factsheet
Pork Information Gateway

Purchasing vs. Closed Herd System

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Introduction

One of the biggest decisions that must be made in a pork production system is the determination of the source of replacement breeding stock, especially females. Purchasing all replacement females is popular because it is simple to manage, maximizes terminal market hog production, and the producer depends on the genetic supplier for all genetic improvement. Closed herd strategies or internal multiplication programs are popular due to decreased health risks compared with frequent introductions into the breeding herd. The use of artificial insemination also makes closing the herd to boar introductions relatively easy as semen is readily available from numerous sources. Purchasing all female replacements or raising them in a closed herd system can be a challenging decision to make.

Choice of Crossbreeding System

The crossbreeding system that maximizes profit for commercial producers in most cases is a terminal crossbreeding system. A terminal cross in which all offspring are market animals offers several advantages over other breeding systems: 1) heterosis is maximized; 2) greater product consistency is possible; 3) it is easier to implement and manage; 4) it allows the best use of genetically selected sire and dam lines. Lines with superior genetic merit for reproductive traits provide females for the crossbreeding system, and specialized lines that excel in growth and carcass traits are used as terminal sires.

Terminal cross systems have become the industry standard for most operations for several reasons. First, larger and more specialized pork production systems have made specific mating schemes for within-herd gilt replacement more feasible. Second, independent seedstock suppliers and companies have expanded their herds to meet the market for parent gilts and/or grandparent females. Finally, the use of artificial insemination and advanced genetic evaluation techniques has made highly selected terminal and maternal sires more readily available.

Optimum Breeding System

The breeding system can be defined as the design and type of mating (crossbreeding) system and the breeding stock associated with it. The goal of the breeding system is to produce a consistent, high quality product as efficiently as possible, given a fixed level of inputs (facilities, capital, labor, etc.). The best breeding system will not always have the greatest total production potential or the least capital outlay. It will generate pigs in an appropriate number during a given period of time resulting in optimum pig flow, not necessarily maximum pig flow. Assuming a terminal crossbreeding system as previously discussed is used, an important question that must be answered is how to obtain replacement females. The question of whether to purchase all replacement females or establish a closed herd production scheme will depend on each producer's individual situation.

Purchasing Replacement Females

Purchasing all gilts from an outside seedstock source is popular for numerous reasons. Given a terminal crossbreeding system is used, it is the simplest system to manage since no breeding decisions have to be made by the producer. All terminal boars (or semen) can be mated to any female in the herd. Buying all gilts maximizes terminal production in the commercial herd which should be the most profitable pigs to produce since terminal pigs are generally leaner and more efficient than barrows and cull gilts from maternal litters. If all replacements are purchased, a producer will depend on his seedstock supplier to do his "genetic work" for him. As a result, the genetic merit of the commercial producer's herd will directly depend on the genetic progress made in the seedstock supplier's herd.

Potential disadvantages of buying all replacement females are the initial cost, availability, timing of introductions into the herd, and the health risks involved. Cost and availability are two questions that must be answered through negotiation with your seedstock supplier. A consistent, reliable supply of gilts is essential if the decision is made to purchase all replacements.

Another method of obtaining replacement gilts that is growing in popularity is the network multiplier or user-group multiplier. These systems consist of a group of producers that establish a separate venture to produce replacement breeding stock for the group members or users. A specific mating scheme is used and the group is generally tied directly to a seedstock supplier. Each member purchases shares (stock or sows) in the group multiplier in relation to the number of females their individual system will require. Network multipliers are designed to maximize genetic improvement and health (biosecurity), and to reduce costs associated with decreased production efficiency and the extra management ability required to maintain grandparent or great-grandparent females. Startup costs will probably be greater, but this system has the potential to reduce genetic costs and maximize long-term genetic gain.

Frequent introductions of breeding age females into the herd are difficult for herds that utilize early weaning, multiple site systems to improve herd health levels. Seedstock suppliers have introduced SEW (<21 days of age) and junior gilt (40-50 lb.) programs to meet the demands of these herds. Under these programs, gilts are placed in an isolation facility separate from the base herd. Introduction at an early age allows more time for females to be isolated for potential disease monitoring and to become acclimated to the health status of the base herd. The isolation period will allow time to uncover any diseases the gilts carry before introduction into the base herd.

An acclimation period following isolation allows new gilts to build immunities comparable to the base herd. Normally this is accomplished by introducing a few sentinel animals into the isolation facility after the initial monitoring period. These sentinel animals may not have clinical symptoms of diseases present in the base herd, but differences in immune systems may cause the new gilts to exhibit an immune response upon exposure to the disease pathogens. An adequate acclimation period will facilitate close monitoring of any immune response and allow time to establish a common health status between the new gilts and the base herd.

Energy intake of developing gilts can be restricted after 180-200 pounds without delaying puberty. This can be accomplished by limit feeding 5-6 pounds per day of a 14-15% protein, well-balanced diet. This program will allow moderate lean tissue growth and save on feed costs over ad libitum feeding. It also allows accumulation of adequate body reserves necessary to support reproduction without increasing unneeded body weight that may decrease longevity and contribute to unsoundness in developing gilts as well as older breeding females.

It should be noted that introducing females at or near market weight (5-6 months of age) increases the temptation to reduce the time spent in isolation and acclimation. The isolation and acclimation periods should be a minimum of 30 days each to allow adequate time for disease monitoring and adjustment to the breeding herd environment. Proper time spent here will boost lifetime reproductive performance and longevity.

Closed Herd Systems

Several requirements should be met before a producer sets up a closed, within-herd gilt multiplication system. First and foremost, willingness and the desire to operate the system is necessary due to the extra management ability that is required. Extra discipline, time, and effort are essential. These systems require identification of all nucleus females, an evaluation and selection program, and management of the production supply. An analysis of the potential benefits and the associated costs is essential before a decision to raise replacements is made.

In any closed multiplication system, a portion of the sow herd is designated to produce parent replacement gilts for the terminal portion of the herd. These production schemes lower the health risks involved because introduction of new animals into the herd is eliminated. They also offer potential cost savings, but require extra management ability and reduce the number of females devoted to terminal production.

Regardless of the type of closed herd system used, development of potential replacements starts at birth. A record of specific matings made to produce replacement females must be maintained and gilts in those litters must be identified at birth by ear notching and/or ear tags. Some producers choose to raise these potential replacements together with their contemporaries while others may pen them together to facilitate identification and selection. This also allows them to be fed separately and developed on a different plane of nutrition.

Within Herd Great Grandparent Program

The most popular scheme that truly is a closed herd system is the within-herd great-grandparent program outlined in Figure 1. In this system, a small number of maternal females (Yorkshire) from a maternal line are purchased initially. These pureline females (approximately 12% of the total sow herd) are mated to sires of another maternal line (Landrace) to produce F1 parent females (L x Y). This Yorkshire line is maintained by mating enough of them each year to purchased Yorkshire semen to produce an adequate of replacements for this population. The L x Y females would be mated to terminal boars (Duroc in this example) for terminal market hog production. Once this system is up and running, it is not necessary to purchase any outside females if AI is used. However, it requires a great deal of management ability and attention to detail, and reduces the number of females available for terminal market hog production. It also does not work well in herds smaller than 400-500 sows.

The following table outlines the number of females of each type and the number of replacements that must be produced by each mating type each year for a 600-sow herd. Calculations are based on 2.2 litters/female/year. Note that 12% of the total sow herd (72) would be purebred Yorkshire females and 88% (528) would be Landrace x Yorkshire F1 females. At a 40% replacement rate, 211 L-Y females and 29 pureline Yorkshire females would be needed each year. An average of 1.60 gilts would need to be retained from each Landrace x Yorkshire litter farrowed and more selection pressure could be exerted on the pure matings since only 1.12 gilts would need to be saved from each pure Yorkshire mating. If the herd's replacement rate goes up to 50%, more gilts would be needed and less selection pressure would be available. Increasing the percentage of Yorkshire females in the herd would allow the producer to reduce the number of gilts that must be retained from each maternal litter.

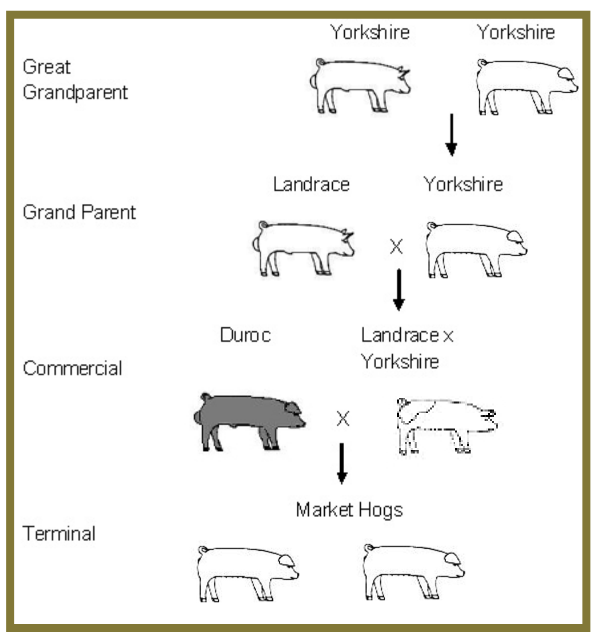

Figure 1. Within Herd Great Grandparent Program

Table 1. Number of females in a within herd great grandparent program

Level	Matings	% of Matings	No. Females	No. of Litters/yr	40% Replacement Rate: No. Gilts Needed	40% Replacement Rate: Gilts/Litter	50% Replacement Rate: No. Gilts Needed	50% Replacement Rate: Gilts/Litter
Great Grandparent	York x York	2	12	26	29	1.12	36	1.38
Grandparent	Land x York	10	60	132	211	1.60	264	2.00
Commercial	Duroc x L-Y	88	528	1162	---	---	---	---
	Total		600	1320	240	---	300	---

Rotaterminal System

Another popular breeding system for commercial producers raising their own gilts is the rotaterminal system outlined in Figure 2. Because boars of several breeds or lines are needed, it is ideally suited for AI. In this system, the females that wean the largest and heaviest litters are mated to boars superior in maternal traits to produce replacement gilts in a rotational manner. The balance of the sow herd is mated to terminal sires for market hog production. If approximately 15% of the sow herd is dedicated to producing replacements and 1.5 gilts are retained per maternal litter, a 40% annual female replacement can be met if 2 litters are produced per female per year. Many producers using the rotaterminal system breed all replacement gilts to terminal sires for their first litter. The most productive females are then candidates to be bred to maternal sires for their second and subsequent litters. Some producers do the opposite and breed all replacement gilts to maternal sires for their first litter, resulting in a shorter generation interval. Matings for subsequent litters are then to terminal boars.

In this system, females in the top 15% of the sow herd (dedicated to producing replacements) that are sired by Breed B are bred to Breed A, those sired by A are bred to C, and those sired by C are bred to B. A simple method that can be used to accurately maintain the breed makeup of each female in the herd is to use a specific colored tag for all females sired by each breed of boar.

This system has an advantage in that it is not necessary to maintain pureline females in the herd. It is, however, even more complex to manage since it is critical that rotaterminal females are mated to the correct breed of boar in order to maintain maternal heterosis. In a three-breed rotaterminal, 86% of potential maternal heterosis is realized if the correct rotation of breeds is maintained. If two breeds are used, potential maternal heterosis is reduced to 67%.

The percentages of the herd needed to raise replacement gilts that are included in these two options are rule-of-thumb estimates. Actual number of females needed will depend on production levels, replacement rate, and selection intensity desired. The breeds and breed combinations shown are examples that would maximize both maternal and pig heterosis in each system. Various other breed or line combinations are also available.

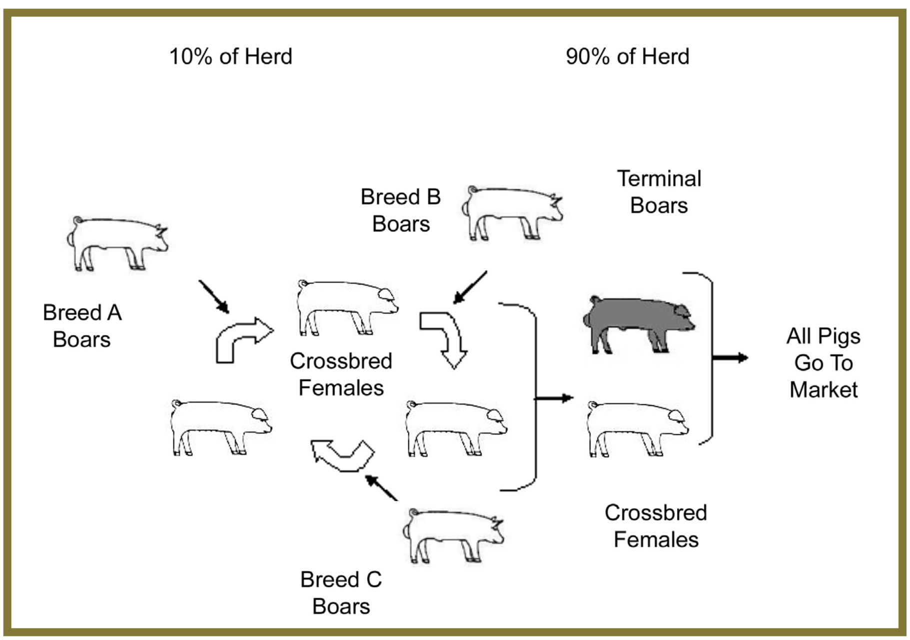

Figure 2. Rotaterminal System

Number of Replacement Females

A planned breeding and farrowing schedule, along with previous production records, will help to determine how many gilts are needed in the gilt pool. Season of the year, age, environment, and genetics are factors that may affect the number of females exhibiting estrus and conceiving at any one time.

The number of replacement gilts needed to add to a farrowing group must be determined in advance of the breeding period. Culling rates and previous conception rates for both older females and gilts will determine how many gilts will need to be bred. In general, at least three gilts should be selected for the gilt pool for each farrowing crate that needs to be filled. Even more gilts are needed during problem breeding periods, if pen breeding is used, or any health challenge occurs.

It is generally recommended that females are not bred before they reach 7-7 ½ months of age. This will ensure that gilts are bred on at least their third heat period. This usually results in an increase in ovulation rate and fewer rebreeding and lactation failure problems than if gilts are bred at their first or second estrus. Temporary situations may make it advantageous to breed females earlier than their third heat cycle but lifetime production will likely be reduced.

Genetic Merit

An important consideration is that of the relative genetic merit of purchased vs. closed herd gilts. It should be remembered that the genetic merit of home-raised gilts in a closed system is a function of the genetic merit of the great-grandparent females and the maternal sires used in the herd. Gilt selection efforts will contribute very little to the genetic improvement of the herd and are relatively unimportant when compared to the importance of the genetic merit of the maternal sires used. Because of the relatively small number of great-grandparent females needed and the premium generally paid for them, it is extremely important that they have performance records and are selected from the top end of a herd that is making consistent genetic improvement. In addition, AI has become a powerful tool in making the best maternal sires in the industry available to commercial pork producers to sire their replacement females.

Equally important or perhaps of even greater importance is the genetic merit of replacement gilts if they are purchased. If these gilts come directly from a multiplier herd that is supplied by a nucleus herd making significant genetic improvement, this improvement will be channeled directly to the commercial herd and genetic lag will be kept to a minimum. If the multiplier herd is using average or below average females from a nucleus herd, genetic progress in the commercial herd will be limited. It is equally important to select both boars and gilts from herds that have a sound testing and selection program.

Cost Comparisons

Accurate cost comparisons between the various systems should be made to determine which will be the most cost-effective for each individual herd. Each system may have a different genetic cost depending on such factors as structure of the breeding herd, initial purchase price, replacement rate, expected production levels, and economic values specific for the herd. It is important to remember that the value of different alternatives will vary from farm to farm and the lowest genetic cost may not be the best. The genetic merit of the pigs produced must also be considered in evaluating the benefits of the various systems.

Summary

Choice of a system for obtaining breeding stock replacements depends on management ability, herd size, expected reproductive performance, and availability and cost. All must be considered when the evaluating the merits of each individual system. The purchase of replacement females for terminal crossbreeding systems is an alternative that should be given careful consideration. If a consistent supply of genetically superior females is available from a reliable supplier, a high level of productivity in an easy-to-manage system can result. Properly designed terminal crossbreeding programs will achieve a maximum level of both maternal and pig heterosis. Purchasing all replacement females must also be considered relative to the cost and the potential disease risk involved.

Raising females in a closed herd, within-herd multiplication system can be cost effective and greatly reduce the disease risk involved in the continuous introduction of replacement gilts. Artificial insemination (AI) is ideally suited to closed herd systems and is especially helpful because it allows the use of superior maternal boars that might not be available through natural service.