EVALUATION OF LARGE WHITE AND YORKSHIRE BREEDS AND RECIPROCAL CROSSES

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SUMMARY

Purebred Yorkshire, Large White and their reciprocal crosses were evaluated for growth and carcass traits. A portion of each set of females was retained and mated to Duroc sires to produce 205 litters for evaluation and estimation of maternal heterosis. Of the four genotypes purebred Large White gilts had the fastest daily gain ($P<.05$), the least backfat ($P<.05$), the greatest loin depth ($P<.05$) and the highest percentage lean cuts ($P<.05$). The difference between purebred average and crossbred average for growth and carcass traits was not significant. Crossbred average exceeded purebred average for average pig birth weight ($P<.05$). Maternal heterosis for average pig birth weight was 6.18%. Average pig birth weight was heaviest for pigs produced by Yorkshire-Large White dams ($P<.05$). Other litter traits were not significantly different between breeds or breed crosses.

INTRODUCTION

The Yorkshire breed of pigs in the U.S. originated from the Large White breed from England. For the most part, the breeds have been separated until recently. Of interest in this experiment, was speculation regarding the potential superiority of crosses of the 2 breeds relative to purebred Yorkshires and Large Whites. At the present, the two breeds are considered to be the same, in that, both are included in the same breed registry. If in fact heterosis exists in the cross, estimates of breeding values may be biased. The primary objective of this study was to determine the presence and magnitude of individual and maternal heterosis in crosses of Yorkshire and Large White breeds of swine.

MATERIALS AND METHODS

The foundation animals for the pure breeds included 10 unrelated boars (5 of each breed) and 20 unrelated gilts (10 of each breed). These animals were randomly mated within breed to multiply the population size and resulted in 45 pure Large White females and 49 pure Yorkshire females. Both the original and subsequent females were randomly mated (avoiding inbreeding) to the original set of boars to produce progeny females of each of the following types: pure Yorkshire (Y), pure Large White (LW), Y sire X LW dam (YLW), and LW sire X Y dam (LWY). A portion of these 4 groups of females and contemporary gilts were evaluated to estimate individual heterosis. These 4 sets of gilts were then randomly mated to 6 Duroc sires to produce 205 litters for evaluation and estimation of maternal heterosis.

Breeding animals were fed a standard corn-soybean meal gestation and lactation diet. Pigs were weighed at birth and 21 days. Creep feed was not provided and cross-fostering was not done. Traits for which data were collected for estimation of individual heterosis included average daily gain from approximately 36 kg to 104 kg (ADG), carcass 10th rib fat depth (BF), carcass loin depth (LD) and estimated carcass percentage lean cuts (LC). Carcass information was obtained from data reported from a commercial slaughter facility using a Fat'o'meat'er

probe.

Traits measured on litters for estimating maternal heterosis in sows included number of piglets born alive (NBA), stillborns, mummies and overlays, number weaned (NWEANED) average pig birth weight (BW) and average pig 21 day weaning weight (WW).

Analysis for the estimation of individual heterosis utilized a model including the effects of season, breed of sire, breed of dam, and the breed of sire by breed of dam interaction and appropriate covariates (ADG adjusted to a constant on-test weight; BF, LD and LC adjusted to a constant end-test weight). Least squares means were estimated and a linear contrast was used to compare the average of the pure breeds with the average of the reciprocal crosses.

Litter data for the estimation of maternal heterosis were analyzed using a model which included the effects of season, parity, breed of dam and sire of the litter (random effect) and appropriate covariates (NWEANED adjusted for age at weaning; WW adjusted for BW and age at weaning).

RESULTS

Individual Heterosis Data

Table 1 shows number of observations and means for breed groups and crosses. Large White and YLW gilts were faster gaining than Yorkshire gilts (6% and 4.5%, respectively, $P<.05$). However, there was no difference between the pure and cross average. Large White and LWY were significantly leaner at the 10th rib than pure Yorkshire (13.6% and 11.9%, respectively, $P<.05$). Although not significant, crossbred pigs tended to be leaner (1.29%) than purebred pigs. Pure Yorkshire gilts had less loin depth than all other types ($P<.05$) and the reciprocal cross types averaged .545 mm more loin depth than the average of the purebreds ($P>.05$). Results of fat and loin depth translated into similar results for percentage lean cuts. Yorkshire gilts had 2.3% less percent lean cuts than LW ($P<.05$) and 1.8% less percent lean cuts than LWY ($P<.05$).

Table 1. Least squares means for growth and carcass data in gilts for breeds and breed crosses

	ADG		BF[a]		LD[a]		LC	
Breed	n	Mean	n	Mean	n	Mean	n	Mean
Y X Y	88	.67±.012[b]	59	21.84±.71[b]	59	42.17±1.05[b]	59	56.6±.28[b]
LW X LW	37	.71±.015[c]	28	19.23±.76[c]	28	46.21±1.11[c]	28	57.9±.30[c]
Y X LW	60	.70±.015[c]	46	21.03±.81	46	44.97±1.21[c]	46	57.1±.33
LW X Y	40	.68±.017	38	19.51±.81[c]	38	44.50±1.21[c]	38	57.6±.33[c]
Cross minus Pure		0.0		-.265		.545		.10
% Individual Het.		0.0%		-1.29%		1.23%		.17%

[a]Measured in mm.

[bc]Means in the same column with different letters differ $P\leq.05$

Maternal Heterosis Data

Results of the litter data are shown in table 2. Although not significant, Y and LWY had about .5 more pigs born alive than both LW and YLW dams. This trend continued for number of pigs weaned for LWY dams only. Perhaps in a larger experiment, the superiority of the LWY cross for number weaned would be validated (LWY vs Y, P<.16). Reciprocal cross dams averaged .4 more pigs per litter weaned (P>.05). Average piglet birth weight was lowest for Y compared to all other types (P<.05). The linear contrast of purebred average compared to crossbred average pig birth weight was significant, indicating that maternal heterosis was present for average pig birth weight (6.18%, P<.05). No significant differences were observed in average pig weaning weight.

Table 2. Least squares means for litter traits for breeds and breed crosses

	NBA		NWEANED		BW[a]		WW[a]	
Breed	n	Mean	n	Mean	n	Mean	n	Mean
Y X Y	49	10.26±.69	48	8.93±.60	49	1.32±.062[b]	48	5.10±.22
LW X LW	48	9.74±.68	48	9.09±.59	48	1.43±.061[c]	48	5.08±.21
Y X LW	51	9.72±.66	50	9.14±.58	51	1.50±.059[c]	50	5.02±.21
LW X Y	57	10.25±.65	55	9.68±.57	57	1.42±.058[c]	55	4.89±.20
Cross minus Pure		-.015		.40		.085		-.135
% Maternal Het.		-.15		4.44		6.18[d]		-2.65

[a]Measured in kg.
[bc]Means in the same column with different letters differ P≤.05
[d]Linear contrast of pure vs cross P<.05

DISCUSSION

Results from this experiment indicated some evidence of heterosis in the cross between Large White and Yorkshire breeds of swine. Johnson (1980), summarizing a large group of crossbreeding experiments reported that maternal heterosis for pig birth weight was 1.5%. In this experiment, average pig birth weight had higher heterosis than literature values. Other traits did not show significant differences between pure and cross averages. Large White gilts had superior gain and carcass characteristics. The LWY crossbred female tended to have superior litter size weaned. Further study may provide more evidence of Yorkshire and Large White breed differences.

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