EFFECTS OF RAW SOYBEANS, ROASTED SOYBEANS, AND SOYBEAN OIL ON FINISHING PIG PERFORMANCE

R. D. Goodband and R. H. Hines

Summary

Two trials were conducted to evaluate the effects of raw soybeans, roasted soybeans, and soybean oil on finishing pig performance. In trial 1, pigs were fed a low protein control diet containing 7.5% soybean meal and synthetic lysine. Raw soybeans were added at levels of 8.75, 11.90, 15.05, and 18.20% of the diet. The raw soybean additions replaced the synthetic lysine and part of the milo in the diet and provided lysine levels of .60, .67, .74, and .81% as raw soybean level increased, respectively. Increasing level of raw soybeans had no affect on average daily gain (ADG) or average daily feed intake (ADFI). However, pigs fed increasing levels of raw soybeans had poorer (linear $P<.10$) feed conversion (F/G).

In a second trial, pigs were fed the same control diet or diets containing 3.25% added fat from either raw soybeans, roasted soybeans, or soybean oil. As in the first trial, neither ADG nor ADFI were affected by dietary treatment; however, pigs fed diets containing roasted soybeans or soybean oil had improved F/G compared to pigs fed the control or raw soybean diet.

These data indicate that for finishing pigs (> 125 lb) additions of raw soybeans up to 18.2% of the diet did not affect ADG; however, F/G becomes poorer as raw soybean level increases. Furthermore, fat additions from roasted soybeans or soybean oil are utilized more efficiently than that from raw soybeans.

(Key Words: Raw Soybeans, Roasted Soybeans, Soybean Oil, Finishing Pigs.)

Introduction

Numerous studies have been conducted to evaluate the effects of raw soybeans on pig performance. These studies have primarily evaluated raw soybeans as a replacement for soybean meal. However, because of the trypsin inhibitor and other anti-nutritional factors contained in raw soybeans, they are not an effective replacement for soybean meal in most pig diets. Last year (KSU Swine Day, Report of Progress 528), we compared raw soybeans to soybean oil as fat sources in finishing pig diets. As a follow-up to those experiments, we wanted to examine the effects on pig performance when raw soybeans replace some of the lysine in the diet as well as being a fat source. A second objective was to compare raw soybeans, roasted soybeans and soybean oil as fat sources in finishing pig diets.

Procedures

In each trial, 120 or 160 finishing pigs were allotted on the basis of weight, ancestry, and sex to dietary treatment. In trial 1, there were five dietary treatments (Table 1) with eight pigs per pen and three replications per treatment. Average initial weight was 137 lb, and the trial lasted 63 days, at which time the pigs averaged 233 lb. In trial 2, there were four treatments with 10 pigs per pen and four replications per treatment (Table 2). Average initial wt was 128 lb, and the trial lasted 55 days, at which time the pigs averaged 236 lb. The control diet used in each experiment was a low protein diet containing 7.5% soybean meal and

L-lysine HCl in the diet. Although this diet only contained 11.4% crude protein, it was calculated to meet all the pig's amino acid requirements. In trial 1, raw soybeans were substituted for the L-lysine HCl and provided lysine levels of .60, .67, .74, and .81%. In trial 2, raw soybeans, roasted soybeans, or soybean oil were added at the expense of milo to provide 3.25% added fat to the diet.

Results and Discussion

In trial 1, increasing levels of raw soybeans in the diet had no affect on average daily gain (ADG); however, pigs fed raw soybeans had approximately 4% slower ADG when compared to pigs fed the control diet (Table 3). Average daily feed intake (ADFI) also was not affected by dietary treatment. Pigs fed increasing levels of raw soybeans had 5% poorer feed conversion (F/G; linear $P<.10$) than pigs fed the control diet.

In trial 2, ADG and ADFI were not affected by addition of raw or roasted soybeans or soybean oil to the diet (Table 4). However, pigs fed diets containing either roasted soybeans or soybean oil had numerically greater ADG compared to pigs fed the control or raw soybean-containing diets. Feed conversion was improved for pigs fed roasted soybeans and soybean oil. This indicates that the fat provided by either of these sources was more efficiently utilized by the pig. Pigs fed the control or raw soybean-added diets had poorer F/G.

These data suggest that the trypsin inhibitor and possibly other anti-nutritional factors contained in raw soybeans limit utilization of the fat and other nutrients. Although only slightly depressing ADG, increasing levels of raw soybeans resulted in poorer F/G for finishing pigs. Roasted soybeans and soybean oil appear to be effective fat sources in finishing pig diets.

Table 1. Diet Composition (Trial 1)

Ingredient	Raw Soybeans, %				
	0	8.75	11.90	15.05	18.20
Milo	89.55	80.80	77.90	74.75	71.60
Soybean meal 44%	7.50	7.50	7.50	7.50	7.50
Raw soybeans		8.75	11.90	15.05	18.20
L-lysine HCl	.25				
Monocalcium phosphate	1.10	1.10	1.10	1.10	1.10
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	.40	.40	.40	.40	.40
Vitamin premix	.15	.15	.15	.15	.15
Trace mineral premix	.05	.05	.05	.05	.05
Calculated analysis					
Crude protein	11.4	13.8	14.7	15.5	16.4
Lysine	.60	.60	.67	.74	.81
Ca	.65	.65	.65	.65	.65
P	.55	.55	.55	.55	.55

Table 2. Diet Composition (Trial 2)

Ingredient, %	Control	Roasted Soybeans	Raw Soybeans	Soybean Oil
Milo	89.55	71.60	71.60	86.30
Soybean meal	7.50	7.50	7.50	7.50
Roasted soybeans		18.20		
Raw soybeans			18.20	
Soybean oil				3.25
L-lysine HCl	.25			.25
Monocalcium phosphate	1.10	1.10	1.10	1.10
Limestone	1.00	1.00	1.00	1.00
Salt	.40	.40	.40	.40
Vitamin premix	.15	.15	.15	.15
Trace mineral premix	.05	.05	.05	.05
Calculated analysis				
Crude protein	11.6	16.4	16.4	11.4
Lysine	.60	.81	.81	.60
Ca	.65	.65	.65	.65
P	.55	.55	.55	.55

Table 3. Effects of Increasing Levels of Raw Soybeans on Finishing Pigs Performance (Trial 1)[a]

Item	Raw Soybeans, %				
	0	8.75	11.90	15.05	18.20
Avg daily gain, lb	1.99	1.88	1.93	1.93	1.92
Avg daiy feed intake, lb	7.58	7.51	7.81	7.68	7.72
Feed efficiency (F/G)[b]	3.81	4.00	4.04	3.97	4.02

[a]A total of 120 finishing pigs, average initial and final weight was 137 and 233 lb, respectively.
[b]Linear effect of raw soybeans (P<.10).

Table 4. Effects of Raw or Roasted Soybeans and Soybean Oil on Finishing Pig Performance (Trial 2)[a]

Item	Control	Roasted Soybeans	Raw Soybeans	Soybean Oil
Avg daily gain, lb	1.91	1.99	1.95	1.98
Avg daily feed intake, lb	7.14	6.75	7.04	7.00
Feed efficiency (F/G)	3.73[bc]	3.39[b]	3.62[c]	3.54[c]

[a]A total of 160 finishing pigs, average initial and final weight 128 and 236 lb, respectively.
[bc]Means on the same row with different superscripts differ (P<.05).

Dr. Jack Riley, Animal Sciences and Industry Department Head, beside a bust of Dr. Arthur D. (Dad) Weber.