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FACT SHEET

L-728

Crossbreeding for Commercial Pork Production

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Records from the Regional Swine Breeding Laboratory and the cooperating state sub-stations during the last 40 years indicate that a *planned crossbreeding program yields increased production efficiency.*

The mating of individuals from different breeds produces "heterosis" or "hybrid vigor," a condition in which offspring are *superior in certain traits to the average of their parents.* The greater the genetic difference in the parents, the greater the hybrid vigor. In a swine crossbreeding program, *heterosis results in stronger pigs at birth, faster growth and more pigs farrowed and weaned by the crossbred dam.* Heterosis gives little or no improvement in feed efficiency and carcass merit. These traits must be improved through selection of superior parents.

The relative performance of purebreds, first crosses and multiple crosses is given in Table 1. All differences in the first cross (cross between two purebreds) are because of better livability and faster growth of crossbred pigs. Additional advantages in later crosses are gained because crossbred mothers farrow larger litters and make better mothers. The *crossbred sow* contributes over half the increased performance gained through heterosis.

For full benefits of crossbreeding, follow an aggressive, systematic program in selecting crossbred replacement gilts and purebred boars. A purebred boar should provide uniform germ plasm to his offspring, and using purebred boars allows a producer to bring the strong points of different breeds into his program. **Rapid-growing, muscular boars from strains with proven performance and carcass data are the key to a successful crossbreeding program.** Any breeding program, including crossbreeding, will improve through use of superior animals identified through on-the-farm testing, breed certification and litter testing programs.

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Table 1. Advantages of crossbreeding in commercial pork production*

Trait	First cross (between two breeds)	Multiple crosses
	Sows purebred, boars purebred	Sows crossbred, boars purebred
	Advantage over purebred pigs	Advantage over purebred pigs
Litter size		
No. born	none (because sows are purebred)	12%
No. weaned	7% (better survival of pigs born)	20%
Pig weight at 154 days	12%	12%
Litter weight at 154 days	22%	40%
Efficiency of gain	Negligible to slight (other than that due to correlation with gain)	
Meatiness	none	none

*Regional Swine Breeding Laboratory and Iowa State University data.

BREEDS TO USE

Overall performance from crossbreeding comes from two sources. One is the hybrid vigor obtained in certain traits, and the other is combining good points of different breeds in the crossbred offspring. The basic goal in a commercial operation is to produce large litters of fast-growing, efficient, muscular market hogs. In choosing breeds, consider the ability of selected individuals to contribute the following:

1. Sow productivity
Large number of pigs farrowed and weaned, good milking ability, desirable temperament
2. Rapid and efficient growth
3. Meatiness
Well-muscled, correctly finished market hogs with a high lean-to-fat ratio

No breed has a monopoly on all desirable traits. Select breeds so the strong points of one breed will complement the strong points of the other and result in a better combination of traits in the crossbred offspring.

* Consider the following things in choosing the best combination of breeds:

- Housing and management program
- Availability and cost of animals with known health status, production and carcass information
- System of crossbreeding

The foundation sow herd should be a breed noted for good sow productivity. Traits having low heritability, such as number of pigs farrowed and weaned, respond little to individual selection. To improve these traits, select a *breed* strong in these characteristics. Traits having high heritability, such as length, backfat, loin-eye area and other carcass traits, can be improved rapidly through selection and use of *individuals* with superior merit, regardless of breed.

SYSTEMS OF CROSSBREEDING

The two most common crossbreeding systems are the two-breed rotational cross and the three-breed rotational cross.

Two-breed Rotational Cross

This system is often called the backcross or criss-cross method. Boars of two different breeds are used in alternate generations. Crossbred gilts are retained and mated to boars from one of the two parent breeds. Crossbred gilts and sows are always mated to a boar of the breed farthest away in their pedigree.

Crossbred females are used after the first crossing in this system. If sows are retained for a varying number of litters, boars from both breeds will be required in the same season. Record the sire of each sow to keep the breeding program working efficiently.

The two breeds should complement each other. Both breeds should be reasonably good in litter size, growth and carcass characteristics. Stress meatiness and growth in selecting boars.

Three-breed Rotational Cross

The three-breed rotational cross is perhaps the most widely used system. Research indicates a slight increase in hybrid vigor by using three breeds instead of two. Including a third breed can often

strengthen certain performance characteristics in the crossbred offspring.

Selection standards for the boar should be extremely rigid, especially for feed efficiency and carcass merit. Boars of the three breeds are used in succession on each generation of crossbred gilts. Mate the gilts in each generation to boars of the breed farthest removed in their pedigree as shown in Figure 1. This rotational program can operate indefinitely if good boars are used and an effective gilt selection program is followed.

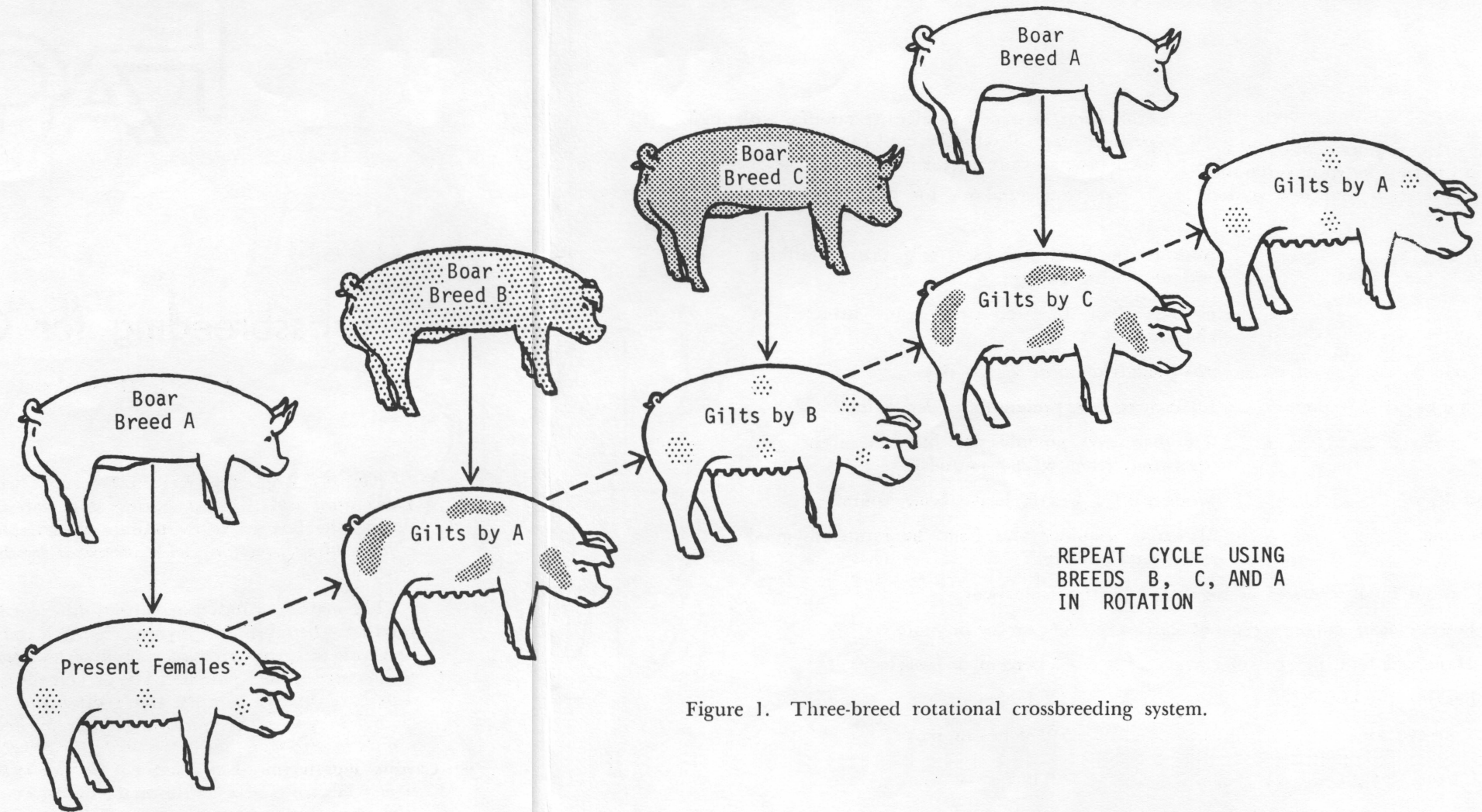


Figure 1. Three-breed rotational crossbreeding system.

SELECTION OF A BREEDING STOCK IN A CROSSBREEDING PROGRAM

Gilt Selection

Specific standards for gilt selection in a given herd are governed by the herd's present production and carcass merit. The following realistic standards are used by many progressive producers:

1. Litter size.....from a large litter and a sow with proven milking and mothering ability.
2. Nipples.....no less than 12, well-spaced, not inverted or abnormal.
3. Growth rate.....200 pounds or more at 154 days.
4. Backfat probe at 200 pounds.....1.1 inches or less.
5. Feet and legs.....moderate leg length, adequate bone, sound.
6. Conformation.....muscular, long-rumped, good length and balance.
7. Carcass cut-out on littermates or pigs sired by the same boar:
 - a. Percent lean cuts, percent of carcass.....60 percent or more
 - b. Ham and loin, percent of carcass.....42 percent or more
 - c. Backfat thickness.....1.3 inches or less
 - d. Loin-eye.....4.5 inches or more
 - e. Carcass length.....29 inches or more

Boar Selection

Boars must meet strict requirements. Many breeders participate in testing programs (on-the-farm testing, breed certification and test station

evaluation) designed to identify families with high performance. Production and carcass records from such programs are useful in selecting the "best."

Selection standards for boars are these:

1. Litter size.....from a large litter and a sow with proven milking and mothering ability.
2. Nipples.....no less than 12, well-spaced, not inverted or abnormal.
3. Growth rate.....220 pounds or more at 154 days.
4. Backfat probe at 200 pounds.....1.0 inch or less, preferably under .8 inch.
5. Feed efficiency.....less than 300 pounds per hundredweight gain (measured from 60-200 pounds).
6. Feet and legs.....Moderate leg length, heavy bone, sound.
7. Conformation.....Muscular shoulder and ham, long-rumped, good length and balance.
8. Carcass cut-out on littermates or pigs sired by the same boar:
 - a. Percent lean cuts, percent of carcass.....63 percent or more
 - b. Ham and loin, percent of carcass.....44 percent or more
 - c. Backfat thickness.....1.2 inches or less
 - d. Loin-eye area.....5.0 inches or more
 - e. Carcass length.....29 inches or more

Environment, level of feeding, sex and season of year influence animal performance. One of the most overlooked factors is sex. Table 2 shows differences in full brothers and sisters at the Ohio Swine Evaluation Station. Review these records

carefully and consider these "built-in" sex differences when evaluating records.

Table 2. Records of full brothers and sisters under the same management program*

	Boar	Gilt	Barrow
Backfat	1.3	1.5	1.6
Length	30.5	30.2	29.8
Loin-eye area	4.5	4.0	3.5
Percent lean cuts per carcass	53.0	51.3	49.0
Age in days at 200 pounds	150.0	167.0	160.0
Feed per 100 pounds gain	300.5	338.0	346.5

*Ohio Swine Evaluation Station.

SUMMARY

- ✓ Crossbreeding results in:
 - Larger litters farrowed
 - Larger litters weaned
 - Faster growth rate
- ✓ Crossbreds are no better in meatiness and feed efficiency than the parents selected.
- ✓ Selection and use of good purebred boars is a most important factor in a successful crossing program.