GeneSeek launches improved version of its low density genomic profiler

Developed in conjunction with the United States Department of Agriculture—Agricultural Research Service (USDA-ARS) and other collaborators, GeneSeek is happy to announce the release of GGP-LDv4, the latest generation low density genomic profiler, which has become a global standard in cattle genomics.

GeneSeek’s latest version of its Bovine GeneSeek® Genomic Profiler-LD chip screens cattle DNA for approximately 42,000 markers, of which more than 30,000 are publicly available. GeneSeek’s previous version of the array featured approximately 26,000 publicly available single nucleotide polymorphisms (SNPs). Several important new SNPs have been added to the already extensive list of causative gene markers known to impact disease susceptibility and performance.

“Additional SNP serve to increase the accuracy of the genomic evaluations, specifically by improving the imputation accuracy,” George Wiggans from the USDA-ARS said. “We at the USDA have had an ongoing collaboration with GeneSeek suggesting the most informative SNP to aid in their development of new versions of chips.”

In addition to the USDA, many GeneSeek clients contact GeneSeek looking to include their new discoveries on the next version of the array so that their important work can be applied throughout the industry. The array improves with each generation but, importantly, the cost has remained the same.

Effective immediately, all samples received at GeneSeek for GGP-LD processing will be processed on the new GGP-LD v4 array.

The GGP-LD offers high-accuracy genomic prediction at about half the price of high-density products, and is an ideal tool to test an entire bull-calf crop and replacement females. It is also being added to the list of GGP products that Illumina will distribute to the global cattle community.

The improved chip contains all of the International Society for Animal Genetics (ISAG) parentage markers, and approximately 4,000 SNPs identified by American Angus Association for their predictive performance in Angus.

The first generation GGP-LD was developed in 2012 with 7,000 SNPs available plus 1,800 additional SNPs for increased imputation accuracy and single gene tests. Then, a year later, GeneSeek released GGP-LDv2 at the same low cost and with an additional 12,000 SNPs available. 2014 brought the GGP-LDv3 with 19,000 additional SNPs and at the end of 2015, GGP-LDv4 was introduced with an additional 35,000 SNPs.
Ever wonder why that nice replacement heifer didn’t conceive the first, or second time around? Maybe her body condition was a little low. Maybe she was delayed in her maturity. Maybe, maybe, maybe.

When things go wrong, the tendency is to think that given enough time, or improved management, the little bovine ship will right herself. But a breakthrough in genetics research has found some of these open heifers may have reduced ability to conceive—no matter how long they stay in the herd. They aren’t hidden freemartins, either. They are females carrying a portion of a Y, or male, chromosome. It’s called the “Y SNP.”

Based on this information, GeneSeek now offers Y chromosome testing options for both heifers and bulls. By incorporating this technology, the cattle industry could be greatly impacted as better reproductive decisions can be made throughout the herd.

Discovering this, however, was no easy task and involved a team of researchers led by geneticist Tara McDaneld, of the U.S. Meat Animal Research Center (USMARC) in Clay Center, Neb. McDaneld and her team examined records for 6,400 cows and heifers from herds across Colorado, Florida and Nebraska. They separated data based on whether or not the animal became pregnant in its first spring breeding.

The research team used a genetic screening method called “DNA pooling” groups of about 100 animals each were created and genotyped—meaning their genetic makeup was examined. Of those animals that had not conceived, researchers found 20% to 25% tested positive for a portion of the Y chromosome, or the Y SNP, on their DNA.

“Basically we found that the animals that tested positive for the Y chromosome anomaly do not get pregnant,” McDaneld said. She adds that given this is part of the animal’s DNA, it is present from birth and would not change over time. The group used a SNP chip, which had over 700,000 SNPs, or variations, in an animal’s DNA.

Using this technology it is possible to find portions of Y chromosome where they don’t belong, like on female DNA, for example. If this information were available to a producer it would allow them to eliminate any female calf carrying the Y SNP as a potential breeding animal early in its life, saving development costs and increasing herd fertility on the whole.

“Once we identified those SNPs, we developed PCR [polymerase chain reaction] tests which are a way of amplifying the section of the Y, so you can more quickly find this anomaly,” McDaneld explained. “We’ve shared that with the genetics companies and they are using the information to develop DNA tests for use within the industry.”

This finding is the first significant step in being able to pinpoint genetic anomalies that impact fertility. The team’s work has found its way to genetic tests for both commercial and seedstock producers.

Currently GeneSeek is using a low density (LD) Illumina chip on its Igenity Silver and Igenity Gold tests, which are for commercial and crossbred producers that can identify the Y SNP. In addition, GeneSeek Genomic Profilers (GGP) for seedstock producers, both in the LD and the HD (high density) 150k versions, can also note the anomaly.

McDaneld also said their finding has value when choosing a bull as well. She explains there are genetic variations on a sire’s DNA that make it possible he will produce daughters with a portion of a Y chromosome. A bull with Y chromosome segments in its X chromosome will produce normal male calves, but its daughters would have a copy of the contaminated X chromosome. That means the reproductive capacity of the bulls’ daughters would potentially be much poorer.

Molecular biologist John Keele, who also worked on the project, explains a genetic test for female reproduction in a bull would not improve his reproductive performance, but it would be an indicator of how his daughters would perform.

“Bulls are able to have more offspring than cows; consequently, male selection is more effective than female selection for improving any trait,” he explains. “Testing a sire before using him to produce replacement females will improve reproductive performance in the herd if bulls with the X chromosome genetic defect are identified and culled.”

McDaneld adds this finding is just the first fruit to come from research aimed at uncovering genetic answers to fertility questions within the cattle industry.

“I really hope we get better at predicting the genetic merit of these animals. It is a big deal to be able to look at an animal and predict its productivity in your herd. What that can do for the industry would be huge.”

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For the latest food safety, animal safety and life science news, Neogen announcements and useful information, check out the Neogen blog at [www.neogen.com/blog](http://www.neogen.com/blog)
We named our new website the Igenity Dashboard because it provides essential genomic information to a dairy producer at a glance, and it helps drive profitable production,” said Dr. Stewart Bauck, general manager of Neogen’s GeneSeek operations. “The latest dairy genomic technology provides a tremendous amount of useful information on a single animal, a producer’s entire herd, or even animal and herd comparisons against database averages for a given breed. The challenge is then managing that information to make better decisions on the farm. Igenity Dashboard was developed to make it easier to make those better decisions, and positively impact future performance and profits.”

Igenity Dashboard was designed for use with Neogen’s Dairy Heifer Program genomic tests. These tests include Igenity-Select, which is validated by the USDA-AGIL and provides Council for Dairy Cattle Breeding (CDCB) results consisting of an evaluation of a heifer on over 45 select traits; Igenity-Essential, which doesn’t require dairymen to provide the information necessary to nominate an animal for the CDCB program, and includes an evaluation on 15 essential traits; as well as Igenity-Elite and Igenity-Prime.

Results from genomic tests can deliver highly reliable genomic predictions on a variety of traits. This includes health traits such as net merit, pregnancy rate, productive life in months and somatic cell score as well as yield traits, such as milk, fat pounds, fat percentage, protein pounds and protein percentage.

For more information on the Igenity Dashboard, contact Neogen or visit www.igenitydashboard.com.
GeneSeek’s expansion project

As GeneSeek continues to grow, we also need to accommodate additional personnel and therefore, need extra space. Since we moved into the current facility in May of 2014, we have expanded the number of employees from 90 to more than 130, that’s nearly a 45% increase in personnel! The majority of this expansion has been associated within specific laboratory groups, customer service and sales.

The new 3,000 square foot expansion will include a new lab space that will expand our current DNA extraction lab. This extra space will be designated for sample reception and the DNA extraction process. Adjacent to the lab space, we will also have a new office area designated for the relocation of the customer service group. The new space allows for 10 new workstations and brings the group closer to sample reception, which is key to improve efficiencies and communication for these groups. The vacated office space that once housed customer service will be repurposed as a centralized location for the sales and marketing groups. As you can see in these images, it started out as a warehouse area which made it a blank slate for us to design to fit our process. The spaces are designed to improve work flow and efficiencies in daily tasks. The expanded spaces have become fully functioning and occupied as of February 3.

New chip arriving soon

AgResearch, a New Zealand agriculture research institute, has worked to develop a consortium low density Ovine SNP chip. GeneSeek is a part of this consortium and will offer the Sheep LD chip commercially in early March.

The design will have ~16K SNPs:
- parentage SNPs (various panels) ~840
- imputation SNPs (NZ and Aus mostly from existing chips) ~12K
- enhanced imputation SNPs from regions of interest (not separately identified) ~2500
- literature SNPs ~500 – Some of the causatives include:
  - BCO2
  - callipyge
  - microphthalmia
  - scrapie
  - boorooala
  - horns
  - Inverdale
  - TMEM
  - spiderlamb
  - scrapie
  - TMEM
  - (blank)
  - GDF8

Get social: Neogen is also on Facebook, Twitter, YouTube, LinkedIn and Instagram. #geneseek
From the desk of Dr. Stewart Bauck

When Friday rolls around at GeneSeek, it is time to take the Husker gear out of the closet and support the home team — there is Husker red everywhere! It has been a particular good year to support the University of Nebraska-Lincoln (UNL) teams with the women’s volleyball team taking the NCAA Division One National Championship and the football team capping off a transition year with a solid victory over the UCLA Bruins in the Foster Farms Bowl...we can already hardly wait for spring training to begin.

But college sports isn’t the only important connection GeneSeek shares with the University of Nebraska. The bio-informatics group, under the direction of Dr. Nick Wu, established a post-doctoral position with UNL. In cooperation with Dr. Matt Spangler and Dr. Gota Morota in the Department of Animal Science and Dr. Steve Kachman in the Department of Statistics, the group was successful in bringing Dr. JungJae Lee into the new position in October of 2015.

The focus of this joint initiative is to provide young researchers the opportunity to work on projects that leverage resources from GeneSeek and training from UNL, and to advance the science of animal breeding and genetics. Dr. Lee is the first entrant into this position and comes to us from Iowa State University where he had previously worked with Dr. Dorian Garrick.

The scientists at UNL bring great depth of experience in genomics research and extensive industry connections, to which we add the data resources from GeneSeek, supported by the new BC Platforms genotype database and our dedicated database manager, Anna Fuller. Thrown in programming support from JiaQi Xu (a computer science Ph.D student at UNL who works part time for GeneSeek and provides software support) and the suite of bio-statistics tools developed by Dr. Nick Wu, and over time, this is a recipe for exciting science. As I write this, the group is working on one of their inaugural projects which is a re-analysis and update of prediction equations for one of the major North American beef breed associations.

Over time, we at GeneSeek have come to appreciate the resources that are available for us and the opportunity we have to assist in the development of the next generation of researchers and leaders in animal and plant breeding. To be successful requires an investment in people, computer systems and software development, but we know it is the right thing to do. We greatly value the unique opportunity we have to partner not only with our local university, but also the relationships we have with others — all around the world.

In the end, we are privileged to have a myriad of international collaborations, but on Friday all we really care about is the home team — Go Big Red!

Featured employee: Barry Simpson
GeneSeek Director of Research and Development

Born in Colorado and raised in western Nebraska, GeneSeek’s Dr. Barry Simpson has spent most of his life either around or working with animals. From growing up in the country with pigs, sheep and horses, Barry now coordinates the research and development efforts across all platforms at GeneSeek. His biggest responsibility is the creation of GeneSeek’s custom chips, such as the GGP family, and has been responsible for implementing dozens of custom chips that GeneSeek bases much of their work on today.

“There is always something interesting popping up when dealing with genetic testing,” Barry said. “It is a nice feeling knowing that what I help to create will influence (for the better) producers and consumers around the world.”

Barry received his undergraduate degree in biology from University of Nebraska–Lincoln and then went on to receive a Ph.D. in molecular biology from Southern Methodist University in Dallas. After graduating, Barry started his career working in Dallas before moving back to Lincoln and marrying his wife, Deanna.

“I originally started working with GeneSeek’s chief scientific advisor, Daniel Pomp, on a number of projects and then officially started working for GeneSeek in 2004,” Barry said. “We were acquired by Neogen in 2010 and at the time I thought I was only going to stay on to help organize some projects. However, five years later, here I am.”

In his free time Barry said he stays busy with his three daughters — Ava, 10, Elena, 8, and Hanna, 7 — in their various activities and athletic events. In addition, he enjoys fishing and cross-country skiing — two things in limited supply in Lincoln, but great at the family cabin in Colorado.

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