Effect of Divergent Selection for postweaning gain on body weight changes of gilts

A.C. Clutter and D.S. Buchanan

Story in Brief

The effects of divergent genetic merit for postweaning ADG and feed intake on body weight changes in gestating and lactating gilts were examined in lines of pigs resulting from divergent selection for ADG. For the postweaning period from 9 weeks of age to 100 kg, barrows and gilts from the line selected for fast ADG (line F) consumed .71 kg/day more feed, gained .235 kg more weight per day, and had 7.44 mm more backfat at market weight than those from the line selected for slow ADG (line S). Neither litter size nor total litter weight, at birth or a weaning, differed between F and S. Gilts from F were heavier than S gilts at breeding and gained more during gestation, yet S gilts had greater weight loss during farrowing and lactation. It appears that genetic differences in postweaning feed intake may be reflected in weight loss differences during lactation. Genetic potential for feed intake can also be reduced when selection is for increased leanness or lean tissue feed conversion. The effects of selection methods for market pig performance on the appetite of reproducing females in the line should be an important consideration in seedstock breeding programs.

(Key Words: Pigs, Lactation, Appetite, Growth, Selection.)

Introduction

Feed intake represents the largest single component of the cost of pork production. Intake of market hogs should be at a level sufficient to allow full expression of potential for lean tissue growth, but not great enough to result in the wasteful deposition of fat. Gilts and sows in the breeding herd are usually restricted in their feed intake to avoid over-fattening. But during some phases of reproduction, such as lactation and rebreeding, breeds or genetic lines with relatively low appetite may be challenged to consume adequate energy. Consequently, the optimum weighting for feed intake in a selection objective will vary based on the paternal or maternal role of the line, and the current genetic potential of the line for feed intake relative to lean tissue growth.

Selection lines that differ in genetic merit for postweaning growth and feed intake provide an opportunity to study correlated differences in traits of reproduction. The objective of the present analyses was to determine the effects of divergent selection for postweaning ADG on body weights of gilts during first gestation, farrowing and lactation.

Materials and Methods

Lines of pigs were established at Oklahoma State University in 1981 to evaluate responses to divergent selection for postweaning ADG. Duroc and Hampshire boars were purchased in breed pairs from central performance testing stations where they were ranked on an index that emphasized high ADG and feed efficiency and low fat relative to lean. One of each purchased breed pair was above the test average for the index and the other below. A fast growth line (F) was initiated from pigs sired by high-indexing Duroc boars and out of gilts sired by high-indexing Hampshire boars. A slow growth line (S) was derived from pigs sired by low-indexing Duroc boars and out of gilts sired by low-indexing Hampshire boars. In the initial matings to establish the lines, Hampshire boars were crossed with a population of Duroc x Yorkshire x Landrace x Spotted crossbred gilts from a previous study. Following the initial matings, lines were closed and single-trait selection practiced for either fast or slow ADG from 9 weeks of age to 100 kg (in F and S, respectively). Selection was replicated in spring and fall farrowing groups.

Data for the present analyses were collected after eight generations of selection were completed. Replacement gilts in each line were housed in outside lots with shelters during breeding and gestation. Gilts were hand-mated at approximately 8 months of age and fed 2.27 kg of a corn-based gestation diet per day in individual feeding stalls. Gilts were moved to a farrowing house approximately 1 week before parturition, and gilts and litters were housed in a nursery from 1 week after parturition until weaning at 42 days of age. Gilts had ad libitum access to a corn-based lactation diet during the entire 42-day lactation. All replacement gilts were weighed at breeding, day 110 of gestation and 42 days postpartum. Gilt weights at breeding, gestation gain (difference in weights at day 110 of gestation and breeding), farrowing/lactation loss (difference in weights at weaning and day 110 of gestation), litter size at birth and weaning, and total litter weight at birth and weaning were each analyzed using least-squares methods and a model that accounted for the effects of selection line, farrowing group and their interaction.

To characterize corresponding direct and correlated responses in postweaning performance, ADG, average daily feed intake, feed conversion ratio (feed/gain) and average backfat probe of barrows and gilts in F and S were analyzed. Average daily gain and backfat were analyzed using a model that accounted for the effects of selection line, farrowing group and sex of pig and associated interactions. Feed traits were measured for pens of barrows of gilts and were analyzed with model that included the effects of selection line, farrowing group and the interaction.

Results and Discussion

Least-squares means depicting the postweaning performance of F and S are presented in Tables 1 and 2. There was a line x sex interaction for ADG and backfat thickness ($P<.01$; Table 1). Pigs from F gained faster and had more backfat at market weight than those from S, but the differences were greater for gilts than for barrows. Barrows and gilts from F consumed an average of .71 kg more feed per day than those from S during the postweaning period ($P<.01$; Table 2), but the difference in feed intake tended to be offset by differences in ADG so that feed/gain tended to be less in F than in S. These results are consistent with previous evaluations of the lines for postweaning performance (Woltmann et al., 1992, 1995; Clutter et al., 1995).

Gilts from F were heavier than S gilts at breeding (P<.01; Table 3) and gained more during gestation (P<.01), yet S gilts had greater weight loss during farrowing and lactation (P<.01). Neither litter sizes, nor total litter weights were significantly different in F and S (P>.10).

Assuming that weight lost at farrowing was similar in the lines, an assumption supported by the similar total litter weights at birth in F and S, the S gilts lost significantly more weight during lactation. The similar weaning weights in the lines suggest that the difference in lactation loss was due to less feed intake rather than greater milk production. Only limited feed intake data were collected during the lactation period, but based on the few data collected (not shown) and feed intake differences during the postweaning period (Table 2), one could speculate that the genetic differences in appetite are once again revealed during lactation. A difference in weight loss of this magnitude might also be expected to result in differences in subsequent reproduction. Unfortunately, as is the case with many selection experiments, females only produced a single litter and there are no measurements of rebreeding performance or reproductive performance in subsequent pariites.

Although the line difference in feed intake in the present experiment was the result of divergent selection for ADG, genetic potential for feed intake can also be reduced when selection is for increased leanness or lean tissue feed conversion. The effects of selection methods for market pig performance on the appetite of reproducing females in the line should be an important consideration and priority area for research.

Literature Cited

Woltmann, M.D. et al. 1992. J. Anim. Sci. 70:1049.

Clutter, A.C. et al. 1995. J. Anim. Sci. 73:1776.

Woltmann, M.D. et al. 1995. J. Anim. Sci. 73:1940.

Table 1. Average daily gain and average backfat depth in barrows and gilts from the fast and slow divergent selection lines.

Sex	Line	n	ADG, kg[a]	Average Backfat, mm[b]

Barrows	Fast	173	.91	33.68
	Slow	129	.70	27.09
Gilts	Fast	365	.88	31.50
	Slow	218	.62	23.21
	Average standard error		.01	.30

aNine weeks of age to 100 kg.

bAverage of three measurements with an ultrasonic probe, adjusted to 105 kg body weight.

Table 2. Average daily feed intake and feed conversion (feed/gain) in barrows and gilts from the fast and slow divergent selection lines.

Line	Daily Feed Intake, kg[a]	Feed Conversion [ab]
Fast	2.72	3.10
Slow	2.01	3.14
Average standard error	.02	.02

aPen basis.

bFeed/Gain.

Table 3. Body weight and litter characteristics of gilts from the fast and slow divergent selection lines.

Trait	Fast (n = 105)	Slow (n = 55)	SEa

Breeding wt, kg	131.62	118.54	1.29
Gestation gain, kgb	54.56	45.22	1.60
Farrowing/Lactation Loss, kgc	2.40	20.99	2.26
Litter size-birth	9.74	10.37	.27
Litter size-weaning	7.79	8.33	.25
Litter wt-birth, kg	14.42	14.35	.36
Litter wt-weaning, kg	80.66	79.48	2.44

aAverage standard error.

bWeight at day 110 of gestation minus breeding weight.

cWeight at weaning minus weight at day 110 of gestation.

1997 Research Report