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## Improving Winter Rations for Pigs

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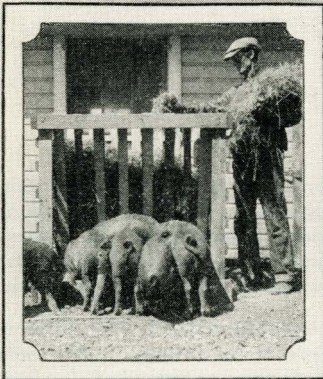
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# *Improving Winter Rations for Pigs*



Animal Husbandry Department  
Agricultural Experiment Station  
of the  
South Dakota State College of  
Agriculture and Mechanic Arts  
Brookings

## Digest

The difficulty experienced by many farmers in securing good results with fall pigs prompted a series of experiments at South Dakota State College on winter rations for hogs. Various combinations of protein supplements were tried under dry lot conditions to secure information which would make the winter feeding of market pigs more profitable.

The standard ration of yellow corn and tankage is not a very efficient winter ration for fall pigs because these feeds do not supply sufficiently the vitamins which are so necessary for satisfactory growth and development. Fortunately, this practical and popular ration may be easily improved by the addition of alfalfa hay and linseed meal, or buttermilk.

The addition of chopped alfalfa hay and oilmeal to a ration of yellow corn and tankage greatly increased the efficiency of the ration. Pigs fed this ration made an average daily gain of 1.54 pounds as compared to 1.32 pounds for pigs fed only corn and tankage.

Alfalfa hay fed in racks gave almost as good results as when added to the ration in the chopped form. When choice alfalfa was used, the gains were just as good. There seems to be little or no advantage in chopping alfalfa hay if pigs can be induced to consume sufficient uncut hay to insure beneficial results.

Corn and alfalfa hay alone did not prove an efficient ration showing that alfalfa hay can not replace tankage as a supplement for corn.

Direct sunlight proved an important factor in producing good gains in these experiments. Results indicate that much of the unthriftiness in fall pigs is due to rickets caused by a lack of direct sunlight.

A corn, tankage and buttermilk ration proved more efficient than either a corn and tankage ration or a corn and buttermilk ration. More rapid and cheaper gains resulted as well as greater uniformity and finish.

Semi-solid and condensed buttermilk were found to be good substitutes for creamery buttermilk in rations of corn, tankage and buttermilk. These feeds might be used to advantage where skim milk or creamery buttermilk are not available.

Where ground barley was substituted for corn in the ration with tankage, it proved satisfactory. One hundred pounds of barley were equal in value to 100 pounds of the corn which graded about No. 3 or No. 4. One could afford to feed barley and tankage instead of corn and tankage when the cost of a bushel of ground barley was not more than 83 to 87 per cent of the cost of a bushel of corn.

# Improving Winter Rations for Pigs

ARTHUR H. KUHLMAN and JAMES W. WILSON

FARMERS who have had considerable success in raising market hogs during the summer months have often experienced failures with fall pigs. In the past, a widely prevalent opinion has been held by many farmers that unthriftiness, slow gains and high feed requirements were largely due to the unfavorable and severe weather of the winter season. In actual practice, the feeding of fall farrowed pigs resolved itself largely into attempts to use, as nearly as possible, such rations as had proven their worth under summer conditions. On the better hog farms, this meant the use of ordinary farm grains, mill feeds and such supplements as tankage, skimmilk and buttermilk. While these feeds, when properly combined and used with forage crops, will produce rapid and economical gains during the summer months, quite unsatisfactory results were often obtained when they were used in the winter. As a result, many farmers came to the conclusion that the feeding of fall pigs was not profitable.

With such conditions obtaining on some of the best farms, it is not difficult to understand why the raising of fall pigs proved even more unsatisfactory on those farms where little or no attention was given to furnishing good rations.

Since 1920, investigations have been conducted at this station to determine the value of various combinations of protein supplements under dry lot conditions in order to secure information which would make the winter feeding of market pigs more economical. This bulletin reports the results of investigations which have been obtained in the feeding of fall farrowed pigs during the winter seasons of 1923-24 and 1924-25. The results of an experiment conducted in the fall of 1920 are also included because this experiment has a close bearing on the feeding of pigs under winter conditions, as well as ordinary dry lot feeding. While these experiments involve a number of problems which need further study, the results obtained do indicate the importance of improving winter rations by the use of feeds which are either available on the farm or may easily be procured.

## Rations and Method of Feeding

The following five rations were used in feeding trials carried on during the winter seasons of 1923-24 and 1924-25:

Ration I—Yellow corn and tankage, self-fed in separate compartments.

Ration II—Yellow corn, self-fed, and a protein supplement, self-fed, consisting of a mixture of 50 pounds tankage, 25 pounds oilmeal, and 25 pounds chopped alfalfa hay.

Ration III—Yellow corn, self-fed, a mixture of 50 pounds tankage and 25 pounds oilmeal, self-fed, and alfalfa hay fed separately in a rack.

Ration IV—Yellow corn, self-fed, and creamery buttermilk, hand-fed twice daily.

Ration V—Yellow corn, self-fed, tankage, self-fed, and one-half as much buttermilk, hand-fed twice daily, as was fed in Ration IV.

A single feeding trial was conducted with the following rations and the results are reported in this bulletin as tentative until further investigations can be conducted:

Corn, tankage and alfalfa hay

Corn, tankage and creamery buttermilk

Corn, tankage and semi-solid buttermilk

Corn, tankage and powdered buttermilk

Ground barley and tankage

Ground barley, tankage, linseed meal and chopped alfalfa hay.

All lots in these experiments received salt.

### ALFALFA HAY IN A WINTER RATION

Experiments conducted at the Wisconsin Station by Morrison and his associates during recent years have shown the efficiency of a mixture of 50 pounds of tankage, 25 pounds of oilmeal, and 25 pounds of chopped alfalfa hay, as a supplement for yellow corn in winter rations for fall pigs. Observations made in feeding a carload of fall pigs at the South Dakota Station in the winter of 1922-23 indicated that the pigs consumed considerable quantities of choice third cutting alfalfa hay fed in a rack. Since many farmers in this state have abundant supplies of alfalfa hay but no means or facilities for chopping it, an experiment was begun December 27, 1924 in which a comparison was made of Rations II and III which differed only in one respect; namely, that the alfalfa hay was fed separately in a rack in Ration III instead of being chopped and mixed with the tankage and oilmeal. The hay used in this experiment was a very choice, bright, fine-stemmed, third cutting. The chopped hay was cut in an ordinary feed and silage cutter. Three separate lots were fed Rations II and III, and for purposes of comparison, two lots were fed Ration I, the standard corn and tankage ration for fattening market hogs. Thirty purebred Duroc Jersey and ten crossbred Duroc Jersey-Chester White pigs, all by the same sire, were used in this trial.

A comparison of the results of this experiment as summarized in Table I shows that the pigs fed Ration I made an average daily gain of 1.32 pounds and consumed 362.87 pounds of corn and 37.64 pounds of tankage for each 100 pounds of gain in live weight. The greater efficiency of Ration II over Ration I is shown by the greater average daily gain of 1.54 pounds as compared to 1.32 pounds; but even more significant is the saving of almost 16 pounds of feed. With corn worth \$1.12 per bushel, tankage \$70 per ton, linseed oilmeal \$60, and chopped alfalfa hay \$20 per ton, the cost of 100 pounds of pork would be \$8.19 for Ration II and \$8.61 for Ration I, or a difference of \$.41 in favor of the more efficient ration. A ration which effects a saving of 17 days in reaching market weight at a saving of feed furnishes a combination of factors which should command the attention of the hog feeder.

### Chopped Alfalfa Hay

A comparison of the results obtained in feeding Rations II and III to three different lots of pigs shows that Ration II was slightly more effi-

cient in producing rapid gains as well as in lowering the feed requirements for one hundred pounds of gain. An outstanding feature is that the average results for the two rations are so similar. This is true not only for the rate of gains and feeds required for 100 pounds of gain, but also for the average daily feed consumed per pig on each ration. The main advantage secured in using chopped alfalfa hay is that when fed in this manner there is greater certainty that the pigs will receive the necessary amount of alfalfa hay. This is shown by the fact that the three lots receiving chopped hay consumed 12.68, 11.54 and 11.64 pounds of alfalfa hay for each 100 pounds of gain, while the corresponding lots respectively consumed 7.77, 14.71 and 3.30 pounds of unchopped hay. Even though there was considerable variation in the amounts of unchopped hay consumed by these three lots, there were only small differences in the amounts of corn, tankage and oilmeal consumed, indicating that in this experiment a very small amount of choice alfalfa hay was sufficient to maintain the efficiency of this ration.

TABLE 1—THE VALUE OF ALFALFA HAY AND LINSEED OILMEAL IN WINTER RATIONS

Lot Number	V, VIII	VI, IX, XII	VII, X, XIII
Summary of results of Experiment II, started Dec. 27, 1923. Results for separate lots are given in Table V. All feeds self-fed.	Ration I	Ration II	Ration III
	Corn Tankage	Corn, Tankage, Linseed Meal, Alfalfa Hay (chopped)	Corn, Tankage, Linseed Meal, Alfalfa Hay (fed in rack)
Number of pigs	10 *	15	15 *
Average initial weight per pig	56.10	59.00	59.20
Average final weight per pig	199.44	201.21	202.36
Total gain	1267.	2158.	1976.
Average daily gain per pig	1.32	1.54	1.49
Days required to reach 200 pounds	109.	92.	95.
Total feed consumed:—			
Corn	4597.5	7298.5	6692.
Tankage	489.5	513.75	507.33
Oilmeal		256.88	253.67
Alfalfa Hay		256.88	168.25
Feed consumed for 100 lbs. gain:—			
Corn	362.87	338.21	338.66
Tankage	38.63	23.81	25.67
Oilmeal		11.90	12.83
Alfalfa Hay		11.90	8.51
Total	401.50	385.52	385.67
Average daily ration per pig:—			
Corn	4.77	5.20	5.05
Tankage	.51	.37	.38
Oilmeal		.13	.19
Alfalfa hay		.18	.13
Total	5.28	5.93	5.75

(\*One pig removed during experiment)

Table II shows the results obtained by feeding Rations I, II, and III in 1925, to two series of lots. The pigs in one series averaging 66 pounds were started in the experiment on January 16, and those in the other, averaging 48 pounds, January 29, 1925. All the pigs used were Duroc Jerseys and each lot was continued in the experiment until the pigs attained an average weight of 225 pounds. The alfalfa used in this experiment was only of ordinary quality, second cutting. It was not a good

color and was somewhat coarse. The corn used was shelled yellow dent purchased at local elevators and was representative of the best corn sold locally during the winter months of 1925. A sample of each load was

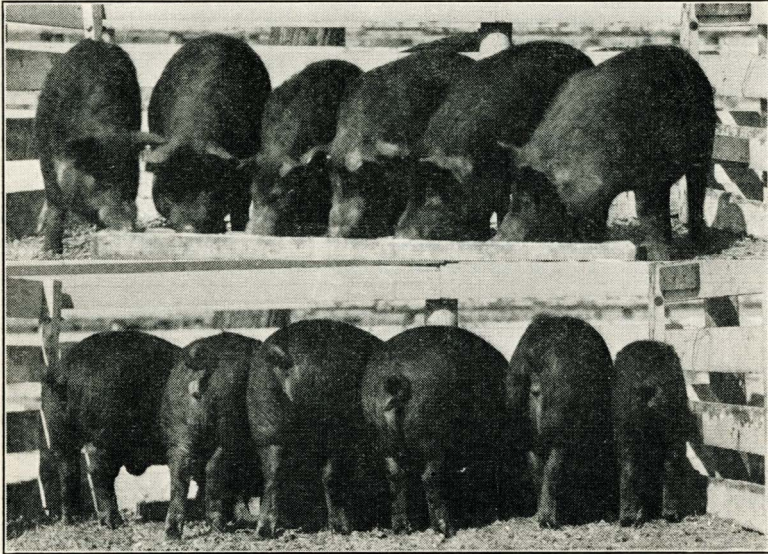


FIG. 1.—PIGS FED CORN AND TANKAGE

A front and rear view of the pigs in Lot XIV which received Ration I consisting of corn and tankage, as they appeared at the end of the experiment. Although the average weight was 227 pounds per pig, the small pig at the lower right weighed only 120 pounds while the largest weighed 298. Such extreme variations are undesirable. In the winter, the standard ration of corn and tankage often produces slow gains, many rough coats and extreme variations in rate of growth and finish.

analyzed for moisture. The range in moisture content varied from 16 percent to 22 percent with an average of 18 percent. The weights of corn as given in Tables II and III are the actual weights of the corn as fed.

The following chemical analysis was made of a composite of the various samples:

Moisture .....	18.10 %
Ether Ext. ....	1.54 %
Protein .....	9.97 %
Ash .....	1.31 %
C. F. ....	2.45 %
N. E. F. ....	66.63 %

A comparison of the results of the 1925 experiment shows the superior efficiency of Ration II over the standard corn and tankage ration in rate of gains as well as in economy of production. The two lots on corn and tankage required 126 days to reach a market weight of 225 pounds,

while the two lots on Ration II attained market weight in 106 days—a saving of 20 days in the feeding period as well as a saving of 26.60 pounds of feed. The pigs fed Ration III made a slightly larger average daily gain but consumed 9.85 pounds more feed for 100 pounds gain than the pigs on Ration II and 16.75 pounds less than the pigs fed corn and tankage.

#### Alfalfa Hay In Racks

The pigs receiving the whole hay in racks consumed more corn, tankage and oilmeal than those fed chopped hay, but only about one-eighth as much hay. In this experiment, Ration II was most economical, indicating that if only an average grade of alfalfa hay is used, chopping is necessary in order to insure that the pigs will consume an amount adequate for best results. Although this is true, it is also evident that even a

TABLE II—THE VALUE OF ALFALFA HAY AND LINSEED OILMEAL IN WINTER RATIONS

Lot Number	XIV, XX	XV, XXI	XVI, XXII
Summary of Experiments III and IV begun Jan. 16 and 29, 1925, detailed records of which are given in Tables VI and VII. All feeds self-fed.	Ration I	Ration II	Ration III
	Corn Tankage	Corn, Tankage, Linseed Meal, Alfalfa Hay (chopped)	Corn, Tankage, Linseed Meal, Alfalfa Hay (fed in rack)
Number of pigs	11.	11.	11.
Average initial weight per pig	56.64	57.09	56.91
Average final weight per pig	225.55	225.27	224.73
Total gain	1858.	1850.	1846.
Average daily gain per pig	1.34	1.58	1.67
Days required to reach 225 pounds	126.	106.	101.
Total feed consumed:—			
Corn	6752.10	5881.	6097.90
Tankage	619.80	483.65	591.33
Oilmeal		241.83	295.67
Alfalfa Hay		241.83	30.20
Feed consumed for 100 lbs. gain:—			
Corn	363.41	317.89	330.33
Tankage	33.36	26.14	32.03
Oilmeal		13.07	16.02
Alfalfa Hay		13.07	1.64
Total	396.77	370.17	380.02
Average daily ration per pig:—			
Corn	4.87	5.04	5.52
Tankage	.45	.41	.54
Oilmeal		.21	.27
Alfalfa Hay		.21	.03
Total	5.32	5.87	6.36

very small amount of hay fed with corn, tankage and linseed oilmeal is much superior to a ration of corn and tankage. The combinations of very small amounts of alfalfa hay with corn, tankage and linseed oilmeal, or corn and tankage, increased the rate of gains, produced more uniform gains, and saved considerable amounts of higher priced concentrates as compared to the standard ration of corn and tankage.

#### Corn and Alfalfa Hay Not Suitable Ration

That alfalfa hay, even if very choice, cannot replace tankage as a supplement for corn is indicated by the results obtained in self-feeding a



ration of yellow corn and choice third cutting alfalfa hay in a rack to a group of five pigs in Lot XI. At the end of a ten weeks period during which these pigs made a total gain of only 124 pounds, which is equiva-

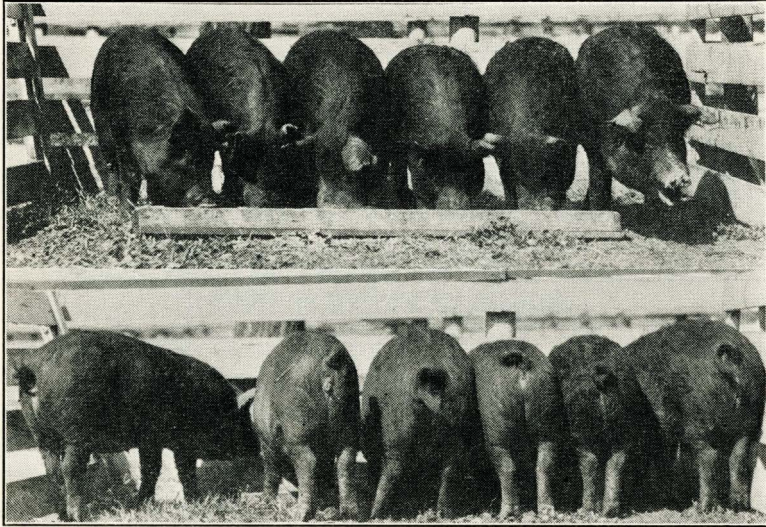


FIG 2.—PIGS FED YELLOW CORN, TANKAGE, LINSEED MEAL AND CHOPPED ALFALFA HAY

This ration fed to Lot XV was so efficient that these pigs reached an average market weight of 225 pounds 33 days earlier than the pigs shown in Fig. 1, and in addition this ration saved 47 pounds of feed for each 100 pounds of gain produced. There was little variation in weight and condition of these pigs. Uniformity in growth and fattening is an important asset in the feed lot and on the market.

lent to an average daily gain of .35 pounds per pig, the feed consumption was only slightly greater than at the beginning of the experiment and the pigs had reached such a condition of unthriftiness that very small gains were made. During this period, these five pigs consumed a total of 745.5 pounds of corn and 160.5 pounds of alfalfa hay, and since only 124 pounds of gain were obtained, these results show that 100 pounds of gain were produced by each 601.21 pounds of corn and 129.44 pounds of choice alfalfa hay consumed. At the beginning of the eleventh week a mixture of 50 pounds of tankage, 25 pounds of linseed meal and 25 pounds of chopped alfalfa hay was offered in a self-feeder in addition to the former ration of yellow corn and alfalfa hay. Improvement began at once and regular and rapid gains were made. That the pigs responded very well to the ration as improved by the addition of the tankage, linseed meal and chopped alfalfa hay mixture is shown by the fact that in the second part of the experiment 100 pounds of gain were produced by 314.34 pounds of corn, 21.55 pounds of tankage, 10.77 pounds of linseed meal, 10.77 pounds of chopped alfalfa hay and 4.85 pounds of alfalfa hay fed in the rack.

While the gains in the second period were very economical, the costs of gains of this lot for the entire experiment were higher than for either

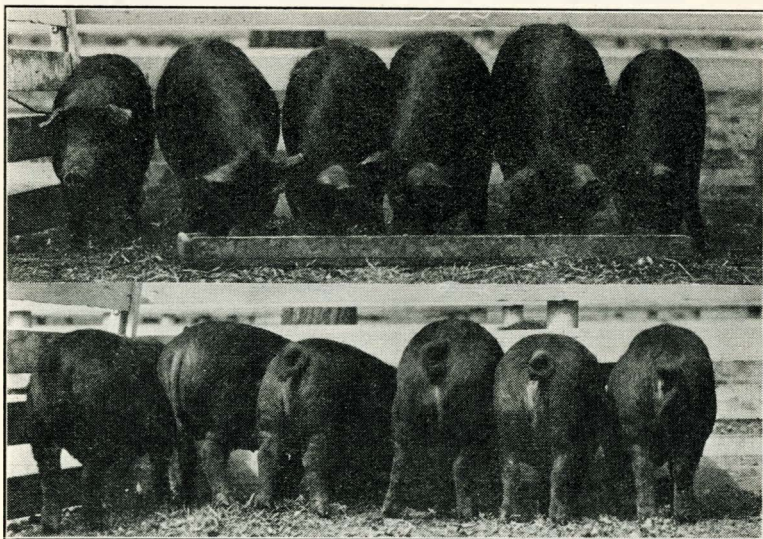


FIG. 3.—PIGS FED WHOLE ALFALFA HAY INSTEAD OF CHOPPED HAY

The pigs in Lot XVI were fed alfalfa hay separately in a rack instead of being forced to eat it with their tankage and linseed meal. As a result they made faster gains but consumed more concentrates and only one eleventh as much alfalfa hay. Since each additional pound of hay consumed by Lot XV saved 2 pounds of concentrates, it may often be very profitable to chop alfalfa hay rather than to feed it "free choice." Although only a small amount of hay was consumed, this ration was much more efficient than corn and tankage alone.

Lots VIII, IX, and X (see Table V). When, in addition to this it is noted that the time required to reach an average weight of approximately 200 pounds exceeds that of the other three lots in the series by a period of 26 to 38 days, the inefficiency of a yellow corn and alfalfa hay ration for small pigs becomes apparent. Such a ration may, however, have merit under a system of management in which fall pigs are to be carried over the winter, then kept on pasture and a limited grain ration during the summer and finished on new barley or corn for the fall market.

#### How Alfalfa Hay Improves Ration

While the combination of tankage, linseed meal and alfalfa hay as a supplement to corn has proven satisfactory for securing high efficiency in a winter ration, it may not always be possible to provide the entire mixture. The results obtained in a single trial in which alfalfa hay was offered in a rack in addition to yellow corn and tankage self-fed indicate that the consumption of only a small amount of alfalfa hay of average quality greatly improved a corn and tankage ration. The results obtained

from such a ration fed to Lot XIX, Table VI, show that the pigs in this lot made just as good gains as those in Lot XV, and while the feed requirements for 100 pounds of gain were somewhat greater, they were, however, much lower than for Lot XIV which received corn and tank-

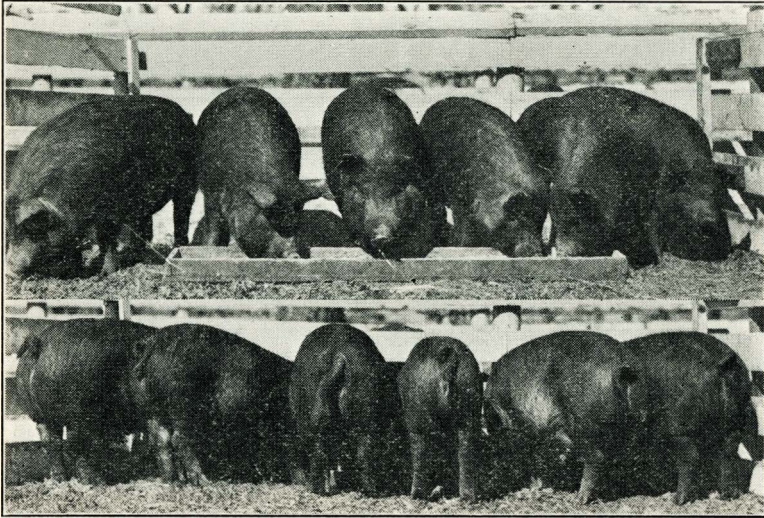


FIG. 4.—PIGS FED CORN, TANKAGE AND ALFALFA HAY

The addition of alfalfa hay fed in a rack to a ration of corn and tankage greatly improved its efficiency. Gains made on this ration by Lot XIX were very satisfactory and while the ration was not as good as those which also contained linseed meal, it again emphasizes the value of alfalfa hay in winter rations. A comparison with Fig 1 indicates the high degree of uniformity and finish which was an outstanding characteristic of this lot.

age. A comparison of the results of these lots shows that 374.12 pounds of corn and 32.46 pounds of tankage were consumed for each 100 pounds of gain by Lot XIV, and only 346.02 pounds of corn, 30.51 pounds of tankage and 3.14 pounds of alfalfa hay by Lot XIX. On this basis 3.14 pounds of hay replaced 28.10 pounds of corn and 1.96 pounds of tankage, indicating a rather sensational value for ordinary alfalfa hay. A study of the weekly feed records, however, shows that 90 percent of the total hay consumed by the lot was taken during the first eight weeks of the experiment. In other words, these six pigs consumed 27.3 pounds of hay during the first eight weeks of the experiment and only 2.9 pounds during the last six weeks.

An analysis of the feed records of these two lots shows that from the beginning of the experiment until the pigs reached an approximate average weight of 150 pounds, 336.17 pounds of corn and 42.37 pounds of tankage were required to produce 100 pounds of gain in LOT XIV and 331.99 pounds of corn, 38.09 pounds tankage and 5.39 pounds of alfalfa hay for the same gain in Lot XIX. This is a relatively small difference and such as might be expected from these rations. More important dif-

ferences, however, appeared in the final period in which the pigs in each lot were fed to a weight of about 225 pounds. While 313.94 pounds of corn and 15.63 pounds of tankage were needed to produce the last 75 pounds of gain in Lot XIV, only 271.50 pounds of corn, 16.40 pounds of tankage and .44 pounds of alfalfa hay were consumed for the last 75 pounds of gain in Lot XIX. This shows rather strikingly that a small amount of alfalfa hay forming a part of a corn and tankage ration for young pigs apparently makes such an efficient combination that the resulting returns are altogether out of proportion to any intrinsic value which may be attributed to the alfalfa hay alone.

These results seem to indicate that although only a relatively small amount of alfalfa hay was consumed even in this first period, it formed such an efficient combination with corn and tankage before the pigs reached a weight of 150 pounds that certain beneficial results were obtained, the effects of which continued during the finishing period, although almost no hay was consumed in the final period.

These indications agree with observations which have been made in an experiment which is being repeated for a third time this summer in which there have been rather marked evidences that certain feeds exert a "carry over" or residual effect and influence subsequent gains made on different rations.

The practical significance of this for the farmer who is feeding young pigs during the fall and winter months is that alfalfa hay should be provided as a definite part of the ration.

### SUNLIGHT AND WINTER PORK PRODUCTION

In the past, many farmers have often observed that some of their young pigs were afflicted with "stiffness" or "rheumatism" during the winter season. This condition is now generally recognized as rickets. There is little doubt that much of the unthriftiness of winter-fed pigs is often due to a rachitic condition, for apparently many pigs may be affected for a considerable period before they show any actual symptoms of this disorder.

A report of the development of rickets in a lot of five pigs which were fed a ration of cooked potatoes, corn and tankage in the winter of 1923-24 was made in Bulletin 209 of this station. In this case a half ration of choice yellow corn was fed with cooked potatoes and tankage. After the tankage was replaced by a mixture of 50 pounds tankage, 25 pounds linseed oilmeal and 25 pounds of chopped alfalfa hay and the pigs were exposed to direct sunlight the rachitic condition of the pigs gradually improved and eventually disappeared altogether.

Recent investigations have shown that ordinary so-called chemically balanced rations do not always prevent the appearance of rickets in young pigs during the winter. The conditions under which very typical cases of rickets appeared among the pigs in one of the lots which received a ration of yellow shelled corn and creamery buttermilk in the 1925 experiments illustrate very definitely some very interesting features connected with rachitic developments.

This lot consisting of five purebred Duroc Jersey pigs averaging 48 pounds each was one of a series of five similar groups started on a feeding experiment January 29, 1925. These pigs were farrowed in the late fall but were very thrifty and uniform in condition and individuality. The

difficulty that is often noticed in getting small pigs to consume enough buttermilk to balance the ration was not encountered in this lot for these pigs were consuming about 3 pounds of buttermilk for each pound of corn before the end of the second week.

During the third week, these pigs consumed 108.8 pounds of corn and 113 pounds of buttermilk and during the fourth week, 114 pounds of corn and 350 pounds of buttermilk. Very consistent gains were made during this period and on February 26 the lot weight of these five pigs was 423 pounds which represents a total gain of 83 pounds in four weeks. This exceeds the gains made by the best of the other four lots in the series by 26 pounds.

In spite of the fact that these pigs were making more rapid gains, consuming larger amounts of feed and, judged by appearances, were at that time the best of five separate lots, very pronounced signs of rickets suddenly appeared on March 8. This condition continued without any changes in either the ration fed or method of management until March 12 when the entire lot was moved to another pen in the same barn, connected with an outside pen on the south side of the building instead of a larger yard on the north side to which these pigs previously had access. By this time, each of the five pigs had advanced to such a stage that they moved about with extreme difficulty and usually rested on their knees while feeding. The pigs were forced to remain out of doors in direct sunlight as much as possible. Feed consumption, which had decreased during this period, now increased rapidly, and after a ten day period all signs of stiffness had disappeared. No further symptoms appeared during the remainder of the experiment and the lot, with the exception of the short interval, continued to be the best in the series.

While exposure to direct sunlight apparently "cured" the "stiffness," restored normal feed consumption and rate of gains, it did not correct all of the disorders that had developed, for without exception each of the five pigs showed considerable enlargement and deformity in the knees and pasterns at the end of the experiment which continued until April 14.

Another lot of six pigs of the same breeding, fed the same ration, but which had access to an outdoor pen on the south side of the barn, did not at any time during the experiment show any signs of "stiffness."

These results emphasize the importance of direct sunlight in the production of farm animals and indicate that, for the winter feeding of pigs, a proper arrangement of outdoor pens deserves perhaps as careful consideration as the selection of the ration or the kind of shelter provided.

### BUTTERMILK IN WINTER RATIONS

While a ration of corn and tankage has been considered the standard by which the values of most other rations for fattening pigs are measured, observations have been made and records obtained in a number of lots under both summer and winter conditions which show that pigs receiving corn and tankage without pasture often show wide variations in the rate of gain and general thriftiness. While some pigs on such a ration make satisfactory gains, others occasionally do not seem to respond as they should. The pigs in Fig. 1 give an illustration of such a condition. The addition of alfalfa hay and linseed oilmeal greatly improves the standard ration as has been shown in Tables I and II and produces more uniformity in condition and finish.

Buttermilk and skim milk have for many years been considered very valuable supplements to farm grains for growing pigs. Many good feeders have held that a combination of corn and either buttermilk or skim milk formed such an efficient ration that, when these feeds were available, the feeding of tankage was unnecessary. Several years of experience with a large number of young pigs indicated, however, that when either of these dairy by-products were fed to weanling pigs with farm grains and mill feeds under dry lot conditions, some groups of these young pigs did not do as well as they should. This unthriftiness seemed to be

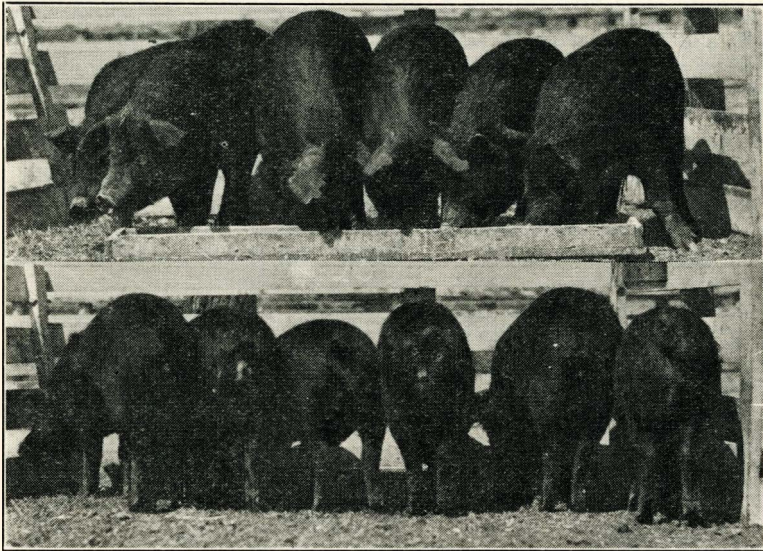


FIG. 5.—PIGS FED YELLOW CORN AND BUTTERMILK

Yellow corn and buttermilk usually rank high as a desirable combination for rapid growth and economical gains. The pigs in Lot XVII fed this ration were uniform, smooth and "stretchy" at the end of the experiment. One hundred pounds of buttermilk as fed in these experiments replaced 10.8 pounds of corn and 5.5 pounds of tankage. The efficiency of this ration is often impaired by failure of young pigs to consume sufficient buttermilk to balance the ration.

largely due to the fact that it was not always possible to induce some of the young pigs to take enough of the milk to properly balance the ration.

The investigations of the problem of improving a corn and tankage and a corn and buttermilk ration include two experiments. The first of these was conducted in the late summer and fall of 1920 and the second began January 16, 1925. The results of the latter are given first because it was a part of the same experiment of which results are given in Table II and because all of these results may be compared in a study of winter rations under comparable conditions.

The efficiency of buttermilk when fed with yellow corn is shown by a comparison of the results secured from Ration IV as compared to those

obtained from the standard corn and tankage ration. While the corn and tankage ration produced very satisfactory daily gains of 1.34 pounds per pig, the combination of yellow corn and buttermilk by producing an average daily gain of 1.53 pounds per pig shortened the period required to reach 225 pounds by sixteen days. On the basis of these results 611.24 pounds of buttermilk replaced 65.87 pounds of corn and 33.36 pounds of tankage, or each 100 pounds of buttermilk fed saved 10.78 pounds of corn and 5.46 pounds of tankage. With corn worth \$1.12 per bushel and tankage \$70.00 per ton, buttermilk was actually worth 41 cents per 100 pounds. If corn is valued at 56 cents per bushel and tankage at \$60.00 per ton, then buttermilk would be worth 27 cents per 100 pounds. It should be kept in mind that in these experiments only enough buttermilk was fed to properly balance the ration. At times the pigs would have consumed larger quantities than were offered. If more had been fed than was actually needed, the value of the milk consumed would, of course, have decreased proportionately.

TABLE III—IMPROVING A CORN AND TANKAGE AND A CORN AND BUTTERMILK RATION

Lot Number	XIV, XX	XVII, XXIII	XVIII, XXIV
Summary of Experiments III and IV detailed results of which are given in Tables VI and VII.	Ration 1	Ration IV	Ration V
	Corn Tankage	Corn Buttermilk	Corn Tankage Buttermilk
Number of pigs	11	11	11 *
Average initial weight per pig	56.64	56.91	56.82
Average final weight per pig	225.55	225.91	227.20
Total gain	1858.	1859.	1717.
Average daily gain per pig	1.34	1.53	1.70
Days required to reach 225 pounds	126.	110.	99.
Total feed consumed:—			
Corn	6752.10	5531.3	5442.5
Tankage	619.80		342.6
Buttermilk		11363.	4870.
Feed consumed for 100 pounds gain:—			
Corn	363.41	297.54	316.98
Tankage	33.36		19.95
Buttermilk		611.24	283.63
Total	396.77	365.00**	368.24**
Average daily ration per pig:—			
Corn	4.87	4.56	5.38
Tankage	.45		.34
Buttermilk		9.37	4.81
Total	5.32	5.59**	6.25**

(\*One pig removed during experiment

(\*\*With buttermilk reduced to 10 per cent moisture)

The difficulty that is sometimes encountered in feeding buttermilk or skimmilk to young pigs is well illustrated in this experiment. The pigs in one of these lots with an initial weight of 64 pounds could not be induced to consume more than an average of 1.7 pounds of buttermilk for each pound of corn during the first five weeks or until they reached an average weight of 100 pounds per pig. During this period from 2.5 to 3.0 pounds of milk should have been consumed for each pound of corn in order to properly balance the ration. In contrast to this, it is interesting to note the behavior of the lot consisting of five pigs of the same

breeding but weighing only 48 pounds. During the same period they consumed three pounds of milk for each pound of corn.

### Corn, Tankage and Buttermilk

That a combination of corn, tankage and buttermilk is more efficient than a combination of yellow corn and tankage or yellow corn and buttermilk is indicated by the results obtained from Ration V. This ration which produced an average daily gain of 1.70 pounds per pig secured the most rapid gains of the six rations fed in 1925. The pigs in these two lots reached an average market weight of 225 pounds in 99 days, or 11 days earlier than the pigs fed yellow corn and buttermilk and 21 days earlier than those fed corn and tankage. The average feed requirement for 100 pounds of gain for these two lots was 316.97 pounds of corn, 19.95 pounds tankage and 283.63 pounds buttermilk. Compared with the corn and tankage ration, this means that 283.63 pounds of buttermilk saved 46.44 pounds of corn and 13.41 pounds of tankage. On this basis, 100 pounds of buttermilk fed with corn and tankage replaced 16.37 pounds of corn and 4.73 pounds of tankage. With corn worth \$1.12 per bushel and tankage \$70.00 per ton, 100 pounds of buttermilk are worth 49 cents when fed in this manner. When corn is worth 56 cents and tankage \$60.00 the value of the buttermilk would be 31 cents. The value of buttermilk is determined by the price of both corn and tankage but the values as determined by the prices assumed show that in either case the value of the buttermilk is higher when fed with both tankage and corn than when fed with corn alone.

A comparison of the feeds required for each 100 pounds gain produced by Rations IV and V shows that the addition of 19.95 pounds of tankage and 19.43 pounds of corn in Ration V replaced 327.61 pounds of buttermilk. With corn worth \$1.12 per bushel and buttermilk 41 cents per hundred pounds, the tankage consumed in Ration V was actually worth 4.78 cents per pound or \$95.60 per ton. With corn worth 56 cents per bushel and buttermilk 27 cents per hundred pounds, tankage would be worth 3.46 cents per pound or \$69.20 per ton. Both of these valuations represent very good returns for the tankage fed in connection with buttermilk and yellow corn.

A ration of buttermilk, tankage and yellow corn is more efficient than one of yellow corn and tankage or yellow corn and buttermilk because it produces more rapid gains as well as cheaper gains and greater uniformity in condition and finish than either of the other rations.

### Buttermilk and Buttermilk Products

In recent years many farmers have become interested not only in the value of buttermilk for pigs, but of buttermilk products such as semi-solid or condensed buttermilk and powdered buttermilk. The results of an experiment conducted from August 27 to October 29, 1920, furnish an interesting comparison of the value of these three feeds added to a self-fed ration of yellow corn and tankage.

Fortyeight spring farrowed pigs of Duroc Jersey, Poland China, Chester White and Hampshire breeding were divided into six lots of eight pigs each. Care was exercised to secure uniformity as to weight, age, sex, and breed representation. Pigs from the same litter were distributed



among the various lots as much as possible. All pigs were in a thrifty condition and had received the same treatment previous to the beginning of the experiment. The following method of feeding was followed:

Lot I received shelled corn and tankage both fed "free choice" style; that is, each feed was fed in a separate compartment in a self-feeder.

Lot II received shelled corn and tankage the same as Lot I and in addition as much creamery buttermilk was fed at night and morning as the pigs would readily consume in a short time. Obviously, if pigs so fed consume less corn and tankage, the amounts saved could be credited to the use of the buttermilk.

Lot III also received shelled corn and tankage and in addition was offered semi-solid buttermilk at night and morning diluted to about the same consistency as creamery buttermilk.

Lot IV, in addition to receiving corn and tankage self-fed, had access to powdered buttermilk in a separate compartment in the self-feeder.

#### Adding Buttermilk to Corn and Tankage

The results show that the pigs in Lot I, which was the check lot of the experiment, made an average gain of 81.88 pounds in 70 days.

TABLE IV.—THE VALUE OF BUTTERMILK AND BUTTERMILK PRODUCTS FOR IMPROVING A CORN AND TANKAGE RATION

Experiment I	Lot I	Lot II	Lot III	Lot IV
	Shelled Corn Tankage	Shelled Corn Tankage Creamery Buttermilk	Shelled Corn Tankage Semi-solid Buttermilk	Shelled Corn Tankage Powdered Buttermilk
No. of pigs per lot	8	8	8	8
No. of days fed	70	70	70	70
Total initial weight	462	462	462	462
Total final weight	1117	1411	1314	1352
Total gain	655	949	852	890
Av. initial weight per pig	57.75	57.75	57.75	57.75
Av. final weight per pig	159.63	176.38	164.25	169.
Av. gain per pig	81.88	118.63	106.50	111.25
Av. daily gain per pig	1.17	1.69	1.52	1.59
Feed consumed				
Corn	2347.	2539.	2576.	2549.
Tankage	249.	122.	213	131
Creamery buttermilk		3308		
Semi-solid buttermilk			322	
Powdered buttermilk				397.5
Feed consumed for 100 lbs. gain:—				
Corn	358.33	267.54	302.35	286.41
Tankage	38.02	12.86	25.00	14.71
Creamery buttermilk		348.57		
Semi-solid buttermilk			37.79	
Powdered buttermilk				44.66
Feed consumed daily per pig.				
Corn	4.19	4.53	4.6	4.55
Tankage	.45	.22	.38	.23
Creamery buttermilk		5.91		
Semi-solid buttermilk			.57	
Powdered buttermilk				.71

This is equivalent to an average daily gain of 1.17 pounds per pig. These pigs consumed 358.33 pounds of shelled corn and 38.02 pounds of tank-

age for every 100 pounds of gain secured in live weight. These results agree very closely with those of many other trials obtained with pigs of the same weights and fed the same feeds.

A comparison of the results of Lots I and II shows that the addition of about six pounds of buttermilk daily per pig to a ration of corn and tankage greatly increased the gains, for the pigs in Lot II made an average daily gain of 1.69 which is an increase of .52 of a pound daily per pig over the gains of Lot I as a result of feeding buttermilk. When corn and tankage alone were fed, 358.33 pounds of corn and 38.02 pounds of tankage were required to produce 100 pounds of gain but when creamery buttermilk was fed to the pigs in Lot II at the rate mentioned above, 100 pounds of gain were produced by 267.54 pounds of corn, 12.86 pounds of tankage and 348.57 pounds of buttermilk. Using these results, it is easy to determine that 100 pounds of buttermilk replaced 26.05 pounds of corn and 7.22 pounds of tankage. Assuming that corn is worth \$1.12 per bushel and tankage \$70 per ton, buttermilk would then be worth 77 cents per hundred pounds.

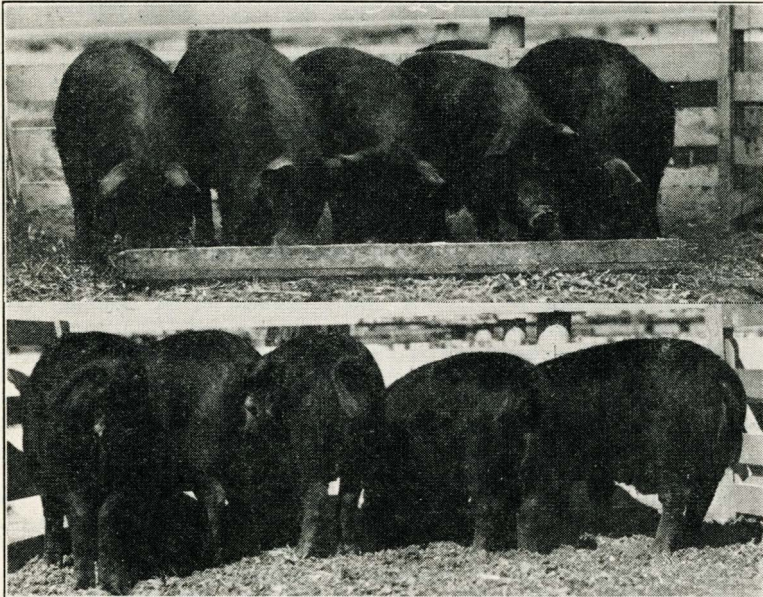


FIG. 6.—PIGS FED A RATION OF YELLOW CORN, TANKAGE AND BUTTERMILK

Buttermilk improved a corn and tankage ration and tankage improved a corn and buttermilk ration. The combination of these three feeds in three experiments excelled over all other rations fed in producing the most rapid gains, the greatest uniformity and the best finish. This ration seems to be especially efficient for young pigs. Since sweet and sour skimmilk has about the same feeding value as buttermilk (Bulletin 136 of this station), it may be safe to assume that it could be used to replace it with equally good results.

This is a much higher value for buttermilk than was obtained from

the comparison of Rations I and V in the 1925 experiments. In the later experiment, when pigs were fed to an average final weight of 225 pounds, it was found that 100 pounds of buttermilk replaced 16.37 pounds of corn and 4.73 pounds of tankage, making the buttermilk worth 49 cents. However, if a comparison is made between the 1925 rations for such periods as will make the final weights of the groups comparable to those in the 1920 experiment, values of 52 and 63 cents per hundred pounds are obtained for buttermilk when fed with corn and tankage. These results are of interest because they indicate the high efficiency of the corn, tankage and buttermilk ration, especially for young growing pigs.

While the 1920 experiment was conducted for only one year, the value obtained for creamery buttermilk agrees so well with the averages of the 1925 experiments that the results of the first trial may be considered indicative of what may be expected from such rations when fed under similar conditions.

### **Adding Semi-Solid Buttermilk**

During the past few years, many hog raisers have made extensive use of semi-solid or condensed buttermilk, a product which is manufactured by a number of firms at the present time. It is a palatable product being essentially buttermilk which has been condensed by removing a considerable portion of the water ordinarily contained in it. Manufacturers usually claim that one part of this condensed buttermilk when diluted with nine or ten parts of water will make a feed having the consistency of ordinary buttermilk. No attempt was made in this experiment to verify these statements but the dilution was made in approximately those proportions because the pigs seemed to relish it in that form.

It required considerable care and some time to get the pigs accustomed to this feed, but after they were once started on it, no difficulty was experienced in feeding it. In fact, this lot seemed to be gaining very rapidly toward the close of the experiment. It required 302.35 pounds of corn, 25 pounds of tankage and 37.79 pounds of semi-solid buttermilk to produce 100 pounds of gain. On this basis when compared with Lot I, it may be said that 37.79 pounds of semi-solid buttermilk replaced 55.98 pounds of corn and 13.02 pounds of tankage. One hundred pounds of the semi-solid buttermilk would therefore be equivalent to 148.14 pounds of corn and 34.45 pounds of tankage.

With corn worth \$1.12 per bushel and tankage \$70.00 per ton, 100 pounds of the semi-solid buttermilk would have a value of \$4.17. Naturally, when corn and tankage are worth less than the values used, the semi-solid buttermilk would also be worth less if economy of production is considered. At higher values for corn and tankage, semi-solid buttermilk would, of course, also be worth more as a feed.

That semi-solid buttermilk is a valuable feed is shown by the results obtained in Lot III in which the gains compare quite favorably with those obtained from the use of ordinary creamery buttermilk. Doubtless, many feeders could often use this feed to advantage when neither skimmilk nor buttermilk are available.

### **Adding Powdered Buttermilk**

Powdered buttermilk is the product remaining after all visible moisture

has been removed from ordinary buttermilk. On account of its high cost it is not ordinarily used as a feed for hogs. Many breeders of purebred swine have occasionally used it with excellent results. The results obtained in Lot IV indicate that powdered buttermilk has considerable merit as a hog feed for the gains of this lot are nearly as good as those of Lot II receiving creamery buttermilk which ranked first in this experiment.

The pigs in this lot consumed 286.41 pounds of corn, 14.71 pounds of tankage and 44.66 pounds of powdered buttermilk for every 100 pounds of gain secured. Again comparing these results with the check lot, namely, Lot I, it is evident that 44.66 pounds of powdered buttermilk replaced 71.92 pounds of corn and 23.31 of tankage. One hundred pounds of powdered buttermilk would therefore be equivalent to 161.04 pounds of corn and 52.19 pounds of tankage.

With corn worth \$1.12 a bushel and tankage \$70.00 per ton, powdered buttermilk would have a value of \$5.05 per hundred pounds. Powdered buttermilk is very palatable and the pigs relish it greatly. Undoubtedly much more profitable results could be obtained if the amount fed were limited and not self-fed as was done in this experiment, for it seems probable that a smaller amount of powdered buttermilk added to a corn and tankage ration would still yield a large share of the benefits secured from this ration.

#### BARLEY IN WINTER HOG RATIONS

In a single trial in which a ration of ground barley and tankage was compared with a ration of shelled corn and tankage, the results show that in Lot XXV, Table VI, 395.02 pounds ground barley and 23.81 pounds of tankage were consumed for each 100 pounds of gain and that these pigs made an average daily gain of 1.57 pounds per pig. These may be considered very satisfactory returns. Lot XIV made 100 pounds gain on a feed requirement of 374.12 pounds corn and 32.46 pounds tankage. Although somewhat more barley was consumed than corn, less tankage was required with the barley. On the basis of these results with the usual relation between the prices of corn and tankage, 100 pounds of ground barley are equal in feeding value to 100 pounds of the yellow corn fed in this experiment which would grade No. 3 or No. 4. This means that under the conditions of this experiment, one could afford to feed barley and tankage instead of corn and tankage if the cost of a bushel of ground barley is not more than 83 per cent to 87 per cent of the cost of a bushel of corn. With tankage worth \$60 to \$70 a ton, if corn of this grade is worth 56c, 80c, \$1.00, or \$1.12 per bushel, then one could afford to use ground barley provided its cost did not exceed respectively 48c, 69c, 86c, or 95c per bushel.

The tankage, linseed meal and chopped alfalfa hay mixture when fed with barley to Lot XXVI did not produce results similar to its use with corn. While the total amounts of feed required for 100 pounds of gain were almost equal, the mixture did reduce the amount of barley needed by about 13 pounds, but the rate of gain was somewhat less than with the barley and tankage ration. If the results of Lots XXV and XXVI are compared it is evident that the ration of barley and the supplementary mixture as fed was not an improvement on a barley and tankage ration. Further work is necessary on this problem, but these tentative results do indicate the relative merits of corn and barley in winter rations.

Tables V, VI and VII in the back of this bulletin give the results of the individual lots which received the various rations fed in the experiments conducted during the two winter seasons discussed in this bulletin.

### SUMMARY

An efficient winter ration for fall pigs is one which supplies not only the essential nutrients of a balanced ration but which also furnishes adequately those energizing elements which are obtained so abundantly, even if incidentally, from direct sunlight and succulent pasture during the summer months.

The standard ration of yellow corn and tankage is not a very efficient winter ration for fall pigs because these feeds do not supply sufficiently the vitamins which are so necessary for satisfactory growth and development. Fortunately, this practical and popular ration may be easily improved by the addition of alfalfa hay and linseed meal, or buttermilk.

The average results of four lots fed the standard ration under winter conditions show that 363.19 pounds of yellow corn and 35.50 pounds of tankage were required to produce 100 pounds gain.

The ration of yellow corn, tankage, linseed meal and chopped alfalfa hay fed to five different lots produced 100 pounds gain for each 328.83 pounds corn, 24.89 pounds tankage, 12.44 pounds linseed meal and 12.44 pounds chopped alfalfa hay consumed.

When whole hay was fed in a rack to five similar lots 100 pounds of gain were produced for each 334.69 pounds yellow corn, 28.75 pounds tankage, 14.38 pounds linseed meal and 5.19 pounds of alfalfa hay.

The average results of two lots show that 297.54 pounds of yellow corn and 611.24 pounds of creamery buttermilk produced 100 pounds gain.

One hundred pounds of buttermilk fed with yellow corn replaced 10.76 pounds of corn and 5.46 pounds of tankage. If corn is worth \$1.12 a bushel and tankage \$70 a ton, then 100 pounds of buttermilk are worth 41 cents.

A combination of buttermilk and tankage is a very efficient supplement for yellow corn, for 100 pounds of gain were produced for every 316.98 pounds of corn, 19.95 pounds tankage and 283.63 pounds buttermilk consumed.

In a ration of yellow corn, tankage and buttermilk, 100 pounds buttermilk replaced 16.37 pounds corn and 4.73 pounds tankage. Under these conditions buttermilk was worth 49 cents per hundred pounds.

A ration of yellow corn, tankage and buttermilk is more efficient than one of yellow corn and tankage or one of yellow corn and buttermilk. With corn worth \$1.12 a bushel, tankage \$70 a ton and buttermilk 41 cents per hundred weight, then the addition of tankage to a ration of yellow corn is also a profitable practice for under such conditions 100 pounds of tankage were worth \$4.78.

The addition of alfalfa hay improved standard rations to such an extent that the rate and cost of gains of winter fed pigs compare very favorably with those that may be obtained during the warmer seasons.

The relative efficiency of each of the rations which were fed under comparable conditions is further emphasized by the following statement

which shows the amount of pork produced by a bushel of corn as supplemented in each ration.

One bushel of corn fed with:

- (1) 5.47 lbs. tankage, produced 15.42 lbs. gain;
- (2) 4.24 lbs. tankage, 2.12 lbs. linseed meal and 2.12 lbs. chopped alfalfa hay, produced 17.03 lbs gain;
- (3) 4.81 lbs. tankage 2.41 lbs. linseed meal and .87 lbs. alfalfa hay, produced 16.73 lbs. gain;
- (4) 115.04 lbs. buttermilk produced 18.82 lbs. gain;
- (5) 3.53 lbs. tankage and 50.11 lbs. buttermilk, produced 17.67 lbs. gain;
- (6) 4.94 lbs. tankage and .51 lbs. alfalfa hay, produced 16.19 lbs. gain.

On the basis of the results obtained in the experiments reported in this bulletin, the total pounds of feed and the time in days required to carry a 50 pound pig to a weight of 225 pounds for several rations are as follows:

Ration	Corn	Tankage	Linseed Meal	Alfalfa Hay	Butter-milk	No. of days
1	636	62				136
2	574	44	22	22		112
3	586	50	25	9		111
4	521				1071	115
5	555	35			496	103

TABLE V—EXPERIMENT II

Lot Number	V	VI	VII	VIII	IX	X	XI	XII	XIII
Started, Dec. 27, 1923.									
Five pigs per lot. Each lot fed until pigs averaged approximately 200 lbs. Lots V to XI inclusive were purebred Duroc Jersey, and Lots XII & XIII crossbred Chester White-Duroc Jersey pigs. All feeds self-fed.	Corn, Tankage	Corn, Tankage, Linseed meal, Alfalfa hay (chopped)	Corn, Tankage, Linseed meal, Alfalfa hay (fed in rack)	*Corn, Tankage	Corn, Tankage, Linseed meal, Alfalfa hay (chopped)	Corn, Tankage, Linseed meal, Alfalfa hay (fed in rack)*	Corn, Alfalfa hay (fed in rack)**	Corn, Tankage, Linseed meal, Alfalfa hay (chopped)	Corn, Tankage, Linseed meal, Alfalfa hay (fed in rack)
No. of days fed	86.	85.	84.	121.	112.	109.	147.	84.	84.
Initial weight (Av.)	72.8	72.8	73.0	39.4	39.8	40.0	38.6	64.8	65.4
Final weight (Av.)	198.2	199.6	204.2	201.0	205.8	202.75	199.4	203.6	200.2
Total gain per lot	627.	634.	656.	640.	830.	646.	804.	694.	674.
Av. daily gain per pig	1.46	1.49	1.56	1.20	1.48	1.33	1.09	1.65	1.60
Total Feed consumed:—									
Corn	2369.	2293.5	2248.	2228.5	2637.	2168.	2882.5	2368.	2286.5
Tankage	293.	160.75	166.	196.5	191.5	185.66	146.5	161.5	155.66
Oilmeal		80.38	83.		95.75	92.83	73.3	80.75	77.83
Alfalfa Hay		80.38	51.		95.75	95.	266.8	80.75	28.25
Feed consumed for 100 lbs. gain—									
Corn	377.83	361.75	342.68	348.20	317.71	335.60	358.52	341.21	339.24
Tankage	46.73	25.35	25.31	30.70	23.07	28.74	18.22	23.27	23.09
Oilmeal		12.68	12.65		11.54	14.37	9.11	11.64	11.54
Alfalfa Hay		12.68	7.77		11.54	14.71	24.08	11.64	3.30
Total	424.56	412.46	398.41	378.90	363.86	393.42	409.93	387.76	377.17
Average daily ration per pig:—									
Corn	5.51	5.40	5.35	4.18	4.71	4.47	3.92	5.64	5.44
Tankage	.68	.38	.40	.37	.34	.38	.20	.38	.37
Oilmeal		.19	.20		.17	.19	.10	.19	.19
Alfalfa Hay		.19	.12		.17	.20	.36	.19	.05
Total	6.19	6.16	6.07	4.55	5.39	5.24	4.58	6.40	6.05

\*\*Mixture of tankage, linseed meal, and chopped alfalfa hay added to ration March 13, 1924

\*One pig taken out of lots VIII and X Feb. 14, 1924.

TABLE VI—EXPERIMENT III

Lot Number	XIV	XV	XVI	XVII	XVIII	XIX	XXV	XXVI
Started Jan. 16, 1925. Six purebred Duroc Jersey pigs per lot. Each lot fed until pigs averaged approximately 225 lbs. All feeds except buttermilk self-fed.	Corn, Tankage	Corn, Tankage, Linseed meal, Alfalfa hay (chopped)	Corn, Tankage, Linseed meal, Alfalfa hay (in rack)	Corn, Buttermilk	Corn, Tankage, Buttermilk*	Corn, Tankage, Alfalfa hay (in rack)	Ground Barley, Tankage.	Ground Barley, Tankage, Linseed meal, Chopped Alfalfa hay
No. of days fed	122.	98.	90.	108.	88.	97.	102.	111.
Initial weight	64.0	64.83	64.17	64.33	64.33	64.17	64.5	64.0
Final weight	226.83	225.17	225.67	225.83	225.40	224.33	225.0	220.83
Total gain per lot	977.	963.	969.	969.	821.	961.	963.	941.
Average daily gain per pig	1.33	1.64	1.79	1.50	1.76	1.65	1.57	1.42
Total feed consumed:								
Corn or barley	3655.2	2943.1	3072.5	2958.7	2583.8	3325.2	3804.0	3595.5
Tankage	317.1	261.1	343.9		230.1	293.2	229.3	167.1
Linseed meal		130.6	172.0					83.6
Alfalfa hay		130.6	11.6			30.2		83.6
Buttermilk				5404.	2003.			
Feed consumed for 100 lbs. gain:—								
Corn or barley	374.12	305.62	317.08	305.34	314.71	346.02	395.02	382.09
Tankage	32.46	27.11	35.50		28.03	30.51	23.81	17.76
Linseed meal		13.56	17.50					8.88
Alfalfa hay		13.56	1.20			3.14		8.88
Buttermilk				558.69	243.97			
Total	406.59	359.85	371.28	**367.01	**369.73	379.67	418.83	417.61
Average daily ration per pig:—								
Corn or barley	4.99	5.00	5.69	4.57	5.05	5.71	6.22	5.40
Tankage	.43	.44	.64		.45	.50	.37	.25
Linseed meal		.22	.32					.13
Alfalfa hay		.22	.02			.05		.13
Buttermilk				8.34	3.91			
Total	5.42	5.88	6.67	**5.42	**5.97	6.26	6.59	5.91

\*One pig removed from experiment Feb. 12 on account of injury.

\*\*Buttermilk reduced to 10 percent moisture.

WINTER RATIONS FOR PIGS



TABLE VII—EXPERIMENT IV

Lot Number	XX	XXI	XXII	XXIII	XXIV
Started Jan. 29, 1925. Five purebred Duroc Jersey pigs per lot. Each lot fed until pigs averaged approximately 225 lbs. All feeds excepting buttermilk self-fed.	Corn, Tankage.	Corn, Tankage, Linseed meal, Alfalfa hay (chopped)	Corn, Tankage, Linseed meal, Alfalfa hay (in rack)	Corn, Buttermilk	Corn, Tankage, Buttermilk
No. of days fed	131.	116.	113.	113.	109.
Initial weight (Av.)	47.8	48.	48.2	48.	47.8
Final weight (Av.)	224.	225.4	223.6	226.	227.
Total gain per lot	881.	887.	887.	890.	896.
Average daily gain per pig	1.35	1.51	1.55	1.58	1.64
Total feed consumed:—					
Corn	3096.9	237.9	3025.4	2572.6	2858.7
Tankage	302.7	222.6	247.4		112.5
Linseed meal		111.3	123.7		
Alfalfa hay		111.3	18.6		
Buttermilk				595.9	286.7
Feed consumed for 100 lbs. gain:—					
Corn	351.52	331.22	344.97	289.06	319.05
Tankage	34.36	25.10	28.21		12.56
Linseed meal		12.55	14.10		
Alfalfa hay		12.55	2.12		
Buttermilk				669.55	319.98
Total	385.88	381.42	389.40	362.96*	366.93*
Average daily ration per pig:—					
Corn	4.66	5.07	5.35	4.55	5.24
Tankage	.45	.38	.44		.21
Linseed meal		.19	.22		
Alfalfa hay		.19	.03		
Buttermilk				10.55	5.26
Total	5.11	5.83	6.04	5.71*	6.03*

(\*With buttermilk reduced to 10 per cent moisture)