

GENOMIC APPLICATION ACROSS THE DAIRY INDUSTRY

New genomic tools open door for commercial dairy operations

Since first introduced, genomic evaluations have changed the way breeding decisions are made within the dairy industry. Genomics provides a deeper look at sequencing of the genetic material in DNA. This allows dairy producers and industry professionals to interpret how genes are expressed, controlled, what relationships they have with each other and where they are physically located on the chromosome.¹

Today, all young bulls available through A.I. organizations are selected using their genomic profile. The reliability of these evaluations can reach approximately 75 percent for yield traits, which is adequate for wide marketing of semen for two-year-old bulls. Sampling dairy cattle at a young age has shortened generation interval—the most important factor in increasing the speed of genetic improvements, both on- and off-farm. This genomic evaluation by A.I. organizations is based on 43,382 single nucleotide polymorphisms (SNP) gathered from the Illumina Bovine SNP0 BeadChip.²

An evolving concept, genomics is continually providing means for steady genetic improvement. The tests available to the dairy industry are continuously increasing in accuracy and potential value. Since their release in 2007, genomic tests have become more enhanced and economical for on-farm use. Specifically, one of the most recent genomic developments is the opportunity to evaluate cows and heifers with a 3K genomic test.

THE 3K SNP GENOMIC TEST

The 3K SNP test gives dairies greater accuracy when predicting a calf's future when compared to evaluating parent averages. Since September 2010 the 3K test has been providing an estimate of an animal's genetic merit for many traits, including milk production and Net Merit (NM\$). Evaluating 3,000 SNPs, the 3K test compares an animal's DNA to a database that associates DNA patterns with the genetic merit of certain traits.

Kits are available for using the 3K test on-farm and aid a producer in collecting DNA through a nasal swab, blood or hair sample. After sending it to a processing lab, the genetic merit of the particular animal is then analyzed and calculated by the United States Department of Agriculture Animal Improvement Programs Laboratory (USDA AIPL). Results from a 3K genomic test take a month or two to be returned and provide producers with an additional tool for making herd decisions.

Ultimately, the 3K test provides a multitude of benefits to the dairy industry compared to other methods of selection. The more accurate evaluations of an animal's genetic potential are better able to track the loci for genetic difference. Additionally, the test allows for easier mating decisions, minimized inbreeding and improved selection of replacement heifers and cows for embryo transfers.

EXPLORING THE BENEFITS OF THE 3K TEST

What is most revolutionary about the 3K test is that producers can now make decisions on the female side of the pedigree, while most genetic progress has been made through bull selection. First and foremost, genomic testing of any sort provides producers with an opportunity to increase genetic gain by selecting superior animals as the next generation of the herd. Other ways the technology can be used include:

- **Net Merit projection.** Net Merit (NM\$) is an estimate of the expected lifetime profit of a female compared to the breed base of an average cow born and raised in the same environment. NM\$ includes traits that capture an economic impact, such as milk yield, health, longevity, fertility and calving ease. The breeding value of an animal is her genetic merit compared to the genetic merit of the breed base animal.

Producers can collect the NM\$ information at an early age with the 3K genomic to gain an understanding of how profitable the animal will be as a lactating cow.

- **Heifer replacement selection decisions.** As dairy cattle reproduction becomes more efficient and the use of sexed semen increases, dairy producers have a larger pool of replacement heifers to choose from. The decision of which heifers and their genetics should remain in the herd is a difficult one that has been made easier by using prerankings of heifers obtained from the 3K genomic test.

With an abundance of replacement heifers to choose from, producers now have the option to replace less profitable cows, shortening the generation interval and speeding up genetic progress. Additional sources of information to focus attention toward when these decisions are made include: health events early in life, the dam's calving difficulty or age and season of calving.

- **Proliferation of elite genetics.** The 3K test provides additional information for producers utilizing embryo transfer to quickly grow herd numbers and genetic merit. Using information gathered from the genomic evaluation, producers can determine early-on the benefits each heifer provides for future herd success and select accordingly.

A 3K test can ease the uncertainty of producing top-tier genetics from an embryo flush. Combining genomic evaluation with traditional methods can stack the benefits of embryo transfer decisions for particular cows and allow producers to advance their herd's genetic merit, production and profitability quickly and efficiently from within.

Using the 3K genomic test offers multiple benefits in tandem with traditional selection methods to determine which heifers can offer genetic improvements to the dairy. Genomic selection on the female side of the pedigree has the potential to revolutionize genetic improvement, selection and management decisions, allowing for additional productivity and profitability.

References:

- 1 Holstein Association USA, Inc. Understanding Genomic Predictions. Available at: http://www.holsteinusa.com/pdf/print_material/genomics.pdf. Accessed October 11, 2011.
- 2 Wiggins GR, Cooper TA. Genomic Evaluations: Past, Present, Future., in *Proceedings*. 2010 Dairy Cattle Reproduction Conference. Page 45 – 52.

Referenced Article:

De Vries A, Galligan DT, Cole JB. The Use and Economic Value of the 3K SNP Genomic Test for Calves on Dairy Farms. IFAS Extension. University of Florida. Available at: <http://edis.ifas.ufl.edu/an270>. Accessed October 11, 2011.