EVALUATION OF EXPELLED SOYBEAN MEAL IN STARTER DIETS

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Summary

Forty-eight weanling pigs (6.9 lb initial wt) were used in a 28-d growth study to determine the feeding value of expelled soybean meal (43% CP) as compared to conventionally extracted soybean meal (48.5% CP). Pigs were fed one of two dietary treatments containing either expelled soybean meal or conventional soybean meal. Both diets contained milo and 10% dried whey and were formulated to be slightly lysine deficient (.95%) to determine any potential differences in amino acid availabilities between the two soybean meals. From d 0 to 14, pigs fed conventional soybean meal had higher average daily gain (ADG) and average daily feed intake (ADFI) and were more efficient (F/G; 26.2%, 11.3%, and 21.6%, respectively) than pigs fed expelled soybean meal. Similar trends were noted for the overall experiment (d 0 to 28),with pigs fed conventionally extracted meal having greater ADG (16.1%) and ADFI (8.8%) and better F/G (6.2%) than pigs fed the expelled soybean meal. Both soybean meal products were analyzed for percentage fat; the expelled meal contained 6.2% and conventional meal contained .83%. The added fat in the expeller meal did not improve F/G compared to the conventional soybean meal. Protein solubility in both expelled and conventionally extracted soybean meal was greater than 70%, thus neither meal was overprocessed. However, trypsin inhibitor activity was higher in the expelled soybean meal (3.4 mg/g) as compared to the conventional soybean meal (.5 mg/g). This difference may be responsible for the poorer ADG, ADFI, and F/G found when feeding the expelled soybean meal. Based on this research, expelled soybean meal has approximately 84% the feeding value of conventionally extracted soybean meal when formulated on a lysine basis.

(Key Words: Starter, Performance, SBM, Process, Soybean.)

Introduction

Prior to solvent extraction, soybeans were processed by expeller procedures to remove the oil. Today solvent extraction is the most common method of extracting soybean oil; however, the expeller process is still being used in some areas. In the expeller process, the soybeans are cracked, dried, and transported to a tempering device, which stirs the soybeans for uniform heat processing. The soybeans are then fed into an expeller barrel, which presses the oil from the beans. The soybeans leave the barrel and are ground. The expeller process leaves the beans with approximately 5% fat. In solvent extraction, the beans are cracked and then heated to 140°F for 10 min. Soybeans are then allowed to cool to 113°F. The beans are then hexane extracted, volatilized, and dried. From the dryer, the beans are conveyed to a toaster, cooled, and ground, leaving them with less than 1% fat. Expeller meal is higher in fat content, which could add to its feeding value. Therefore, this experiment was designed to determine the feeding value of the expelled soybean meal in starter diets compared to conventionally extracted soybean meal.

Procedures

The expelled and conventional soybean meals were analyzed for percentage protein and diets were then formulated (Table 1) to .95% lysine. Lysine was assumed to be a fixed percentage of protein in the two soybean meals. Lysine was set to be slightly deficient to ensure that differences in protein quality could be detected. Light pigs (6.9 lb) were used in the study to further stress the need for lysine availability in the two soybean meals. Only 10% dried whey was added to the diet to minimize the confounding effects of other protein sources.

Forty-eight weanling pigs (6.9 lb initial wt) were fed the dietary treatments for the 28 d study. The pigs were blocked by weight and allotted by ancestry and gender to pens (six per pen and four pens per treatment) in an environmentally controlled nursery equipped with elevated pens. Each pen had a self-feeder and nipple waterer, so feed and water could be consumed ad libitum. The pigs and feeders were weighed weekly to calculate performance data (ADG, ADFI, and F/G). Feed and soybean meal samples were collected and analyzed for percentage CP, dry matter, fat, protein solubility , trypsin inhibitor activity, and urease activity (Table 2).

Results and Discussion

Pigs fed conventional soybean meal from d 0 to 14 had increased ADG (26.2%, $P<.05$) and improved F/G (21.6%, $P<.07$) compared to pigs fed expelled soybean meal. Also seen was an increased ADFI (11.3%) for the pigs fed conventionally extracted soybean meal, although this was not a significant increase. Similar responses were noted for the overall experiment (d 0 to 28), though the differences were not as pronounced, with pigs fed conventional soybean meal showing a 16% increase in ADG ($P<.05$) compared to those fed expelled soybean meal. Pigs fed the conventional soybean meal tended to have improved ADFI and F/G (8.8% and 6.3%, respectively) compared to those fed the expelled soybean meal. Protein solubility values are indicators of overprocessing. Any value less than 70% indicates the sample is overcooked. However, both the expelled soybean meal (82.8%) and the conventional soybean meal (82.7%) are well above 70% and, therefore, not overprocessed. The trypsin inhibitor activity assay, which measures amount of trypsin inhibitor in soybean meal samples, revealed that the expelled soybean meal contained more trypsin inhibitor (3.40 mg/g) than conventional soybean meal (.5 mg/g), with less than 2 mg/g being optimum. This difference may have contributed to the poorer ADG, ADFI, and F/G, seen in the pigs fed the expelled soybean meal. Urease activity was determined, to check for underprocessing in the two soybean meals (the optimum range being .02 to .2). Expelled soybean meal (.037) was slightly higher than conventional soybean meal (.017). However, based on urease activity, neither soybean meal was underprocessed, contradicting the trypsin inhibitor activity values. The percentage fat was determined; the expelled soybean meal contained 6.29%, whereas the conventional soybean meal contained only .82%. However, when the diets were formulated, the expeller meal diet contained 1.5% fat, whereas the conventional soybean meal diet contained .83% fat. This .7% higher fat content in the expeller meal diet had no apparent effect on ADG, ADFI, or F/G. Although expelled soybean meal appears to be a poorer protein source (approximately 84% of the feeding value of conventional soybean meal) for starter pig diets, future studies may be needed to further evaluate its feeding value.

Table 1. Diet Composition

Ingredient %	Conventional Soybean Meal Diet	Expelled Soybean Meal Diet
Conventional SBM	22.44	---
Expelled SBM	---	25.16
Milo	62.84	60.06
Dried whey	10.00	10.00
Monocalcium phosphate	1.93	1.87
Antibiotic	1.00	1.00
Limestone	.86	.99
Salt	.40	.40
Vitamin premix	.25	.25
Trace mineral mix	.15	.15
Copper sulfate	.08	.08
Selenium premix	.05	.05
Total	100.00	100.00

Table 2. Chemical Analysis

	Conventional SBM	Conventional SBM Diet	Expelled SBM	Expelled SBM Diet
Crude protein, %	49.56	18.99	43.25	17.54
Dry matter, %	89.90	90.15	90.90	90.75
Crude fat, %	.82	.83	6.29	1.53
Trypsin inhibitor activity, mg/g	.50		3.40	
Protein solubility, %	82.70		82.82	
Urease activity, pH	.02		.04	

Table 3. Performance of Nursery Pigs Fed Conventional Soybean Meal or Expelled Soybean Meal[a]

	Conventional Soybean Meal Diet	Expelled Soybean Meal Diet
d 0 to 14		
ADG, lb[b]	.42	.31
ADFI, lb	.62	.55
F/G[c]	1.48	1.78
d 0 to 28		
ADG, lb[b]	.56	.47
ADFI, lb	1.14	1.04
F/G	2.05	2.18

[a]A total of 48 pigs, 6.9 lb avg initial wt, 23.7 lb avg final wt, 28 d trial.
[b]($P < .05$).
[c]($P < .07$).