Evaluating Inclusion Levels of Soybean Hulls in Finishing Pig Diets

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Introduction

Soybean hulls are a by-product of soybean processing that is low in energy and protein content. The addition of soybean hulls to swine diets has been shown to increase the feed to gain ratio when added at 12 to 24% of the diet with little or no effect on ADG. Today's pigs have lower feed intake than pigs 10 to 15 years ago and have higher lean gain per day. With these lower feed intakes in today's genetics, one question that needs evaluation is: do today's pigs have the capacity to adjust feed intake when fed a more dilute energy diet to maintain similar body weight gains? This trial was conducted to reevaluate the amount of fiber/energy dilution that today's grow-finish pig could utilize without reducing ADG. This trial was conducted in the fall of 1999.

Experimental Procedures

Five finishing dietary treatments were formulated utilizing differing levels of soybean hulls (SH) and fed for eight weeks. Treatments were as follows: 1) 0% SH; 2) 3% SH; 3) 6% SH; 4) 9% SH; and 5) 9% SH with added fat to make it near-isocaloric to diet 1. Diets were formulated for the first 4 weeks (P1) at .56% apparent digestible lysine and the second 4 weeks (P2) at .48% apparent digestible lysine (Table 1).

One hundred sixty-five pigs (85 barrows and 80 gilts; avg. initial BW=156 lbs) were blocked by weight and sex (6 or 7 pigs/pen; 8 or 9 ft^2 /pig). One of the five dietary treatments was randomly assigned to each pen within a block. Pigs were weighed and feed intake recorded every 2 weeks for the 8-week trial to determine ADFI and ADG, from which G:F was calculated. Backfat thickness was measured on 3 pigs/pen with an Aloka 210 ultrasound at weeks 4 and 8. Fat and loin depth, percent lean, carcass weight, and carcass premium were determined on all pigs at a commercial slaughter facility in Indiana.

Statistical analysis of the data collected was performed using the GLM procedure of SAS. Diets 1 through 4 were compared for linear, quadratic, and cubic effects of SH concentrations, and diet 5 was contrasted with diet 1 for effects of SH in a similar energy density diet.

Results and Discussion

Results are summarized in Table 2. In P1, ADG and ADFI increased with diet 2 and then decreased with increasing concentration of SH (ADG: linear P<.04, cubic P<.01; ADFI: cubic P<.04). G:F tended to increase with diet 2 and then decrease with increasing SH concentration (quad. P<.11, cubic P<.11). Pigs fed diet 5 during P1 had greater G:F than pigs fed diet 1 (0 vs. 9+Fat, P<.005); however, no differences were observed in ADG or ADFI during P1, P2, or overall between pigs fed diets 1 and 5. During P2, ADG (linear P<.10) and G:F (linear P<.03) decreased with increasing levels of SH, and gilts had higher G:F than barrows (P<.005). Over the entire 8-week period, ADG, G:F, and final body weight increased with diet 2, but then decreased with increasing levels of SH (ADG: linear P<.02, cubic P<.03; G:F: linear P<.02; BW: linear P<.02, cubic P<.03).

Carcass fat depth tended to decrease in pigs fed diet 2, but then increased with increasing levels of SH (cubic P<.08), returning to similar levels as the control pigs. Loin depth increased in pigs fed diet 2 and then decreased with increased SH levels (quad. P<.01), also returning to similar loin depths as the control pigs. Pigs fed diet 5 had greater loin depth than pigs fed diet 1 (0 vs. 9+Fat, P<.01). Barrows had greater fat depth (P<.0002), and lower loin depth (P<.0001) and percent lean (P<.002) than gilts. A diet x sex interaction occurred for carcass fat depth (P<.0004). Fat depth for barrows increased from 3% SH to 6% SH and then decreased again with 9% SH (.93, 1.10, and 1.01, respectively), but fat depth for gilts decreased from 3% SH to 6% SH and then increased with 9% SH (.95, .87, and .95, respectively).

These results indicate that adding 3% SH may improve growth performance of late-finishing pigs. However, inclusion rates higher than 3% SH without increasing ME/lb with a supplemental fat source results in significant reductions in ADG and G:F, culminating in a 7 to 8 lb lighter pig at market.

Application

These results suggest that low levels of SH can be used successfully in swine finishing diets and may improve ADG and G:F. Higher levels of SH can be used, but supplemental energy sources need to be added in order for the energy requirements of the pigs to be met. This data would indicate that today’s leaner pig genetics do not have as great an ability to adjust feed intake to meet their energy needs and maintain growth. This has a greater implication in diet formulation and the utilization of low energy by-products. These by-products’ values may be less than before, because of the need to add supplemental fat to diets utilizing these feedstuffs to ensure that the pig’s energy needs are being met to maintain growth.

Table 1. Diet formulation using soybean hulls.

	Finisher 1 Period; 150-200 lbs body weight				
Ingredients, %	0	3	6	9	9+Fat
Corn	84.26	81.51	78.47	75.43	71.81
Soybean Meal, 48%	12.33	12.10	12.17	12.24	12.85
Soybean Hulls	0	3.00	6.00	9.00	9.00
Choice White Grease	1.00	1.00	1.00	1.00	4.00
Lysine-HCl	.15	.15	.15	.15	.15
Vit/Min/Anti/phytase	2.26	2.24	2.21	2.18	2.19
Total	100	100	100	100	100
Nutrient Content					
Lysine, %	.70	.70	.71	.72	.73
Calcium, %	.58	.58	.58	.58	.58
Total Phosphorous, %	.45	.45	.45	.45	.45
ME, kcal/lb	1532	1513	1493	1473	1535

	Finisher 2 Period; 200 lbs to market				
Ingredients, %	0	3	6	9	9+Fat
Corn	88.27	85.55	82.81	80.09	76.86
Soybean Meal, 48%	8.67	8.42	8.18	7.93	8.14
Soybean Hulls	0	3.00	6.00	9.00	9.00
Choice White Grease	1.00	1.00	1.00	1.00	4.00
Lysine-HCl	.15	.15	.15	.15	.15
Vit/Min/Anti/phytase	1.91	1.88	1.86	1.83	1.85
Total	100	100	100	100	100
Nutrient Content					
Lysine, %	.60	.60	.60	.60	.60
Calcium, %	.48	.48	.48	.48	.48
Total Phosphorous, %	.40	.40	.40	.40	.40
ME, kcal/lb	1538	1519	1499	1479	1541

Table 2. Effect of increasing soybean hull concentration in finisher diets.

% Soyhulls	0	3	6	9	9+Fat	CV	Significance
Initial BW, lb	156.4	156.4	156.2	156.1	156.1	.197	NS
Weeks 0-4 (Period 1)							
ADG, lb/d	2.05	2.19	1.85	1.92	2.14	7.61	Linear (.04); cubic (.01)
ADFI, lb/d	6.56	6.76	6.00	6.34	6.44	7.02	Cubic (.04)
G:F	.310	.326	.310	.306	.337	4.07	Quad (.10); cubic (.11); 0 vs 9+Fat (.005)
Weeks 4-8 (Period 2)							
ADG, lb/d	2.02	1.98	1.93	1.90	1.97	5.89	Linear (.10)
ADFI, lb/d	7.26	7.31	7.15	7.53	7.21	5.58	NS
G:F	.279	.274	.271	.252	.275	6.30	Linear (.03)
Overall							
ADG, lb/d	2.03	2.08	1.89	1.91	2.05	4.94	Linear (.01); cubic (.03)
ADFI, lb/d	6.91	7.04	6.57	6.94	6.82	5.31	Cubic (.07)
G:F	.294	.295	.288	.276	.302	4.23	Linear (.02)
Final Wt.	270.1	273.1	260.9	263.2	271.0	2.22	Linear (.01); cubic (.03)
Carcass[a]							
Fat depth, in	1.00	.94	.99	.98	.98	10.6	Cubic (.08)
Loin depth, in	2.48	2.60	2.55	2.53	2.57	5.44	Quad (.01); Cubic (.12); 0 vs. 9+Fat (.01)
% Lean	52.5	53.3	52.8	52.8	53.0	2.93	Quad (.14)
Carcass Premium, ¢/lb	2.94	4.47	3.42	3.58	3.61	76.2	Cubic (.10)
Adjusted scan data prior to slaughter[bc]							
Scan BF, in	.77	.76	.74	.75	.75	8.95	NS
% Lean	49.91	49.96	50.83	50.55	50.23	2.06	NS

[a] Fat-o-meter probe data, determined at a local Indiana slaughter facility.
[b] Aloka 210 measurements prior to slaughter.
[c] Data adjusted to 250 lbs using the 1988 NSIF equation.