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High-Density Genotyping Aids Livestock Improvement

Zoetis uses Illumina BeadChips to enable livestock producers to improve the genetic makeup of their herds.

Livestock producers have used selection to improve their herds for centuries. Traditional practices relied on observed physical characteristics, or phenotype, to determine breeding value. The process was often inexact, inefficient, and time-consuming, with most desired traits hard to assess, and evident only after the animal reached maturity, resulting in delays in verifying breeding results. To overcome the challenge of accurately predicting genetic merit for relevant livestock traits—including improved animal health and productivity, and beef and milk quality—agricultural researchers are additionally turning to incorporating genomics.

Understanding and implementing genetic technologies in humans or livestock can be overwhelming. That is where Zoetis, a certified Illumina CSPro® provider, has made a difference in the livestock area. Zoetis, the world's largest producer of medicine and vaccinations for pets and livestock, builds on more than 60 years of experience as Pfizer Animal Heath. Recognizing that some producers did not want to take on the genetic analysis themselves and understanding the value of the information in making better breeding decisions, they decided to provide genetic analysis services. According to Jason B. Osterstock, D.V.M., Ph.D., Director, Genetics Global Technical Services, "By employing Illumina technology, we offer livestock customers highquality genetic analysis services to unlock the maximum value of each animal's genetic merit, enabling them to understand better the genetic variation within their herds."

iCommunity spoke to Dr. Osterstock and the genetics team at Zoetis, including Sue DeNise, Ph.D., Executive Director, Research and Development; Jon Glynn, Ph.D., Director, Laboratory Operations and Customer Service; and Douglas J. Ricke, Director, Strategic Marketing, Genetics, to learn more about how Zoetis is enabling producers to manage their livestock more effectively.

Q: Describe the Zoetis partnership with Illumina.

Douglas J. Ricke (DR): Zoetis and Illumina partner to collectively provide livestock producers with powerful genotyping technology. Illumina creates genotyping platforms that describe genetic variation broadly, within and among different species of livestock, including cattle and sheep—two areas where we work quite a bit. At Zoetis, we take those platforms and identify ways to use genomic information to predict an animal's genetic potential. We transform the technology into educational and application-based programs for livestock producers to incorporate within their systems. That combination is ultimately what brings value to the customer.

Q: What services are your customers most interested in?

Jason B. Osterstock (JO): Our primary customers are beef cattle, dairy cattle, and sheep producers that have well-managed operations



From left to right: Douglas J. Ricke, Director, Strategic Marketing, Genetics; Jason B. Osterstock, D.V.M., Ph.D., Director, Global Genetics Technical Services; Sue DeNise, Ph.D., Executive Director, Research and Development; and Jon Glynn, Ph.D., Director, Laboratory Operations and Customer Service.

and rely on information to make important decisions about their herds. We provide a comprehensive suite of genetic testing services, coupled with the education and technical support required to make best use of the technology. Our HD 50K assay for Angus cattle supplies predictions for performance using a panel of more than 50,000 genetic markers. The CLARIFIDE® dairy assay delivers comprehensive USDA-CDCB* genomic predictions for Holstein, Jersey, and Brown Swiss dairy cattle. Many of our customers are using Zoetis products that are integrated into genetic evaluations like those for the Angus breed in the U.S., Canada, and Australia, the Nelore breed in Brazil, and dairy breeds in the U.S., Canada, and South America.

Q: What factors influence the ability of livestock producers to utilize genomic testing?

JO: It is important for producers to be ready for the benefits of genetic testing. This means they must have well-managed operations where animals are able to reach their genetic potential. They also must be willing to make a decision based on the testing results, as the value of genetic testing is limited if the information cannot be used to influence on-farm decisions. This is a large part of why helping producers define the appropriate context to apply genomic technologies is a priority for Zoetis. We can assist a beef producer purchasing a new herd bull to understand how genomic data can help them make the right investment, or assist a dairy producer to plan their heifer inventory

*In 2013, the U.S. Department of Agriculture (USDA) began to transition dairy genetic evaluations to the Council on Dairy Cattle Breeding (CDCB).

and allocate reproductive technologies, like sex-sorted semen and embryo transfer.

DR: We emphasize well-managed operations because the technology is particularly compatible when good practices and capabilities for data recording are in place. We see genomics as part of a comprehensive strategy rather than something individually inserted into a management system. We work with producers and their veterinarians to make sure performance metrics such as pregnancy and conception rates, and health factors such as calf mortality/morbidity are satisfactory before implementing a genomic testing program.

Q: How did Zoetis go about choosing its genotyping platform?

Sue DeNise (SD): Illumina provides the industry standard for high-density genotyping. Their platform reduces the complexities of multiplexing tens of thousands of markers, while offering the quality and coverage we need for highly accurate predictions. The streamlined and well-defined process allows us to deliver in a time frame acceptable to our clients. It's a very solid platform.

JO: Illumina platforms have established themselves as the gold standard for cattle genomics globally. This helps to ensure that resources can be assembled from a variety of collaborators throughout the world to help develop and implement technologies that can provide value to livestock producers.

"Illumina BeadChips are the industry standard for high-density genotyping."

Q: How does Zoetis add value to its customers by using Illumina technology?

Jon Glynn (JG): Our products are typically used to aid selection. That is, a customer genotypes an animal, the molecular genetic value is predicted from the SNP marker genotypes, and that prediction may be blended with classical genetic evaluation to create a more accurate prediction of the animal's genetic worth. In order to maximize accuracy, tens of thousands of markers are required to appropriately describe the genetic variation present. Illumina provides a cuttingedge product for adding value to classical predictions and allows us to reliably serve our customers.

SD: Illumina has a product that's really dependable and very robust. It is a great platform for interrogating tens of thousands of SNPs in a high-throughput laboratory.

Q: How do you help customers use genome data to make decisions?

JO: When we're speaking with beef, dairy, or sheep producers, the technology can be a bit overwhelming for them at times. We recognize that genomic data is only valuable if its meaning and application are understood. We try to help translate and illustrate to them in real-world conditions what the data means in terms of their ability to make better decisions. We offer a variety of planning and decision support tools to ensure that our customers get the most from their investment in genetic testing.

DR: Using CLARIFIDE in dairy cattle as an example, the producer receives more than 60 data points on the individual animal tested. However, most of our customers make binomial decisions about whether to invest in or give that animal an alternate career path based on the DNA outcome. We translate the complexity of the technology, and help them apply the information to advance their operation's objectives.

JO: For those 60 data points, we'll distill the data down into a handful of key data points, ultimately rank those animals, and assemble the information so it's ready-made for a decision. We'll apply the technology in a field setting, do the trials, and demonstrate it works. We spend a lot of time trying to educate. We don't want to make molecular geneticists out of every producer, but at the same time we don't want it to be an entirely "black box" exercise.

Q: What advancements are your customers making because of the Zoetis and Illumina partnership?

JO: We are seeing a variety of producers that have been able to use our Illumina platform products—like our CLARIFIDE and HD 50K assays—to great effect in managing their farms and livestock more effectively. Dairy producers who have more heifers than they need to meet replacement demands are able to identify and market heifers with low genetic potential that don't fit their herd's objectives. We see beef producers that are able to make better bull purchase decisions by leveraging genomically enhanced expected progeny differences identified with our HD 50K assay.

Commercial beef producers purchase bulls as herd sires to breed their cows. This is an important decision because many calves will be born out of that sire. If the producer makes a mistake in choosing that sire based on the genetic potential of that bull, it could be very costly financially. The purebred producers will have us genotype all of the bulls using Illumina BeadChip technologies offering a higher degree of confidence for their bull buying customers.

"We see beef producers that are able to make better bull purchase decisions by leveraging genomically enhanced expected progeny differences identified with our HD 50K assay"

Q: What are recent trends in the use of genetic testing?

DR: The number of genotyped animals in the USDA-CDCB dairy genetic evaluation and in the beef sector has begun to accelerate. In the beef sector, we have surpassed 50,000 animals tested with regard to the Zoetis HD 50K for Angus offering in collaboration with our US partner, Angus Genetics. While we're encouraged with that level of adoption, there's about 300,000 animals registered annually by that breed in the US. We still have tremendous upside potential regarding adoption within Angus seedstock operations and the commercial buyers of Angus genetics domestically and globally.

JO: In September 2010, the U.S. dairy genetic evaluation included just under 50,000 genotypes. As of December 2013, it's at about 500,000 genotypes. That's a huge amount of growth over a relatively short period of time. In dairy genetic evaluation, the use of genomic data is very powerful and commercial producers of all types are starting to see the benefits.

Q: What are your next steps?

DR: We will continue to explore mutual opportunities with Illumina where we can inform and expand the awareness, the science, and the value of genomic offerings and their application in the customer segments we serve.

For more information on ag genotyping, visit:

www.illumina.com/applications/agriculture/plant-animal-genotyping.ilmn www.zoetisus.com/genetics

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