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Increasing the energy content of swine diets will generally improve feed efficiency as less feed is consumed and rate of gain is not affected. Limited research with weaned pigs has indicated that the lysine requirement is increased as dietary energy increases when there are relatively large differences in dietary energy content. Previous research at this station (A.S. Series 76-33) did not indicate any significant difference in the lysine needs of growing and finishing pigs when 5% fat was included in a corn-soybean diet. The experiment reported here was conducted to obtain additional information on the effect of lysine and energy relationships in diets fed to growing and finishing swine.

Experimental Procedure

The experiment consisted of two separate trials, a growing and a finishing trial. In both trials, 96 crossbred pigs were allotted on the basis of weight, sex and ancestry to 12 replicated treatments with four pigs per pen. The animals were housed in uninsulated, wooden buildings with concrete floors and an outside concrete lot where self-feeders and waterers were located. Blood samples were taken at the end of each trial for analysis of blood urea nitrogen (BUN).

Growing Trial. The growing trial was conducted for 5 weeks with pigs of an average initial weight of 46 pounds. Treatments consisted of two energy levels and six lysine levels within each energy level. The composition of the two diets used is shown in table 1. The corn starch diet was calculated to contain approximately 1404 kcal of metabolizable energy (ME) per lb. and the diet with 5% fat had 1512 kcal ME per pound. L-lysine was added to the basal diets in .05% increments. Thus, dietary treatments contained .50, .55, .60, .65, .70 and .75% lysine at two energy levels.

Finishing Trial. The pigs used in this trial weighed an average of 126 lb. initially and the trial was conducted for 6 weeks. Treatments again consisted of two energy levels (1427 and 1536 kcal ME per lb.) and six lysine levels (.40, .45, .50, .55, .60 and .65%) within each energy level. Composition of the basal diets is shown in table 2.

Results

Growing Trial. Data for average daily gain, daily feed, feed/gain and BUN levels are presented in table 3. Means for average daily gains did not differ significantly among treatments for either lysine or energy levels. However, there was a trend for more rapid gains as the lysine level increased to .70% in the starch diet. Since gains did not increase in this manner when pigs were fed the higher energy, fat diets, it is possible that the higher energy content increased amino acid requirements which may have resulted in a deficiency of tryptophan prohibiting a response from added levels of lysine.

Daily feed consumption was less when pigs were fed the higher energy diet with 5% fat replacing 5% starch. Approximately 9% less feed was consumed daily by pigs fed the higher energy diet. Significantly less feed/gain was required by pigs fed the higher energy diets. Feed/gain was 2.86 for animals fed the higher energy diet and 3.03 for those fed the starch diet. There was no significant difference in feed/gain among the lysine treatments, although there was a linear decrease in feed/gain as lysine levels increased. Blood urea nitrogen levels were less in pigs fed the 5% fat diet.

Finishing Trial. Table 4 summarizes the results of the finishing trial. Supplemental lysine resulted in improved gains of pigs fed the diet of 5% starch. However, when fat replaced starch, an increase in gains was noted only in pigs fed diets of .45 and .50% lysine with gains decreasing with each additional level of lysine. This may have been due to a lysine imbalance in these diets. Pigs fed the lower energy diets gained 1.68 lb. daily compared to 1.54 lb. for those fed the higher energy diets.

Significantly less feed was consumed daily by pigs fed the higher energy diets. Pigs fed the two higher lysine level diets also consumed less feed and were more efficient in feed conversion than pigs fed the other lysine treatments.

An improvement in lysine balance of the diets with increasing levels of dietary lysine was indicated by the linear decrease in BUN that was observed. The data for both feed/gain and BUN levels indicate that .60% lysine gives optimum performance of pigs fed the lower energy diet of 1427 kcal ME per lb., but the data for pigs fed the higher energy were not consistent enough to establish the dietary lysine needed in this diet.

Summary

Dietary energy and lysine level relationships were studied in two trials, each using 96 crossbred pigs. The lower energy diets, 1404 kcal ME per lb. in the growing phase and 1427 kcal ME in the finishing phase, resulted in near optimum performance when they contained .70 and .60% lysine for the growing and finishing phases, respectively. No requirement was established for the higher energy diet.

Additional dietary energy resulted in less daily feed consumption and an improvement in feed efficiency.

Table 1. Composition of Growing Diets (Percent)

Ingredients	Starch diet	Fat diet
Corn	81.6	81.6
Soybean meal, 44%	10.1	10.1
Corn starch	5.0	--
Animal fat	--	5.0
Trace mineralized salt	.5	.5
Dicalcium phosphate	1.3	1.3
Limestone	1.0	1.0
Premix[a]	.5	.5

[a] Supplied per lb. of diet: vitamin A, 1500 IU; vitamin D, 150 IU; vitamin E, 5 IU; riboflavin, 1.25 mg; pantothenic acid, 5 mg; niacin, 8 mg; choline, 25 mg; vitamin B_{12}, 5 mcg and auroemycin, 10 milligrams.

Table 2. Composition of Finishing Diets (Percent)

Ingredients	Starch diet	Fat diet
Corn	86.0	86.0
Soybean meal, 44%	6.2	6.2
Corn starch	5.0	--
Animal fat	--	5.0
Trace mineralized salt	.5	.5
Dicalcium phosphate	1.1	1.1
Limestone	.7	.7
Premix[a]	.5	.5

[a] See table 1.

Table 3. Effect of Lysine and Energy Levels on Performance of Growing Pigs

	Lysine, %						Means for energy
	.50	.55	.60	.65	.70	.75	
Average daily gain, lb.							
Starch diet	.97	1.06	1.06	1.12	1.15	1.04	1.08
Fat diet	.99	1.08	.99	1.08	.99	.99	1.01
Means for lysine	.98	1.07	1.02	1.10	1.08	1.01	
Average daily feed, lb.							
Starch diet	3.09	3.15	3.28	3.28	3.33	3.00	3.20
Fat diet	2.91	3.28	2.73	3.04	2.69	2.73	2.91
Means for lysine	3.00	3.22	3.00	3.16	3.02	2.87	
Feed/gain, lb.[b]							
Starch diet	3.20	3.00	3.12	2.97	2.88	2.99	3.03
Fat diet	2.95	3.04	2.78	2.86	2.75	2.76	2.86
Means for lysine	3.08	3.02	2.95	2.92	2.82	2.88	
BUN, mg %[b]							
Starch diet	22.45	29.24	21.09	23.16	23.68	25.18	24.13
Fat diet	25.88	21.80	22.28	19.26	13.25	20.21	20.45
Means for lysine	24.16	25.52	21.68	21.21	18.46	22.69	

[a] Two replicates of four pigs each per treatment, average initial wt., 46 pounds.
[b] Significant differences due to energy ($P<.05$).

Table 4. Effect of Lysine and Energy Level on Performance of Finishing Pigs[a]

	Lysine, %						Means for energy
	.40	.45	.50	.55	.60	.65	
Average daily gain, lb.							
Starch diet	1.59	1.63	1.68	1.81	1.74	1.70	1.68
Fat diet	1.54	1.72	1.68	1.52	1.46	1.41	1.54
Means for lysine	1.57	1.68	1.68	1.66	1.60	1.56	
Average daily feed, lb.[b]							
Starch diet	5.93	5.67	5.91	6.15	5.38	5.34	5.71
Fat diet	5.22	5.64	5.49	4.87	4.94	4.52	5.11
Means for lysine	5.56	5.66	5.69	5.51	5.16	4.94	
Feed/gain, lb.							
Starch diet	3.76	3.50	3.50	3.43	3.10	3.15	3.41
Fat diet	3.39	3.30	3.29	3.21	3.42	3.22	3.30
Means for lysine	3.57	3.40	3.40	3.32	3.25	3.18	
BUN, mg %[c]							
Starch diet	12.65	13.80	12.29	13.62	9.89	12.64	12.48
Fat diet	14.32	14.10	11.58	10.86	11.29	10.89	12.17
Means for lysine	13.49	13.95	11.93	12.24	10.59	11.76	

[a] Two replicates of four pigs each per treatment, average initial weight, 126 pounds.
[b] Significant difference due to energy ($P<.05$).
[c] Significant difference due to lysine ($P<.05$).