

Protein and Amino Acids in Swine Rations (Project 110).

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The value of a feed protein is determined by its content of available essential amino acids. For example, in relation to the pigs' needs, corn and milo proteins are definitely deficient in the amino acid lysine. Selection of a supplemental protein, therefore, should be based on its lysine content to balance the deficiency. Experimentally, low-protein rations have been supplemented with appropriate amino acids to produce gains and efficiencies equal to those obtained on rations containing 2 to 6% more protein.

Four experiments were conducted to determine the value of amino-acid supplementation to milo and wheat diets and the replacement value of wheat mill feed for milo in rations for growing-finishing swine.

One experiment was designed to evaluate the replacement value of milo for corn in a starter ration.

I. Replacement Value of Milo for Corn in Pig Starter Rations Fed in Meal and Pellet Form.

Sixty pigs weaned at about 4 weeks were used. They were strong and thrifty and averaged about 15 pounds each. Each treatment group of 5 pigs was confined to a pen in building T. The test lasted 32 days.

Results are summarized in Table 49.

There were no significant differences in rate of gain, feed intake and feed efficiency. There was evidence, however, that the 37.75% milo ration was more readily consumed in pellet form than in meal form. Rate of gain and feed efficiency also favored the pelleted ration.

The results suggest that, to the degree used in these rations, good-quality milo satisfactorily replaced corn in a pig starter ration.

Table 49

A comparison of milo and corn in rations for pigs weaned at four weeks of age, September 11 to October 13, 1961.

Ration no. ¹	43E	43F	43G	
% corn	37.75	18.75	....
% milo	....	19.00	37.75	
Av. initial wt., lbs.:				Av.
Meal	14.9	15.0	14.7	14.9
Pellet	15.0	15.0	14.3	14.8
Av.	15.0	15.0	14.5	
Av. final wt., lbs.:				
Meal	37.0	38.0	32.2	35.7
Pellet	37.5	31.2	35.4	34.7
Av.	37.0	34.6	33.8	
Av. daily gain, lbs.:				
Meal	0.69	0.72	0.54	.65
Pellet	0.68	0.52	0.64	.61
Av.	0.68	0.62	0.59	
Av. daily feed, lbs.:				
Meal	1.19	1.25	0.98	1.14
Pellet	1.11	1.04	1.08	1.08
Av.	1.15	1.14	1.03	
Feed per lb. of gain, lbs.:				
Meal	1.74	1.73	1.80	1.76
Pellet	1.66	1.99	1.69	1.78
Av.	1.70	1.86	1.74	

1. Respective numbers for the pelleted rations (3/16-inch pellets) were 43H, 43I, and 43J.

2. Each figure represents average performance of 2 pens of 5 pigs each.

II. Amino Acid Supplementation of Milo-soybean Meal Rations for Growing-finishing Swine.

Sixty pigs averaging about 45 pounds each were used. All groups of 5 pigs each were confined to pens in building W.

All rations were fed as 3/16-inch pellets.

Results in Table 50 show that adding 0.1% L-lysine to a 12% crude protein ration significantly increased rate of gain and daily feed intake, and decreased feed required per pound of gain. Higher levels of lysine were of no benefit. Growth rates were comparable between the 16% and 12% plus-lysine groups but the most efficient gains were obtained on the 16% ration. Thus, although response to added lysine proved the 12% ration to be lysine-deficient, the 12% plus-lysine rations were still inferior to the 16% rations in total amino acid balance as reflected in feed intake and feed required per pound of gain.

Table 50

Effects of amino acid additions to milo-soybean meal grower rations, July 23 to September 1, 1961.

Ration no.	69	70	70A	70B	70C	70D
Crude protein, %	16	12	12	12	12	12
Lysine added, % ¹	....	....	.10	.20	.30	.20
Methionine added, %	....	....	....	....	....	.10
Av. daily gain, lbs. ²	1.29	0.84	1.37	1.26	1.20	1.19
Av. daily feed, lbs. ³	3.03	2.80	3.39	3.18	3.26	3.12
Feed per lb. of gain, lbs.	2.34	3.33	2.70	2.52	2.70	2.63

1. Added as Lyamine containing 20% L-lysine activity.

2. Two groups of 5 pigs each, 45-95 pounds.

3. $p < .05$.

4. $p < .01$.

III. An Evaluation of Wheat as a Replacement for Milo and the Effects of Lysine Supplementation in Rations for Growing-finishing Swine.

Sixty pigs were used in this experiment. Each treatment group of 7 or 8 pigs was confined to a pen in building W.

Results in Tables 51 and 52 show that wheat was very efficiently utilized. For the growing period (Table 51) there were no significant differences among criteria measured. Neither protein level nor added lysine materially affected performance. Average daily gain for the wheat diets was 1.40 pounds while that on the milo-soybean meal diet was 1.32 pounds. Daily feed intake and feed required per pound of gain were lower for the wheat rations than for the milo-soybean meal rations.

During the finishing stage (Table 52) wheat and wheat plus 0.10% lysine produced gains and feed efficiency equal to the wheat-soybean meal ration. Lowest daily gain and feed efficiencies were realized from the milo-soybean meal ration.

The differences in feed required per pound of gain among treatments were significant ($p < .05$).

The results suggest that in isonitrogenous rations having soybean meal (44% CP) as supplementary protein, wheat was more efficiently utilized than was milo. Further, for the finishing pig (120 pounds to 200 pounds) wheat plus vitamins, minerals and an antibiotic produced satisfactory gains and efficiencies. Lysine supplementation was not beneficial in this experiment.

Additional experiments are planned to determine relative feeding values of different grains in swine rations.

Table 51

Comparison of milo-soybean meal, wheat-soybean meal, wheat-soybean meal-plus-lysine rations for growing swine, November 23 to December 30, 1964.

Ration no. ¹	S-76	S-76A	S-76B	S-76C
Cereal	Milo	Wheat	Wheat	Wheat
Crude protein, % ²	16	16	14	14
Added lysine, % ³	.....	.....	.....	0.12
Av. initial wt., lbs. ⁴	66	68	66	65
Av. final wt., lbs.	115	120	118	117
Av. daily gain, lbs.	1.32	1.40	1.40	1.39
Av. daily feed, lbs.	4.25	4.04	4.19	4.12
Feed per lb. of gain, lbs.	3.23	2.90	2.98	2.95

1. Rations pelleted (3/16-inch pellets) for replicate one. Fed as crumbles in replicate 2.

2. Calculated values.

3. Added as Lysamine containing 50% L-lysine activity.

4. Each figure represents average of 2 pens of 8 and 7 pigs each.

Table 52

Comparison of milo-soybean meal, wheat-soybean meal, wheat, and wheat-plus-lysine rations for finishing pigs, December 30, 1964, to January 29, 1965.

Ration no. ¹	S-76H	S-76B	S-76I	S-76JJ
Cereal	Milo	Wheat	Wheat	Wheat
Crude protein, % ²	12	14	12	12
Added lysine, % ³	.....	.....	.....	0.10
Av. initial wt., lbs. ⁴	115	120	119	117
Av. final wt., lbs.	167	175	176	175
Av. daily gain, lbs.	1.75	1.82	1.91	1.95
Av. daily feed, lbs.	5.50	5.28	5.35	5.44
Feed per lb. of gain, lbs. ⁵	3.14	2.90	2.78	2.77

1. Rations in pellet form for replicate 1. Fed as crumbles in replicate 2.

2. Assay values were 13.4, 16.1, 13.9, and 13.5%, respectively.

3. Added as Lysamine containing 50% L-lysine activity.

4. Each figure represents average of 2 pens of 7 and 8 pigs each.

5. $p < .05$.

IV. An Evaluation of Wheat as the Sole Source of Protein and Wheat Plus Lysine for Growing Swine.

Forty-eight pigs averaging about 45 pounds each were used. Each treatment group of 6 pigs was confined to a pen in building M. All rations were pelleted.

The data in Table 53 show that average daily gains were significantly ($p < .01$) affected by ration treatment. Wheat supplemented with vitamins, minerals and antibiotic was inadequate for the 44-pound pig. Daily feed intake was only 2.73 pounds, which was about 11% less than on the other three rations. This reduced feed intake is a characteristic response to an amino-acid-deficient diet. That lysine was the primary limiting amino acid is proved by the stimulatory effect on feed intake resulting from adding lysine. Rate of gain was about the same from the lysine-supplemented rations, but feed required per pound of gain was least with the 0.20% lysine addition. The latter was comparable to that from the wheat-soybean meal 16% crude protein ration.

Rate of gain was less than satisfactory in this experiment. The two apparent reasons for low performance were severe cold weather and relatively low feed consumption. It has been observed that wheat diet pellets are harder than milo diet pellets and may be less readily consumed because of the hardness. Other experiments are planned to study effects of the physical nature of the ration and its acceptability by pigs of different ages.

Table 53

Comparison of wheat-soybean meal, wheat, and wheat-plus-lysine rations for growing swine, January 25 to March 9, 1965.

Ration no.	S-76A	S-76I	S-76J	S-76JJ
Crude protein, % ¹	16	12	12	12
Added lysine, % ²	.....	.....	.10	.20
Av. initial wt., lbs. ³	44	44	46	44
Av. final wt., lbs.	89	73	88	87 ⁴
Av. daily gain, lbs. ⁵	1.07	0.67	0.97	1.02
Av. daily feed, lbs.	3.01	2.73	3.15	3.04
Feed per lb. of gain, lbs.	2.94	4.08	3.24	2.93

1. Assay values were 18.4, 14.5, 14.3, and 14.7%, respectively.

2. Added as Lysamine containing 50% L-lysine activity.

3. Each figure represents an average of 2 pens of 6 pigs each.

4. Two pigs from one pen died. Cause of death unrelated to diet.

5. $p < .01$.

V. Feed Value of Wheat Mill Feed in Rations for Swine.

By-products of wheat flour milling include such things as bran, shorts and middlings. Those fractions represent about a fourth of the kernel weight and usually have a higher protein value than milo or corn. Certain of the by-products have been considered as supplemental feeds, but more realistically should be considered as substitutes for grain in swine rations.

This experiment was to determine effects of substituting wheat mill feed for milo in milo-soybean meal rations for growing-finishing swine.

The results are shown in Table 54. There were no significant differences due to dietary treatment. The highest rate of gain was obtained with the 7.5% level of wheat mill feed. Daily feed intake tended to increase, and feed efficiency decreased with increase in dietary wheat mill feed.

Table 54
Effects of different levels of wheat mill feed in swine rations, November 17, 1964, to January 15, 1965.

	% wheat mill feed ¹				Av.
	0	7.5	15.0	30.0	
84 to 142 lbs. (November 17 to December 23, 1964)					
Av. daily gain, lbs. ²	1.68	1.91	1.75	1.61	1.74
Av. daily feed, lbs.	5.05	5.77	5.51	5.81	5.53
Feed per lb. of gain, lbs.	3.00	3.00	3.15	3.64	3.20
142 to 183 lbs. (December 23, 1964, to January 15, 1965)					
Av. daily gain, lbs.	1.71	1.88	1.71	1.88	1.79
Av. daily feed, lbs.	6.06	6.23	6.72	7.09	6.52
Feed per lb. of gain, lbs.	3.55	3.30	3.95	3.76	3.64

1. Consisted of approximately 60% bran, 22% shorts, 13% tallings, and 4% red dog. Analyzed about 17% crude protein.

2. The rations analyzed 16.9, 17.1, 18.2, and 18.5% crude protein, respectively, and 2.7, 2.6, 3.3, and 4.2% crude fiber, respectively.

3. Each figure represents average performance of 2 pens of 5 pigs each. They were housed in building M.

Effects of Feed Processing on Ration Utilization (Project 110).

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Previous reports from the Kansas Station have shown that method of processing grains and rations may affect acceptance by the animal and efficiency of utilization.

The experiment reported here was designed to evaluate the effects of grinding fineness (of milo and wheat) on feeding value for growing swine.

I. Effect of Fineness of Grind of Wheat and Milo on Utilization in Diets for Growing Swine.

Forty-eight pigs averaging about 55 pounds each were used. Each treatment group of 6 pigs was confined to a pen in building W.

Either 1/8-inch or 1/16-inch screens were used in the hammer mill grinder to grind the wheat and milo. The respective ground products were mixed with the appropriate ration ingredients, then the ration was pelleted (3/16-inch pellet).

Results are shown in Table 55.

Fineness of grind had no significant effect on rate of gain, daily feed intake or feed required per pound of gain.

Average rate of gain from the milo diets was 1.35 while that from the wheat diets was 1.24 pounds. They reflect the different levels of daily feed intake of 3.60 and 3.22 pounds, respectively. Pigs receiving the milo diet required slightly more feed per pound of gain than those receiving wheat diets.

The results suggest no advantage of 1/16-inch grind over 1/8-inch grind of milo and wheat used in diets for growing swine.

Table 55
Effect of fineness of grind of wheat and milo on utilization in diets for growing swine, January 26 to March 4, 1965.

Ration no. ¹	S-76	S-76N	S-76A	S-76AA
Cereal	Milo	Milo	Wheat	Wheat
Grinder screen	1/8"	1/16"	1/8"	1/16"
Av. initial wt., lbs. ²	54	55	54	55
Av. final wt., lbs.	104	106	102	100
Av. daily gain, lbs.	1.34	1.37	1.28	1.20
Av. daily feed, lbs.	3.54	3.65	3.34	3.10
Feed per lb. of gain, lbs.	2.63	2.66	2.59	2.58

1. Forty-five percent crude protein soybean meal was used to supplement the respective cereals to provide a 16% crude protein ration.

2. Each figure represents an average of 2 pens of 6 pigs each.