

OHIO AGRICULTURAL EXPERIMENT STATION



**SWINE FEEDING EXPERIMENTS
WITH FALL PIGS**



LIVESTOCK DAYS—1929

Wooster, April 19
Kenton, April 22
Columbus, April 24
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SUPPLEMENTS TO CORN FOR WINTER FEEDING

W. L. ROBISON

Unfortunately, during the winter, an outbreak of hemorrhagic septicemia, or swine plague of the pneumonic type, occurred among our experimental hogs. This became so severe as to cause the death of a number of animals before it was checked. There were fewer losses among the older pigs used in this and in the oats experiment than among the later pigs used in the cottonseed meal experiment, and in a mineral experiment which it was deemed advisable to discontinue.

Because of the occurrence of the disease, the gains are doubtless lower and the feed requirements per unit of gain higher than they would have been otherwise. Since, with one or two exceptions, noted elsewhere, in the cases in which it is possible to check the findings with those of other tests, the results agree rather closely; it is believed the relative performance of the various lots was fairly typical of what may ordinarily be expected.

Fish meal has proved superior to tankage, as a sole supplement to corn, in tests which were conducted at this and other stations. The trio supplemental mixture of tankage, linseed meal, and alfalfa is now known to be an improvement over tankage, and has come into rather general use. In this test a simple supplement of fish meal was compared with a more complex one composed of the trio mixture and minerals. The fish meal produced both faster and cheaper gains. Points in its favor for feeding with home-grown grains, are that it provides a simpler ration, that it necessitates the purchase and handling of only one feed, and that it permits the use of a larger percentage of grain in the ration. In considering the purchase of protein concentrates it will pay the hog feeder not to overlook the possibilities of fish meal. Based on the relative amounts of feed required per unit of gain by Lots 1 and 4 and on the prices of other feeds as given in the table, fish meal showed a comparative value of \$96.71 a ton.

Further investigations would be required to determine whether corn and fish meal, like corn and tankage, can be improved by including other materials in the ration.

A mineral mixture of salt, limestone, and iron oxide, fed with corn and tankage gave fully as good results as corn and the trio mixture in two trials conducted during the winter and spring of 1928. In this year's test, however, it was less effective. As in the previous test, a ration of corn and the trio mixture without minerals was not as efficient as was the same ration with minerals, although the difference was less marked.

During the last few years a method of manufacturing tankage by what is known as the dry rendered, or expeller process, has been developed. Briefly, this process consists of crushing, grinding, or hashing the material, passing it through a steam jacketed, horizontal "melter" or cooker having agitators to facilitate cooking and prevent scorching; draining off the liquid fat while the material is in a receiving tank or percolator having a steam jacketed bottom, and pressing out a large share of the remaining grease, or fat, by an expeller or screw-type continuous press. Upon grinding, the material is then ready for use in stock or poultry feed.

Dry rendered tankage has a pleasing odor and is lighter in color than the steam rendered tankage with which we are familiar. Up to the present time practically all of it has gone into the manufacture of poultry feed but eventually, it is claimed, all but about 5 percent of the tankage will be made by the new method. No water, which washes away some of the ammonia or protein, is used in dry rendering. For this reason, according to Clemen's "By-Products of the Packing Industry", the difference in protein content between dry and wet rendering is usually around 10 percent.

The dry rendered tankage used in this experiment was a special product, not yet on the market, which was supplied us through the courtesy of Swift and Company. It analyzed 69.3 percent of protein and was fed in smaller amounts than the steam rendered tankage, or on an equivalent protein basis.

Dry rendered tankage was more palatable than the old style tankage and the pigs receiving it required less feed per unit of gain. With other feeds at the prices given, the amount of these replaced by the expeller tankage gave it a comparative value of \$100.81 and of \$98.61 a ton, respectively, in the two rations in which it was fed. The single trial indicated that, like the steam rendered tankage, it could be improved by the inclusion of a little linseed meal and ground alfalfa in the ration.

Supplements to Corn for Winter Feeding

Experiment started December 5, 1928 Feeds mixed and self-fed	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	Corn	Corn	Corn	Corn	Corn	Corn
	Fish meal	Tankage	Tankage Linseed meal Ground alfalfa	Tankage Linseed meal Ground alfalfa	Dry rendered tankage	Dry rendered tankage Linseed meal Ground alfalfa
	Salt	Minerals	Salt	Minerals	Minerals	Minerals
Number of pigs at beginning.....	8	8	8	8	8	8
Number of pigs at close ^a	6	7	5	7	8	7
Initial weight per pig.....	54.85	54.50	54.44	54.42	55.08	54.77
Final weight per pig ^b	199.0	184.36	199.20	196.07	168.69	199.43
Average daily gain.....	1.11	.99	1.04	1.08	.90	1.18
Daily feed per pig:						
Corn.....	4.07	4.03	3.83	3.96	3.60	4.26
Protein supplement [†]46	.47	.55	.53	.36	.50
Ground alfalfa.....	.....	.....	.14	.14	.....	.15
Minerals.....	.02	.07	.02	.07	.07	.09
Total.....	4.55	4.57	4.54	4.70	4.03	5.00
Feed per 100 lb. gain:						
Corn.....	367.50	406.30	369.14	367.49	399.29	359.50
Protein supplement.....	41.04	47.00	53.42	49.20	39.29	42.55
Ground alfalfa.....	.....	.....	13.14	13.09	.....	12.67
Minerals.....	2.05	6.30	2.19	6.55	8.04	7.60
Total.....	410.59	460.20	437.89	436.33	446.62	422.33
Cost of feed per 100 lb. gain.....	\$7.75	\$8.45	\$8.08	\$7.95	\$8.31	\$7.77

*One pig was taken out of Lot 1, two out of Lot 4, and one out of Lot 6 because of a sickle-hocked or crook-legged condition, which did not show up when the test was started but became so bad as to interfere with the normal growth of the animal. One of these in Lot 4 and another pig which did poorly from the beginning were removed during the early part of the experiment and replaced with other animals.

The other removals were caused by losses which occurred as a result of an outbreak of hemorrhagic septicemia or swine plague.

†With the exception of the slower gaining lots the results are summarized to the time when the weekly weights of the pigs averaged nearest 200 pounds. The data for the former are summarized to April 10.

‡The lots fed linseed meal were given tankage and linseed meal in the ratio of 2:1, by weight.

Minerals—Salt, 19.4; limestone, 77.6; iron oxide, 2.97; potassium iodide, 0.03.

Corn 84¢ a bu.; tankage \$80, dry rendered tankage \$93.40, fish meal \$90, linseed meal \$60, ground alfalfa \$30, salt \$20, and limestone \$10 a ton; iron oxide 10¢ and potassium iodide \$5.00 a pound; grinding corn 10¢ a 100 lb.

The dry rendered tankage was a special product which as yet was not on the market. The price used for it was that which made its protein cost the same a pound as the protein in the ordinary steam-rendered tankage.

SUPPLEMENTS TO CORN FOR WINTER FEEDING

GRINDING OATS FOR PIGS

W. L. ROBISON

Grinding slightly reduced the amount of feed required for each 100 pounds of gain when oats constituted the entire grain portion of the ration, but the reduction was not sufficient to cover the cost of the grinding.

When fed along with corn the whole oats produced more rapid gains, and greater gains from a given amount of feed, than the ground oats. The performance of the pigs in Lot 10, which received the ground oats, however, was probably not typical of what may ordinarily be expected from grinding the oats and feeding them in this manner. At least, with few exceptions, providing the rations contained approximately the same percentages of whole and of ground oats, grinding paid well, when the oats were fed along with corn, in tests conducted by the Illinois, Indiana and Iowa Stations.

On the other hand, the data showing that it did not pay to grind the oats when they were fed as the only grain are substantiated by the findings of similar comparisons at the Iowa and Minnesota Stations.

Oats as a complete substitute for corn made a poorer comparative showing than in the tests which were conducted the two preceding years. In them ground oats, fed as the only grain were worth 86.6 percent as much a pound as corn, while in this year's trial they were worth only 75.5 percent as much.

The inclusion of a limited amount of whole oats in the ration of corn, tankage, ground alfalfa, and minerals, slightly increased the rate and efficiency of the gains and at the prices used also lowered the cost of the gains. The ration containing whole oats as compared with the similar one containing linseed meal, fed Lot 4, produced slightly faster gains but hardly as much gain from a given amount of feed.

Grinding Oats for Pigs

	Lot 7	Lot 8	Lot 9	Lot 10	Lot 11
Experiment started Dec. 5, 1928	Whole oats	Ground oats	Ground corn Whole oats	Ground corn Ground oats	Ground corn
Feeds mixed and self-fed	Tankage Ground alfalfa	Tankage Ground alfalfa	Tankage Ground alfalfa	Tankage Ground alfalfa	Tankage Ground alfalfa
	Minerals	Minerals	Minerals	Minerals	Minerals
Number of pigs at beginning..	8	8	8	8	8
Number of pigs at close.....	8	8	8	7	6
Initial weight per pig.....	53.54	53.54	53.83	54.56	54.52
Final weight per pig.....	140.75	137.25	206.12	173.71	200.75
Average daily gain.....	.66	.63	1.15	.98	1.05
Daily feed per pig:					
Corn.....			3.31	3.10	4.19
Oats.....	3.71	3.53	1.22	1.16	.....
Tankage.....	.13	.13	.38	.36	.49
Ground alfalfa.....	.12	.11	.15	.14	.15
Minerals.....	.06	.06	.08	.07	.07
Total.....	4.02	3.83	5.14	4.83	4.90
Feed per 100 lb. gain:					
Corn.....			289.43	316.14	400.36
Oats.....	564.97	560.59	106.17	118.06	.....
Tankage.....	19.94	20.25	32.90	36.93	46.35
Ground alfalfa.....	18.37	18.25	13.46	14.80	14.03
Minerals.....	9.19	9.12	6.73	7.40	7.02
Total.....	612.47	608.21	448.69	493.22	467.78
Cost of feed per 100 lb. gain....	\$11.05	\$11.83	\$ 8.08	\$ 9.07	\$ 8.54

Corn 84¢ and oats 56¢ a bu.; tankage \$80, ground alfalfa \$30, salt \$20, and limestone \$10 a ton; iron oxide 10¢ and potassium iodide \$5 a lb.; grinding corn 10¢, grinding oats 15¢ a 100 lb.

Two pounds of oats for each pound of tankage, linseed, alfalfa, and minerals were fed Lots 9 and 10.

The data for Lots 9 and 11 are summarized to the time when their weekly weights averaged nearest 200 pounds, and those for Lots 7, 8, and 10 to April 17.

These lots are comparable with the six on the "Supplements to Corn" experiment started on the same day.

ADDITIONS TO CORN, TANKAGE, AND MINERALS FOR PIGS IN DRY LOT

W. L. ROBISON

The merits of the trio supplemental mixture of tankage, linseed meal, and alfalfa for pigs not on pasture, were again demonstrated by the results obtained in this experiment. Including the linseed meal and ground alfalfa in the corn, tankage, and mineral ration enabled the pigs to reach an average weight of 250 pounds 17 days earlier and lowered the feed required for each 100 pounds of gain 16.5 pounds.

Linseed meal with tankage, although less effective than both linseed meal and ground alfalfa, proved superior to tankage alone for supplementing corn and minerals in two earlier tests, but not in this one. The rations differed only with respect to the minerals. Salt and limestone were used in one, and salt, limestone, and copperas in the other, of the earlier trials.

The mineral mixture of salt, limestone, and iron oxide was beneficial, even when the trio supplemental mixture was fed. Practically the same results were obtained from the tankage and minerals as from the trio mixture and no minerals, other than salt. In another trial conducted during the winter and spring of 1928, the same minerals and tankage proved slightly superior to the trio mixture and salt. These results indicate the mineral mixture of salt, limestone, and iron oxide to be an effective one for use with corn and tankage, or corn and the trio mixture.

Rice polish fed in place of the linseed meal and ground alfalfa was practically as efficient as the latter. Which would prove the more economical would depend on the relative prices of the feeds.

Hulled oats, at the price given in the table, were hardly as economical as linseed meal. As determined by the value of the feed replaced they were worth \$55.64 a ton. In 1927 hulled oats fed in the place of linseed meal, but at the same rate as the tankage, showed a value of \$60.76 a ton. In both trials the pigs getting the hulled oats outgained those getting the linseed meal and made as much or more gain from a given amount of feed. Commercial hulled oats were used.

Cottonseed meal compared favorably with linseed meal so far as the cost and the feed required per unit of gain were concerned, but failed to produce quite as rapid gains. In an earlier trial linseed meal produced a little faster gains and a little larger gains from a given amount of feed than did cottonseed meal. Whether to replace the linseed meal in the trio mixture with cottonseed meal depends largely on the price of the two feeds.

Additions to Corn, Tankage, and Minerals for Pigs in Dry Lot

Experiment started Jan. 10, 1928. Seven pigs per lot. Feeds mixed and self-fed

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
	Corn	Corn	Corn	Corn	Corn	Corn	Corn
	Tankage	Tankage, 2 Linseed meal, 1	Tankage, 2 Linseed meal, 1 Ground alfalfa, 1	Tankage, 2 Linseed meal, 1 Ground alfalfa, 1	Tankage, 2 Cottons'd meal, 1 Ground alfalfa, 1	Tankage* Hulled oats Ground alfalfa	Tankage, 1 Rice polish, 1
	Minerals	Minerals	Minerals	Salt	Minerals	Minerals	Minerals
Number of pigs.....	7	7	7	7	7	7	7
Initial weight per pig.....	57.38	57.19	57.45	57.31	56.98	58.94	56.14
Final weight per pig.....	246.64	246.20	251.93	251.90	246.25	258.17	247.64
Average daily gain.....	1.23	1.16	1.38	1.24	1.30	1.58	1.37
Days required to gain 190 lb.....	155	164	138	153	147	120	139
Daily feed per pig, lb:							
Corn.....	4.56	4.50	4.68	4.40	4.48	4.65	4.47
Supplement.....	.45	.57	.72	.70	.66	1.25	.95
Minerals.....	.08	.08	.08	.02	.07	.08	.07
Total.....	5.09	5.15	5.48	5.12	5.21	5.98	5.49
Feed per 100 lb. gain, lb:							
Corn.....	370.79	388.86	339.42	353.94	345.23	294.17	327.13
Supplement.....	36.79	49.89	52.26	56.49	51.09	78.83	69.18
Minerals.....	6.21	6.68	5.56	2.06	5.63	5.30	5.22
Total.....	413.79	445.43	397.24	412.49	401.95	378.30	401.53
Cost of feed per 100 lb. gain.....	\$7.46	\$8.11	\$7.11	\$7.45	\$7.13	\$7.36	\$7.30

*Until the pigs reached an average weight of 120 lb. the tankage, hulled oats and ground alfalfa were fed in the proportions of 2:2:1; thereafter they were fed in the proportions of 2:3:1. For the experiment an average of .46 lb. of tankage, .56 lb. of hulled oats and .23 lb. of ground alfalfa was consumed daily a head; 28.78, 35.66 and 14.39 pounds of the three feeds, as named, were eaten per 100 lb. of gain produced.

Minerals—Salt, 19.4; limestone, 77.6; iron oxide, 3.

Corn 84¢ a bu.; tankage \$80, linseed meal \$60, ground alfalfa \$30, cottonseed meal \$53, hulled oats \$69.50, rice polish \$36.60, salt \$20, and limestone \$10 a ton and iron oxide 10¢ a lb.; grinding corn 10¢ a 100 lb.

MINERALS FOR FEEDING WITH CORN, TANKAGE, AND LINSEED MEAL TO PIGS IN DRY LOT

W. I. ROBISON

Adding only limestone to a ration of corn, tankage, linseed meal, and salt apparently failed to improve it. That the limestone did not appear to be helpful possibly was due to the unusually good showing made by the check lot. In tests reported in the Bimonthly Bulletin for September-October, 1927, limestone proved beneficial for feeding with a somewhat similar ration composed of corn, tankage, and salt.

Additional phosphorus in some form, such as a bone product or treble superphosphate was found helpful in mineral mixtures when they were fed with grains and protein feeds of plant origin. To secure data as to the need of a phosphorus-containing material in the minerals, when tankage, which carries around 15 percent of ash or bone, is fed, bone meal was included in the mineral mixture fed Lot 3. Apparently little was gained by adding it to the ration.

Iron, besides that contained in the feed, has been shown to be needed by pigs under certain conditions. Copperas, or iron sulphate, when fed with rations containing tankage has given both positive and negative results. In this experiment iron oxide was tried in the place of copperas as a source of iron and rather striking results were obtained from its use.

The ground alfalfa in the trio supplemental mixture made the only difference between the rations fed Lots 1 and 5. Although it did not increase the rate of growth, the alfalfa lowered the feed required per unit of gain and made the ration more economical. Further work is needed to definitely determine whether a ration of corn, tankage, and minerals, such as was fed Lot 4, would ordinarily prove more effective than one of corn and the trio mixture with no minerals except salt.

Unlike the other experiments in which the pigs were confined indoors, those in this test were kept outside in brick paved lots and sheltered in movable houses.

Minerals for Feeding With Corn, Tankage, and Linseed Meal to Pigs in Dry Lot

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Experiment started Feb. 8, 1928	Corn Tankage Linseed meal	Corn Tankage Linseed meal	Corn Tankage Linseed meal	Corn Tankage Linseed meal	Corn Tankage Linseed meal Ground alfalfa
Seven pigs per lot					
Feed mixed and self-fed	Salt	Salt, 20 Lime- stone, 80	Salt, 20 Lime- stone, 40 Raw bone meal, 40	Salt, 19.4 Lime- stone, 77.6 Iron oxide, 3.0	Salt
Initial weight per pig	47.55	47.93	48.79	47.98	47.43
Final weight per pig	224.75	208.00	216.29	223.07	213.07
Average daily gain	1.32	1.20	1.19	1.32	1.25
Daily feed per pig:					
Corn	4.23	3.93	3.84	3.90	3.67
Supplement* .....	.55	.51	.49	.50	.61
Minerals .....	.02†	.07	.07	.07	.02†
Total	4.80	4.51	4.40	4.47	4.30
Feed per 100 lb. gain:					
Corn	320.29	326.81	322.89	296.48	294.27
Supplement	41.67	42.31	41.37	38.32	49.28
Minerals	1.45	5.62	5.55	5.10	1.38
Total	363.41	374.74	369.81	339.90	344.93
Cost of feed per 100 lb. gain..	\$6.67	\$6.81	\$6.78	\$6.19	\$6.26

*Consists of tankage 2, linseed meal 1; except for Lot 5 which is tankage 2; linseed meal 1; ground alfalfa 1.

†Salt only.

Corn 84¢, tankage \$80, linseed meal \$60, ground alfalfa \$30, salt \$20, limestone \$10, and raw bone meal \$65 a ton; iron oxide 10¢ a lb.; grinding corn 10¢ a lb.

FLAX SEED FOR FATTENING PIGS

W. L. ROBISON AND L. E. THATCHER

Among spring seeded crops a mixture of barley and flax, as reported in Bulletin 421 by Thatcher, was found to yield 93.9 percent as much grain as oats alone and to slightly surpass oats in total digestible nutrients and in farm value per acre. The mixture contained an average of 92.8 percent of barley and 7.2 percent of flax by weight. To determine whether such a mixture could be fed to hogs successfully and to secure data as to its actual feeding value, a ration of ground barley and flax, in these proportions, supplemented with tankage, ground alfalfa, and minerals, was compared with a similar ration in which a sufficient amount of linseed meal to supply an equivalent percentage of protein was substituted for the flax seed.

The shotes in each lot were hand-fed twice daily and given all they would clean up readily. Those getting the flax seed ate less feed but made faster gains than those getting the linseed meal. According to analyses given in Henry and Morrison's "Feeds and Feeding", the ration containing flax seed and the one containing linseed meal had fat or oil contents of 5.25 and 2.60 percent, respectively. Although the former was relatively high in oil no difficulty from scouring was experienced.

The mixture made an average yield of 1,841 pounds to the acre. Based on the feed required per pound of gain in this test, the barley and flax grown on an acre, together with 100 pounds of tankage, 40 pounds of ground alfalfa, and 20 pounds of minerals, would thus produce 404 pounds of gain in live weight.

Since flax seed carries approximately 33.7 percent of oil, perhaps a word of warning as to the danger of producing soft pork, if it is fed in large amounts, is not out of place.

Flax Seed for Fattening Pigs

Five pigs per lot From November 27, 1928 to March 19, 1929 Feed mixed and hand-fed	Lot 1		Lot 2	
		Ground barley	82.8	Ground barley	87.2
	Ground flax	9.2	Linseed meal	6.0
	Tankage	5.0	Tankage	3.8
	Ground alfalfa	2.0	Ground alfalfa	2.0
	Minerals	1.0	Minerals	1.0
Initial weight per pig	97.7		98.43	
Average daily gain	1.13		1.03	
Daily feed per pig:				
Ground barley	46.2		5.43	
Ground flax .....	.51			
Linseed meal .....			.37	
Tankage .....	.28		.24	
Ground alfalfa .....	.11		.12	
Minerals .....	.06		.06	
Total	5.58		6.22	
Feed per 100 lb. gain:				
Ground barley	410.33		525.77	
Ground flax	45.59			
Linseed meal			36.18	
Tankage	24.78		22.91	
Ground alfalfa	9.91		12.06	
Minerals	4.95		6.03	
Total	495.56		602.94	
Cost of feed per 100 lb. gain	\$9.81		\$10.43	

Minerals—Salt, 18.4; limestone, 36.8; Glauber's salts, 5; iron oxide, 2.97; potassium iodide, .03.

Barley 72¢ a bu.; ground flax \$90, linseed meal \$60, tankage \$80, ground alfalfa \$30, salt \$20, and limestone \$10 a ton; Glauber's salts 4¢, iron oxide 10¢ and potassium iodide 5¢ a lb.; grinding barley 10¢ a 100 lb.

For a comparison of corn and barley, see Circular No. 10.

Barley alone yielded an average of 1,746 pounds to the acre which, along with 120 pounds of linseed meal, 76 pounds of tankage, 40 pounds of ground alfalfa and 20 pounds of minerals, on a basis of these data would produce 332 pounds of gain in live weight to the acre.

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