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EFFECT OF LYSINE IN STARTER DIETS ON PERFORMANCE AND CARCASS CHARACTERISTICS OF SWINE

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Current research indicates that the lysine level suggested by the National Research Council for starter pigs (10 to 20 kg) may be inadequate. Lysine, the first limiting amino acid in most swine rations, is mainly provided by soybean meal in cereal-based diets. With the increasing price of soybean meal, it is important to determine the correct lysine requirement in order to minimize the amount of soybean meal needed in the ration. In low protein diets, lysine has been shown to increase rate of gain and decrease feed/gain in swine. It also effects carcass characteristics by increasing loin-eye area and total amount of lean, while decreasing fat percentage.

The purpose of this experiment was to determine the effects of varying levels of lysine in starter diets on performance of swine from weaning to slaughter and on the resulting carcass characteristics.

Experimental Procedure

A total of 265 crossbred weanling pigs averaging 17 lb were used in three trials and allotted to four treatments by weight, sex and ancestry. Two barrows and two gilts were assigned to a pen, and pens in the same replication had uniform weights. In trials 1 and 3, each treatment was replicated six times and trial 2 consisted of five replicated lots per treatment. The pigs were housed in an environmentally controlled room on a slotted floor until they reached a pen average weight of 44 lb. They were then moved to a confinement barn where all pigs in the same trial received identical diets. The pigs in trial 1 received .70% lysine from 44 lb to 77 lb and .61% lysine from 77 lb to 220 lb. At 220 lb, the barrows were slaughtered and carcass data obtained. The pigs in trial 2 received .70% lysine from 44 lb to 77 lb at which time the trial was terminated. Data for trial 3 are included only for the period to 44 lb. The four lysine treatments fed to 44 lb in each trial were as follows:

Trial 1	Treatment 1 --	.75% lysine
	Treatment 2 --	.85% lysine
	Treatment 3 --	.95% lysine
	Treatment 4 --	1.05% lysine
Trial 2	Treatment 1 --	.8 % lysine
	Treatment 2 --	.9 % lysine
	Treatment 3 --	1.0 % lysine
	Treatment 4 --	1.1 % lysine
Trial 3	Treatment 1 --	.8 % lysine
	Treatment 2 --	.95% lysine
	Treatment 3 --	1.1 % lysine
	Treatment 4 --	1.25% lysine

The composition of the diets is shown in table 1.

Table 1. Composition of Experimental Diets (%)

Ingredients	Trial 17 to 44 lb 1	17 to 44 lb 2,3	44 to 77 lb 1	44 to 77 lb 2	77 to 220 lb 1
Ground corn	50.22	65.71	80.18	78.28	84.10
Oat groats	20.00	---	---	---	---
Soybean meal, 44%	14.20	18.71	17.00	19.00	13.50
Dried whey	10.00	10.00	---	---	---
Yellow grease	2.00	2.00	---	---	---
Dicalcium phosphate	2.20	2.20	1.60	1.50	1.30
Ground limestone	.65	.65	.70	.70	.70
Trace mineral mix[a]	.05	.05	.05	.05	.05
White salt	.30	.30	.30	.30	.30
Vitamin premix[b]	.03	.03	.03	.03	.03
ASP 250	.25	.25	---	---	---
Banminth	.10	.10	.10	.10	---
Aureo-50	---	---	.04	.04	.02

[a] Provided the following minerals in ppm: zinc, 100; iron, 75; copper, 7.5; manganese, 25; iodine, .175 and selenium .1.

[b] Provided per 1b of diet: vitamin A, 2000 IU; vitamin D, 200 IU; riboflavin, 2.25 mg; pantothenic acid, 9 mg; niacin, 12 mg; vitamin B_{12}, 9 mcg; vitamin E, 7.5 IU and vitamin K, 1.5 mg.

Results

The performance data for the pigs in trial 1 are summarized in table 2. During the period from 17 to 44 lb, pigs receiving diets containing .95 and 1.05% lysine gained faster ($P<.01$) than pigs fed the .75% lysine diet. Also, pigs fed the 1.05% lysine diet gained faster ($P<.05$) than did pigs fed the .85% lysine diet. For the periods of 44 to 77 and 77 to 220 lb and the composite growth period (17 to 220 lb) there were no significant differences in rate of gain among treatments. There were no differences among treatment means for average daily feed during any of the periods. During the initial period, pigs receiving diets containing .95 and 1.05% lysine required less feed/gain ($P<.01$) than did pigs fed diets of .75 and .85% lysine. There were no differences among treatments in feed efficiency during the subsequent growth periods or for the overall period. The varying levels of lysine fed during the initial period did not result in any significant differences in any of the carcass characteristics measured.

The results of the second trial are presented in table 3. Pigs fed the three highest lysine levels (.9, 1.0 and 1.1%) had significantly greater average daily gains than the pigs fed the .8% lysine diet. Gains for the 44 to 77 lb and 17 to 77 lb periods were not significantly different. Feed consumption during the 17 to 44 lb period was significantly greater for pigs receiving the .9% lysine diet. However, average daily feed was not significantly different among treatments for the periods of 44 to 77 lb or 17 to 77 lb. Dietary lysine levels had an effect on the feed efficiencies during each of the growth periods. During the 17 to 44 lb stage, pigs consuming diets containing 1.0 and 1.1% lysine required significantly less feed/gain than did pigs receiving .8 and .9% lysine diets. During the period from 44 to 77 lb pigs that had previously received the .8% lysine diet required the most feed/gain while those previously fed .9% dietary lysine required the least feed/gain. For the overall period, 17 to 77 lb pigs fed .9, 1.0 or 1.1% lysine from 17 to 44 lb required less feed/gain ($P<.05$) than did pigs fed the .8% lysine diet to 44 lb.

The only data available for trial 3 at the time of writing this report were for the 17 to 44 lb period. These data are summarized in table 4. There were no significant differences due to dietary lysine levels in average daily gain or average daily feed. However, pigs receiving diets containing 1.10 and 1.25% lysine had significantly better feed efficiencies than did pigs receiving the .95% lysine diet.

Table 2. Performance Characteristics (Trial 1)[a]

Treatment No	1	2	3	4
Lysine level, %	.75	.85	.95	1.05
	Avg daily gain, lb			
17 to 44 lb[b]	.73	.78	.83	.86
44 to 77 lb	1.23	1.25	1.26	1.25
77 to 220 lb	1.77	1.71	1.77	1.73
17 to 220 lb	1.38	1.38	1.43	1.43
	Avg daily feed, lb			
17 to 44 lb[c]	1.59	1.60	1.56	1.58
44 to 77 lb	3.92	4.08	3.75	3.94
77 to 220 lb	6.61	6.99	6.85	6.92
17 to 220 lb	4.72	5.06	4.91	5.07
	Feed/gain			
17 to 44 lb	2.20	2.06	1.86	1.85
44 to 77 lb	3.19	3.29	2.99	3.15
77 to 220 lb	3.76	4.10	4.01	4.00
17 to 220 lb	3.46	3.67	3.51	3.55
	Carcass data			
Avg backfat, in	1.20	1.26	1.23	1.18
Loin eye area, sq in	4.40	4.43	4.88	4.63
Lean, %	52.10	52.24	52.40	53.12
Carcass length, in	31.4	31.3	31.7	31.6

[a] Six lots of four pigs per treatment.

[b] Treatment 1 differs from treatments 3 and 4 ($P<.01$); treatment 2 differs from treatment 4 ($P<.05$).

[c] Treatment 1 differs from treatments 2, 3 and 4 ($P<.01$); treatment 2 differs from treatments 3 and 4 ($P<.01$).

Table 3. Performance Characteristics (Trial 2)[a]

Treatment No Lysine level, %	1 .8	2 .9	3 1.0	4 1.1
	Avg daily gain, lb			
17 to 44 lb[b]	.79	.88	.86	.88
44 to 77 lb	1.12	1.29	1.17	1.15
17 to 77 lb	.94	1.06	1.00	1.01
	Avg daily feed, lb			
17 to 44 lb[c]	1.54	1.67	1.52	1.51
44 to 77 lb	3.73	3.37	3.43	3.44
17 to 77 lb	2.53	2.49	2.42	2.46
	Feed/gain			
17 to 44 lb[d]	1.95	1.90	1.78	1.72
44 to 77 lb[e]	3.20	2.71	2.92	2.82
17 to 77 lb[f]	2.66	2.35	2.41	2.35

[a] Five lots of four pigs per treatment.

[b] Treatment 1 differs from treatments 2 and 3 ($P<.05$) and treatment 4 ($P<.01$).

[c] Treatment 2 differs from treatments 1, 3 and 4 ($P<.01$).

[d] Treatments 1 and 2 differ from treatments 3 and 4 ($P<.01$).

[e] Treatment 1 differs from treatments 2, 3 and 4 ($P<.01$); treatment 2 differs from treatments 1, 3 and 4 ($P<.01$), treatment 3 differs from treatment 4 ($P<.01$).

[f] Treatment 1 differs from treatments 2, 3 and 4 ($P<.01$).

Table 4. Performance Characteristics (Trial 3)[a]

Treatment No	1	2	3	4
Lysine level, %	.80	.95	1.10	1.25
Avg daily gain, lb	.75	.79	.79	.78
Avg daily feed, lb	1.66	1.66	1.53	1.54
Feed/gain[b]	2.02	2.09	1.95	1.98

[a] Six lots of four pigs per treatment.

[b] Treatment 2 differs from treatment 3 and 4 ($P<.01$).

Summary

Two hundred sixty-five crossbred weanling pigs averaging 17 lb were used to study the effects that varying lysine levels in starter diets from 17 to 44 lb had on performance for several growth periods. Forty-eight barrows were slaughtered to determine if differences existed in carcass characteristics. The lysine levels used in trial 1 were .75, .85, .95 and 1.05%. In trials 2 and 3, lysine levels of .8, .9, 1.0 and 1.1% and .8 .95, 1.1 and 1.25% were used, respectively.

Average daily gain was increased in the initial period by the higher lysine ration. However, subsequent and total gains were not effected by varying lysine levels during the starter period. Average daily feed was also unaffected by the lysine levels used, except during the 17 to 44 lb stage in trial 2. Feed efficiency was improved during the 17 to 44 lb period in all 3 trials when pigs received diets containing the higher levels of lysine. However, in trial 1, this difference in feed efficiency did not exist after 77 to 220 lb. In trial 2, pigs fed the lowest lysine starter diet also had the poorest feed efficiency during the 44 to 77 lb period and for the combined 17 to 77 lb period. No differences in carcass characteristics were observed. Thus, the advantages of high dietary lysine levels were mainly confined to the initial growth stage (17 to 44 lb). There were no detrimental effects during the subsequent growth periods or the total growth period caused by the lower lysine levels used in these trials. It appears that the pig can compensate for the reduction in performance that occurs when diets slightly deficient in lysine are fed to weights of 44 lb if subsequent diets are adequate in lysine.