2006

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Mike Brumm
University of Nebraska, mbrumm1@unl.edu

Larry Himmelberg
University of Nebraska - Lincoln

Tom Rathje
University of Nebraska - Lincoln, trathje2@unl.edu

John Sonderman
University of Nebraska - Lincoln

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Michael C. Brumm
Larry Himmelberg
Tom Rathje
John Sonderman[1]

Summary

Two experiments were conducted to determine the influence of sire line and dietary energy levels on grow-finish pig performance. In each experiment, dietary treatments were corn-soybean meal based diets with no added fat and corn-soybean meal based diets with fat added and soybean meal adjusted to maintain a similar lysine: calorie ratio. Fat additions to the added fat diets ranged from 3.75% for the 40 to 70 pound body weight period to 1.5% for pigs over 220 pounds body weight. Within each of five phases during the growing-finishing period, feed budgets were used to maintain a similar total caloric intake between experimental diets. In both experiments, pigs were progeny of Danbred NA 230 females. In Exp. 1, the sire lines compared were Danbred NA 771 versus Danbred NA 671. In Exp. 2, the sire lines compared were Danbred NA 771 versus Danbred NA 600. There were no interactions between sire line and dietary treatment in either experiment. There was no effect of dietary treatment on daily gain. In Exp. 1, feed conversion was improved 6.8% and in Exp. 2, feed conversion was improved 3.7% for the fat added diets versus the control treatment. The lack of daily gain response, when combined with the lack of a genetic interaction, suggests that for these genetic lines daily gain is not a consideration in the decision regarding the use of fat in grow-finish diets.

Introduction

There are numerous reports in the literature detailing the response of barrows and gilts to dietary fat additions during the growing-finishing phase of production. In general, there is almost always an improvement in feed conversion efficiency from the addition of fat to corn-soy based diets. However, an improvement in daily gain is less consistent, especially if the lysine:calorie ratio is similar for the fat added and no fat added diets. Unclear from the literature is whether there is a genetic component to this response. Genetic differences related to feed intake exist; therefore, dietary energy levels necessary to maximize daily gain may differ according to genotype. The following experiment was designed to examine the possible interaction between sire line and dietary fat additions to grow-finish diets.

Materials and Methods

Two experiments were conducted using progeny of the Danbred NA (Columbus, Neb.) 230 female. The experimental diet treatments during the grow-finish phase were:

1. Corn-soybean meal based diets with no added fat (No).
2. Corn soybean meal based diets with added fat (Added).

In Exp. 1, the Danbred NA sire lines compared were 771 versus 671. In Exp. 2, the sire lines compared were 771 versus 600. There were two farrowings of the sire lines within each experiment. Treatments were arranged as a 2 x 2 factorial.

Sire line matings were made at a commercial production unit approximately 200 miles from the research site. The commercial unit was negative for PRRSV. No information is available as to parity distribution of the females used for these matings although an attempt was made to balance sire line matings across parity.

On the day prior to weaning, a representative from Danbred NA identified pigs within litters for use in the experiment. Pigs selected were the heaviest pigs in at least 10 litters and were balanced by sex.

On the day of weaning, 140 pigs (70 from each sire line mating) were transported to the University of Nebraska's Haskell Ag Lab near Concord. At arrival, pigs were ear tagged, weighed, and assigned to nursery pen on the basis of sire line, sex and arrival weight such that within sire line, pens were balanced for sex and similar for arrival weight and coefficient of variation (CV) of arrival weight.

Pigs were housed in 4 x 8 ft nursery pens with woven wire flooring in two nursery rooms. There were five pens per nursery room and the connecting doors between rooms were open. Each pen contained one Drik-o-Mat bowl drinker and one, two-hole Farmweld wean-to-finish feeder. Sire line pens were randomized. There were 14 pigs per pen (2.28 ft^2/pig).

Pigs were fed according to the nursery feed budget detailed in Table 1. Pigs were moved from the nursery on day 34 for both replications in Exp. 1 and on day 35 (replicate 1) and 36 (replicate 2) post weaning in Exp. 2.

Upon removal from the nursery, pigs were moved to a partially slatted grow-finish facility. Facilities were naturally ventilated in the first experiment and mechanically ventilated in the second experiment. Each facility contained 12 6 ft x 15 ft pens. There were 11 or 12 pigs per pen (7.5-8.2 ft^2/pig). There was one nipple drinker and

Table 1. Experimental diets.

	Nursery diets				Grow-finish diets									
Ingredient	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Corn		920	1105	1195	1340.2	1210.3	1430	1304.6	1547.5	1429.1	1644.2	1576.6	1688.3	1644.4
46.5% CP SBM		410	525	645	609.8	665.5	522.6	573.1	407.3	451.5	315.1	337.9	271.6	285.5
Fat[a]		20	20	60	0	75	0	75	0	75	0	45	0	30
Limestone					17.4	16.5	16.7	16.6	16.5	15.8	16.2	16	15.9	16
Dical					15.7	15.5	14.1	13.9	12.7	12.6	10	10	11.7	11.6
Salt					8	8	8	8	8	8	7	7	6	6
Akey 2000[b]	2000													
Akey 650 [b]		650												
Akey 300[b]			350											
Akey 100[b]				100										
Akey 4S Premix[b]					4	4	4	4	4	4	4	4	3.5	3.5
L-lysine					3.5	3.5	3.5	3.5	3.5	3.5	3	3	2.5	2.5
Methionine					0.9	1.2	0.6	0.8	0	0	0	0	0	0
Natuphos 1200G[c]					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Pig wt range, lb					40-70	40-70	70-120	70-120	120-170	120-170	170-220	170-220	220-mkt	220-mkt
Feed budget, lb/pig	1.79	7.14	10.7	20.8	54	51	110	104	135	128	163	158		
Calculated composition														
ME, Kcal/lb		1452	1449	1490	1510	1595	1513	1597	1516	1600	1520	1571	1521	1555
Lysine,%	1.60	1.44	1.37	1.31	1.20	1.26	1.08	1.14	0.93	0.98	0.79	0.81	0.71	0.73
g Lysine/Mcal					3.61	3.59	3.24	3.24	2.79	2.78	2.36	2.34	2.12	2.13

[a]HiEnergy Feed, Des Moines, Iowa.
[b]Akey Inc., Lewisburg, Ohio.
[c]BASF Inc., Florham Park, N.J.

one, two-hole Staco wean-to-finish feeder per pen. Sprinklers were used for summer heat relief with on-off timed sprinkling beginning at 80°F. Following the move to grow-finish, pigs were vaccinated for erysipelas and M hyo. All pigs that died were examined for cause of death by a veterinarian and pen size was not adjusted.

Within sire line, pigs were randomly assigned to grow-finish pens on the basis of weight and sex such that all pens had similar sex ratios and the initial weight and CV for initial weight in all pens was similar.

The experimental diets were formulated to have a constant lysine:calorie ratio within phase. A feed budget was prepared for each diet (Table 1). Feed was budgeted within each phase so as to standardize caloric intake between the no and added fat treatments. The feed budget for the 40-70 lb period was adjusted based on pig weight at the time of relocation from the nursery to the grow-finish facility based on a 1.41 feed:gain for the added fat treatment and 1.51 for the no fat treatment. Prior to relocation, all pigs remained on diet 4 (Table 1).

Because of the difference in arrival weight, pig weight at arrival was used as a covariate in the analysis of nursery performance. Pig weight at the move to the grow-finish facility was used as a covariate in the grow-finish analysis. The pen of pigs was the experimental unit. Within experiment, the model included replicate, sire, diet, and all two- and three-way interactions for grow-finish performance. For nursery performance, the model included replicate, sire, and all two-way interactions.

Results and Discussion

The significance (P = 0.007) in final weight for the 671 vs 771 sired pigs in the first experiment (Table 2) is due in part to the 1.3 lb heavier arrival weight of the 671 sired pigs. There were no interactions between sire lines and diets during the grow-finish phase so the main effects of sire line and diet are presented in Table 3. There was no difference (P > 0.1) in daily gain, daily feed, or feed conversion between the sire lines during the grow-finish phase of the experiment.

As expected, pigs fed diets with added fat during the grow-finish phase had a lower daily feed disappearance (P = 0.003) and improved feed conversion (P < 0.001) compared to pigs fed diets with no added fat during the grow-finish phase of production in Exp. 1. There was no difference in daily gain between the low and high energy diets.

In Exp. 2, there was no effect (P > 0.1) of sire line on nursery performance (Table 4). Similar to Exp. 1, there was no interaction between sire line and diets during the grow-finish phase so the main effects of sire line and diet are presented in Table 5. There was no effect (P > 0.1) of sire line on grow-finish performance.

As in Exp. 1, pigs fed diets containing added fat had a reduction in daily feed (P = 0.001) and an improvement in feed conversion

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(P = 0.007) compared to pigs fed diets with no added fat during the grow-finish phase. There was no difference in daily gain between the low and high energy diets.

The magnitude of the response to added fat varied between experiments. Daily feed was reduced 5.0% for the fat added diets in Exp. 1 and 3.9% in Exp. 2. Feed conversion was improved 6.8% in Exp. 1 while it was only improved 3.7% in Exp. 2 for the fat added diets.

The difference in feed conversion efficiency between the experiments is somewhat surprising. Both replicates of Exp. 1 and the first replicate of Exp. 2 were conducted in winter and spring seasons. Only during the final weeks of replicate 2 of Exp. 2 were the pigs exposed to temperatures above 90°F for extended periods of time. Generally the response to fat additions in diets is greatest when pigs are heat stressed versus grown in thermal-neutral conditions.

Conclusions

While the magnitude of the response to dietary fat additions varied between experiments, the overall improvement in feed conversion efficiency for the pigs fed the fat added diets is in agreement with published results. In both experiments, dietary energy levels higher than typical corn-soybean meal based diets did not result in an improvement in daily gain. The lack of daily gain response, when combined with the lack of a genetic interaction, suggests that for these genetic lines daily gain is not a consideration in the decision regarding the use of fat in grow-finish diets.

[1]Michael C. Brumm is professor of animal science and extension swine specialist at the Northeast Research and Extension Center in Concord, Neb. Larry Himmelberg was director of technical services, Tom Rathje is chief technical officer and John Sonderman is manager of technical services for Danbred North America.

Table 2. Effect of sire line on nursery performance in Exp. 1 – LS means are reported using arrival weight as a covariate, Exp. 1.

	Sire[a]			P value	
Item	671	771	SE	Sire	Sire x trial
No. pens	10	10			
Pig wt, lb					
Arrival	15.6	14.3			
32 day	45.7	42.6	0.5	0.007	0.763
Daily gain, lb	0.963	0.861	0.016	0.006	0.662
Daily feed, lb	1.316	1.288	0.039	0.710	0.583
Feed:gain	1.362	1.493	0.034	0.068	0.299

[a]Danbred NA, Columbus, Neb.

Table 3. Effect of sire line and diet on grow-finish performance in Exp. 1 – LS Means are reported using day 0 weight as a covariate.

	Sire line[a]		Diet[b]			P values		
Item	671	771	Fat	No	SEM	Sire	Diet	Sire x Diet
No. pens	12	12	12	12				
Pig wt, lb								
Day 0	44.9	43.3	44.1	44.1	0.2			
Final[c]	284.5	279.6	284.3	279.7	2.5	0.438	0.212	0.650
Daily gain, lb	1.923	1.885	1.923	1.885	0.020	0.460	0.202	0.638
Daily feed, lb	5.163	5.029	4.965	5.227	0.053	0.327	0.003	0.680
Feed:gain	2.684	2.674	2.585	2.773	0.022	0.863	< 0.001	0.941

[a]Danbred NA, Columbus, Neb.
[b]Fat = added fat per Table 1; No = no added fat.
[c]Day 125 in both trials.

Table 4. Effect of sire line on nursery performance in Exp. 2 - LS means are reported using arrival weights as a covariate.

	Sire Line[a]			P value	
Item	600	771	SE	Sire	Sire x trial
No. pens	10	10			
Pig wt, lb					
Arrival	13.4	14.3	0.04		
Final[b]	47.4	47.3	1.1	0.951	0.761
Daily gain, lb	0.944	0.940	0.030	0.942	0.759
Daily feed, lb	1.357	1.316	0.038	0.583	0.494
Feed:gain	1.436	1.400	0.38	0.583	0.494

[a]Danbred NA, Columbus, Neb.
[b]35 d rep 1; 36 d rep 2.

Table 5. Effect of sire line and diet on grow-finish performance in Exp. 2 – LS Means are reported using day 0 weight as a covariate.

	Sire line[a]		Diet[b]			P value		
Item	600	771	Fat	No	SEM	Sire	Diet	Sire x Diet
No. pens	12	12	12	12				
Pig wt., lb								
Day 0	46.7	47.8	47.4	47.1	0.3			
Final[c]	271.1	269.8	270.4	270.6	2.2	0.737	0.963	0.456
Daily gain, lb	2.045	2.033	2.038	2.040	0.020	0.729	0.951	0.459
Daily feed, lb	5.682	5.634	5.550	5.766	0.041	0.490	0.001	0.814
Feed:gain	2.778	2.774	2.724	2.828	0.025	0.926	0.007	0.255

[a]Danbred NA, Columbus, Neb.
[b]Fat = added fat per Table 1; No = no added fat.
[c]Day 109 and day 110 in trials 1 and 2, respectively.