

Performance Differences Among Littermate Boars, Barrows and Gilts

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Story in Brief

The pigs used in this study were selected from each litter prior to weaning on the basis of similar 3-week weights with one male pig from each litter chosen at random to be castrated.

Growth rate data from 184 littermate boar-barrow-gilt trios and carcass data from 237 barrow-gilt littermate pairs were analyzed to evaluate the influence of sex on post-weaning performance and carcass traits. The relative magnitude of these sex differences for different sire groups was also evaluated to investigate the possibility of sire-sex interactions.

Barrows gained faster than boars and gilts, and reached market weight in fewer days than gilts while there was essentially no difference in age at 200 lbs. between boars and barrows. Little difference was noted between barrows and gilts for feed required per unit of gain while boars were considerably more efficient. Boars probed less backfat than gilts and gilts less than barrows. Gilt carcasses were longer, had less carcass backfat and larger loin eye areas than barrows. Trimmed hams, loins and shoulders from gilt carcasses weighed more than lean cuts from barrow carcasses and yielded a greater percentage of lean cuts based on slaughter weight and cold carcass weight. Barrow carcasses were scored higher for firmness and tended to have more marbling in the loin eye but a sire-sex interaction was obtained for marbling score. This would indicate that if marbling is to be evaluated in a testing program, both sexes may need to be included in the test to adequately evaluate a sire's potential for transmitting this aspect of carcass quality to his offspring. Sire-sex interactions were not found in the other traits studied. The correlations obtained showed similar relationships among the various traits when based on either gilt data or barrow data.

Introduction

Sex differences exist for many traits in swine. Since both males and females are oftentimes included in performance testing programs, this necessitates a thorough understanding of the influence of sex on the traits evaluated in order to properly interpret the results obtained.

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In general, barrows gain faster and reach market weight at an earlier age than gilts, but gilts yield more heavily muscled carcasses with less backfat. Research investigations comparing the performance of boars to the performance of barrows or gilts are very limited and the results that are available are usually biased due to the fact that the boars used represent a highly selected group. Meaningful sex adjustment factors require not only knowledge pertaining to the relative magnitude of these sex differences, but also some assurance that these differences are similar for the various sire groups evaluated.

This study was initiated to evaluate the differences in performance of littermate boars, barrows and gilts selected on the basis of comparable weights at 3 weeks of age and to investigate the similarity of these differences for different sire progeny groups.

Experimental Procedure

Data from the swine breeding research herds at Stillwater and Fort Reno were used in this investigation which extended over a three year period (1965-1967). Performance records on 184 boar-barrow-gilt littermate trios and carcass data on 237 barrow-gilt littermate pairs from five breeding groups were utilized as shown in Table 1. Traits evaluated included growth rate, feed efficiency, backfat thickness, carcass length, loin eye area, lean-cut yield, marbling and firmness.

The pigs used in these analyses were selected prior to weaning on the basis of similar weights at 21 days. The 184 littermate boar-barrow-gilt pairs were used in the carcass evaluation. In selection of trios, two males and one female were chosen from each litter and then one of the male pigs was selected at random to be castrated prior to weaning. The littermate pairs used in the carcass evaluation included the barrow and gilt from the trio when available plus additional barrow-gilt littermate pairs selected on the basis of similar 21-day weights.

Pigs were self fed milo-wheat-soybean meal rations containing 16 percent protein from weaning to 120 lb. and 15 percent protein from 120

Table 1. Distribution of Littermate Pairs and Trios by Line of Breeding.

Line of breeding	No. Pairs	No. Trios
Duroc	--	16
Beltsville No. 1	49	21
Hampshire	79	47
2-line cross (Belts x Duroc)	42	59
3-line cross (Hamp x Belts-Duroc)	67	41
Total	237	184

lb. to 200 lb. Pigs were fed in confinement in groups of 6 pigs per pen from 8 weeks of age until end of test. Feed records were obtained on a pen basis for 6 pigs of the same sex.

Pigs were removed from test and probed on a weekly basis as they weighed 200 lb. The probe backfat measurements were taken approximately 1.5 in. off each side of the mid-dorsal line behind the shoulder, at the last rib and the last lumbar vertebrae.

Carcass weights and measurements were taken 48-hours after slaughter. Area of *l. dorsi* muscle and quality scores were obtained from the right side of the carcass at a cross section of the loin between the 10th and 11th ribs. The loins were scored for firmness and marbling by a committee of three evaluators and the average of their scores was used in the analysis. The weights of the closely trimmed loins, hams and shoulders from both sides of the carcass were obtained and expressed as a percentage of off-test weight and as a percentage of cold-carcass weight. Samples for ether extract and total moisture determinations were taken from the *l. dorsi* muscle at the 9th and 10th rib section. Since not all lines of breeding appeared each season, analyses were done within season and line and pooled over season and line under the assumption of equal variances.

Results and Discussion

Data for the performance traits of 184 boar-barrow-gilt full-sib trios and for the carcass traits of 237 barrow-gilt parts are summarized in Table 2.

Even though the pigs from each sex within a litter were selected to be of approximately equal weight at three weeks of age, the difference in weight at weaning between sexes was significant ($P < .01$). A difference in weight between boars and barrows at weaning was expected since the male selected to be the barrow was castrated at approximately five weeks and the weaning weights possibly still reflect the stress imposed on the barrows by castration.

Barrows gained 0.20 lb. per day faster and reached market weight approximately 10 days sooner than gilts. The barrows averaged 0.05 lb. per day faster gain than the boars, but because of weaning weight differences, there was essentially no difference in the time required to reach market weight. Differences in weaning may have influenced the differences observed in postweaning daily gain since weaning weight and postweaning gain are positively correlated. Since the boars were heavier at weaning than the barrows, the differences observed in average daily gain during the postweaning phase were possibly not as large as would have been obtained if the two groups had been equal in weight at weaning.

Table 2. Means and Standard Deviations for Performance and Carcass Data of Littermate and Trios and Littermate Pairs.

	Boars	Barrows	Gilts	Standard Deviation
Numbers of littermates	184	184	184	
42-day wt., lb. **	29.3	28.3	28.8	1.80
Postweaning daily gain, lb.**	1.75	1.80	1.60	.15
Days to 200 lbs.**	148	147	157	3.7
Feed per unit gain, lb.**	2.60	2.87	2.89	.10
Probe backfat at 200 lb., in.**	1.18	1.36	1.24	.11
Carcass data:				
Number of littermates		237	237	
Cold carcass weight, lb.		144.9	144.3	3.83
Carcass length, in.**		29.6	30.1	.54
Backfat thickness, in.**		1.36	1.26	.11
Loin eye area, sq. in.**		4.20	4.67	.37
Total wt. of ham, loin and shoulder, lb.		77.3	80.2	2.88
Lean cuts of off-test wt., %**		38.7	40.5	1.25
Lean cuts of carcass wt., %**		53.4	55.6	1.61
Marbling score ¹ *		3.7	3.3	.99
Firmness score**		4.4	3.9	1.13
Ether extract, %**		4.8	3.9	1.56
Total moisture, %**		70.8	71.2	1.49

¹ Loin eye muscle at 10th rib was scored for marbling and firmness. Scores ranged from 1 to 7 with 1 = devoid of marbling and very soft and 7 = abundant marbling and very firm.

*Sire-sex interaction significant ($P < .05$).

**Difference between sexes significant ($P < .01$).

Boars required 27 lb. and 29 lb. less feed per cwt. gain than the barrows and gilts, respectively ($P < .01$). The difference between the barrows and gilts was not significant. Other work has shown boars to be more efficient than either barrows or gilts, but considerable variation regarding differences between barrows and gilts have been reported. Although the number of comparisons available are limited, the trend in most other studies has been for gilts to require less feed per unit of gain than barrows.

Gilts probed 0.12 in. less backfat than their littermate barrows in this study while boars probed 0.06 in. less than gilts and 0.18 in. less than barrows. Similar differences in carcass backfat between barrows and gilts were also noted. Gilt carcasses were 0.5 in. longer, had 0.47 sq. in. larger loin eye areas and yielded 2.2 percent more lean cuts of carcass weight than barrows.

The loin eyes of barrow carcasses were scored 0.5 of a unit higher for firmness ($P < .01$) and 0.4 of a unit higher for marbling than the loin eyes of gilt carcasses. However, a sire-sex interaction was obtained for marbling score in that in two lines of breeding (Hampshire and 3-line

cross), the gilts were scored higher than barrows for the progeny of a few sires while barrows were scored higher than gilts for most sire groups.

The presence of the sire-sex interaction for marbling score would indicate that both sexes may need to be included in a progeny testing program to adequately evaluate this aspect of carcass quality. Since sire-sex interactions were not found for any of the other traits, it appears that one can test either sex and apply adjustment factors in a progeny testing program. Although the magnitude of these sex differences may be similar for different sire groups, it should be realized that these sex differences are not constants and that the most accurate progeny test would include animals of all the same sex or include both sexes in equal numbers.

The phenotypic relationships among the various traits for each sex are presented in Table 3. To quantize the similarity between correlations obtained using barrow data with those obtained using gilt data, a correlation coefficient was calculated between the corresponding correlations for each sex. This correlation between the sets of estimates presented in Table 3 for the 2 sexes was 0.94 indicating that the relationships among the various traits were similar for both sexes.

The correlations presented in Table 3 indicate that an increase in carcass backfat was associated with a decrease in carcass length and per-

Table 3. Phenotypic Correlations for Barrows (Upper Line) and Gilts (Lower Line) Among Carcass Traits Evaluated.

Trait	Sex	Carcass length	Loin eye area	Percent lean of carcass	Marbling score	Firmness score	Ether extract	Total moisture
Carcass backfat	B	-.16*	-.04	-.47**	-.05	0.00	-.03	-.09
	G	-.46**	-.11	-.52**	-.02	0.16*	-.02	-.02
Carcass length	B		-.06	0.18*	0.00	-.08	0.03	0.03
	G		-.13	0.22**	0.10	0.05	0.12	-.07
Loin eye area	B			0.41**	-.17*	-.28**	-.23**	0.15
	G			0.45**	-.13	-.27**	-.16*	0.09
% lean of carcass	B				-.10	-.29**	-.05	0.00
	G				-.10	-.29**	-.05	0.00
Marbling score	B					-.42**	0.48**	-.55**
	G					-.53**	0.62**	-.44**
Firmness score	B						0.39**	-.29**
	G						0.27**	-.19**
Ether extract	B							-.82**
	G							-.79**

* Significant at 5% level.

** Significant at 1% level.

cent lean of carcass while an increase in carcass length was associated with an increase in percent lean of carcass. Increased marbling and fat content were associated with a decrease in loin eye area and total moisture and an increase in firmness. No appreciable relationships were found between fat content and percent lean of carcass.

The Effects of Heat Stress on Rectal Temperatures and Respiration Rates in Gilts

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In the spring of 1970, 24 Hampshire gilts averaging 7 months of age and averaging 208.9 pounds were confined to a cool or hot chamber for a one-week period (2 gilts/chamber/week) to determine the effects of heat stress on rectal temperatures and respiration rate. Both environmental control chambers were also evaluated for capabilities and limitations. When gilts were first subjected to the chambers, both chambers were operated at 70°F. with 60 percent humidity and 5 m.p.h wind velocity. Twenty hours after each group of pigs was confined to the chambers, the temperature in one chamber was elevated to 80°F. and then four hours later elevated to 85°F. and held at that level for the remainder of the confinement period.

The desired chamber temperatures and humidity in the hot chamber were obtained. However, humidity in the cool (70°F.) chamber was affected by increased air moisture content outside the chamber.

Exposure to the chambers tended to induce estrus. Ten gilts (4 in cool chamber and 6 in hot chamber) showed signs of estrus on either days 3 or 4 of confinement. The average rectal temperature for pigs in the cool chamber was 102.4°F. compared to 103.0°F. for those in the hot chamber. As chamber temperature increased rectal temperatures and respiration rates increased. The pigs exposed to the hot chamber had higher average rectal temperatures than the cool chamber pigs at all