A Comparison of Mating Systems Utilizing Duroc, Hampshire and Yorkshire Breeds for Swine Production

E. R. Wilson and R. K. Johnson

Story in Brief

This study utilized eight years of crossbreeding data at this station to compare the number of pigs produced by different mating systems using Duroc, Hampshire and Yorkshire breeds. Mating systems were defined to include the purebred and crossbred herds. These were herds required to produce replacement breeding stock for commercial pig production for a particular two-breed terminal, two-breed rotation, three-breed terminal, three-breed rotation or backcross mating scheme.

The best three-breed terminal crossbred system was a Duroc sire mated to a Hampshire-Yorkshire female (D-HY). This system produced 3.8 percent and 2.9 percent more market pigs than Yorkshire X Duroc-Hampshire (Y-DH) and Hampshire X Duroc-Yorkshire (H-DY) crosses. A backcross system using a Yorkshire sire mated to a Duroc-Yorkshire female (Y-DY) produced 2.4 percent more pigs than the D-HY system. The three-breed rotation and Duroc-Yorkshire rotation produced 3.3 percent and 2.9 percent fewer pigs than D-HY respectively. A greater reduction in production as compared to D-HY was predicted for Duroc-Hampshire and Hampshire-Yorkshire rotations which produced 13.0 percent and 7.9 percent fewer pigs, respectively.

The three-breed rotation maintained 91 percent of the farrowing sows in commercial production as compared to 76 percent for D-HY and about 81 percent for the backcross system Y-DY. In the three-breed terminal system D-HY, about 8 percent of the farrowing females were Duroc and about 16 percent were of Yorkshire and Hampshire breeding.

Introduction

The advantage of crossbred pigs and dams for increasing the efficiency of pork production has been accepted by the swine industry. Crossbred pigs reach market weight about 10 days earlier and have approximately 3 percent better feed conversion than purebred pigs. The mating of a purebred female to a boar of another breed will increase the number of pigs per litter at 42-days by about .8 pig per litter and the use of a two-breed crossbred dam mated to a boar of a third breed will increase the number of pigs per litter at 42-days by an additional 1.2 pigs.

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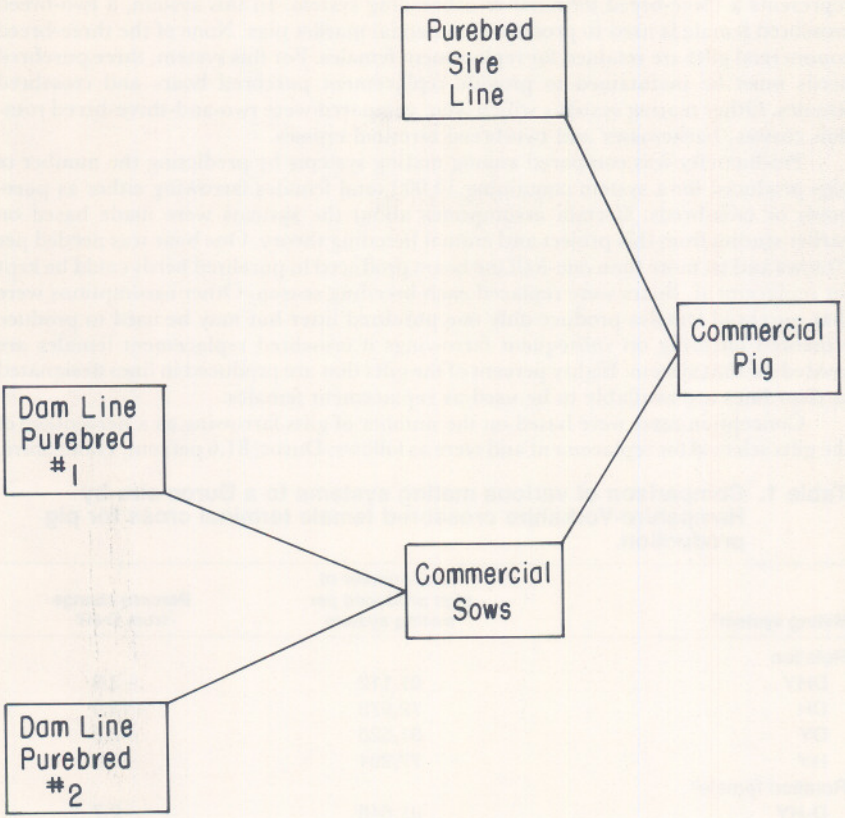


Figure 1. Diagram of three-breed terminal crossbred mating system.

Recommendations to swine producers concerning mating systems have been based on maintaining maximum heterosis for the mating system or for ease of producing replacement females. Many producers have been sacrificing maximum heterosis when they use rotation crossbreeding; however, this system provides the producer with an easy method for supplying replacement females. The object of this study was to compare predicted pig production from three-breed rotation, two-breed rotation, terminal sire on two-breed rotation female, three-breed terminal sire, two-breed terminal sire, backcross and purebred mating systems utilizing Duroc, Hampshire and Yorkshire breeds.

Experimental Procedure

Eight years of crossbreeding data involving Duroc, Hampshire and Yorkshire breeds were utilized in a computer model to compare the productivity of alternative crossbreeding systems involving these breeds. Traits which were considered in this analysis were average number of pigs per litter at 42-days, age at 220 lb, average backfat probe and feed efficiency.

Predicted performances for breeds and breed crosses were used in a computer model to compare productivity of different mating systems. Figure 1 diagrammatically

represents a three-breed terminal crossbreeding system. In this system, a two-breed crossbred female is used to produce commercial market pigs. None of the three-breed commercial gilts are retained for replacement females. For this system, three purebred herds must be maintained to provide replacement purebred boars and crossbred females. Other mating systems which were compared were two-and-three-breed rotation crosses, backcrosses and two-breed terminal crosses.

Productivity was compared among mating systems by predicting the number of pigs produced for a system containing 10,000 total females farrowing either as purebreds or crossbreds. Certain assumptions about the systems were made based on earlier studies from this project and animal breeding theory. One boar was needed per 10 sows and no more than one-half the boars produced in purebred herds could be kept for replacement. Boars were replaced each breeding season. Other assumptions were that purebred females produce only one purebred litter but may be used to produce crossbred offspring on subsequent farrowings if crossbred replacement females are needed for that system. Eighty percent of the gilts that are produced in lines designated as dam lines are available to be used as replacement females.

Conception rates were based on the number of gilts farrowing as a percentage of the gilts selected for replacement and were as follows: Duroc, 81.6 percent; Hampshire,

Table 1. Comparison of various mating systems to a Duroc sire by Hampshire-Yorkshire crossbred female terminal cross for pig production.

Mating system[a]	Total number of pigs produced per mating system	Percent change from D-HY
Rotation		
DHY	81,112	−3.3
DH	72,973	−13.0
DY	81,520	−2.9
HY	77,291	−7.9
Rotation female[b]		
D-HY	81,648	−2.7
Y-DH	79,127	−5.7
Three-breed terminal[b]		
H-DY	80,714	−3.8
Y-DH	81,505	−2.9
Backcross[b]		
Y-DY	85,922	2.4
Y-HY	83,099	−1.0
D-DY	80,129	−4.5
D-DH	75,974	−9.5
H-HY	75,224	−10.4
H-HD	73,911	−11.9
Two-breed terminal		
DH	68,373	−18.5
DY	79,390	−5.4
HY	74,945	−10.7
Purebred		
D	59,624	−28.9
H	57,035	−32.0
Y	77,504	−7.6

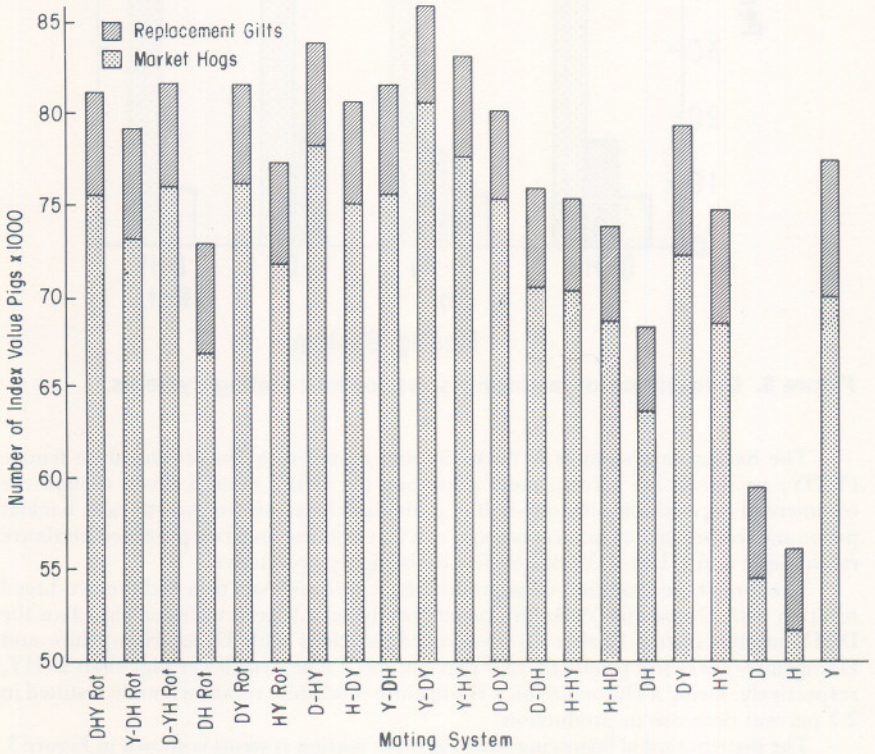
[a]D= Duroc, H= Hampshire, Y= Yorkshire.
[b]Breed of sire listed first.

86 percent; Yorkshire, 70.9 percent; Duroc-Hampshire, 78.1 percent; Duroc-Yorkshire, 83.4 percent and Hampshire-Yorkshire, 82.4 percent. Conception rate was assumed to be the same for gilts and sows. Ninety percent of the gilts which farrowed one litter could be retained in the breeding herd to farrow a second litter. On the average, one-half of the purebred sows farrowing two or more litters and producing crossbred offspring were saved for replacements. An average of 60 percent of the crossbred sows were retained in the breeding herds.

The total number of pigs produced by each breed or breed cross within a mating system was adjusted to compensate for economic differences in production costs and product value due to differences in age at 220 lb, average backfat probe and feed efficiency. Thus, each pig produced in a mating system is of equivalent value. Since each system has an equal number of sows farrowing, the fixed costs for reproduction would be the same for each system. Thus in comparing systems, the system which produces the greatest number of pigs should be the most efficient for swine production.

Results

Figure 2 compares the number of pigs produced by each system. The best three-breed terminal cross was a Duroc sire mated to a Hampshire-Yorkshire female (D-HY). This system produced 3.8 percent and 2.9 percent more pigs than the two other three-breed terminal cross systems, Y-DH and H-DY, respectively, (Table 1).



The average retention rate for purebred sows producing F_1 offspring is .5 and for commercial offspring is six-tenths. The limit of gilts which can be retained for replacements is .8 of female offspring in dam lines.

Figure 2. Number of pigs produced by mating systems.

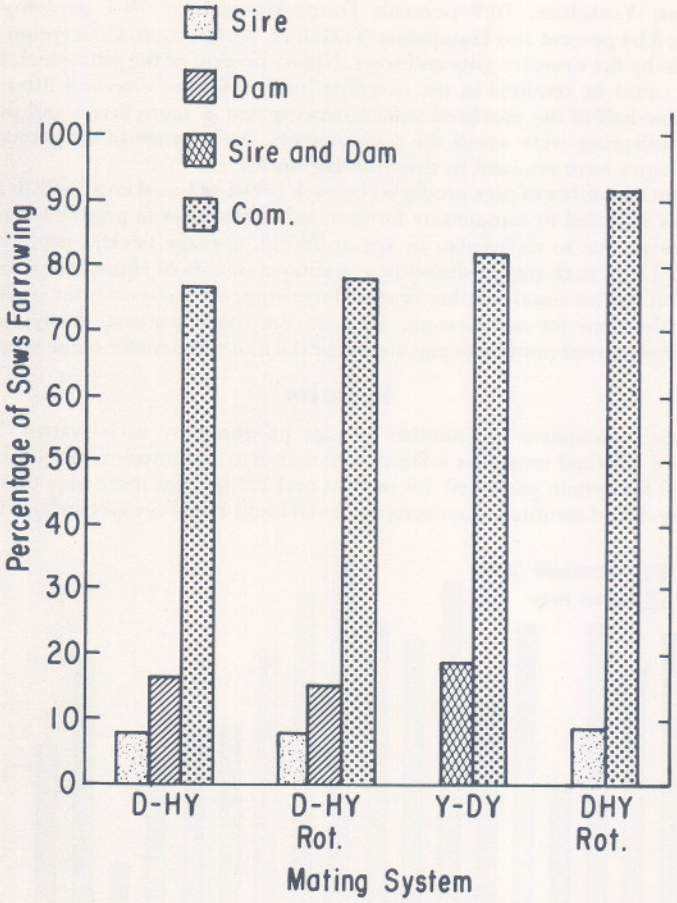


Figure 3. Distribution of farrowing sows for four mating systems.

The backcross system of a Yorkshire sire mated to a Duroc-Yorkshire female (Y-DY) produced 2.4 percent more pigs than the D-HY system. Even though the commercial pigs exhibit only one-half of individual heterosis for growth rate, backfat probe and feed efficiency in this system is efficient because only two purebred herds are maintained and a Duroc-Yorkshire female is highly productive.

The three-breed rotation cross produced 3.3 percent fewer pigs and the two-breed rotation with Duroc and Yorkshire breeds produced 2.9 percent fewer pigs than the D-HY mating system (Table 1). Two-breed rotations with Duroc-Hampshire and Hampshire-Yorkshire produced 13.0 percent and 7.9 percent fewer pigs than D-HY, respectively. Using a Duroc sire on a Hampshire-Yorkshire rotation female resulted in 2.7 percent decrease in production.

The distribution of farrowing sows for three mating systems is shown in Figure 3. The three-breed rotation cross has about 91 percent of farrowing sows as commercial sows as compared to about 76 percent in the D-HY terminal cross. The D-HY system requires about 8 percent of the sows as Durocs and 16 percent as Yorkshire and

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

L. K. Hutchens, E. R. Wilson, R. K. Johnson, R. L. Hintz, and R. Vencl

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