EFFECTS OF TIME OF INTRODUCTION AND LEVEL OF SOYBEAN MEAL ON PERFORMANCE OF SEGREGATED EARLY-WEANED PIGS [1]

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Summary

A growth trial was conducted utilizing segregated early weaned (SEW) pigs to evaluate the effects of time of introduction and level of soybean meal on growth performance. Few differences were observed in growth performance indicating that including up to 40% soybean meal in the diet will not adversely affect growth of high-health status, SEW-reared pigs.

(Key Words: SEW Pigs, Soybean Meal, Growth Performance.)

Introduction

Recent studies from Kansas State University have investigated the effects on performance of including higher levels of soybean meal (SBM) in the diets of SEW-reared pigs. They have shown that these high-health pigs can tolerate much higher levels of dietary SBM than can conventionally reared nursery pigs. This nutritional adaptation has the potential to tremendously lower diet cost for producers by decreasing the amount of specialty products needed without affecting growth performance. The mechanism(s) behind the ability of these pigs to tolerate these higher levels of SBM is not well understood. The objective of this experiment was to evaluate the effects of time of introduction and level of SBM on growth performance of SEW pigs.

Procedures

A total of 175 SEW barrows (initially 8.8 lb and 12 to 15 d of age) were used in a 35 d growth trial. Pigs were blocked on the basis of weight and randomly allotted to one of seven dietary treatments with five pigs per pen and five replications (pens) per treatment.

The experimental SEW diets were pelleted to a diameter of 3/32 in. and were fed for 21 d postweaning. These diets contained 1.60% lysine, .90% Ca, .80% P, and .44% methionine (Table 1). The trial consisted of three times of introduction to SBM (0, 7, or 14 d postweaning) and two levels of SBM (20% or 40%) within each time (Table 2). A positive control with no SBM was included as a seventh treatment. A combination of skim milk, fish meal, and blood meal was used to replace the SBM in the experimental diets. The levels of dried whey and spray-dried plasma protein were kept constant in all diets, whereas lactose was added with added levels of SBM. The levels of soybean oil were increased with increasing levels of SBM in order to keep the energy content of all diets constant.

A common phase diet, in meal form, was fed to all pigs for the remainder of the growth trial (d 21 to 35 postweaning). This simple corn-SBM based diet contained 1.40% lysine, .80% Ca, .70% P, and .39% methionine (Table 1).

[1]The authors thank Newsham Hybrids, Colorado Springs, CO for providing the pigs used in this experiment.

Pigs were housed in an environmentally controlled nursery in 4 × 4 ft pens with tri-bar flooring and allowed ad libitum access to feed through a five-hole self-feeder and water through a single water nipple. Weekly weight gains and feed intakes were measured and used to determine ADG, ADFI, and feed efficiency (F/G).

Data were analyzed as a randomized complete block design using the general linear model (GLM) procedures of SAS. The pen was the experimental unit for all measurements. Single degree of freedom contrasts were used to determine the significance of all possible dietary comparisons. Linear and nonlinear contrasts also were included for d 0 to 7. Performance means and CV values are presented in Table 3, and the associated probability values are presented in Table 4.

Results and Discussion

From d 0 to 7, no effect of treatment (P>.20) was found on ADG, ADFI, or G/F (Table 3). From d 0 to 14, the change from the control diets to diets containing SBM adversely affected (P<.10) ADFI. However, feed efficiency was improved (P=.01) during this same interval by changing from the control diet to the diet containing 20% SBM. No effect of treatment (P>.10) was observed from d 0 to 21 or d 0 to 35 for ADG, ADFI, or F/G other than a small (P<.10) decrease in ADFI over the total trial for pigs fed the control diet for 1 week followed by 20% SBM as compared to pigs fed 20% SBM throughout.

Numerous research reports have evaluated soybean protein in the form of SBM in all stages of swine diets. However, complex proteins in SBM have been implicated as a cause of transient hypersensitivity in the early weaned pig. To avoid detrimental hypersensitivity responses such as increased crypt cell division and reduced digestive and absorptive capacities associated with SBM, postweaning diets typically have been very complex (containing milk and animal protein products), albeit involving a much greater cost than the much simpler SBM-type diets.

In the current experiment, including up to 40% SBM in these complex, nutrient dense diets did not adversely affect growth performance. Spray-dried animal plasma may help mask the effects of dietary SBM. Previous research (1996 KSU Swine Day Report of Progress 772, p 34) found that SBM could effectively replace a portion of the spray-dried animal plasma in diets for SEW pigs. Interestingly, in the current study, no reduction in performance occurred when pigs were changed from the control diet to the SBM diets at any point throughout the experiment. This suggests that these high-health status, SEW-reared pigs have the immune capacity to tolerate high dietary inclusion levels of SBM, whereas conventionally reared nursery pigs do not. Although not statistically significant, an overall comparison of the control pigs and the pigs fed 40% SBM showed that the control pigs had approximately 2% higher ADG, 4% higher ADFI, and 2% poorer feed conversion efficiency.

In conclusion, these data suggest that high-health status, SEW-reared pigs can effectively utilize dietary inclusion levels of up to 40% SBM without any reduction in growth performance.

Table 1. Compositions of Diets (As-Fed Basis)

Ingredient, %	Soybean Meal Level, %[a] 0	20	40	Common Phase III[b]
Corn	43.17	30.40	17.61	54.36
Soybean meal (46.5%)	----	20.00	40.00	38.07
Dried skim milk	23.01	11.50	----	----
Dried whey	15.00	15.00	15.00	----
Select menhaden fish meal	6.00	3.00	----	----
Lactose	----	5.75	11.50	----
Soybean oil	5.00	6.60	8.20	3.00
Spray-dried plasma protein	3.00	3.00	3.00	----
Spray-dried blood meal	2.00	1.00	----	----
Monocalcium phosphate	.52	1.05	1.59	1.43
Limestone	.14	.55	.96	1.11
Antibiotic[c]	1.00	1.00	1.00	1.00
Zinc oxide	.38	.38	.38	----
Premix	.40	.40	.40	.40
L-Lysine	.15	.12	.09	.15
Salt	.15	.15	.15	.35
DL-Methionine	.08	.10	.12	.05
Copper sulfate	----	----	----	.08
Total	100.00	100.00	100.00	100.00

[a]Diets were formulated to contain 1.60% lysine, .44% methionine, .90% Ca, and .80% P and were fed from d 0 to 21 postweaning.
[b]Common diet was formulated to contain 1.40% lysine, .39% methionine, .80% Ca, and .70% P and was fed from d 21 to 35 postweaning.
[c]Provided 50 g/ton carbadox.

Table 2. Timeline for Introduction to Soybean Meal

Trial (d)	Treatment (% Soybean Meal) 1	2	3	4	5	6	7	Pig Age (d)
0 to 7	0	20	40	0	0	0	0	12-15
7 to 14	0	20	40	20	40	0	0	19-22
14 to 21	0	20	40	20	40	20	40	26-29

Table 3. **Effect of Soybean Meal Level and Time of Introduction on SEW Pig Performance[a]**

	Dietary Treatment Combination (% Soybean Meal)							
Item	1	2	3	4	5	6	7	CV
d 0 to 7								
Treatment:	0	20	40					
ADG, lb	.41	.45	.39					19.49
ADFI, lb	.37	.38	.34					17.78
F/G	.92	.86	.89					20.41
d 0 to 14								
Treatment:	0-0	20-20	40-40	0-20	0-40			
ADG, lb	.59	.61	.57	.60	.57			12.81
ADFI, lb	.64	.63	.59	.57	.56			12.32
F/G	1.09	1.06	1.04	.94	1.00			10.81
d 0 to 21								
Treatment:	0-0-0	20-20-20	40-40-40	0-20-20	0-40-40	0-0-20	0-0-40	
ADG, lb	.73	.72	.68	.71	.68	.69	.72	9.72
ADFI, lb	.79	.79	.76	.74	.74	.73	.77	9.94
F/G	1.09	1.10	1.12	1.04	1.09	1.06	1.07	8.28
d 0 to 35								
Treatment:	0-0-0	20-20-20	40-40-40	0-20-20	0-40-40	0-0-20	0-0-40	
ADG, lb	.95	.97	.93	.89	.92	.93	.96	8.00
ADFI, lb	1.21	1.21	1.16	1.13	1.19	1.18	1.19	6.54
F/G	1.28	1.26	1.25	1.27	1.30	1.27	1.24	5.81

[a]Means represent a total of 175 pigs (initially 8.8 lb and 12-15 d of age) with five pigs per pen and five replicate pens per treatment.

Table 4. Probability Values for Growth Performance Contrasts

	Probability (P<)																				
Contrast	1 v 2	1 v 3	1 v 4	1 v 5	1 v 6	1 v 7	2 v 3	2 v 4	2 v 5	2 v 6	2 v 7	3 v 4	3 v 5	3 v 6	3 v 7	4 v 5	4 v 6	4 v 7	5 v 6	5 v 7	6 v 7
d 0 to 7[a]																					
ADG	.29	.57					.21														
ADFI	.60	.34					.25														
F/G	.48	.71					.80														
d 0 to 14																					
ADG	.65	.59	.74	.59			.42	.92	.42			.47	.99			.48					
ADFI	.83	.16	.06	.05			.32	.17	.15			.69	.65			.96					
F/G	.52	.38	.01	.12			.85	.12	.44			.17	.56			.42					
d 0 to 21																					
ADG	.88	.23	.70	.29	.37	.83	.30	.82	.37	.46	.95	.41	.89	.76	.33	.50	.60	.87	.87	.40	.49
ADFI	.93	.43	.25	.28	.21	.63	.48	.28	.32	.24	.69	.71	.77	.62	.76	.93	.91	.49	.84	.55	.43
F/G	.81	.57	.36	.99	.64	.77	.74	.25	.81	.48	.59	.15	.57	.30	.39	.37	.66	.54	.64	.77	.86
d 0 to 35																					
ADG	.62	.78	.26	.56	.80	.71	.44	.11	.28	.45	.90	.39	.76	.98	.52	.58	.38	.14	.74	.35	.53
ADFI	.92	.38	.12	.66	.63	.71	.32	.09	.58	.55	.63	.47	.65	.69	.60	.25	.27	.22	.96	.94	.91
F/G	.67	.60	.87	.70	.83	.40	.92	.79	.41	.83	.67	.71	.36	.75	.74	.58	.96	.49	.55	.22	.52

[a]Linear and nonlinear contrasts during d 0 to 7 were nonsignificant (P>.20).