard	38.9	43.2
	55	172	76.2	Hard	37.9	43.4
	32	200	75.5	Hard	36.3	42.8
	17	202	72.3	Hard	37.5	41.7
	106	210	76.7	Hard	36.4	43.6
Average.....		204	76.8		38.8	43.2
Lot 5. Grazed on peanuts 30 days followed by 27 days on on milo chops, six parts and cottonseed meal one part, hand fed.	34	232	78.0	Hard	40.4	43.5
	6	186	73.1	Hard	38.5	41.9
	7	218	76.1	Hard	39.6	43.6
	103	186	72.6	Hard	39.8	43.1
	12	228	75.0	Med. soft	37.9	41.7
	56	200	72.5	Hard	38.9	41.5
	47	210	75.7	Soft	38.9	42.8
	94	216	73.1	Hard	39.7	42.6
	95	214	76.2	Hard	41.1	44.1
	46	178	73.6	Med. soft	37.0	42.5
Average.....		207	74.6		39.2	42.7

## THE KILLING TEST

The pigs in this experiment were purchased by Swift & Company, Fort Worth, Texas. The officials of the company very graciously assisted in collecting the slaughter data. The company furnished the fat samples free of charge. After the carcasses had remained in the packer coolers 48 hours, the official "Soft Pork" grader for Swift & Company classed each carcass. All carcasses in Lots 2, 3, and 4 were classed as "hard." In Lot 1, which grazed peanuts 57 days, 8 carcasses were classed as "soft," one as "medium soft," and one as "oily." In Lot 5, which grazed peanuts 30 days followed by grain 27 days, 7 carcasses were classed as "hard," 2 as "medium soft," and one as "soft." The grader made an impartial classification, as he had no means of knowing from which lot any particular carcass came. The author could see clearly enough the reasons for the grades assigned each carcass. So far as appearances were concerned, each carcass had a good white color and satisfactory quality, except that the fat was too soft.

Table 24 gives the dressing percentages, carcass grades based on the firmness of the pork, and the melting points of the leaf and back fat samples. The dressing percentages were calculated from the live weights in the feeding pens obtained November 20th and the weights of the warm carcasses obtained in the slaughter rooms on November 23rd. The warm weight of each carcass was obtained after the removal of the head, offal, and leaf fat. The back fat samples were taken from just under the skin where the median back line crosses the loin region. The leaf fat samples were taken from the posterior portion of the leaf fat. The fat samples were taken from the same relative position in each carcass. The table shows that the average melting points of the leaf fat and back fat were considerably lower in Lot 1, grazed on peanuts during the entire test, than in any other lot. In this respect, the other four lots differed very little. In Lot 5, it does not seem that thirty days on peanuts during the first part of the test affected the melting points of the fat samples. However, the three pigs that killed "soft" ranked among the lowest in this lot as to melting points. Feeding grain 27 days to Lot 5 after they had grazed peanuts 30 days, not only produced seven carcasses that graded "hard," whereas all carcasses graded "soft" in Lot 1, but it also resulted in higher average melting points of the fat.

The melting point determinations were furnished by Dr. G. S. Fraps, Station Chemist.

## SUMMARY

The average daily gains ranked as follows: Lot 2, 2.06; Lot 1, 1.61; Lot 5, 1.55; Lot 3, 1.52; Lot 4, 1.50. It is important in considering the gains to study in connection therewith the feed requirements as given in Table 23.

Lot 2, fed corn chops and tankage in a free-choice self-feeder, was the most profitable lot in this test.

The peanuts used in this test produced 279 pounds of pork per acre.

Ten pigs in Lot 1 and three in Lot 5 were docked \$2 per hundred pounds live weight for being "soft."

The feeding system followed in Lot 5 produced both "hard" and "soft" carcasses.

Under the results obtained in this test, it proved more profitable to change Lot 5 from peanut grazing, after 30 days, to a 27-day period of grain feeding, than it did to hold Lot 1 on peanuts for the entire period of 57 days.

The use of a free-choice self-feeder is an excellent method of finishing market pigs if appropriate feeds are utilized. It is highly important that a good supply of each feed used be kept in the feeder at all times.

In a free-choice self-feeder system of fattening pigs, the pigs may not consume sufficient protein to balance the ration if they are suddenly changed to a protein feed to which they are not accustomed. This proved true in the case of lots 3 and 4. If pigs do not consume a sufficient quantity of the protein feed offered, it should be mixed with the grain until they become accustomed to it.

**EXPERIMENT V****PROTEIN SUPPLEMENTS IN FATTENING RATIONS FOR PIGS**

BY

G. R. WARREN

**TIME OF TEST**

This experiment was begun March 5, 1922, and continued for a period of 85 days, closing May 29, 1922.

**OBJECTS**

The principal objects of this experiment were:

1. To determine the firmness of pork produced by finishing hogs eighty-five days on the rations herein given.
2. To secure a direct comparison of wheat shorts, tankage, and cottonseed meal as supplements to milo chops as a finishing ration for swine.
3. To secure a direct comparison of corn chops and milo chops supplemented with the same proportion of tankage.
4. To determine the pork producing value and relative economy of the rations herein tested.
5. To compare peanut meal and cottonseed meal as supplements to rations composed of rice bran and milo chops.

**PIGS USED AND THEIR PREVIOUS TREATMENT**

Sixty Duroc-Jersey barrows and gilts raised by the Experiment Station were used in this test. Six barrows and four gilts were used in each lot. They were all farrowed during September, 1921. Previous to the beginning of the test, the feed and management of all pigs were practically the same. They were developed on a balanced ration of milo chops and tankage. From birth until the test began they had access to pastures of Sudan grass, oats, or Bermuda grass.

**FEEDS USED**

The feeds used were all of excellent quality. The following table shows the analyses of representative samples.

Table 25. Percentage composition of feeds used.

Feeds	Protein	Fat	Crude fiber	Nitrogen-free extract	Water	Ash
Corn chops.....	10.37	4.33	2.57	69.45	11.78	1.50
Milo chops.....	9.94	2.76	2.48	71.72	11.36	1.74
Rice bran.....	13.20	14.22	13.73	36.44	9.30	13.11
Tankage.....	61.35	8.31	2.01	2.11	9.85	16.37
Cottonseed meal.....	42.24	6.32	11.56	25.64	8.64	5.60
Peanut meal.....	42.01	11.52	11.52	21.03	6.96	6.96
Wheat shorts.....	18.30	4.61	4.82	56.42	11.88	3.97

(Analyses by Dr. G. S. Fraps, Station Chemist.)

METHOD OF PROCEDURE

The sixty pigs were divided into six lots of ten pigs each, the lots being arranged as nearly equal in weight, sex, size, condition, and general appearance, as possible. All pigs were individually weighed on three consecutive days at the beginning and close of the test, and the average of the three weights considered the initial and final weights, respectively. They were also weighed individually each fifteenth day during the test.

The lots were fed in dry pens as follows:

Lot 1. Corn chops nine parts and tankage one part, by weight.

Lot 2. Milo chops nine parts and tankage one part, by weight.

Lot 3. Milo chops six parts and cottonseed meal one part, by weight.

Lot 4. Milo chops four parts and wheat shorts one part, by weight.

Lot 5. Rice bran five parts, milo chops four parts, and cottonseed meal one part, by weight.

Lot 6. Rice bran five parts, milo chops four parts, and peanut meal one part, by weight.

Each lot had access to shelter and clear water at all times. They were fed and watered in concrete troughs in pens with concrete floors sheltered by the north half of the hog barn. Each lot had access to a 20x50-foot dry pen. The feed was thoroughly mixed in the correct proportion for each lot, and moistened to a thick slop just before feeding. They were all fed twice daily. The rations seemed of about equal palatability and each lot received the same amount of feed. They were all fed about what would be readily cleaned up twice daily.

Table 26. Individual weights and gains in Lot 1, fed corn chops and tankage 85 days

Pig number.....	35	7	82	77	24	12	63	20	28	46	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	132	98	85	84	82	86	104	85	71	108	93.5
Final weight, pounds.....	258	189	169	170	186	191	217	188	155	240	196.3
Average daily gain, pounds.....	1.48	1.07	.99	1.01	1.22	1.24	1.33	1.21	.99	1.55	1.21

Table 27. Individual weights and gains in Lot 2, fed milo chops and tankage 85 days.

Pig number.....	20	68	11	33	69	84	13	61	22	49	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	115	94	94	114	88	75	101	89	84	84	93.8
Final weight, pounds.....	222	189	209	210	207	170	212	188	198	186	199.1
Average daily gain, pounds.....	1.26	1.12	1.35	1.13	1.40	1.12	1.31	1.16	1.34	1.20	1.24

Table 28. Individual weights and gains in Lot 3, fed milo chops and cottonseed meal 85 days.

Pig number.....	32	41	4	82	90	14	71	42	39	18	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	120	99	100	86	86	82	104	94	81	88	94.0
Final weight, pounds.....	235	205	214	187	191	184	218	209	181	181	200.5
Average daily gain, pounds.....	1.35	1.25	1.34	1.19	1.24	1.20	1.34	1.35	1.18	1.09	1.25

Table 29. Individual weights and gains in Lot 4, fed milo chops and wheat shorts 85 days.

Pig number.....	2	53	21	25	74	62	6	45	17	81	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	115	102	8	94	90	68	107	90	93	85	93.3
Final weight, pounds.....	209	207	181	199	193	150	198	162	179	176	185.4
Average daily gain, pounds.....	1.11	1.24	1.08	1.24	1.21	.96	1.07	.85	1.01	.07	1.08

Table 30. Individual weights and gains in Lot 5, fed rice bran, milo chops, and cottonseed meal 85 days.

Pig number.....	54	67	51	78	72	64	36	6	80	3	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	108	106	94	93	85	77	105	90	77	100	93.5
Final weight, pounds.....	201	197	183	173	183	162	209	200	162	201	187.1
Average daily gain, pounds.....	1.09	1.07	1.05	.94	1.15	1.00	1.22	1.29	1.00	1.19	1.10

Table 31. Individual weights and gains in Lot 6, fed rice bran, milo chops and peanut meal 85 days.

Pig number.....	73	55	65	70	87	8	57	76	47	5	Average
Sex.....	B	B	B	B	B	B	S	S	S	S	
Initial weight, pounds.....	109	108	90	88	89	79	89	79	112	90	93.3
Final weight, pounds.....	216	211	163	177	179	177	191	174	209	181	187.8
Average daily gain, pounds.....	1.26	1.21	.86	1.05	1.06	1.15	1.20	1.12	1.14	1.07	1.11

## INDIVIDUAL WEIGHTS

The six tables above give the individual weights and gains. The individual weights show that no pig made an abnormally low gain. It is interesting to note the variations in daily gains between individuals of similar weights. The daily gains vary considerably, even with pigs of equal or similar weights that eat from the same trough.

Table 32. Summary of results.

Lot No.	No. pigs per lot	Average initial weight per pig, pounds	Average final weight per pig, pounds	Average daily gain per pig, pounds	Average daily feed per pig, pounds	Feed per 100 lbs. gain		
						Kinds, pounds		Total, pounds
1	10	93.5	196.3	1.21	4.89	Corn chops Tankage	363.94 40.44	404.38
2	10	93.8	199.1	1.24	4.89	Milo chops Tankage	355.29 39.48	394.77
3	10	94.0	200.5	1.25	4.89	Milo chops Cottonseed meal	334.57 55.76	390.33
4	10	93.3	185.4	1.08	4.89	Milo chops Shorts	361.08 90.27	451.35
5	10	93.5	187.1	1.10	4.89	Rice bran Milo chops Cottonseed meal	222.06 177.65 44.41	444.12
6	10	93.3	187.8	1.11	4.89	Rice bran Milo chops Peanut meal	219.95 175.95 43.99	439.89

## DISCUSSION OF RESULTS

Table 32 gives a summary of the test. It will be noted that the average daily gains fall into two groups. The first group contains the first three lots, which differed very little in average daily gains. The second group contains the last three lots, which differed very little in average daily gains, but were somewhat lower in this respect than was the first group. Since the amount of feed consumed by each lot was the same, a similar grouping follows for the amount of feed required per 100 pounds of gain. The difference between the amounts required in the three lots was not very great either in the first or second groups, but the difference between groups is quite noticeable. This is partially accounted for by the fact that the first group received feeds that contained more digestible nutrients per 100 pounds of feed mixture than was contained in the more bulky feeds received by the second group. Rice bran and wheat shorts are rather bulky. When fed the same number of pounds of feed, Lot 2, receiving milo chops and tankage nine to one parts by weight, made an average daily gain of 1.24 as compared to an average daily gain of 1.21 by Lot 1, receiving corn chops and tankage nine parts to one part by weight. In Lot 3, which received a ration of milo chops and cottonseed meal combined to give the same nutritive ratio as used in Lots 1 and 2, the average daily gain was 1.25, which is slightly higher than that in the first two lots. The lowest daily gain was made by Lot 4 in which wheat shorts was used as the source of protein. Considering the usual cost of wheat shorts, this lot was fed the least desirable ration. If these results may be considered representative of results to be expected from the use of the rations tested, a pork producer can easily figure out the approximate cost of producing 100 pounds of pork by the use of local feed prices. The pigs receiving cottonseed meal for the entire 85 days were thrifty and hearty at all times.

Table 33. Melting points of back fat samples.\*

Lot No.	Rations fed	Pig No.	Initial weight, pounds	Final weight, pounds	Average daily gain	Carcass grade	Melting point of back fat, C.°	
							Individual	Average
1	Corn chops, tankage.....	28	71	155	.99	Hard	31.2	31.2
		35	132	258	1.48	Missed	Missed	
2	Milo chops, tankage.....	84	75	170	1.12	Hard	36.2	36.5
		20	115	222	1.26	Hard	36.8	
3	Milo chops, cottonseed meal.....	18	88	181	1.09	Hard	43.7	43.0
		32	120	235	1.35	Hard	42.3	
4	Milo chops, wheat shorts.....	62	68	150	.96	Hard	28.1	32.9
		2	115	209	1.11	Hard	37.8	
5	Rice bran, milo chops, cottonseed meal.....	64	77	162	1.00	Slightly soft	28.1	33.1
		36	105	209	1.22	Slightly soft	38.1	
6	Rice bran, milo chops, peanut meal.....	65	90	163	.86	Slightly soft	28.5	28.5
		73	109	216	1.26	Slightly soft	28.4	

\*Fat samples were obtained from the heaviest pig and the lightest pig in each lot.



## THE KILLING TEST

These pigs were purchased by Armour & Company, Fort Worth, Texas, and handled as test pigs. The company furnished the fat samples free of charge. The officials graciously cooperated in collecting the necessary slaughter data. The regular "Sort Pork" grader for the company passed on each carcass. All carcasses in the first four lots were classed as "hard." Eight carcasses in Lot 5 and eight in Lot 6 were described as of "a softish nature," but were not considered soft enough to require the customary \$2 per hundred pounds live weight dockage in price. Two carcasses in Lot 5 and two in Lot 6 were passed as "hard" without notice of any soft tendency.

Table 33 gives the melting points of the back fat samples obtained from the heaviest and the lightest pig in each lot. The samples were taken from the same relative position in each pig. This position was just under the skin where the median back line crosses the center of the loin. A great variation is shown between the melting points obtained, both as between lots and between pigs within a given lot. The lowest average melting point was in Lot 6, while the highest average melting point was in Lot 3.

The melting point determinations were furnished by Dr. G. S. Fraps, Station Chemist.

## SHRINKAGE IN SHIPMENT

The pigs were weighed at the feed lots on the 29th of May and weighed in Fort Worth on the 30th, or the next day. The shrinkage in shipment was as follows for each lot: Lot 1, 3.2 per cent.; Lot 2, 3.6 per cent.; Lot 3, 5.7 per cent.; Lot 4, 5.1 per cent.; Lot 5, 5.9 per cent.; and Lot 6, 4.2 per cent.

## SUMMARY

Each lot in this test was fed the same number of pounds of feed. The resulting average daily gains ranked as follows:

Lot 3.	Milo chops and cottonseed meal.....	1.25 lbs.
Lot 2.	Milo chops and tankage.....	1.24 lbs.
Lot 1.	Corn chops and tankage.....	1.21 lbs.
Lot 6.	Rice bran, milo chops, and peanut meal.....	1.11 lbs.
Lot 5.	Rice bran, milo chops, and cottonseed meal.....	1.10 lbs.
Lot 4.	Milo chops and wheat shorts.....	1.06 lbs.

Under the conditions fed, all rations proved fairly satisfactory. The average daily gains are sufficiently close as to indicate that the feed combination selected would depend very largely on local feed prices. The rations used in the first three lots seemed to be somewhat superior, pound for pound, to those used in the last three lots.

Rice bran was used at the rate of 50 per cent. of the rations in Lots 5 and 6 without producing pork sufficiently soft to require a dockage in price.

There was no obvious difference between the carcasses from Lot 5, receiving rice bran and milo chops supplemented with cottonseed meal, and those from Lot 6, receiving peanut meal as the supplement instead of cottonseed meal.

Milo chops and tankage proved slightly superior to corn chops and tankage in this test.