DAIRY CATTLE REPRODUCTION COUNCIL

Featured Column

Genomic Selection for Improved Dairy Cow Fertility
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Fertility is a fundamental component of success for modern dairy farms. As a result, fertility challenges carry serious financial and production risks for each operation.

For instance, limited fertility or the failure to get cows to conceive in a timely manner will extend the lactation and reduce the percentage of cows at peak production, increase insemination cost from repeat breedings and eventually delay genetic progress.

In addition, impaired or reduced fertility, which lead to low milk production, are often the reasons to remove a cow from the herd. That's because cows with extended lactation due to increased days open are often associated with a greater risk of herd removal in the current and subsequent lactations.

Over time the dairy industry has encountered an overall trend in declining dairy fertility across diverse production systems. There are a number of reasons that may explain this performance dip, including changes in cow physiology tied to greater milk production, nutritional management, housing, increased herd size, reduced estrous expression and current genetic makeup.

Stop the Trend
Despite the changes that have occurred, healthy cows still achieve high pregnancy rates. But early lactation disease can quickly negate this performance.

The question then becomes, can genetics help producers improve fertility by breeding cows that carry a better make up of genes for fitness traits such as health and fertility?

The answer seems to be, at least partially, yes.

Although fertility traits are strongly influenced by the environment, there is evidence to support the influence of genetics on reproductive performance.

Effect of DPR
There has been an important rise in phenotypic daughter fertility and a smaller, but also positive increase in the genetic trend for daughter fertility since the incorporation of daughter pregnancy rate (DPR) into bull genetic evaluations in 2003. Using this parameter, concurrent with improved reproductive management, producers found that it is possible to select for improved milk yield and fitness traits including fertility.

As a result, there's been a bit of a recovery in dairy fertility that has coincided with the incorporation of DPR into bull genetic evaluations. This improvement occurred even while there's been no apparent slowing down in the increase of milk production per cow.

Furthermore, indirect selection for fertility has occurred since reproductive efficiency is essential for the cow's ability to remain in the herd.

Genetic Progress Continues

The use of DNA analysis in the evaluation of dairy cattle genetics is increasing. And USDA's genomic evaluations are official since 2008, giving the industry a good base of knowledge for informed decisions.

This technology has the potential to influence reproductive performance in many ways. For instance, from the perspective of embryo production efficiency, markers associated with the number of viable oocytes, fertilization, cleavage and developmental rates have been explored.

Quantitative markers have also been identified for ovulation rate, pregnancy rate, DPR, cow and heifer conception rates, non-return rate, intensity of estrus and calving performance. These markers have also have been identified for gestation duration, dystocia and stillbirth and overall postpartum fertility.

In addition to the potential for genomic selection for fertility traits, this technology has offered the capability of locating lethal recessive genes. Researchers have identified a number of new recessive defects on fertility in Holsteins, Jerseys and Brown Swiss. These recessive lethal genes affect reproduction by reducing conception and increasing pregnancy loss or the risk of stillbirths.

These advances help producers improve herd reproductive performance.

The Future

Current efforts are underway by multiple research groups including an integrated project at Texas A&M, University of Florida, University of Wisconsin, Ohio State University, Cornell University, University of Illinois and University of Minnesota to learn more.

Researchers have collected a large number of accurate fertility phenotypes (observable characteristics) in 16 farms in four regions of the United States that encompass different management and environments to identify genomic markers associated with those phenotypes. This large scale evaluation of genomics of fertility will eventually be combined with current selection traits to further refine genomic selection of cattle by dairy producers.

Although the genetic trend for daughter fertility has slightly increased during the last decade, future progress will benefit from the development of genomic estimated breeding values for measures of fertility less likely to be influenced by management decisions. Identifying markers for genomic selection for uterine health, early resumption of postpartum ovulation, detection of

estrus, conception and reduced pregnancy loss will embrace a new step in improving fertility of cattle.

Lastly, as the cost of genotyping decreases, the number of animals with genomic evaluations is expected to increase. If adequate markers for fertility and further identification of genetic causes of infertility in dairy cattle are identified, molecular breeding values could be more accurately estimated for each trait. This would enable the adoption of efficient selection throughout the entire dairy industry.