Choose 'em by the numbers

Use estimated breeding values and expected progeny differences to tell if performance is due to the herd or the herdsman.

BY NANCY GRATHWOHL

Individual performance is a valuable selection tool. However, it's not influenced solely by genetics, says Dennis Banks, Michigan State University (MSU). Known environmental differences must be accounted for to accurately measure performance.

Environmental differences aren't passed on to offspring, and progeny inherit only half of a parent's genetic ability, he explains. Breeders must sort through phenotypes influenced by a host of environmental factors that mask the genetic ability of the parents.

Therefore, says Banks, "If we wish to compare the difference between two animals, the key to the genetic evaluation is the management of the environmental component. If the environment can be 'equalized, then the genetic difference can be addressed."

The MSU animal scientist discussed selecting cattle by the numbers with cattlemen from the United States, Canada and South America attending the National Beef Cattle Symposium. Sponsored by MSU's animal science department and the American Shorthorn Association, the symposium was held Dec. 17-20 at MSU's new state-of-the-art livestock facility.

"Breeders who select on observed phenotype do not account for different contemporary groups or adjustments made for known environmental factors, which is essential — that's breeding by the numbers," Banks explains.

Adjusted weights, which adjust for known environmental differences, allow an animal to be evaluated on its ability as a parent, or estimated breeding value (EBV). However, some people don't see the value of adjusted weights, reasoning they sell actual weights. Says Banks, "If you are interested in environment, then you should purchase the herdsman — not the herd."

After adjusting for known environmental differences, consider unknown environmental differences. Heritability is the single most important parameter influencing genetic change, Banks explains. It's the degree that offspring resemble the parents in the performance of a trait.

"If traits are highly heritable, we are more sure of the genetic capabilities of the animal in question due to a minimal amount of environmental effects masking the performance if selection were based on phenotype;' says Banks. Lowly heritable traits have a great deal of environmental effects that cause less certainty in the estimate of the breeding value based on the phenotype of the animal being evaluated," says Banks (see Table 1).

Estimated breeding value (EBV) is a comparison of genetic worth of an animal to a population, says Banks. An EBV is figured by subtracting the average performance of the contemporary group from an individual's performance, then multiplying the result by the heritability for the trait. Split the EBV in half to figure the expected progeny difference (EPD), since only half of an individual's genetic merit is inherited by it's progeny.

Our level of confidence in an EBV is measured by accuracy, which can range from 0- 1, with a 1 being highly accurate, explains Banks. "Accuracy can be increased by simply getting additional information."

Comparisons can be made across herds by using National Genetic Evaluation Programs. These programs increase accuracy by increasing the information on performance in the population, says Banks. They calculate the environmental effects of contemporary groups and are able to equalize the environment across herds.

When looking at numbers, remember that genetic evaluation can account for multiple environments, genetic merit of contemporaries, nonrandom mating and culling on poor performance. However, it can't account for preferential treatment, contemporary group errors or partial herd reporting.

"If you remember one thing from today's discussion, please remember to correctly report all the cattle in the herd and to correctly form the contemporary groups," says Banks.

If you doubt the ability of genetic evaluations, look at the success that many of the breeds have had in changing their populations using genetic evaluation, he adds.

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Genetic progress is influenced by four factors: accuracy, intensity, variation and generation interval. They determine how quickly a trait can be changed, says Banks.

"Make the most of genetic progress by simply selecting within the population— going out and finding the most superior genetics that you can that are accurate to some degree," he adds. "The key to genetic progress is the records that go in to produce the accuracy, intensity and variation."

While making genetic progress, the effect of correlated response should be considered. Correlated response is the change in other traits caused by the selection for a certain trait, says Banks. It's affected by pleiotrophy, one gene affecting two traits; and linkage, two genes that are close on the same chromosome.

Accuracy, intensity, generation interval and genetic correlation also influence correlated response. "Genetic correlation tells how other traits are affected by the genes that affect the trait you have in your selection program. They are basically relationships," says Banks.

Cattlemen are most concerned with genetic antagonisms in the following traits: milk production and growth rate (size) vs. fertility; growth rate vs. calving ease; lean yield vs. carcass quality; and milk production vs. growth (size) maintenance requirements, says Banks. "Genetic antagonisms do exist and must be dealt with within breeding programs.

"Past genetic progress has been driven by intensity and accuracy," says Banks. "As we move to the future, genetic variation and generation interval will become major components."

Table 1: Genetic differences for varying levels of heritability

Heritability of trait	Adj. phenotypic dif. in bulls	Adj. phenotypic dif. in cows	Genetic dif. in bulls EPD	Genetic dif. in cows EPD	Expected progeny dif. (EPD)
100	-69	0	-69.00	0	-34.50
50	-69	0	-34.50	0	-17.25
25	-69	0	-17.25	0	- 8.63
10	-69	0	- 8.63	0	- 3.45
0	-69	0	0	0	0