Pig Breeding Systems for Small and Beginning Pig Farmers

Introduction

Breeding or mating systems are the approach taken to pairing a boar and a gilt or sow for breeding in order to incorporate or maintain desired traits. Because the genetics of a pig plays an important role in its performance and meat quality, all pig producers should be familiar with breeding systems for pigs. This factsheet provides an introduction to pig breeding systems and heterosis. Practical swine breeding systems for small and beginning pig farmers are also discussed.

Objectives

- Introduce pig breeding systems
- Introduce heterosis or hybrid vigor
- Discuss pig breeding systems for small and beginning farmers

Pig Mating Systems

A breed is defined as a group of animals sharing a common ancestry that have distinguishable, fixed characteristics who when mated with a member of the same breed will produce offspring with the same characteristics (Damron, 2013). Breeding or mating systems are the approach taken to pairing individuals for breeding in order to incorporate or maintain desired traits. There are two main type of mating strategies — positive assortive mating and negative assortive mating. In positive assortive mating we breed like to like in order to narrow the genetic pool so that the desired traits express themselves more frequently. In negative assortive mating we breed unlike to unlike in order to correct a deficiency or improve expression of a specific trait. Through these mating strategies five basic breeding systems arise (NSIF 2003):

1. Inbreeding—breeding individuals who are very closely related within the breed.
2. Linebreeding—a form of inbreeding which attempts to concentrate the inheritance of one ancestor or line of ancestors within a herd.
3. Outcrossing—breeding individuals that are less closely related within the breed.
4. Random mating within a breed—mating individuals within a breed without considering their pedigree.
5. Crossbreeding—a planned approach to mating pigs of very different genetic backgrounds which typically results in heterosis. Heterosis is the improved performance of offspring compared to the average of their parents (NSIF, 2003).

Inbreeding and linebreeding encourage uniformity within the genetic pool and can be used to develop new breeds of pigs. However, as uniformity within the genetic pool increases, the potential for expressing undesirable genes also increases. This in turn can lead to a decline in performance commonly known as inbreeding depression (Buchanan, 2006). Outcrossing and random mating within a breed is used to maintain genetic diversity within a breed of pigs. While breeding like to like can support uniform transmission of superior traits to all offspring, usually some level of inbreeding depression occurs whenever breeds or lines within breeds are kept pure. Thus, crossbreeding is by far the most common form of mating strategy used in the U.S. swine industry because of the advantages of heterosis.

Heterosis

Heterosis or hybrid vigor is the improved performance of offspring compared to the average of their parents (NSIF, 2003). Heterosis occurs when unrelated lines or breeds of pigs are bred to each other and can be thought of as the recovery of performance depressed by inbreeding in the parent populations. This advantage typically occurs via expanded genetic diversity. Table 1 and 2 summarize heritability and heterosis estimates for important swine production parameters. Heterosis tends to be largest for traits with low heritability such as prewean mortality and 21-day litter weight. For traits with high heritability—for example average daily gain—heterosis tends to be less.

For most farms not raising animals primarily for breeding or show stock, a crossbreeding system is used because it provides significant improvements in traits relating to reproductive performance and mothering ability. Table two presents estimates of heterosis advantage for selected production traits under different breeding scenarios. The values presented in the table are percentages. For example, if a purebred sow was bred to a boar of the same breed and she gave birth to 10 live pigs, that same sow would be expected to give birth to 0.5% more pigs for a litter size of 10.05 pigs if she was bred to a boar of a different breed. Alternatively, if a crossbred sow was mated to a boar of a completely different breed we would expect an 8% advantage over the purebred scenario or 10.8 live born pigs.

Crossbreeding Strategies

Because of hybrid vigor, crossbreeding systems are used on almost all U.S. pig farms. There are several different approaches to crossbreeding that producers may use, each with different advantages and challenges.

Terminal System

One of the most common crossbreeding strategies in the U.S. swine industry is the terminal system. In this system crossbred females are bred to a terminal sire (either purebred or crossbred) and all the offspring are sold. This is a simple system to manage, will create genetically uniform groups of pigs from year to year, and captures 100% of available hybrid vigor in the females and all offspring. The drawback to this system for small and beginning farmers is that you will have to purchase all replacement gilts and boars. Regularly purchasing replacement gilts may be cost prohibitive and increases the potential for introducing novel pathogens into your swine herd.

Rotational Systems

Many small pig farms use a rotational system. In this system boars of selected breeds are rotated into the herd with each generation of replacement gilts. Replacement, cross-bred gilts are raised on-farm which helps support herd biosecurity. Table three summarizes various crossbreeding strategies in terms of complexity and percent heterosis maintained in the offspring. As the number of breeds included in the rotation increases, the amount of heterosis maintained also increases. A rotational system does not allow

maximization of hybrid vigor but is a common system due to the potential for lower cost when compared with purchasing replacement animals. If natural service is used a large number of boars (at least one of each breed used in the crosses) may need to be kept on the farm in order to maintain the planned genetic program. Table four provides an example of a three-breed rotation. Historically the cost of purchasing and maintaining multiple boars and the level of record keeping necessary to track each generation of offspring led to most farms settling on a three breed rotation (Ahlschwede, 1988). Using artificial insemination allows a wider variety of boars to be accessed without having to maintain those individuals on site. Today with the availability of purchased semen and personal computing technology some of the barriers to more complex breed rotations have been reduced.

Combination System

There is also the option of utilizing a combination of the two systems. A small subset of the herd is kept in a rotational system that is used primarily to produce replacement gilts for the entire farm. Some of the replacement gilts are kept within the rotational system, but most are bred to a terminal sire with 100% of the offspring being marketed. This combination allows you to raise your own replacement gilts and maximize hybrid vigor in most of the pigs raised for market. For producers managing a small group of sows and gilts, this system can become cumbersome and difficult to manage well. Detailed recordkeeping and management are needed to insure the success of this system.

Summary

Pig breeding systems influence the genetic background of your pigs and thus play an important role in performance and meat quality. Because of the advantages of heterosis—particularly for traits related to mothering ability—crossbreeding systems are most commonly used in the U.S. A rotational system of crossbreeding is generally the most practical option for small and beginning farmers, especially if artificial insemination is used.

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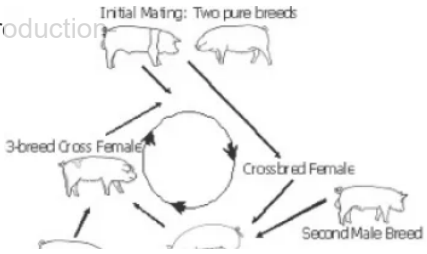

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