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The effects of increasing dietary energy density on growing-finishing pig growth performance and carcass characteristics

Abstract

Eighty crossbred gilts were used in a growth trial to evaluate the effects of increasing dietary energy density on growing-finishing pig growth performance and carcass characteristics. In this trial, adding fat to corn-soybean meal diets with a constant calorie: lysine ratio to increase the energy density during the growing phase (98 to 160 lb) improved feed efficiency with no influence on growth rate. However, increasing the energy content of the diet by adding fat had no benefit during the finishing phase (160 to 233 lb).; Swine Day, Manhattan, KS, November 16, 1995

Keywords

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THE EFFECTS OF INCREASING DIETARY ENERGY DENSITY ON GROWING-FINISHING PIG GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS

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Summary

Eighty crossbred gilts were used in a growth trial to evaluate the effects of increasing dietary energy density on growing-finishing pig growth performance and carcass characteristics. In this trial, adding fat to corn-soybean meal diets with a constant calorie:lysine ratio to increase the energy density during the growing phase (98 to 160 lb) improved feed efficiency with no influence on growth rate. However, increasing the energy content of the diet by adding fat had no benefit during the finishing phase (160 to 233 lb).

(Key Words: Growing-Finishing, Fat, Performance.)

Introduction

Research has shown that the addition of dietary fat improves growth and efficiency of growing-finishing swine. However, these improvements are coupled with an increase in backfat thickness and a decrease in carcass lean. Swine producers must address the paradox of growth performance increasing while the leanness of their animals decreases. Therefore, our objective was to determine the effects of increasing energy density of growing-finishing swine diets on growth performance and carcass characteristics.

Procedures

Eighty crossbred gilts (initially 98 lb) were used in a growth assay to evaluate the effects of increasing energy density in growing-finishing swine diets on growth performance and carcass characteristics. Choice white grease (CWG) was added at 1.5, 3, 4.5, and 6% to a corn-soybean meal-based control diet (Table 1). Pigs were blocked by weight and ancestry and allotted to one of the five dietary treatments. The experimental diets were fed in two phases: growing (98 to 160 lb) and finishing (160 to 233 lb). A constant lysine:calorie ratio of 3.2 g lysine/Mcal ME was maintained during the growing phase. During the finishing phase, a lysine:calorie ratio of 2.47 g lysine/Mcal ME was maintained.

The pigs were housed two per pen in an environmentally controlled finishing barn with 4 ft × 4 ft totally slatted pens. The pens contained a single-hole feeder and a nipple waterer to allow pigs ad libitum access to feed and water. Drip coolers were activated when temperatures exceeded 80°F, cycling on 3 out of every 15 min. Pigs and feeders were weighed every 14 days to calculate ADG, ADFI, and F/G. Pigs were scanned ultrasonically to determine body composition when they were weighed. When mean pig weight reached 230 lb, pigs were slaughtered at a commercial slaughter facility to collect carcass data.

The data from this trial were analyzed with the GLM procedure of SAS. The statistical model included linear and quadratic effects of increasing energy density of the diet.

[1]Northeast Area Extension Office.

Results and Discussion

During the growing phase (98 to 160 lb), increasing energy density in the diet decreased ADFI and improved F/G (linear, $P<.01$; Table 2). However, ADG was not affected by energy density. Total energy and lysine intake were not affected by dietary energy density. This is in agreement with previous research showing that increasing the energy level will improve efficiency but decrease feed intake. This also indicates that the pig adjusts its daily feed intake to maintain a constant caloric intake.

Increasing the energy density of the diet during the finishing phase (161 to 233 lb) decreased ADG (quadratic, $P<.05$); pigs fed the diet with no added dietary fat had the greatest gain. Feed efficiency became poorer and then improved as energy density of the diet increased (quadratic, $P<.05$); pigs consuming the diet with 6% added fat had the best F/G. Similar to the growing phase, total energy and lysine intakes were not affected by the energy content of the diet.

For the entire trial (98 to 233 lb), ADG was decreased (quadratic, $P<.10$) as energy density increased. Feed efficiency improved and intake decreased (linear, $P<.01$) with increasing energy density. This suggests that increasing energy density in growing pigs diets (< 161 lb) has a positive effect on growth performance but increasing energy density in the late finishing phase has a detrimental effect on growth performance of this genetic line of high-lean growth pigs.

Before pigs were sent to the commercial slaughter plant, they were scanned ultrasonically at the tenth rib. Ultrasonic images were interpreted to determine tenth rib backfat (TRFD) depth and loin muscle area (LMA, Table 3). Increasing dietary energy density decreased TRFD ($P<.05$). Pigs fed the diet containing 6% CWG had the least tenth rib fat depth at .84 in, whereas the pigs fed the diet with 1.5% CWG had the highest TRFD, .94 in. Loin muscle area was not affected by increasing dietary energy density.

When the pigs were slaughtered at 233 lb, carcass data were collected from carcass performance sheets provided by the packer. Pigs were skinned prior to evaluation by an optical probe (Fat-O-Meater). Increasing dietary energy density decreased backfat depth (BF; quadratic, $P<.05$). Pigs fed the diet with the highest and second highest energy densities (6% added CWG) had the lowest BF of .56 in. Loin muscle depth (LMD), similar to the ultrasound data, was not affected by increasing energy density of the diet. Percentage lean, collected from the optical probe data, was variable in response to dietary energy density. Percentage lean decreased through 3 % CWG and then increased with 6% CWG. Increasing energy density in the diet also affected the percentage carcass yield. Increasing the energy density of the diet through 6% added CWG improved carcass yield (linear, $P<.01$). The premium paid by the packer was not affected by dietary treatment. The average premium was $2.44/carcass cwt.

These data indicate that dietary fat can be added to the growing diet to improve F/G without affecting ADG. However, during the finishing phase, the addition of CWG to the basal diet decreased ADG. During the entire trial, pigs adjusted ADFI so that energy intake across treatments was equal. Increasing the level of CWG had no significant impact on BF or LMA. A consistent linear response was detected for carcass yield, which must be investigated further. Overall, adding fat to the growing diet may be justified, depending on the cost of fat, to improve feed efficiency without affecting subsequent carcass characteristics.

Table 1. Basal Diet Composition[a]

Item, %	Growing (100 to 160 lb)	Finishing (160 to 230 lb)
Corn	67.39	76.41
Soybean meal, 46.5%	29.62	20.89
Monocalcium phosphate	1.30	1.04
Limestone	1.09	.96
Salt	.35	.35
Vitamin premix	.20	.20
Trace mineral premix	.15	.15
Choice white grease	--	--
Total	100.00	100.00

[a]Grower diets were formulated to 3.2 g lysine / Mcal ME, .75% Ca, and .65% P. Finisher diets were formulated to 2.47 g lysine/Mcal ME, .65% Ca, and .55% P. Dietary lysine levels range from 1.06 to 1.14% in the grower phase and .82 to.88% in the finishing phase.

Table 2. The Effects of Increasing Energy Level Growing-Finishing Pig Growth Performance[a]

	Choice white grease, %					
Item	0	1.5	3.0	4.5	6.0	CV
Growing						
ADG, lb	1.96	2.01	1.97	1.94	2.04	7.5
ADFI, lb[b]	4.33	4.23	4.10	3.90	4.06	6.6
F/G[b]	2.23	2.11	2.08	2.02	1.99	7.9
Energy intake, Mcal	6.49	6.44	6.38	6.17	6.55	6.5
Lysine intake, g	20.85	20.74	20.48	19.81	21.00	6.5
Finishing						
ADG, lb[f]	2.11	1.91	1.94	1.94	1.97	7.9
ADFI, lb[b]	7.82	7.57	7.36	7.39	7.05	6.5
F/G[f]	3.74	3.94	3.81	3.81	3.58	6.0
Energy intake, Mcal	11.78	11.62	11.52	11.78	11.44	6.5
Lysine intake, g	29.13	28.71	28.41	29.03	28.15	6.5
Overall						
ADG, lb[g]	2.03	1.95	1.95	1.94	2.00	6.0
ADFI, lb[b]	6.18	5.99	5.82	5.75	5.64	5.4
F/G[b]	3.04	3.01	2.99	2.97	2.81	4.8

[a]Means derived from 80 pigs housed at two per pen with eight replicate pens per treatment.
[bcd]Linear effect of energy (P<.01, .05, and .10).
[efg]Quadratic effect of energy (P<.01, .05, and .10, respectively).

Table 3. The Effects of Increasing Energy on Carcass Characteristics

	Level of choice white grease, %					
Item	0	1.5	3	4.5	6	CV
Real time ultrasound[a]						
Tenth rib fat depth, in	.87	.94	.93	.86	.84	16.9
Tenth rib LMA, in^2	5.26	5.32	5.18	5.35	5.33	11.7
Percent lean[b]	49.81	49.47	49.11	50.39	50.45	5.1
Fat-O-Meater[c]						
Backfat depth. in[f]	.60	.66	.68	.58	.56	22.1
Loin muscle depth, in	2.17	2.24	2.09	2.18	2.18	9.7
Percentage lean%[dg]	56.18	55.45	54.76	56.48	56.75	4.2
Carcass yield, %[de]	63.91	64.58	64.73	65.12	65.30	2.3

[a]Means derived from 80 pigs scanned at 232 lb with 16 pigs per treatment.
[b]Percent lean was derived from NPPC equations for carcasses with 5% fat utilizing real time ultrasound measurements.
[c]Means derived from 79 pigs slaughtered at 232 lb with 15 or 16 pigs per treatment.
[d]Percent lean and carcass yield derived form plant carcass performance data sheet.
[e]Linear effect of energy ($P < .01$)
[fg]Quadratic effect of energy ($P < .05$ and .10, respectively).