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High feed prices the past few years have stimulated interest in adding fat to swine rations in an attempt to increase feed efficiency and improve rate of gain. Research has shown that, to get maximum utilization of added energy, protein levels in the diet also must be increased to maintain the calorie to protein ratio. In normal corn-soybean meal rations, lysine has been shown to be the first limiting amino acid. The experiment reported here was conducted to determine the lysine levels necessary in diets with and without fat and their effect on feed consumption, feed efficiency and rate of gain.

Experimental Procedure

The experiment consisted of a growing and a finishing trial. In the growing trial 108 crossbred pigs were allotted to 12 experimental treatments in two replicates on the basis of weight, sex and ancestry. In replicate 1 there were 5 pigs per treatment and 4 per treatment group in replicate 2. The growing trial was conducted for 5 weeks. Treatments consisted of two energy levels and six lysine levels within each energy level. Diets were as follows:

Diets 1-6--Low energy, corn-soy-starch
Diets 7-12--High energy, corn-soy-fat

	Lysine content, %
Diets 1 and 7	0.60
Diets 2 and 8	0.65
Diets 3 and 9	0.70
Diets 4 and 10	0.75
Diets 5 and 11	0.80
Diets 6 and 12	0.85

The compositions of the basal diets used in the growing trial are shown in table 1. A low protein (13%) diet containing 0.6% lysine was used with lysine supplemented at increments of 0.05% up to 0.85%.

In the finishing trial 96 crossbred pigs were allotted to 12 treatments, with 4 pigs per pen and two replicates per treatment. The trial was conducted

for 5 weeks. Treatments again consisted of two energy levels and six lysine levels within each energy level. Diets were as follows:

Diets 1-6--Low energy, corn-soy-starch
Diets 7-12--High energy, corn-soy-fat

	Lysine content, %
Diets 1 and 7	0.40
Diets 2 and 8	0.45
Diets 3 and 9	0.50
Diets 4 and 10	0.55
Diets 5 and 11	0.60
Diets 6 and 12	0.65

The compositions of the 10% protein basal diets used in the finishing trial are shown in table 2. Lysine was added to the basal diet which contained 0.4% lysine in 0.05% increments up to 0.65%.

All diets were supplemented with minerals and vitamins to meet National Research Council recommendations. Feed and water were provided ad libitum. The animals were housed in uninsulated wooden buildings set on concrete. Feeders and waterers were located on the outside concrete lots to which animals had access at all times. The growing trial was conducted from the beginning of September to mid-October and the finishing trial ran from the end of October to mid-December. Blood samples were taken at the end of each trial for analysis of blood urea nitrogen (BUN).

Results

Growing

Results of the growing trial are shown in table 3. Means for average daily gains did not differ significantly among treatments for either lysine or energy levels and no interaction was observed. Feed efficiency data, although not significantly different, showed a trend toward greater efficiency when rations containing fat were fed.

Blood urea nitrogen (BUN) levels were significantly lower for the higher lysine diets. BUN levels are an indicator of optimum protein or amino acid levels. A lower BUN value indicates fewer amino acids are being used for energy. The higher values obtained for the low lysine diets (1, 7 and 2, 8) indicate these diets were probably deficient in lysine. Diets containing 0.7% lysine or more appeared to be adequate in lysine.

Finishing

Results of the finishing trial are shown in table 4.

Pigs fed the diets containing 5% fat (diets 7-12) were more efficient than pigs fed diets with 5% added corn starch (diets 1-6). No differences were observed in regard to feed efficiency due to different lysine levels.

One interaction between lysine and fat levels existed with respect to average daily feed consumption. As lysine levels increased in the rations without fat, average daily feed consumption decreased for the high lysine rations of 0.60 and 0.65%. For the rations with 5% fat a trend in the opposite direction was observed, as pigs fed the 0.65% lysine diet had the highest average daily feed consumption (figure 1). This may indicate an amino acid imbalance occurred in the starch ration as the lysine level increased.

Summary

One hundred eight crossbred pigs averaging 50.9 lb. were used in the growing trial and 96 crossbred pigs averaging 160.6 lb. in the finishing trial. Both trials were used to study the effect of dietary lysine and energy levels.

BUN values for the growing pigs indicate that optimum lysine levels are around 0.7% of the diet. No increase in requirement was observed with diets containing added fat.

The results indicate that dietary fat improved feed efficiency for finishing pigs and tended to have a similar effect when fed to growing pigs. An interrelationship was observed in the finishing diets between lysine and energy levels. Increasing lysine beyond 0.55% in diets that did not contain fat resulted in decreased consumption, while consumption increased with increasing lysine levels when pigs were fed diets of 5% fat.

Table 1. Composition of Growing Diets (Percent)

Ingredients	Diet no. 1-6	Diet no. 7-12
Corn	77.6	77.6
Soybean meal, 44%	14.1	14.1
Corn starch	5.0	--
Fat	--	5.0
Trace mineralized salt[a]	0.5	0.5
Dicalcium phosphate	1.3	1.3
Limestone	1.0	1.0
Premix[b]	0.5	0.5

[a] Contained 0.8% zinc.

[b] Supplied per pound 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 aureomycin, 10 milligrams.

Table 2. Composition of Finishing Diets (Percent)

Ingredient	Diet no. 1-6	Diet no. 7-12
Corn	86.0	86.0
Soybean meal, 44%	6.2	6.2
Corn starch	5.0	--
Fat	--	5.0
Dicalcium phosphate	1.1	1.1
Limestone	0.7	0.7
Trace mineralized salt[a]	0.5	0.5
Premix[b]	0.5	0.5

[a]See table 1.
[b]See table 1.

Table 3. Effect of Lysine and Fat on Performance of Growing Pigs[a]

Lysine %	0.60	0.65	0.70	0.75	0.80	0.85	Means for energy
Average daily gain, lb.							
Low energy	1.42	1.58	1.40	1.50	1.48	1.44	1.47
High energy	1.50	1.52	1.55	1.43	1.63	1.53	1.53
Means for lysine	1.46	1.55	1.47	1.47	1.55	1.48	
Average daily feed, lb.							
Low energy	4.21	4.58	4.08	4.38	4.03	4.05	4.22
High energy	3.90	4.44	4.01	3.92	4.37	4.04	4.11
Means for lysine	4.05	4.51	4.04	4.15	4.20	4.04	
Feed/gain, lb.							
Low energy	3.00	2.92	2.90	2.96	2.76	2.81	2.89
High energy	2.64	2.96	2.60	2.78	2.70	2.67	2.73
Means for lysine	2.82	2.94	2.75	2.87	2.74	2.74	
BUN, mg %[b]							
Low energy	15.15	13.02	11.95	12.22	12.37	11.06	12.63
High energy	14.89	13.06	12.11	11.74	10.56	11.13	12.25
Means for lysine	15.01	13.04	12.03	11.98	11.46	11.09	

[a]Nine pigs per treatment--average initial weight 50.9 lb., average final weight 103 lb.
[b]Significant difference due to lysine, mg % decrease at decreasing rate as lysine increases (linear, $P<.005$; cubic, $P<.05$).

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

Lysine %	0.40	0.45	0.50	0.55	0.60	0.65	Means for energy
Average daily gain, lb.							
Low energy (starch)	1.84	1.93	1.93	1.95	1.75	1.62	1.84
High energy (fat)	1.74	1.81	1.96	1.97	1.98	1.96	1.90
Means for lysine	1.79	1.87	1.95	1.96	1.86	1.79	
Average daily feed, lb.[b]							
Low energy	7.58	8.44	8.00	8.05	7.23	6.52	7.64
High energy	7.32	7.56	7.38	7.48	7.52	7.84	7.52
Means for lysine	7.46	8.00	7.69	7.76	7.38	7.18	
Feed/gain, lb.[c]							
Low energy	4.14	4.42	4.14	4.12	4.13	4.04	4.17
High energy	4.22	4.18	3.78	3.80	3.80	4.00	3.96
Means for lysine	4.18	4.30	3.96	3.96	3.96	4.02	
BUN, mg %							
Low energy	13.59	14.71	15.38	16.94	14.53	11.94	14.51
High energy	15.61	15.94	14.14	11.39	11.39	12.60	13.71
Means for lysine	14.60	15.32	14.76	14.17	13.54	12.27	

[a]Eight pigs per treatment--average initial weight 160.6 lb., average final weight 225 lb.
[b]Interaction between fat and lysine ($P<.05$).
[c]Significantly greater feed/gain for low energy than for high energy ($P<.05$).

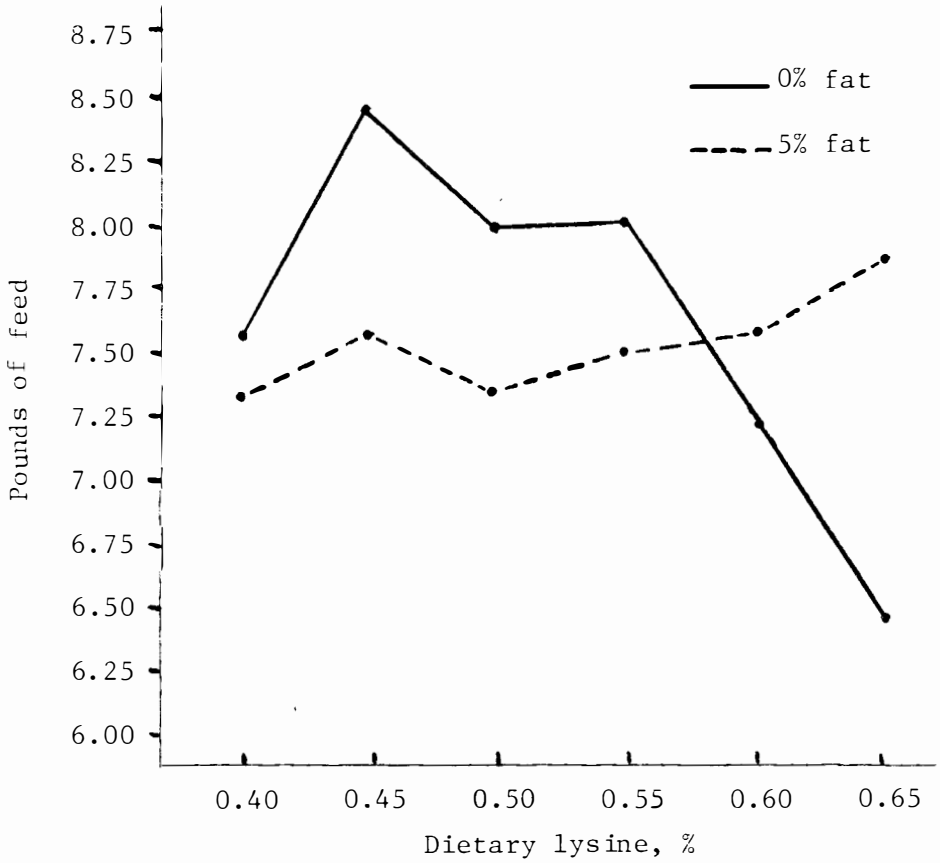

Figure 1. Effect of dietary lysine level and fat control.