Evaluating High Oil Corn and Normal Corn on an Equal Substitution Basis for Grow-Finish Pigs

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Introduction

High oil corn is a specialty hybrid type of yellow corn that has a higher oil content than normal yellow corn. The higher oil content of this corn increases the energy density of grow-finish swine diets. Energy-dense diets have the potential to improve feed efficiency, which is economically valuable to pork producers.

A grow-finish pig study was conducted to evaluate the effects of high oil corn and normal corn during the grower and finisher phases on average daily gain (ADG), average daily feed intake (ADFI), feed efficiency (G:F), fat and loin depth, carcass weight and premium, and percent lean. The trial was conducted from February to May, 1999.

Experimental Procedures

Four dietary treatments were formulated using normal corn (NC) and high oil corn (HOC) and fed during a 16-week period (8 week grower and 8 week finisher). Treatments were as follows: 1) NC in both grower and finisher periods (NC/NC), 2) NC in the grower period and HOC in the finisher period (NC/HOC), 3) HOC in the grower period and NC in the finisher period (HOC/NC), and 4) HOC in both periods (HOC/HOC). The diets were formulated on a pound for pound substitution of HOC for NC for each sex and phase of growth (Table 1). Diets were changed every 4 weeks to create two grower and two finisher diets. Near infrared spectrophotometry analysis of the two corn types after harvest showed 3.4% oil, 8.4% crude protein, and 59.8% starch in normal corn, and 7.8% oil, 9.4% crude protein, and 54.7% starch in high oil corn.

One hundred seventy-six pigs (88 barrows and 88 gilts) were blocked by sex, ancestry, and weight into 32 pens (5 or 6 pigs/pen; 9 or 11 ft^2/pig). One of the four dietary treatments was randomly assigned to each pen within a block. Average initial body weight was 50.2 lbs for barrows and 48.6 lbs for gilts. Pigs were weighed and feed intake recorded every 2 weeks for the 16-week period 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 8 and 16. Pigs were marketed at 16 weeks, and fat and loin depth, percent lean, carcass weight, and carcass premium were determined at a commercial slaughter facility in Indiana.

Statistical analysis of the data collected was performed using the GLM procedure of SAS. Pigs were blocked by sex and initial body weight. Dietary treatment, sex, and treatment x sex interaction were examined to determine their effect on growth and carcass characteristics.

Results and Discussion

Results are summarized in Table 2. There were no significant dietary treatment differences in ADG at any time period. Pigs fed NC during the finisher period had 6.3% higher ADFI (P<.03). A treatment by sex interaction also occurred during the finisher period, in which barrows fed NC had higher ADFI than barrows fed HOC (7.84 vs. 7.09), while gilts fed NC had only a slightly higher ADFI compared to the gilts fed HOC (6.8 vs. 6.68 lbs/day; P<.09). Pigs fed HOC had 8.0% greater G:F ratio than pigs fed NC during the finisher period (P<.005). Pigs fed the HOC/HOC treatment over the entire 16-week period had 8.4% greater G:F than pigs fed the NC/NC treatment (P<.02). The dietary treatments did not affect any of the carcass characteristics for pigs fed NC or HOC.

Barrows had greater ADG than gilts during the grower period (1.92 vs. 1.75 lbs/day; P<.0001), finisher period (2.08 vs. 1.92 lbs/day; P<.003), and overall (1.99 vs. 1.83 lbs/day; P<.0001). Barrows also had higher ADFI than gilts during the grower period (4.87 vs. 4.36 lbs/day; P<.002), finisher period (7.46 vs. 6.74 lbs/day; P<.0005), and overall (6.06 vs. 5.47 lbs/day; P<.0003).

Barrows had greater fat depth than gilts at slaughter (1.11 vs. .92 in; P<.0001). Gilts had greater loin depth (2.62 vs. 2.53 in), percent lean (53.5 vs. 52.0), and carcass premium ($4.94 vs. $2.10/cwt) than barrows at slaughter (P<.0001). However, barrows reached market weight 9 days faster than gilts (P<.0006).

As with most supplemental energy sources, pigs fed the HOC treatments had better feed efficiency in both periods. During the grower period, gilts fed HOC showed a 6.4% increase in G:F over gilts fed NC, and barrows fed HOC showed a 1.3% increase in G:F. During the finishing period, barrows fed HOC had a 10.3% greater response in G:F over barrows fed NC, and gilts fed HOC had a 6.0% increase in G:F over gilts fed NC. Gilts fed HOC over the entire 16-week period had an 11.7% increase in G:F over gilts fed NC. However, barrows fed HOC over the entire 16-week period had only a 5.0% increase in G:F over barrows fed NC. These data demonstrate that gilts can utilize the extra fat content in the diet provided by HOC throughout the grow-finish period and yield a consistent improvement in performance and a 5 day reduction in days to market. While barrows had the greatest response to limit feed intake and improved G:F in the late finisher period when fed HOC, they had no change in the days to market.

Application

These results suggest that high oil corn can increase the gain to feed ratio in grow-finish pigs. The premium value of high oil corn will be reflective of the enhanced performance, and may range from 3 to 26 cents per bushel depending on oil and protein content and the phase of production it is utilized in. The cost of raising high oil corn needs to be carefully calculated and compared to the costs of purchasing rendered fat, and the maintenance issues associated with the identity of high oil corn versus the equipment cost of fat tanks and associated feed mixing equipment. In this trial, you could pay approximately $.10/bu more for HOC if feeding barrows and $.22/bu more for HOC if feeding gilts if corn were $2.50/bu.

Table 1. Example diet formulation using high oil corn.

Ingredients, %	Barrow		Gilt	
	NC Diet	HOC Diet	NC Diet	HOC Diet
(Grower 1 Period; 50 to 100 lbs body weight)				
Normal Corn	75.06	0	71.53	0
High Oil Corn	0	75.06	0	71.53
Soybean Meal, 48%	21.4	21.4	25.01	25.01
Lysine-HCL	.15	.15	.15	.15
Vit/Min/Anti	3.39	3.39	3.31	3.31
Total	100	100	100	100
Nutrient Content				
Lysine, %	.95	1.00	1.05	1.09
Fat, %	2.89	6.05	2.80	5.80
ME, kcal/lb	1492	1533	1493	1531
Lys:Cal, g/Mcal ME	2.89	2.96	3.19	3.23
(Finisher 2 Period; 200 lbs to market)				
Normal Corn	90.61	0	87.06	0
High Oil Corn	0	90.61	0	87.06
Soybean Meal, 48%	6.82	6.82	10.44	10.44
Lysine-HCL	.15	.15	.15	.15
Vit/Min/Anti	2.42	2.42	2.35	2.35
Total	100	100	100	100
Nutrient Content				
Lysine, %	.55	.60	.65	.70
Fat, %	3.32	7.13	3.23	6.88
ME, kcal./lb	1510	1559	1511	1558
Lys:Cal, g/Mcal ME	1.65	1.75	1.95	2.04

Table 2. Effect of feeding high oil corn or normal corn on an equal percentage of the diet during the grow-finish period.

	Barrows				Gilts					
Item	NC/NC	NC/HOC	HOC/NC	HOC/HOC	NC/NC	NC/HOC	HOC/NC	HOC/HOC	CV	Significance
Initial BW, lb	50.3	50.3	50.0	50.1	48.2	48.8	48.6	48.6	13.5	
Days 0-56										
ADG, lb	1.91	1.87	1.96	1.94	1.74	1.75	1.76	1.73	3.37	Trt (P=.14), Sex (P=.0001)
ADFI, lb	4.99	4.66	4.93	4.91	4.42	4.56	4.38	4.10	8.93	Sex (P=.002)
G/F[a]	.385	.402	.399	.397	.396	.385	.404	.428	7.11	Trt (P=.14)
Days 56-112										
ADG, lb	2.09	2.03	2.08	2.11	1.87	1.90	1.90	2.03	6.50	Sex (P=.003)
ADFI, lb	7.80	6.76	7.88	7.41	6.72	6.53	6.88	6.83	7.33	Trt (P=.03), Sex (P=.001), Trt*Sex (P=.09)
G/F[b]	.269	.303	.264	.285	.278	.291	.278	.298	7.15	Trt (P=.005)
Days 0-112										
ADG, lb	1.99	1.94	2.02	2.01	1.81	1.82	1.83	1.86	3.83	Sex (P=.0001)
ADFI, lb	6.25	5.74	6.24	6.02	5.56	5.52	5.60	5.19	6.96	Sex (P=.0003)
G/F[c]	.319	.338	.324	.335	.325	.331	.328	.364	6.50	Trt (P=.08)
Final BW, lb	253.6	249.6	256.4	255.7	251.5	250.9	255.5	253.8	3.83	
Carcass[d]										
Fat depth, in	1.12	1.08	1.15	1.07	.92	.88	.97	.92	16.3	Sex (P=.0001)
Loin depth, in	2.52	2.56	2.50	2.52	2.63	2.61	2.56	2.67	5.32	Sex (P=.0001)
% Lean	51.9	52.3	51.6	52.1	53.6	53.8	53.0	53.7	3.30	Sex (P=.0001)
Premium, $/cwt	2.13	2.53	1.67	2.07	4.91	5.38	4.08	5.38	83.9	Sex (P=.0001)
Slaughter wt**, lb	259	253	259	257	255	262	256	256		
Carcass wt**, lb	193	194	193	193	193	201	193	189	8.50	Trt*Sex (P=.11)
Ultrasound[e]										
10th Rib BF, in	.90	.81	.85	.87	.64	.68	.71	.69	9.42	Sex (P=.0001)
Loin Depth, in	1.89	1.86	1.97	1.83	2.04	2.01	1.99	1.85	9.12	
Adj. Days to Market[f]	156.5	160.2	155.2	155.5	168.1	166.5	165.9	163.4	4.03	Sex (P=.0006)

[a] Treatment contrast HOC/HOC vs. NC/NC (P<.14).
[b] Treatment contrast HOC/HOC vs. NC/NC (P<.11).
[c] Treatment contrast HOC/HOC vs. NC/NC (P<.02).
[d] Fat-o-meter probe data, determined at a local Indiana slaughter facility.
[e] Aloka 210 ultrasound data, determined prior to slaughter.
[f] Adjusted to 250 lb using the 1988 NSIF equation.
** Pigs that actually went to slaughter; pigs under 230 lbs and replacement females were not slaughtered; carcass weight is hide off.