Swine Feed Efficiency: Genetic Impact

Author
John W. Mabry, Iowa State University

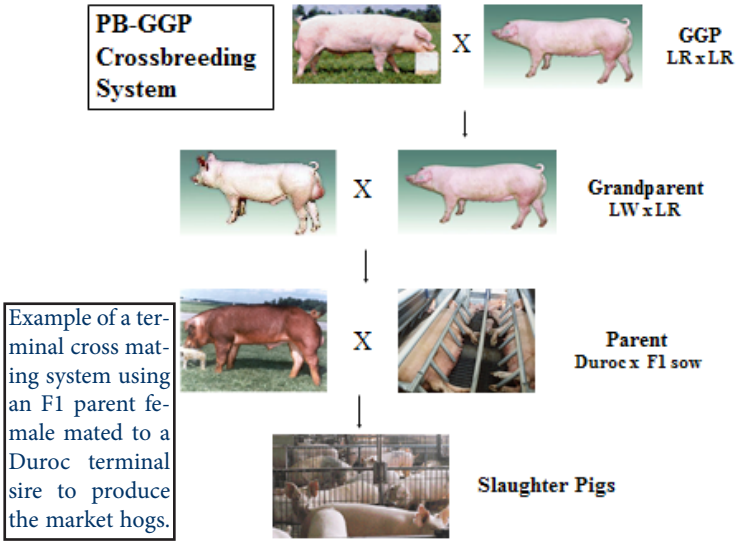
Reviewers
Mike D. Tokach, Kansas State University
Joel M. DeRouchey, Kansas State University

Introduction

Feed costs have traditionally been the highest contributor to cost of production in swine, representing 2/3 of the cost to produce a market hog. Feed efficiency is a trait that is significantly influenced by genetics, with a heritability in the moderate range (30%-40% of the differences between animals in feed efficiency are due to genetics). The genetic system that a swine producer utilizes can have a significant impact on herd feed efficiency and the operation's feed costs. The genetic system is comprised of the genetic composition of the sire and dam lines, plus, the crossbreeding system. The critical aspects for the sire and dam lines include a combination of the genetic supplier used by the producer, the specific lines utilized for the terminal sire lines and maternal dam lines, and the genetic improvement program of the genetic supplier. It is important to remember that the genetic composition of each market hog is derived equally from the sire and from the dame of the pigs.

Terminal Sire Line Impact on Feed Efficiency

Although other terminal sires exist, the majority of terminal sire lines can be broken down into three primary genetic types: Pietrain-Terminal LW based, pureline Duroc based, and crosses between Duroc and Pietrain-LW. Based on results from the National Pork Board Terminal Line Evaluation trial, the differences between these terminal lines are not large, but the Pietrain-LW lines are generally a little better in feed conversion but of lesser merit in growth rate, survival, and meat quality when compared to the pureline Durocs, with the crosses in-between. Remember, these terminal sire lines supply half of the genetics to each pig for feed efficiency.



Example of a terminal cross mating system using an F1 parent female mated to a Duroc terminal sire to produce the market hogs.

Maternal Dam Line Impact on Feed Efficiency

In contrast, maternal lines offered by most genetic suppliers are combinations of maternal Large White (Yorkshire) and Landrace. These maternal dam lines supply the other half of each pig's genetic composition for feed efficiency. Differences exist between genetic suppliers in the selection intensity exerted on feed efficiency in their maternal selection indices.

Tools for Genetic Supplier to Improve Feed Efficiency

There are several technology-based tools that the genetic supplier can use to make genetic improvement in feed efficiency. These include: objective measurement of feed intake [FIRE (Feed Intake Recording Equipment) systems], objective measurement of traits related to feed efficiency (growth rate, lean percent), BLUP (Best Linear Unbiased Prediction) estimation of genetic merit, utilization of molecular genetic technology (gene markers, SNP information), and the use of Mate-Selection software for the matings in the nucleus populations. If the genetic supplier is directly selecting for feed efficiency, then the genetic correlation between feed conversion and other important traits (such as feed intake, growth rate) must be taken into consideration. The simplest way to manage these correlated traits is to be sure the genetic supplier is using a multiple-trait BLUP process of estimating breeding values for feed efficiency. This process will take into account these correlated traits in making the breeding value estimate for feed efficiency. If the genetic supplier is not directly measuring feed efficiency, then they are probably trying to improve feed efficiency by selecting for genetically correlated traits. An example would be to select simultaneously for fast growth and high lean percentage; two traits that are favorably correlated to feed efficiency.

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Differences Between Genetic Suppliers

While there is no current, publically available, unbiased comparison from different genetic suppliers of the genetic merit of terminal sire or maternal lines, there are differences between genetic suppliers that can be used in making a decision on which genetic supplier to employ. The differences include the genetic base for the terminal or maternal line, the tools used to foster genetic improvement, and the actual rate of genetic improvement in feed efficiency (referred to as the genetic trend).

Selection Pressure on Feed Efficiency

While feed efficiency is extremely important for maximizing profit, other traits also influence profit and must be included in the overall selection objective. In terminal sire lines, their role is to provide half of the genes for post-weaning performance to the progeny. This post-weaning performance includes feed efficiency, but also should include other economically important traits such as growth rate, meat quality, and survival rate. In maternal dam lines, their role is first to produce a litter of pigs, and then to provide the other half of the genes for post-weaning performance to the progeny. The reproductive part of the dam line role is to have a large litter size weaned with a minimum number of non-productive sow days. Then the sow impacts on the post-weaning traits in the progeny are considered much as in the terminal sire lines. The relative value of each of these traits should be included in formulation of the most efficient selection indexes utilized in selection for terminal sire lines and maternal dam lines.

Key Questions to Ask the Genetic Supplier

1. What is the genetic base of their terminal sire line?
2. Do they measure feed intake directly?
    a. If yes, do they measure on both terminal sire and maternal dam lines?
    b. Do they measure both boars and gilts?
    c. What percent of pigs are measured?
3. In the Terminal Line Index used for selection in sire lines, what is the percent of emphasis on feed efficiency?
4. In the Maternal Line Index used for selection in dam lines, what is the percent of emphasis on feed conversion?
5. What genetic markers are used in their selection programs for sire and dam lines?
6. What is the rate of genetic improvement in feed efficiency (genetic trend) over the past 5 to 10 years?

References

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