

Swine

The Comparison of Three-Breed Cross And Backcross Swine For Litter Productivity And Feedlot Performance

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Story in Brief

Crossbred gilts of Duroc, Hampshire and Yorkshire breeding were mated to produce backcross litters (mating crossbred gilts to a boar of one of the two breeds that were the same as the breeding of the gilt) or three-breed cross litters (mating a crossbred gilt to the third breed of boar). A total of 199 backcross and 100 three-breed cross litters were compared for sow productivity from birth to weaning, while 137 backcross and 63 three-breed cross litters were compared for feedlot performance from 40 to 220 pounds. The type of mating did not influence litter size or pig weight at birth. However, survival rate to weaning for three-breed crosses was 2.3 percent greater than for backcrosses, and three-breed cross litters had $0.42 \pm .28$ more pigs per litter at weaning than backcross litters.

Three-breed cross pigs grew significantly faster, 0.05 pound per day, and were five days younger at 220 pounds than the backcross pigs. Three-breed cross pigs also gained more efficiently than backcross pigs from 40 to 220 pounds. Three-breed cross pigs required 2.99 pounds of feed per pound of gain compared to 3.12 pounds of feed per pound of gain for the backcross pigs. There was no difference between the two groups for backfat probe at 220 pounds.

Introduction

Crossbreeding is an effective way to increase the total efficiency of swine production. Crossbred litters produced by crossing two pure breeds have given a 15 percent increase over purebreds in litter weight at weaning. An additional 20 percent has been realized by mating a two-breed cross sow to a

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boar of a third breed. Other advantages of crossbred pigs over purebreds are faster (8 percent) and more efficient (3 percent) growth.

Near maximum productivity can be attained when crossbred sows are producing three-breed cross pigs. This system, however, requires purchasing replacement females or maintaining purebred herds within the system to produce the crossbred females. A system preferred by most commercial producers is rotating purebred boars of two, three or four breeds and saving replacement females. Since in the rotation, the sow will contain some percentage of the same breed as the boar, some loss in heterosis is expected. In addition, the rotation system does not make maximum use of the differences in mothering ability, growth and carcass merit of the breeds involved, as each breed gets used both in the sire and the dam side of the rotation.

To identify mating systems that maximize the productivity of crossbred females, crossbred gilts of Duroc, Hampshire and Yorkshire breeding were mated to purebred Duroc, Hampshire and Yorkshire boars to produce backcross and three-breed cross litters. These results will assist breeders in deciding how best to mate breeds for maximum efficiency in their particular system.

Experimental Procedure

The purebred boars and crossbred gilts used in this study were raised at the Stillwater Swine Farm and transported to the Southwestern Livestock and Forage Research Station, El Reno, prior to the breeding season. The records of approximately 100 gilts for each of three seasons, fall 1975, spring 1976 and fall 1976 are included in the litter productivity data. Only the pigs from the first two seasons have completed the feedlot trial and are included in the feedlot performance data.

The mating scheme used each season is shown in Figure 1. Five to six boars from each breed were each mated to two gilts from each breed group. Gilts were checked daily for estrus and were hand mated on two consecutive days to the same boar. A two-month breeding season began December 1 for the spring farrowing and June 1 for the fall farrowing.

The gilts were farrowed in confinement and the litters were penned separately until weaned at 42 days. Creep was provided at approximately 21 days. Two weeks after weaning the pigs were transported to the confinement finishing barns and allotted to pens by breed group with approximately 16 pigs per pen. After a one-week adjustment the pigs were weighed on test. The pigs were weighed off test at weekly intervals as they reached 220 pounds. All pigs were probed for backfat when they were weighed off test. Total feed consumed per pen was recorded from nine weeks of age to 220 pounds and used to measure feed efficiency.

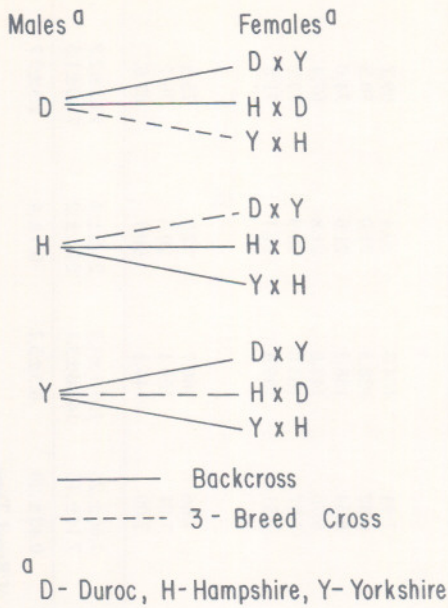


Figure 1. Breeding system.

Results

There were essentially no differences between backcross and three-breed cross litters for litter size, litter weight or average pig weight at birth (Table 1). Previous studies have shown that individual pig heterosis is not responsible for increased litter number at birth; however, maternal heterosis for litter size, which is the increase in number born from a crossbred female, has been significant. Since all of the females in this study were crossbred, there was no difference between backcross and three-breed litters for maternal heterosis. Therefore, litter birth traits would not be expected to differ for three-breed or backcross litters.

Duroc x Yorkshire gilts farrowed 10.44 pigs as compared to 10.06 for Duroc x Hampshire and 10.18 pigs for Hampshire x Yorkshire gilts. When mated to a Yorkshire boar, Duroc x Yorkshire gilts had the largest average litter size at birth 11.03 pigs.

Three-breed cross litters were 0.46 larger and 8.3 pounds heavier at 42 days than were backcross litters. Litter size at 42 days is the average number of pigs raised per gilt raising a litter to 42 days. The average litter size at 42 days was 7.58 for Duroc x Yorkshire females, 7.24 for Hampshire x Yorkshire females and 7.02 for Duroc x Hampshire females. The differences between female breed groups for litter size were very similar at birth and 42 days due to

Table 1. Litter productivity of three-breed and backcross litters at birth and 42 days

	No. of litters ²	Birth			42 days			Survival percent
		No.	Litter wt., lbs.	Pig wt., lbs.	No.	Litter wt., lbs.	Pig wt., lbs.	
<u>Backcross¹</u>								
D x D-H	35-33	10.49	29.1	2.76	7.44	154.3	20.4	69.2
D x D-Y	34	9.91	28.4	2.91	6.82	138.5	21.0	70.5
H x D-H	28	9.29	27.7	3.09	6.54	138.2	21.6	74.0
H x H-Y	34-33	10.11	27.6	2.77	6.76	143.8	21.8	67.4
Y x D-Y	33	11.03	29.6	2.71	7.97	163.8	20.9	73.2
Y x H-Y	35	10.43	29.0	2.81	7.31	154.4	21.1	71.8
<u>3-Breed Cross</u>								
D x H-Y	33-32	10.00	27.5	2.79	7.66	166.7	22.3	75.5
H x D-Y	33	10.39	29.2	2.85	7.94	159.1	20.5	76.7
Y x D-H	34-33	10.38	30.5	2.98	7.09	145.5	20.7	67.6
3-Breed Cross	100-98	10.26±.26	29.1±.7	2.87±.05	7.56±.23	157.1±4.7	21.2±.4	73.3±2.2
Backcross	199-196	10.21±.18	28.6±.5	2.84±.03	7.14±.16	148.8±3.1	21.1±.2	71.0±1.5
Difference		0.05±.32	0.5±.9	0.03±.06	0.42±.28	8.3±5.7	0.1±.4	2.3±2.7
Average Performance For Gilts of Breed Type								
D x H	97-94	10.06±.26	29.1±.7	2.94±.05	7.02±.23	146.0±4.8	20.9±.4	70.3±2.2
D x Y	100	10.44±.26	29.1±.7	2.82±.05	7.58±.23	153.8±4.6	20.8±.4	73.5±2.2
H x Y	102-100	10.18±.25	28.0±.7	2.79±.05	7.24±.23	155.0±4.6	21.7±.4	71.6±2.2

¹D-Duroc, H-Hampshire, Y-Yorkshire, (Breed of sire x crossbred female).²Number of litters at birth and 42 days, respectively.

Table 2. Feedlot performance of three-breed and backcross pigs.

	No. of litters	Avg. daily gain, lbs.	Age at 220 lbs.	BF probe 220 lbs., in.	No. of pens	Feed Gain	Daily feed intake, lbs.
Backcross ¹							
D x D-H	22	1.43	197	1.24	5	3.10	4.43
D x D-Y	25	1.47	193	1.22	7	3.03	4.48
H x D-H	17	1.42	198	1.09	4	3.21	4.49
H x H-Y	24	1.41	198	1.08	5	3.13	4.41
Y x D-Y	26	1.46	194	1.19	7	3.16	4.41
Y x H-Y	23	1.35	202	1.18	5	3.08	3.91
3-Breed Cross ¹							
D x H-Y	20	1.52	187	1.21	9	2.92	4.30
H x D-Y	22	1.46	194	1.08	8	2.97	4.11
Y x D-H	21	1.43	195	1.23	8	3.08	4.29
3-Breed Cross	63	1.47±.02	192±1.9	1.17±.013	25	2.99±.03	4.23±.09
Backcross	137	1.42±.01	197±1.3	1.17±.009	33	3.12±.02	4.36±.08
Difference		0.05±.024*	-5±2.3*	0.00±.015		-0.13±.03**	-0.13±.12

*P<.05

**P<.01

¹D-Duroc, H-Hampshire, Y-Yorkshire (Breed of Sire x crossbred female)

the similar survival rates for pigs out of each gilt breed type. Survival rate was measured as the percentage of pigs raised per litter that farrowed. Three-breed cross litters had a slightly higher survival rate than backcross litters (73.3 percent compared to 71.0 percent). This slight reduction in survival may be due to the decrease in individual pig heterosis in the backcross pigs since backcross pigs will have one-half the heterosis as the three-breed cross pigs.

Although three-breed cross litters weighed 8.3 pounds more at 42 days than backcross litters, there was essentially no difference in average pig weaning weight between the two groups. Duroc x Yorkshire and Hampshire x Yorkshire females had heavier litters at 42 days than did Duroc x Hampshire females. Hampshire x Yorkshire females had the heaviest average pig weight (21.7 pounds) at 42 days as compared to 20.9 pounds for Duroc x Hampshire and 20.8 pounds for Duroc x Yorkshire.

In the feedlot, three-breed cross pigs grew significantly faster, 0.05 pound/day, and were five days younger at 220 pounds than were backcross pigs (Table 2). These differences are approximately one-half the difference between purebred and two-breed cross pigs for growth rate and days to 220 pounds which have been previously reported. Three-breed cross pigs required significantly less feed per pound gain (0.13 lbs. feed/lb. gain) than the backcross pigs required. This advantage for the three-breed pigs is somewhat greater than expected based on previous results. There was no difference between the two groups for backfat probe at 220 pounds.

Differences in performance of pigs by each breed of sire are similar to what has been found in other studies. Duroc sired pigs grew the fastest and had the lowest feed/gain ratio. Yorkshire and Hampshire sired pigs were very similar for both traits. Hampshire sired pigs, however, had the least backfat probe at 220 pounds, while Yorkshire and Duroc sired pigs were very similar in probe backfat thickness.

The differences between three-breed crossbred litters and backcross litters are very similar to the expected differences based on the purebred and two-breed crossbred performance of these breeds. This suggests that litter productivity performance for backcross litters or other breeding systems can be predicted from purebred performance and heterosis estimates of two-breed crosses.
