

## ***Nature vs. Nurture: Heritability of Reproduction***

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There are many “rules of thumb” and general statements that get repeated so often, and for so long, that they are considered fact even when we do not fully understand them. One of those general statements is that “reproduction is not highly heritable.” Or, in other words, that it is difficult to identify individual animals that exhibit a beneficial trait related to reproduction, mate them, and expect an improvement in that trait. On the other hand, there are several production traits that can be rapidly changed with that type of selective mating. An example of a trait that is highly heritable is height (frame score). If you breed a large frame bull to a large frame cow, you can expect a large frame calf from that mating. The fact that reproductive traits are lowly heritable is certainly unfortunate since reproductive performance has the largest influence on profitability in cow-calf production.

A basic understanding of genetics will help us understand why some traits are more heritable than others. The basis for heritability has to do with a phrase you have probably heard before – “nature verses nurture.” This phrase is often used when talking about human behavior and poses the question of what is more influential on the way an individual looks or acts, the genes that the individual inherited from their parents or the environment they are raised in? Of course, it is always a mix of both those influences. But, the point here is that some traits can be explained by the environment better than they can be explained by genetics. Reproduction, or the likelihood of a calf being produced by mating a particular bull and cow, is one of those traits that is influenced dramatically by environment.

Even if we focus on one half of the mating, it is difficult to predict an outcome for pregnancy rate to that mating because there are so many genes that impact how the reproductive tract functions and then how the early embryo develops. And, many of the genes that influence reproductive function work differently in different environments. To make predicting fertility even more difficult, the way we measure the outcome of a mating only gives us a yes or no (pregnant or open) answer from each mating instead of a number within a broad range (ex: 632 lbs. at weaning). Analyzing data with only two outcomes (binomial) does not give geneticists much power for predicting an outcome unless they have several thousand animals raised in a similar environment.

If it is hard to change reproductive performance by individual animal selection and it is hard to predict it by using statistics, then how can cow-calf producers improve it? One of the most tried-and-true, low cost methods for commercial cattle producers to improve reproduction is to make use of heterosis by crossbreeding two or more complimentary breeds. That brings up another rule of thumb that is often repeated but perhaps not fully understood – “traits that do not respond well to selection respond well to heterosis.” Methods for crossbreeding to improve reproduction have been covered in these articles before and are covered in many educational meetings across the state. So, rather than making this article too long by rehashing all that

here, just realize that most breeding objectives can be met while using heterosis in commercial cattle production. Those targets include consistent hide color (including black-hided if that happens to be the desired outcome), polled, good carcass merit, and a host of many others. This is especially true when you include the use of artificial insemination to access genetics of bulls from smaller breed registries where above average multi-trait genetic merit might be more expensive in a live sire because of low supply with high demand.

Another simple way to improve reproductive performance is to safeguard against reproductive failures by ensuring that nutrition and health are adequately maintained for all males and females. It would be lacking to write about nutrition and health management without mentioning the single most effective way to make sure health and nutrition are managed properly – that is by having a defined breeding season. If all the calves are a similar age and the cows are at similar points in their production cycle on any given day, it makes managing health and nutrition easier and much more efficient.

Trying to improve an outcome without measuring it is a difficult proposition. The most basic method for cattle producers to measure reproductive performance is to record which breeding age females have a calf each year. You could think of calving as the most conclusive way to determine if all the genes that influence reproductive performance fit your environment in one simple record. Again, that does not make it easy to predict, but it is at least a simple way to measure the actual outcome. Putting heavy selection pressure on cows by only keeping cows that produce a calf every year in a defined calving season is the surest way to improve reproduction in that environment with the genetics you manage. Luckily, we can check pregnancy early cows and heifers to determine whether they will have a calf instead of investing feed and resources in them until we see whether or not they actually have a calf.

None of these approaches for improving reproductive performance in a cow herd seem very high-tech and they certainly are not new ideas. However, they have not been widely adopted in our state. There are valid reasons for why many producers decide not to make these improvements. But, it seems reasonable to at least acknowledge the lost potential revenue by not using them for what it is – the cost of convenience. It also seems reasonable, if not responsible, to adopt these basic methods before seeking other, less effective and more economically- or socially-expensive methods for improving beef cattle production on an individual herd or statewide scale.