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Compensatory Growth in Swine

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It is well known that young growing pigs have a higher dietary protein need than older finishing pigs. Previous research at this station, reported in A.S. Series 76-35, showed that pigs fed low-protein diets during early growth had reduced growth rate and increased feed/gain. Feeding an adequate protein diet after the deficient diet resulted in a trend for performance above that of pigs fed adequate diets during both periods. The study reported herein was designed to further study the effect of a short period of protein insufficiency on gain and feed/gain during subsequent growth periods.

Experimental Procedure

One hundred eight pigs with an initial weight of approximately 60 lb. were allotted on the basis of ancestry, weight and sex to 18 lots of six pigs each. Three replicate lots were assigned to each of six treatments. The pigs were housed in an enclosed confinement building with slatted floors.

The dietary treatments varied in protein content during various periods as follows:

Treatment	First 4 Weeks	4 to 8 Weeks	8 Weeks to 220 Lb.
1	12	14	14
2	14	14	14
3	16	14	14
4	12	14	12
5	14	14	12
6	16	14	12

During the first 4 weeks, the 16% protein diet was considered adequate, the 14% protein diet slightly deficient and the 12% protein diet deficient. The 14% protein diet during the second 4-week period was expected to be adequate and in the third period 12 and 14% protein diets were compared. Composition of the three diets is shown in table 1.

Results

Table 2 summarizes the results of average daily gain by periods and on an accumulative basis. There was a significant difference in daily gains during the first 4-week period, with gains increasing as dietary protein increased. Daily gain averaged 1.43, 1.61 and 1.76 lb. for pigs fed diets of 12, 14 and 16% protein, respectively. Although there were no significant differences in average daily gain among treatments during the second 4 weeks or the finishing period from 8 weeks to 220 lb., gains during these periods were inversely related to level of protein fed the first 4 weeks.

Accumulative gain indicated little difference among treatments at market weight as pigs fed 12, 14 or 16% protein diets the first 4-week period had daily gains of 1.76, 1.75 and 1.80 lb., respectively, for the entire experiment. These data indicate compensatory growth occurred both during the second 4-week period when all pigs were fed a 14% protein diet and in the third period, 8 weeks to 220 lb., when 12 and 14% protein diets were fed.

Feed/gain data are shown in table 3. Significantly more feed was required with each decrease in ration protein content during the first 4-week period. Pigs fed 16% protein required only 2.65 lb. of feed/gain compared to 2.95 and 3.24 lb. for pigs fed 14 or 12% protein diets, respectively. However, the pigs fed 12% protein diets the first 4-week period subsequently showed compensatory performance in that they required less feed/gain during the following two periods. Therefore, total feed/gain for the experiment did not differ significantly among treatments and was 3.36, 3.47 and 3.31 lb. for pigs initially fed 12, 14 or 16% protein diets, respectively.

A difference in performance was noted in the 8-week to 220-lb. period in that pigs fed 12-14 or 14-14% protein diets in the first two periods required less feed/gain during the last period when fed 14% protein diets as compared to 12% protein. The last feeding period, 8 weeks to 220 lb., averaged 32 to 40 days for the six different treatments with individual lots ranging from 28 to 45 days.

Summary

One hundred eight pigs were used in a study of compensatory performance following a period of protein insufficiency during early growth. The experiment was divided into three nearly equal periods of 4 weeks, 4 weeks and 8 weeks to 220 lb. which averaged approximately 5 weeks. During the first 4-week period, pigs gained faster and required less feed/gain as dietary protein increased from 12 to 14 to 16 percent. The pigs fed the 12% protein diet initially showed compensatory performance in both growth and feed efficiency during the following two periods. Therefore, at market weight there was little difference in performance of pigs fed diets varying in protein sequence.

Table 1. Composition of Experimental Diets (Percent)

Ingredient	Protein levels 12%	14%	16%
Ground yellow corn	87.8	82.2	76.5
Soybean meal, 44%	9.3	15.0	20.7
Calcium phosphate	1.3	1.2	1.2
Limestone	.9	.9	.9
Trace mineralized salt	.5	.5	.5
Premix[a]	.2	.2	.2

[a] Supplied per lb. of diet: vitamin A, 1500 IU; vitamin D, 150 IU; vitamin E, 2.5 IU; vitamin D, 1 mg; 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. Average Daily Gains by Periods and Accumulative

	Treatments 1,4	2,5	3,6	1	2	3	4	5	6
	Protein, %								
0-4 wk.	12	14	16	12	14	16	12	14	16
5-8 wk.	14	14	14	14	14	14	14	14	14
8 wk.-220 lb.				14	14	14	12	12	12
	Avg. Daily Gain by Period, Lb.								
0-4 wk.[a]	1.43	1.61	1.76	1.38	1.67	1.69	1.49	1.55	1.84
5-8 wk.	1.90	1.88	1.83	1.88	1.89	1.81	1.91	1.86	1.85
8 wk.-220 lb.	1.91	1.84	1.79	1.91	1.91	1.76	1.91	1.77	1.82
	Avg. Daily Gain Accumulative, Lb.								
0-4 wk.	1.43	1.61	1.76	1.38	1.67	1.69	1.49	1.55	1.84
0-8 wk.	1.66	1.74	1.80	1.63	1.77	1.75	1.70	1.71	1.85
Init.-220 lb.	1.76	1.75	1.80	1.74	1.79	1.76	1.78	1.71	1.84

[a] Significant difference ($P<.005$).

Table 3. Feed/Gain by Periods and Accumulative

	Treatments								
	1,4	2,5	3,6	1	2	3	4	5	6
	Protein, %								
0-4 wk.	12	14	16	12	14	16	12	14	16
5-8 wk.	14	14	14	14	14	14	14	14	14
8 wk.-220 lb.				14	14	14	12	12	12
	Feed/gain by Periods								
0-4 wk.[a]	3.24	2.95	2.65	3.29	2.88	2.66	3.18	3.03	2.63
5-8 wk.	3.09	3.34	3.26	3.10	3.20	3.23	3.08	3.48	3.30
8 wk.-220 lb.[b]	3.63	3.95	3.92	3.41	3.52	3.93	3.86	4.38	3.91
	Feed/gain, Accumulative								
0-4 wk.	3.24	2.95	2.65	3.29	2.88	2.66	3.18	3.03	2.63
0-8 wk.	3.15	3.15	2.96	3.18	3.05	2.96	3.12	3.26	2.96
Init.-220 lb.	3.36	3.47	3.31	3.29	3.22	3.32	3.44	3.73	3.30

[a] Significant difference, 1,4 vs 2,3,5,6 and 2,5 vs 3,6 ($P<.005$).
[b] Significant difference, 1 vs 4 and 2 vs 5 ($P<.05$).