

GROWTH PERFORMANCE OF THREE- AND FOUR-BREED CROSS PIGS INVOLVING THE DUROC, YORKSHIRE, LANDRACE AND SPOTTED BREEDS

D.G. McLaren¹, D.S. Buchanan², R.K. Johnson³ and R. Venc⁴

Story in Brief

Purebred and crossbred boars were mated to two-breed cross females to produce all possible three- and four-breed crosses involving the Duroc, Yorkshire, Landrace and Spotted breeds. A total of 3,456 pigs were evaluated for pen feed efficiency and for individual postweaning average daily gain and probed backfat thickness. Genotype by environment interactions, namely breed by year-season and (for gain) breed by parity, were found to be highly significant in these data. The fact that relative performance of the breeds varied in different year-seasons and parities made it difficult to draw overall conclusions as to breed performance. Certain results, however, did appear reasonably consistent. Duroc sired pigs grew more efficiently than other breed groups. They were also leaner than other three-breed cross pigs involving the same dam breeds, whereas Landrace sired pigs were fatter. No real differences between pigs sired by purebred and crossbred boars were apparent for feed efficiency, average daily gain or probed backfat thickness. This would suggest that mating two-breed cross rather than purebred males to females of different breeding would have little or no impact on these traits in offspring produced.

(Key Words: Crossbred Boars, Growth Performance.)

Introduction

A project aimed at evaluating purebred and crossbred performance of Duroc, Yorkshire, Landrace and Spotted breeds of swine was conducted at the Oklahoma Agricultural Experiment Station between 1976 and 1979. As part of this project, three- and four-breed cross litters were produced over five consecutive farrowing seasons starting in fall of 1977 at the Southwest Livestock and Forage Research Station, El Reno.

Litter performance of different two-breed cross females, and the effect of crossbred versus purebred boars on conception rate, have been reported previously (Buchanan, et. al. 1983). This report will summarize the growth and feed efficiency data from pigs farrowed during the fall of 1977 and the spring and fall of 1978 and 1979 at El Reno.

Materials and Methods

Seedstock for the three- and four-breed cross phase of the experiment was produced at the Stillwater Experimental Swine Farm by mating purebred Duroc, Yorkshire, Landrace and Spotted males and females in all possible combinations to produce purebred and two-breed cross offspring. Boars were selected for use in the second phase of the

¹Graduate Assistant ²Associate Professor, Animal Science
³Professor, Animal Science, Nebraska ⁴Herdsmen

experiment based on an index of age and backfat thickness at 220 lbs. Boars from each breed group were transported to El Reno to be used as herd sires each season. Crossbred gilts were sent to El Reno upon detection of estrus.

Generally three boars from each breed group were used at El Reno each season, although for some breeds in some seasons as few as two and as many as five different boars were used. Purebred boars were mated to crossbred females to produce all possible three-breed cross litters, and crossbred boars were mated to crossbred females to produce four-breed cross litters. The breeding season extended over an eight-week period starting in mid-May and mid-November each year. The total number of litters farrowed per breed group is given in Table 1. Only gilts were farrowed in the first season (fall 1977). In subsequent seasons about half the litters were from second parity sows and half from gilts. A total of 309 gilt and 178 sow litters were analyzed in this study.

Table 1. Number of litters farrowed, and pigs completing gain test, for each mating type^a.

Breed of sires ^{b,c}	No. of sires	Breed of dams ^{b,c}					
		D-Y	D-L	D-S	Y-L	Y-S	L-S
D	7				22(168)	26(163)	28(212)
Y	17			27(192)	23(151)		24(189)
L	15		20(146)		25(189)		23(150)
S	14		27(189)	26(187)		23(181)	
D-Y	15						31(192)
D-L	15					30(174)	
D-S	15				34(250)		
Y-L	14			34(242)			
Y-S	15		35(268)				
L-	15	29(213)					

^aNumber of pigs in parentheses.

^bReciprocal crosses combined (ie, D-Y = D x Y and Y x D)

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

Females were maintained throughout gestation in pasture lots and hand-fed 5 lb of a 15% protein ration daily. Litters were farrowed in a barn with individual crates and slatted floors. Sows and litters were moved to a nursery approximately one week post-farrowing, where they remained in individual pens until weaning at six weeks of age. Creep feed was made available, and male pigs castrated, at three weeks of age.

Pigs were moved to a confinement finishing house for gain test approximately two weeks post-weaning, and penned in groups of 12-20 pigs per pen by breed of sire (Duroc, Yorkshire, Landrace, Spotted or Crossbred). A one week adjustment period was allowed before pigs were weighed on test at approximately nine weeks of age. A 16% crude protein ration was fed ad libitum until average pig weight per pen was

approximately 120 lb. A 14% crude protein ration was fed *ad libitum* for the duration of the test period. Pigs were weighed off test weekly at 220 lb, at which time probed backfat thickness was measured. Total gain, total feed consumed and total days on test were obtained for each pen. During the five seasons of this phase of the experiment, 880 four-breed cross pens and 133 three-breed cross pens were tested.

Results and Discussion

Feed Efficiency

Statistical analysis of the pen data indicated no significant differences between average daily feed consumption for the different breed of sire groups. Highly significant differences in feed efficiency, however, were found between breeds of sire and year-seasons, as well as a significant breed of sire by year-season interaction. This interaction indicated that differences in feed efficiency between sire breed groups were not consistent from one year-season to the next.

Pen feed efficiency means by breed of sire and year-season are presented in Table 2, and illustrated graphically in Figure 1. Differences between sire breeds were only significant in the spring of 1978 and fall of 1979 farrowed pigs (although differences in the fall 1978 group approached significance). It should be noted that pigs farrowed in the fall of 1977 suffered badly from Atrophic Rhinitis, and those farrowed in the spring of 1979 from Mycoplasma Pneumonia. It is conceivable that disease stress prevented expression of potential differences in feed efficiency between breed groups in these two year-seasons.

Table 2. Pen feed efficiency (lb feed/lb gain) least-squares means by year-season farrowed and breed of sire.

Breed of sire	Year-season farrowed*					Mean
	77F	78S	78F	79S	79F	
Duroc	3.20	3.03 ^a	3.06	3.13	3.11 ^a	3.11 ^a
Yorkshire	3.22	3.16 ^{ab}	3.24	3.20	3.18 ^{ab}	3.20 ^{ab}
Crossbred	3.27	3.19 ^{ab}	3.11	3.19	3.26 ^{ab}	3.20 ^b
Landrace	3.24	3.32 ^a	3.09	3.16	3.30 ^b	3.22 ^b
Spotted	3.18	3.37 ^b	3.18	3.22	3.20 ^{ab}	3.23 ^b

*1st two numbers represent the year, the letter represents the season (S=spring, F=fall) eg 77F=fall 1977.

^{ab} Means in a column with different superscripts differ significantly.

Duroc sired pens were significantly more efficient than both Landrace and Spotted sired pens in the spring 1978 farrowed group, and more efficient than Landrace sired pens in the fall 1979 farrowed group (see table 2). As is evident, particularly from Figure 1, Duroc sired pigs were consistently more efficient relative to the other breed groups throughout the experiment. The significant breed by year-season

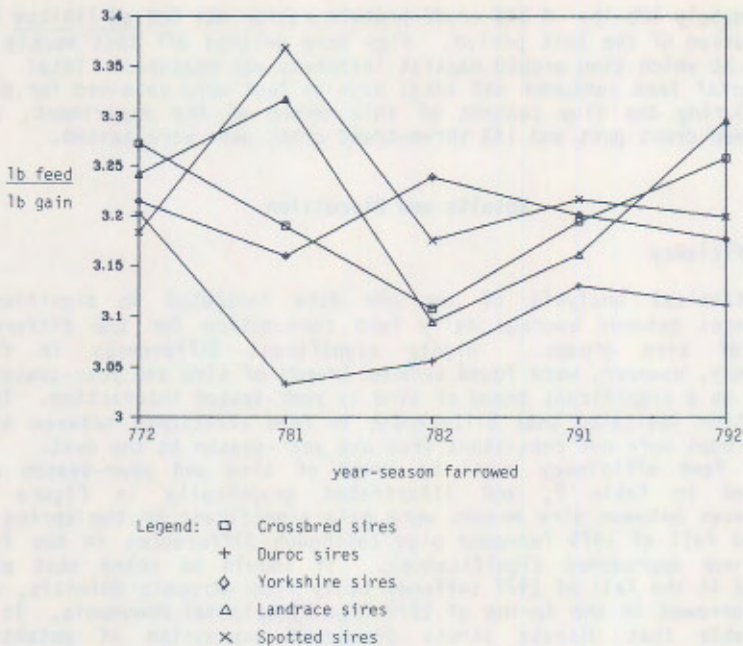


Figure 1. Pen feed efficiency for growing-finishing pigs by year-season.

throughout the experiment. The significant breed by year-season interaction was due to the similarity of the breeds for the fall 1977 and spring 1979 farrowings, and changes in rank by breed groups other than the Duroc sires in other year-seasons. A contributor to this may be that a different set of boars were used each breeding season. It is possible that specific sires selected were more important than the breed the sires were from, with the exception of the consistent advantage for Duroc sired pigs.

Comparing average feed efficiency for purebred sired pens to that for crossbred sired pens revealed no significant difference in any individual year-season or overall. This would suggest that mating two-breed cross rather than purebred males to females of different breeding would have little or no impact on subsequent feed efficiency of offspring produced.

Backfat Thickness

Sex of pig, breed of pig, year-season farrowed and the breed by year-season interaction were all highly significant for probed backfat thickness at 220 lb. Breed group means for backfat thickness are presented in Table 3. Backfat differences between breeds were significant in all but the first year-season of the experiment.

However, caution must be employed in interpreting breed differences due to the significant breed by year-season interaction. The interaction reflects the fact that breeds ranked differently in different year-seasons.

Table 3. Probed backfat thickness least-squares means by breed of pig.^a

Breed sires ^{b,f}	Breed of dam ^{b,c}					
	D-Y	D-L	D-S	Y-L	Y-S	L-S
D				.99	.98	1.01
Y		1.08	1.02			1.05
L	1.11		1.11		1.08	
S	1.07	1.09		1.06		
D-Y						1.07
D-L					1.00	
D-S				1.09		
Y-L			1.08			
Y-S		1.07				
L-S	1.09					

^ainches

^bReciprocal crosses combined (ie. D-Y = D x Y and Y x D)

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

Despite many changes in ranking of breeds in different year-seasons, certain consistent results were observed. Rank of the three sire breed groups mated to Yorkshire-Landrace dams was consistent from one year-season to the next and, for all practical purposes, consistent for the three sire breed groups with Landrace-Spotted dams. Duroc-Landrace x Yorkshire-Spotted pigs were the leanest four breed cross pigs in all but the first year-season. Pairwise comparisons between purebred breeds of sire mated to the same breed of dam revealed that Landrace sired pigs were fatter than the alternative purebred sired pigs for each breed of dam each year-season (i.e. Landrace x Duroc-Yorkshire pigs were fatter than Spotted x Duroc-Yorkshire pigs each year-season; Landrace x Duroc-Spotted pigs were fatter than Yorkshire x Duroc-Spotted pigs each year-season; etc.). Similarly, Duroc sired pigs were leaner than the alternative sired pigs for each breed of dam each year season. When comparing average backfat of all purebred sired pigs and all crossbred sired pigs, no significant difference was found between the three- and four-breed cross pigs either overall or in any individual year-seasons data.

Average Daily Gain

Sex of pig, breed of pig, year-season farrowed and the breed by year-season interaction were all highly significant for postweaning average daily gain, as they were for probed backfat. However, parity of the dam (whether pigs were born to a gilt or to a second parity sow), and the interaction of breed and parity, although non-significant for backfat, were highly significant for average daily gain. Thus

interpretation of breed effects is even more complicated than for backfat. Not only did breeds rank differently for gain in different year-seasons, but also depending upon parity of the dam. The data were therefore analyzed separately by parity. For both parity one and two the terms sex, breed, year-season and the breed by year-season interaction remained highly significant.

Mean average daily gains are presented by parity and breed of pig in Tables 4 and 5. Considering how sire breeds ranked in each parity within each breed of dam group, rank changes were evident for all but the Yorkshire-Spotted dams. However, when considering only purebred sired pigs, the only rank change was for Duroc and Yorkshire sired pigs with Landrace-Spotted dams. Duroc sired pigs from second parity sows grew .07 lb/day faster than Yorkshire sired pigs, whereas Yorkshire sired pigs gained .09 lb/day faster than Duroc sired pigs in gilt litters. In addition to rank changes, differences between breed groups were of noticeably different magnitudes in different parities in many cases.

In addition to summarizing breed performance, an important consideration is the comparison of pigs sired by purebred versus crossbred boars. Average daily gain of crossbred sired pigs from second parity litters was not found to be significantly different from that of purebred sired second parity litter pigs in any year-season's data, or overall. For pigs farrowed in gilt litters, significant differences in growth rate were found in two year-seasons. Crossbred sired pigs farrowed in the spring of 1978 grew significantly faster than purebred sired pigs. However the reverse was true in the fall of 1979 pigs, the three breed cross pigs gaining an average significantly faster than the four breed cross pigs. Overall, no significant difference was detected between growth rate of purebred and crossbred sired pigs.

Table 4. Parity 1 postweaning average daily gain least-squares means by breed group^a.

Breed of sire ^{b,c}	Breed of Dam ^{b,c}					
	D-Y	D-L	D-S	Y-L	Y-S	L-S
D				1.58	1.55	1.51
Y		1.54	1.57			1.60
L	1.44		1.54		1.37	
S	1.43	1.45		1.48		
D-Y						1.52
D-L					1.41	
D-S				1.49		
Y-L			1.50			
Y-S		1.59				
L-S	1.51					

^a lb/day

^b Reciprocal crosses combined (ie. D-Y = D x Y and Y x D)

^c D=Duroc, Y=Yorkshire, L=Landrace, S=Spotted.

Table 5. Parity 2 Postweaning average daily gain least-squares means by breed group^a.

Breed of sire ^{b,c}	Breed of Dam ^{b,c}					
	D-Y	D-L	D-S	Y-L	Y-S	L-S
D				1.62	1.62	1.58
Y		1.57	1.63			1.51
L	1.70		1.58		1.56	
S	1.45	1.56		1.57		
D-Y						1.54
D-L					1.56	
D-S				1.64		
Y-L			1.60			
Y-S		1.55				
L-S	1.63					

^alb/day

^bReciprocal crosses combined (ie. D-Y = D x Y and Y x D)

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

Work will continue to further characterize the important genotype by environment interactions evident in this data. In addition, information obtained from this crossbreeding experiment will be pooled and evaluated in order to establish the expected relative efficiencies of the Duroc, Yorkshire, Landrace and Spotted breeds in alternative crossbreeding systems.

Literature Cited

- Buchanan, D.S., et al. 1983. The Effect of Crossbred vs Purebred Boars on Conception Rate in Swine. Okla. Agr. Exp. Sta. Rep. MP-114: 188.
- Buchanan, D.S., et al. 1983. Litter Performance for Various Types of Crossbred Females in Swine. Okla. Agr. Exp. Sta. Rep. MP-114:195.