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Using Expected Progeny Differences for Swine Selection

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Introduction

Many factors influence the profitability of a swine production unit; however, this discussion will focus on the influence of genetics. The primary goal in making any genetic decision is the identification of seedstock that will maximize the net profits of an operation over time. Remember, superior genetics in a swine operation will improve both the overall efficiency of the swine enterprize and be permanent.

Three key steps to accomplish the genetic goals of optimal efficiency are:

- First and most importantly, seedstock suppliers must focus on the most economically important traits in their selection programs in order to lead the swine industry in the proper direction.
- Second, accurate information on breeding animals at the elite level must be available and breeders must select on this information.
- Third, genetic improvement must be passed to commercial producers as fast as possible.

EPDs Defined

A complete genetic evaluation program combines the often vast and varied information available on an individual into one value that can be used for ranking animals. This value is referred to as the expected progeny difference (EPD).

Traditionally people have evaluated the phenotypic aspects of the pig (weight, frame, color, structure, fat, etc.). Remember this equation: **PHENOTYPE = GENETIC MERIT + ENVIRONMENTAL EFFECTS**. The success of an individual as a breeding animal is determined by its genetic merit or breeding value. Breeding value is defined as the value of an individual as a parent. How the breeding value is expressed by each pig's individual phenotype is dependent on the environmental conditions under which it was raised.

Breeding values describe the genetic merit of each parent. However, swine producers are more interested in the genetic merit that will be passed on to each of the parents' offspring. Basic laws of genetics explain that each parent passes a random one-half of its genes to its offspring. The same is true for genetic merit or breeding values. Because only one-half of the genes are passed on, only one-half of the breeding value is passed to the progeny. The term used for one-half of the average breeding value is EPD. The EPD is the best estimate of breeding value. The EPD based on across-herd genetic evaluations is the most accurate measure of breeding value when making genetic comparisons across different herds.

Estimating EPDs

A genetic evaluation system to estimate EPDs requires that measures of performance be taken on all available animals. When performance records have been collected on the individuals in a population that information is used in a statistical procedure to estimate EPDs.

In the United States there are primarily two types of seedstock suppliers independent purebred breeders and the commercial companies. Independent breeders collect performance records in on farm testing programs, such as the North Carolina On-farm Swine Performance Testing Program. Performance information is also collected on boars in central boar test stations and combined into a national data base. The performance record program for purebreds is known as STAGES (Swine Testing and Genetic Evaluation System). Performance records are collected for days to 230 pounds, backfat, number of pigs born alive, and 21 day litter weights. Breeders also register their animals in the breed associations' pedigree program in order to maintain an accurate record of parentage.

The major seedstock companies have each developed independent performance testing programs and maintain pedigree information on their own animals. In general, performance records on backfat, feed efficiency, growth rate, litter size, and litter weight will be collected on animals in their genetic nucleus herds. Some of the seedstock companies also collect performance records on the multiplier level.

When performance records have been collected on the individuals in a group, that information is combined in a statistical procedure known as Best Linear Unbiased Prediction (BLUP). This procedure uses an "animal model" that combines all information on an animal and all its relatives in the best possible way to obtain the most accurate measure of breeding value. This procedure can also utilize information from correlated traits in multiple trait evaluations.

A multiple trait evaluation is one that estimates EPDs simultaneously for more than one trait. If two traits are correlated (either positively or negatively), information on one is useful to predict the EPD for the other trait. For example, there is a negative genetic correlation between backfat and days to 230 lbs.

Accuracy of EPD Estimation

EPDs are estimates of transmitting abilities that are based on varying information from one individual to the next. Therefore, the accuracy with which each EPD is estimated also varies. The accuracy of an EPD is increased when all of the information available on an individual and its relatives is utilized and on-genetic effects that influence a trait (environment, age, parity) are removed when estimating breeding value. Relative informationcan include records from progeny, pedigree (parents, grandparents), and collateral relatives (sibs, cousins). The accuracy of an EPD for a sire increases when he has progeny information available. Progeny in several herds will result in even higher accuracy.

For each genetic evaluation, an accuracy value is obtained for each EPD. The accuracy values published with EPDs reflect the amount of information available in the genetic evaluation. Accuracies range in value from 0 to 1. The closer the value is to 1, the higher the accuracy.

If an animal has EPDs that meet a producers selection goals it should be used regardless of the accuracy value. A producer may wish to limit the use of an animal with low accuracy, whereas a boar with many progeny and hence a higher accuracy may be used more extensively. Accuracy values are most effective as a tool for risk management because regardless of accuracies EPDs are the best estimates of genetic value available.

How to use EPDs

EPDs are used to compare two individuals of the same breed. At present we can compare EPDs from animals across herds within a breed, but not across breeds. The comparison of EPDs on pigs can take place within a contemporary group, a farm, or a breed.

A positive EPD is desirable when selecting for number of pigs born alive or 21 day litter weights. This translates into more pigs per litter and more pounds per litter. However, when selecting for backfat and days to 230 lbs, a negative EPD is desirable, because we need to reduce the time required to reach 230 and the amount of backfat. Accuracy values will range from zero to one; the higher the accuracy value, the more confidence that can be placed on the EPD. However, regardless of accuracy the EPD is the best estimate of genetic value.

Table 1 contains a sample from the January 1993 Yorkshire Sire Summary. Some examples will describe how this information can be used.

Table 1. A Sample From the American Yorkshire Club STAGES National Genetic Evaluation, January 1993; Trait Leaders

Boar Name	Pigs/Herds	EPD Days	Acc. Days	EPD Fat	Acc. Fat
Ulf	1081 / 20	-2.12	.66	-.15	.76
Jerkiko	40 / 3	-1.51	.56	-.16	.62
Lars	81 / 6	-5.86	.63	-.11	.71
Viking	172 / 7	0.32	.64	-.08	.74
E.T.	76 / 5	-6.01	.59	.06	.70

Example 1: Comparison of Jeriko and E. T. for backfat - If Jeriko and E.T. are bred to a large number of sows randomly picked, the expected difference in their progeny for backfat is determined as follows:

> Jeriko has an EPD for backfat of -.16 while E.T. has an EPD for backfat of .06 (Table 1). Subtract one EPD from the other to get the difference between the two i.e. [-.16 - .06 = -.22]. The -.22 obtained says that the progeny of Jeriko are expected to have, on the average, .22 in. less backfat at 230 lbs than those of E.T..

Example 2: Comparison of Lars and Viking for days to 230 lbs - If Lars and Viking are mated to large numbers of randomly selected sows, what would be the expected difference in their progeny for growth rate?

> By subtracting one EPD from the other the difference is [-5.86 - .32 = -6.18]. The -6.18 says that the progeny of Lars are expected to reach 230 lbs., on the average, 6.18 days faster than the progeny of Viking.

Increased Usage of Genetically Superior Animals

The final and most important step in making genetic progress is simply allowing the better animals to reproduce more often and culling the inferior animals. To make genetic progress the genetically superior animals must produce more offspring.

Published sire summaries make genetic information available and increase the usage of superior animals by public identification. When EPDs are available on proven sires, informed decisions can be made on which groups of offspring to select from, while published EPDs on young animals can aid in seedstock selection. Currently across-herd sire summaries are available from the respective breed associations. Seedstock companies all use EPDs to make selections in their nucleus herds. However, each company differs in its policy on making EPDs and performance information publicly available.

Artificial insemination (AI) is one of the best available tools for expanding the usage of superior sires. Currently several of the top purebred sires are available through the AI studs to elite, multiplier and commercial producers. AI allows for the expanded usage of genetically superior animals and accelerates the passage of genetic improvement to commercial producers.

Summary

Does the use of EPDs in a genetic selection program actually create genetic progress within a herd? The answer is yes. Similar procedures have been highly successful in beef and dairy cattle and will create genetic progress in swine.

The main reason for seedstock and commercial producers alike to use EPDs is that the seedstock industry exists in order to provide the commercial industry with genetically superior breeding stock. The commercial industry must get the most value for its money when purchasing breeding stock and EPDs provide the measure of quality that will ensure that.

Commercial producers should demand that seedstock suppliers follow a sound genetic improvement program and use genetic information in seedstock purchasing along with acceptable health and structure.

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