

# Reproductive and Testicular Characteristics of Purebred and Crossbred Boars

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## Story in Brief

Purebred Hampshire, Duroc and crossbred (H x D, D x H) boars were studied to evaluate reproductive characteristics. One hundred seventeen boars were castrated at 7½ months of age to evaluate testicular weights and sperm numbers. Seventy-eight additional boars were studied to evaluate conception rate and embryo numbers when mated to Yorkshire gilts. Rate of gain and backfat probe were also available for these boars.

The crossbred boars gained faster and had fewer days to 220 lbs. than purebred boars. There was no difference in backfat probe between the crossbreds and purebreds. The Duroc boars gained faster but had a larger backfat probe than the Hampshires. The crossbred boars had 16% heavier testicles and 27.8% more testicular sperm than purebreds. Differences in conception rate and embryo number for gilts mated to purebred and crossbred boars were not significant, although the conception rate for gilts mated to crossbred boars was 8% higher and litters had .89 more embryos 30 days postbreeding than for gilts mated to purebred boars.

## Introduction

The advantage of the crossbred female for reproduction is well documented. Recently, commercial swine producers have also shown an interest in crossbred boars for use in their breeding programs. Little information is available, however, on the performance of sires of different breeds and on the comparison of purebred and crossbred males for reproductive performance. This information is necessary before recommendation can be made concerning the use of crossbred males.

The objectives of this study are to compare purebred and crossbred boars of Duroc and Hampshire breeding for 1) their ability to settle sows; 2) their effect on litter size 30 days after breeding and 3) differences in testicular measurements.

## Materials and Methods

A total of 195 boars were studied. These were farrowed in the fall of 1973, spring and fall of 1974 and spring 1975 at the Experimental Swine Farm. Each season, purebred and crossbred Duroc and Hampshire litters were produced by mating purebred boars to sows of each breed. The pigs were weaned at 42 days and were fed in an open front finishing facility from about 50 pounds to 220 pounds. The boars were weighed off test weekly as they reached 220 pounds at which time they were probed for backfat thickness and placed in dirt lots in groups of 10 to 15 per lot.

In each season, five boars each of Duroc (D), Hampshire (H), D x H and H x D breeding were randomly selected to be used in the breeding portion of the study. The rest of the available boars, approximately eight per breed group per season were castrated at 7½ months of age.

A total of 32 Duroc, 27 Hampshire, 35 D x H and 23 H x D boars were castrated. One testicle was retained from each boar and was separated into three parts: testis, head and body of epididymis and tail of epididymis. Each tissue was weighed and homogenized in a saline solution. Sperm numbers were determined microscopically. Each value was then doubled to put on an individual boar basis.

A total of 20 Duroc, 19 Hampshire, 20 D x H and 20 H x D boars were used in the breeding portion of the study. Each boar was mated to two Yorkshire gilts. Each gilt was bred on the day she was detected in estrus and was given an opportunity for a repeat mating the following day. In each season, the boars were randomly mated to the gilts as the gilts came in heat with the restriction that all boars service a gilt before any boar was exposed to the second gilt. If a gilt did not return to estrus, she was slaughtered approximately 30 days postbreeding. At this time the number of corpora lutea, which indicate the number of eggs ovulated, were counted as were the number of embryos present in the uterus. At breeding, the boars and gilts ranged in age from 7½ to 9 months of age.

## Results

The relative growth rate and backfat thickness of these boars (Table 1) is very comparable to results from other trials at this station involving these breeds. The crossbred boars gained 0.19 lbs/day or 11% more than the average of the purebred boars. Duroc boars gained 0.13 lbs/day more than the Hampshire boars. As expected with the increased gain, the crossbreds were 12.1 days younger at 220 pounds. Durocs were 7.3 days younger at 220 lbs. than the Hampshires. There was no difference between the purebreds and the crossbreds for backfat probe, however, the Hampshires had 0.17 in. less backfat than the Durocs.

In an attempt to determine if there is a difference in sexual development and maturity between these young, post puberal boars, 117 purebred and crossbred boars were castrated at 7.5 months of age. The average performance for testicular measurements is shown in Tables 2 and 3.

There were no differences between the Duroc and Hampshire boars for testes weight, testes sperm or number of sperm per gram testes tissue (Table 2). The crossbred boars testes weighed 92.0 grams (16%) more than the average of the purebreds and had  $15.71 \times 10^9$  (27.8%) more sperm numbers. Since there was no difference between purebreds and crossbreds for sperm numbers per gram testes tissue, it would indicate that the increased sperm numbers in the crossbred boars is a function of heterosis for testes growth and the increased testes weight for crossbreds.

**Table 1. Growth Rate, Age at 220 Pounds and Probe Backfat Thickness for Boars of Each Breed.**

Breed Group	No. of boars	Daily gain lbs/day	Age at 220 lbs.	BF probe
Duroc	52	1.79	167.5	1.03
D x H	54	1.92	156.8	0.97
H x D	42	1.92	161.4	0.97
Hampshire	47	1.66	174.8	0.86
Comparisons among breed groups				
Purebred Avg.		1.73	171.2	0.95
Crossbred Avg.		1.92	159.1	0.97
Duroc-Hampshire		$0.13 \pm 0.04^{**}$	$-7.3 \pm 2.2^{**}$	$0.17 \pm 0.03^{**}$
Crossbred-Purebred		$0.19 \pm 0.03^{**}$	$12.1 \pm 1.56^{**}$	$0.02 \pm 0.02$

\*\*P<.01.

**Table 2. Average Testis Weight, Number of Sperm and Concentration of Sperm for Boars of Each Breed Group.**

Breed group	No. boars	Testis		
		Wt. grams	No. Sperm <sup>1</sup>	Conc. <sup>2</sup>
Duroc	32	569.1	55.02	0.107
D x H	35	645.6	67.54	0.103
H x D	23	718.1	74.21	0.106
Hampshire	27	610.7	57.92	0.095
Comparisons among breed groups				
Purebred avg.		589.9	56.47	0.101
Crossbred avg.		681.9	72.18	0.105
Crossbred-Purebred		$92.0 \pm 21.9^{**}$	$15.71 \pm 3.79^{**}$	$0.004 \pm 0.008$
Hamp-Duroc		$41.6 \pm 30.6$	$2.90 \pm 5.31$	$-0.012 \pm 0.011$

<sup>1</sup> Total no. of sperm = value reported x  $10^9$ .

<sup>2</sup> Sperm concentration = No. of sperm/gms of tissue x  $10^9$ .

\*\*P<.01.

Other research indicates that testes weight is a good indicator of daily sperm production and total sperm output by the testes.

The path of the sperm in a normal boar reproductive tract is from the testes through the head and body epididymis with final storage in the tail epididymis. Sperm usually take 9-12 days to travel from the testes to the tail epididymis. During this time, the sperm are maturing and becoming more concentrated. The tail epididymis is the area of spermatozoa storage and frequently contain over one-half of the total spermatozoa.

There were no differences between breeds or crossbreds in Head and Body epididymis weight, sperm numbers or sperm numbers per gram of epididymis Head and Body weight (Table 3).

Although the crossbreds had a heavier tail epididymis (6.2 grams) there was no difference in sperm numbers or tail sperm per tail epididymis weight. Duroc boars had  $35.27 \times 10^9$  more sperm stored in the tail epididymis than did Hampshires and consequently more sperm per gram of tail epididymis.

Since the crossbred boars have heavier testes and more testes sperm it appears that they are more sexually mature at 7.5 months than the purebred boars and have the capacity for greater sperm production.

Testicular measurements provide information on the rate of sexual development for boars of different breeds, however, an important criteria for evaluating boars of different breeds is the conception rate of the sows they are mated to and the number of pigs produced. The average reproductive performance for boars of each breed is presented in Table 4.

Hampshire boars had a conception rate of 48.6% compared to 63% for Durocs and 63.8% for crossbred boars, however, these differences were not significantly different. Similarly, the difference in number of embryos, 10.55 for gilts mated to purebred boars compared to 11.45 for those mated to crossbreds, was not significantly different. These embryo numbers are adjusted to a constant ovulation rate in the gilts. Thus, the averages should be interpreted as if the gilts mated to each breed of boar had the same ovulation rate. Even though there were no significant differences for these traits, due to large variability in measurements, differences of this magnitude would be important to swine producers. More information on the reproductive performance of purebred and crossbred boars is necessary before definite conclusions can be made.

Some additional observations which were made during the breeding phase were the number of times a boar failed to mount or breed a gilt. For these observations a total of eighteen boars per breed (6/breed/season) were studied. These records were kept only on the boars in the last three seasons and are shown in Table 5. It should be noted that five boars out of the six per breed were used in the breeding study. They

Table 3. Average Epididymis Weight, Number of Sperm and Concentration of Sperm for Boars of Each Breed Group.

Breed Group	Epididymis					
	Head & Body			Tail		
	Wt. gms.	No. sperm <sup>1</sup>	Conc. <sup>2</sup>	Wt. gms.	No. sperm <sup>1</sup>	Conc.
Duroc	120.4	44.85	0.474	86.3	92.39	1.02
D x H	99.0	50.80	0.524	93.9	90.85	0.93
H x D	89.5	52.73	0.581	83.1	76.10	0.89
Hampshire	84.6	45.94	0.531	78.3	57.10	0.68
Comparisons among breed groups						
Purebred avg.	102.5	45.40	0.503	82.3	74.76	0.85
Crossbred avg.	99.7	51.77	0.553	88.5	83.48	0.91
Crossbred- Purebred	— 2.8±15.4	6.37±4.22	0.050±0.042	6.2±3.18*	8.72± 8.46	0.06±0.08
Hamp-Duroc	—35.8±21.0	1.09±5.88	0.057±0.058	—8.0±4.43	—35.27±11.80*	—0.34±0.11**

<sup>1</sup> Total no. of sperm = value reported x 10<sup>6</sup>.<sup>2</sup> Sperm concentration = No. of sperm/gms of tissue x 10<sup>6</sup>.

\* P &lt; .05.

\*\* P &lt; .01.

were selected on their ability to mate and were tried until five boars of a breed had mated. Although no statistical tests were applied to this data it is interesting to note the few times the crossbreds failed to mate when exposed to a gilt as compared to the purebreds.

**Table 4. Conception Rate and Number of Embryos 30 Days Postbreeding for Gilts Mated to Boars of Each Breed Group.**

Breed group	No. boars	No. gilts exposed	No. gilts pregnant	% pregnant	No. of embryos <sup>1</sup>
Duroc	20	38	24	63.0	10.55
D x H	20	40	27	67.5	11.66
H x D	20	40	24	60.0	11.23
Hampshire	19	35	17	48.6	10.55
	Comparisons among breed groups				
Purebred Avg.		73	41	55.8	10.55
Crossbred Avg.		80	51	63.8	11.44
Crossbred-purebred				8.0	0.89±.64
Duroc-Hampshire				14.4	0.00±.96

<sup>1</sup> Adjusted for ovulation rate.

**Table 5. Mating Behavior for Boars of Each Breed When Exposed to a Gilt Showing Estrus.**

Beef group	No. of boars that					
	Total No. boars	Mated a gilt each time-exposed	Had 1 failure to mate	Had 2 failures to mate	Had 3 failures to mate	Had 4 or more failures to mate
Duroc	18	3	6	6	1	2
D x H	18	16	2	0	0	0
H x D	18	12	6	0	0	0
Hampshire	18	8	3	4	0	3