1981

Crossbred Boars Can Be Used to Improve Reproductive Efficiency

Rodger K. Johnson
University of Nebraska-Lincoln

CROSSBRED BOARS CAN BE USED TO IMPROVE REPRODUCTIVE EFFICIENCY

Rodger K. Johnson
University of Nebraska - Lincoln

Lack of sexual aggressiveness and infertility in boars are problems that have been experienced to some degree by nearly every swine producer. The impact of these problems on the efficiency of swine production depends on their frequency; but even relatively few boar reproductive problems can upset the production schedule of units that are farrowing continuously.

Recent research provides convincing evidence that at 7 to 9 months of age crossbred boars are more aggressive breeders than purebreds and that conception rates are higher for females mated to crossbred boars. The purpose of this report is to examine the research that compares purebred and crossbred boars and to briefly evaluate the economic impact crossbred boars can have on the efficiency of production.

Purebred vs crossbred boars:

Reproductive efficiency. At the Oklahoma Agricultural Experiment Station, we evaluated 195 purebred and crossbred boars of Duroc and Hampshire breeding for reproductive performance. At about 7.5 months of age, 116 boars were castrated to evaluate testicular size and sperm reserves. Seventy-nine boars (aged 7.5 to 9 months) were each hand mated to two Yorkshire gilts. The experiment was conducted during four seasons and in three of the seasons detailed records were kept on the boar's mating behavior.

The boars were randomly selected to be exposed to gilts in estrus. If a boar failed to mate, he was removed from the breeding pen and a different boar was brought into the pen. This boar was given another chance on another day. When a boar mated, he was given a repeat breeding with the same gilt the next day. The interval from when the boar entered the pen until he mounted the gilt was recorded for each boar. Within a season, all boars were given at least one opportunity to mate before any boar was exposed to a second gilt. Thirty days after breeding the gilts were slaughtered and reproductive tracts were evaluated for ovulation rate and number of embryos.

The mating behavior of crossbred and purebred boars was significantly different (table 1). Twenty-eight of 36 crossbreds mated every time they were exposed to an estrus gilt and eight crossbreds had just one failure. In contrast, only 11 of 36 purebred boars mated each time they were exposed to a gilt and several had two or more failures.

There was considerable variation among boars in the time required to mate an estrus gilt, but there was little difference between purebreds and crossbreds. All breed groups mounted faster and maintained the mount longer on the second day than on the first day that a gilt was in estrus.

TABLE 1. MATING BEHAVIOR FOR BOARS WHEN EXPOSED TO AN ESTRUS GILT

Breed group[a]	Total no. boars	No. of boars that			
		Mated each time exposed	Had one failure	Had two failures	Had three or more failures
DxD	18	3	7	5	3
DxH	18	16	2	0	0
HxD	18	12	6	0	0
HxH	18	8	3	4	3

[a]D = Duroc, H = Hampshire; breed of sire listed first. Wilson et al., 1977 (J. Anim. Sci 44:939).

The conception rate for gilts mated to purebred and crossbred boars was not significantly different. However, gilts mated to crossbred boars had a 7.9% higher conception rate than gilts mated to purebred boars (table 2). This was due primarily to the 14.6% lower conception rate for gilts mated to Hampshire boars than for gilts mated to Duroc boars.

TABLE 2. CONCEPTION RATE FOR GILTS MATED TO BOARS OF EACH BREED GROUP

Breed group[a]	No. of boars	No. of gilts		Percent pregnant	No. of boars failing to impregnate a gilt
		Exposed	Pregnant		
DxD	20	38	24	63.2	3
DxH	20	40	27	67.5	3
HxD	20	40	24	60.0	2
HxH	19	35	17	48.6	8

[a]D = Duroc, H = Hampshire; breed of sire listed first. Wilson et al., 1977 (J. Anim. Sci. 44:939).

Litters by crossbred boars contained .6 more embryos than litters by purebred boars. This was not a significant difference and because of the variation in litter size could easily be attributed to chance. Eleven of 39 purebred boars and 5 of 40 crossbred boars failed to impregnate a gilt (table 2). When this was considered, the number of embryos per gilt exposed was 1.11 more for gilts mated to crossbred boars than for gilts mated to purebred boars.

At 7.5 months of age, the testes of crossbred boars were 16% heavier and contained 25% more sperm than did the testes of purebred boars. This would indicate that the crossbred boars were more sexually mature and perphaps explains the observed differences in aggressiveness and fertility.

From the results of this trial it was clear that further evaluations of purebred and crossbred boars were warranted. Purebred and crossbred boars of Duroc, Yorkshire, Landrace and Spot breeding were mated to F_1 gilts and sows

of the same breeds to produce three-breed and four-breed cross litters. Hand mating was used and all boars and gilts averaged 8 months of age at the beginning of the 8-week breeding season. Within breed groups, gilts were randomly assigned to boars and, if they returned to estrus at a later date, were remated to the same boar. Matings were made on the day a gilt was detected in estrus and, if the gilt would stand, again the next day.

Conception rate and the number of services per conception for gilts mated to purebred and crossbred boars are presented in table 3. All crossbred boar groups had higher conception rates and fewer services per conception than each purebred group. Purebred boars were mated to more gilts than crossbreds. Purebreds were each mated to about eight gilts during the 8-week breeding period. It is not felt that the difference in number of matings is enough to affect the conception rate of fertile boars. More likely, crossbred boars were more sexually mature because they had 19% heavier testes and 38% more sperm than did purebred boars.

Overall, the conception rate to the first estrus in the breeding season was 10.3% higher for gilts mated to crossbred boars than for gilts mated to purebred boars. This agrees quite well with the difference of 8% observed in the first experiment. The conception rate to all services during the 8-week breeding season was 96.9% for crossbred boars and 92.1% for gilts mated to purebred boars. Also, there was a difference of .21 services per conception.

TABLE 3. CONCEPTION RATE AND NUMBER OF SERVICES PER CONCEPTION FOR PUREBRED AND CROSSBRED BOARS

Breeding of boar	No. of boars	No. of females exposed	Percent conceived [a]	Percent conceived [b]	No. of services per conception
Duroc (D)	16	113	77.0	92.0	1.36
Yorkshire (Y)	15	115	69.6	91.7	1.50
Landrace (L)	15	111	71.9	93.6	1.43
Spot (S)	14	113	78.2	91.3	1.38
DxY	15	51	89.8	98.0	1.10
DxL	15	48	87.1	98.3	1.18
DxS	15	51	79.0	98.0	1.28
YxL	14	55	82.2	98.2	1.21
YxS	15	57	84.3	96.1	1.25
SxL	15	47	88.3	96.3	1.22
Purebreds	60	452	74.2	92.1	1.42
Crossbreds	89	311	84.5	96.9	1.21

[a]Conception rate to first estrus expressed during the breeding season.
[b]Conception rate during the 8-week breeding season.

Litter size and growth traits. There was essentially no difference between females mated to purebred and crossbred boars for litter size, pig weights, postweaning growth or probe backfat thickness (table 4). This means that the progeny of crossbred boars are expected to perform at a level equal to the average of the breeds involved in the cross. This, of course, is true only if the parents of the purebred and crossbred boars are of equal genetic merit.

TABLE 4. LITTER SIZE, PIG WEIGHTS, POSTWEANING GROWTH AND PROBE BACKFAT FOR PROGENY OF PUREBRED AND CROSSBRED BOARS

Breeding of sire	No of litters	Litter size		Pig weight, kg		Avg daily gain, kg/day	Probe backfat, cm
		Birth	21 days	Birth	21 days		
Purebreds	298	10.1	7.9	1.39	5.22	.69	2.70
Crossbreds	194	10.3	7.9	1.36	5.16	.70	2.71

Variation in progeny performance:

Theoretically, progeny of crossbred boars are expected to be more variable than progeny of purebred boars. And we do see more variation for color, ear shape and perhaps even body shape. However, several experiments have found little difference in variability for performance traits and, in some cases, progeny of crossbred boars have been less variable.

Many breeds breed true for color and ear shape because selection has made them nearly homozygous for genes influencing these characteristics. These traits are influenced by few pairs of genes. On the other hand, performance traits are influenced by several gene pairs and considerable variation exists in each breed. Therefore, progeny of both purebred and crossbred boars are quite variable for these traits.

Economic considerations. These data indicate that at 7 to 9 months of age more crossbred boars than purebred boars are breeders and that crossbred boars can be expected to increase conception rates by about 10%. To determine the economic impact of this difference in conception rate, Dr. Bill Ahlschwede, University of Nebraska Extension Swine Specialist, used estimates of breed differences and heterosis and existing economic conditions to simulate the production of 100 litters from several crossbreeding systems. The budgetary considerations are presented in table 5. A fixed cost of $300 per litter of 7.5 pigs weaned was assumed. This was adjusted at the rate of $5.00 per pig deviation from 7.5. The base conception rate was 80% and expenses were adjusted at the rate of $28 per open sow. This is equivalent to $.50 per day for a 56-day period. Feed costs were assumed to be $.07 per pound and pigs were assumed to be selling for $45 per cwt. Research estimates of breed differences were used to calculate feed and growth costs.

TABLE 5. BUDGET CONSIDERATIONS

Item	Cost
1. Per litter of 7.5 pigs at 40 pounds	$300.00
Adjustment per pig deviation	5.00
Base of 80% conception rate Adjustment per open sow	28.00
2. Nonfeed costs during finishing: base of 180 days to 220 pounds	14.00
Adjustment per day deviation	.05

Based on these budgetary considerations and estimates of the performance for the Duroc, Hampshire, Yorkshire and Landrace breeds (Johnson, 1980; NC Reg. Publ. No. 262), the performance and economic differences for three mating systems are shown in table 6. The three systems involve an F_1 Landrace-Yorkshire sow mated to Hampshire, Duroc or an F_1 Duroc-Hampshire boar. The important comparison is that of the crossbred boar to the average of the purebred boars since the only difference between them is in conception rate. The difference is $565, or an average of $5.65 per litter, in favor of crossbred boars.

TABLE 6. EXPECTED PERFORMANCE FROM 100 LITTERS FOR TERMINAL CROSSBREEDING SYSTEMS OF F_1 YORKSHIRE-LANDRACE FEMALES WHEN MATED TO DUROC, HAMPSHIRE OR F_1 DUROC-HAMPSHIRE BOARS

Item	Boar Breed		
	Hampshire	Duroc	DxH
Conception rate	74	74	87
No. weaned	9.55	9.55	9.55
Days to 220 lb	168	163	166
Backfat at 220 lb, inches	1.13	1.23	1.18
Feed efficiency	3.32	3.33	3.33
Net income	$10,494	$10,561	$11,092

Summary

Experimental results indicate that conception rates will be about 10% higher for crossbred boars than for purebred boars and that fewer crossbred boars are problem breeders than purebred boars. No differences are expected between progeny of purebred and crossbred boars for litter size, pig weights, growth or carcass merit. Economic considerations indicate that the male heterosis for conception rate will result in an increase in profit of about $5.50 per litter produced.