

Hampshire. In the backcross system Y-DY, Yorkshire breeding is required for both male and female lines so there can be no differentiation between the two lines.

Although this study was based on 10,000 sows, the results should be applicable to producers with small sow herds. In choosing a breeding system a producer must take many items into consideration. This study indicates the need to choose breeds and mating system carefully when trying to improve pork production since some rotation and three-breed terminal crosses appear to have similar efficiencies.

The backcross mating system Y-DY, produced the greatest number of pigs per 10,000 sows. This may not be the situation after long term selection programs. A three-breed terminal cross may be more efficient in the long run since selection can be practiced in specialized sire and dam breeds. Selection in sire and dam lines may produce greater response than general selection for all traits in several breeds. Specialized sire and dam breeds are not possible in a backcross system; thus, a general selection program for productivity, growth and carcass merit must be utilized.

Rotation crosses have the advantage of ease in replacement female production; however, there is reduced production from the best three-breed terminal cross. Also, rotation mating systems do not allow a producer to capitalize on those breeds which are best as dam and sire breeds. A variation of rotation crosses which allows for ease of females replacement and maintaining 100 percent heterosis in the market pig is to mate a terminal sire to a two-breed rotation female. These systems were not as productive as the best three-breed terminal cross however.

A Preliminary Evaluation of Mating Systems Involving Duroc, Yorkshire, Landrace and Spot Breeds Producing Three- and Four-Breed Cross Pigs

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Story in Brief

Crossbred and purebred boars were mated to crossbred females involving Duroc, Landrace, Spot and Yorkshire breeds. Conception rate, litter productivity and growth characteristics were compared for the mating systems.

Crossbred boars had a 6.8 percent greater conception rate for first service matings than purebred boars. However, when calculated over matings for the entire breeding season, crossbreds had a 3.1 percent advantage in conception rate.

The comparison of six crossbred female groups indicated that Duroc x Yorkshire and Yorkshire x Landrace females farrowed the largest litters (10.38 and 10.42, respectively). Yorkshire x Landrace females had the highest survival rate to weaning (81.4 percent). Thus at weaning, Yorkshire x Landrace females had litters that were .86 pig larger than any other female group. Litter size and litter weight were similar for purebred and crossbred boars.

Differences for average backfat thickness were small, with ranges from 1.06 to 1.15 inches for sire breed means and 1.08 to 1.12 for dam combinations. Pigs with crossbred

sires were 6.5 days younger at 220 lb than those from purebred sires but probe backfat was essentially the same. In general, mating systems using crossbred boars had a slight overall advantage over mating systems using purebred boars.

Introduction

The superiority of crossbred females as compared to purebred for reproductive traits has been well documented. In addition, crossbred pigs grow faster and are more efficient than purebreds. However, there is little information available concerning the performance of crossbred females of Spot and Landrace breeding.

Previous research at the Oklahoma Agriculture Experiment Station has suggested a higher conception rate and increased libido for crossbred than for purebred boars, suggesting heterosis for male reproductive performance. Therefore, mating systems involving crossbred boars and females of these breeds were investigated.

In 1976, a project was initiated to evaluate the performance of Duroc, Yorkshire, Landrace and Spot breeds as purebreds and in two-, three-, and four-breed crosses. The objectives of the project were to identify mating systems that maximize production efficiency and investigate the effects of crossbred boars. A preliminary comparison of the productivity of purebred females of Duroc, Yorkshire, Landrace and Spot breeding was reported last year (Johnson, 1978). This report is a brief summary of the data collected during the fall 77, spring 78 and fall 78 farrowing seasons. During the first two seasons, growth characteristics were analyzed. Upon completion of the project, a total of five seasons of data will be obtained and a complete analysis will be made.

Experimental Procedure

Crossbred and purebred seedstock used to produce three-breed and four-breed offspring were produced at the Stillwater Experimental Swine Farm by mating purebred boars and females of Duroc, Yorkshire, Landrace and Spot breeding in all combinations. Purebred and crossbred boars were raised in open-front confinement facilities with concrete floors. Boars used in this study were selected within sirebred groups (reciprocals combined in the case of crossbreds) at 220 lb based upon an index of age and backfat thickness at 220 lbs. The selected boars were transported to the Southwest Livestock and Forage Research Station (SLFRS) and used as herd boars for the next breeding season. The crossbred gilts had been randomly assigned within litter to be fed *ad libitum* in either confinement facilities or on pasture. When gilts reached 200 lb, they were taken off *ad libitum* feed and grouped in pasture lots until detected in estrus and then were sent to SLFRS.

At SLFRS, three boars were utilized from each breed group every season. Purebred boars were mated to crossbred females to produce 3-breed cross progeny and crossbred boars were mated to crossbred females to produce 4-breed cross progeny. Females that returned to estrus during the eight-week breeding season were remated to the same boar. The total number of litters farrowed per breed group is listed in Table 1 and the total number of females exposed to each boar is presented in Table 2. One gilt from each breed group mated to each boar was slaughtered 30 days post-breeding to evaluate embryo liveability and ovulation rate. Only gilts were farrowed the first season. In the subsequent farrowing seasons, about half of the litters were from second litter sows and the remainder were from gilts. A total of 210 gilt and 88 sow litters were utilized in comparisons.

Gestating females were maintained in pasture lots and hand fed a daily ration of about five lb of a 15 percent protein ration. All of the litters were farrowed in a farrowing barn with crates and slotted floors. At approximately one week of age, both the sows and litters were moved to the nursery. Sows and litters were in individual pens until weaning at six weeks of age. Male pigs were castrated at three weeks of age and creep

Table 1. Number of litters representing each mating-type, for the production of three-breed and four-breed crosses.^a

Breed of sires, ^{b,c}	No. of sires	Breed of dam ^{b,c}					
		DxY	DxL	DxS	YxL	SxY	SxL
D	9				13	17	17
Y	9		19	14			12
L	9	15		14		18	
S	9	18	17		16		
DxY	9						19
DxL	9					17	
DxS	9				21		
YxL	9			19			
SxY	9		17				
SxL	9	15					

^aFarrowed during fall 77, spring 78 and fall 78 farrowing seasons.

^bReciprocally produced males and females combined.

^cD = Duroc, Y = Yorkshire, L = Landrace, S = Spot.

Table 2. Conception rate and number of services per conception for purebred and crossbred boars at SLFRS.

Type of sire	No. of boars	No. of females exposed	% conceived		No. of services per conception
			a	b	
Purebreds	36	287	78.1	94.8	1.34
Crossbreds	54	188	84.9	97.9	1.22

Spring 77, fall 77 and spring 78 breeding seasons.

^aConception rate to first estrus expressed during the breeding period.

^bConception rate during the 8 week breeding period.

was made available at that time. At eight weeks of age, the pigs were moved to a confinement finishing facility and fed *ad libitum* to a body weight of 220 lb. At that time, all pigs were probed for backfat and marketed.

Results and Discussion

Conception Rate

The mean conception rates and number of services per conception for purebred and crossbred boars are presented in Table 2. Conception rates for first estrus matings were highest for DxS boars (91.8 percent); however, these were mated entirely to YxL females. Conception rate for first estrus matings was 6.8 percent greater for crossbreds than for purebred boars. However, when all matings of the breeding season were included the advantage was only 3.1 percent for crossbred over purebred boars. Services per conception were greater for purebreds than crossbreds (1.34 and 1.22, respectively).

Litter Productivity

Duroc x Yorkshire and Yorkshire x Landrace females had the largest litter sizes at birth (Table 3; 10.38 and 10.42, respectively). However, only 72.8 percent of the pigs farrowed by DxY females survived to weaning as compared to 81.4 percent for the YxL

Table 3. Litter size and average litter weight for crossbred dams bred to purebred or crossbred boars of another breed.^a

Breed of dam ^b	No. of litters	Litter size			Survival % ^d	Ave. litter weight at 21-days, lb
		birth ^c	21 days ^e	42 days ^e		
DxY	48	10.38	7.52	7.27	72.8	84.7
DxL	53/52/52	9.98	7.90	7.71	78.5	88.3
DxS	47	10.04	7.40	7.32	74.7	82.8
YxL	50/49/49	10.42	8.76	8.57	81.4	96.0
YxS	52/51/51	9.62	7.24	6.98	75.2	78.3
LxS	48	9.17	7.33	7.06	78.4	82.4
Comparison of Crossbred and Purebred Sires						
Crossbred	108/105/105	9.85	7.64	7.48	77.6	86.24
Purebred	190	9.95	7.73	7.49	76.3	85.13
Standard deviation ^f		2.63	2.26	2.23	19.1	11.2

^aLitters were produced at SLFRS during spring 77, fall 77 and spring 78 breeding seasons.

^bReciprocals combined (DxY = DxY and YxD).

^cNumber of fully formed pigs.

^dPercentage of fully formed pigs farrowed which survived to weaning at six weeks.

^eOnly litters with more than one pig were included.

^fFrom within breed group pooled sum of squares.

Table 4. Average growth rate and probe backfat for three- and four-way cross barrows and gilts of duroc, yorkshire, landrace and spot breeding.

Breed type ^b	No.	Avg. daily gain, lb/day	Age at 220 lb	Probe backfat, in.
Means by breeding of sire				
Duroc	228	1.56	183.9	1.04
DxY	63	1.59	177.3	1.15
DxL	66	1.54	182.1	1.06
DxS	101	1.64	175.9	1.14
Yorkshire	197	1.60	176.9	1.10
YxL	88	1.60	177.6	1.11
YxS	78	1.55	179.5	1.14
Landrace	202	1.48	189.3	1.15
LxS	73	1.59	176.9	1.11
Spot	248	1.50	187.3	1.12
Means by breeding of dam				
DxY	216	1.51	186.3	1.12
DxL	239	1.54	181.8	1.11
DxS	212	1.59	177.7	1.12
YxL	276	1.61	178.5	1.10
YxS	203	1.50	188.2	1.08
LxS	198	1.56	182.5	1.10
4 breed crosses vs. 3 breed crosses				
Crossbreds	469	1.59	178.0	1.12
Purebreds	875	1.53	184.5	1.10
Standard deviation ^a		.230	22.9	.157

^aFrom within breed group pooled sum of squares.

^bReciprocally produced males and females.

females. Therefore, at weaning YxL litters were .86 pig larger than any other crossbred female group. Duroc x Landrace and Duroc x Spot were intermediate for litter size at birth (9.98 and 10.04, respectively). However, because of a 78.5 percent survival of the pigs farrowed, DxL sows ranked second for litter size at weaning. Yorkshire x Spot and Landrace x Spot dams had the smallest litter size farrowed and raised to weaning.

Average litter weight at 21 days, which is often used as an indicator of the milking ability of the sow, was heaviest for YxL females (96.0 lb). Their average 21 day litter weight was 7.7 lb heavier than for any other breed of dam. Yorkshire x Spot females had the lightest average 21 day litter weight of 78.3 lb. Litter size and litter weight produced by crossbred and purebred boars were similar.

Growth Characteristics

Growth performance and average backfat thickness for the three- and four-breed cross pigs are summarized in Table 4. Considerable differences existed in the mean growth rate for progeny of each sire and dam group. These differences reflect differences in the average genetic make-up of the breeds involved. Additional data will allow more precise estimates of these differences.

Offspring sired by crossbred boars were 6.5 days younger at 220 lb than offspring with purebred sires. The difference between crossbred and purebred boars was very small and nonsignificant for average backfat.

The mating systems involving DxY sires and YxL females were superior for conception rate and litter productivity, respectively. Offspring of DxY sire-breed, and

YxL dam-breed groups also had the fastest growth rate. Crossbred boars had a slight advantage over purebred boars for conception rate, services per conception and offspring growth rate. Purebred and crossbred sires were similar for litter size (at birth, 21 days and 42 days), litter weight at 21 days and average backfat probe of their offspring.

As additional data are collected, a complete analysis will be made and breed differences can be more accurately estimated. These data will then provide information to aid in making decisions concerning breed utilization and mating systems.

Literature Cited

Johnson, R. K., Oklahoma Agri. Exp. Station MP-103:117-119.