Delivering Valued Genomic Products to Livestock Customers

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Abstract

Pfizer entered the genomic space to address a global need for enhanced productivity for protein production and to provide our customers complementary products to the current Animal Health portfolio.   Pfizer Animal Health is committed to investing in the most comprehensive and accurate genomic predictions and providing tools that help our customers use the genomic information to reach their goals. Products can be developed with collaborators, from assets that exist in the public domain, or as a result of basic research within the Pfizer R&D team. Genomic predictions may range from targeted panels for a few traits to a prediction based on a high density panels depending on the value proposition to the customer. The customer may receive a direct genomic value or a genomic enhancement of a breeding value and tools to apply the information to their operation. Through dedicated R&D, Technical Services and Sales teams, Pfizer currently offers genomics products to beef cattle, dairy cattle and sheep in North America, South America, Australia and New Zealand.

Keywords: Genomic Selection, marker-assisted selection, beef cattle, dairy cattle, sheep.

Introduction

Pfizer Animal Health is working to assure a safe and sustainable global food supply from healthy beef and dairy cattle, swine, poultry, sheep and fish. We are also committed to helping dogs, cats and horses live healthier and longer lives. Pfizer Animal Health is a world leader in discovery, development and manufacture of veterinary vaccines and medicines with over 5000 colleagues worldwide in over 60 countries. Our R&D network encompasses 15 sites throughout the world with more than 800 scientists. Pfizer Animal Health has a reputation for innovation and quality as evidenced from the first immunological castration product (Improvest®), cancer treatments for canine (PALLADIA™) and egg injection systems for poultry operations (Embrex® Inovoject® Systems) along with industry leading diagnostics, biologicals, pharmaceuticals and bio-pharmaceuticals. Pfizer Animal Health will continue to build on the core products through complementary spaces that contribute to providing solutions for the customer, and not just offer products.

In 2008, Pfizer Animal Health created Animal Genetics through two acquisitions. The genetics business has supported those original offerings and developed new products for beef and dairy cattle and sheep, marketed in North America, South America, Australia and New Zealand. Products are developed within R&D programs internally and through collaborations throughout the world, including New Zealand AgResearch, Australian CRC, Iowa State University, Colorado State University, researchers in Brazil, American Angus Association, Australian Angus Association, USDA AIPL, and ANCP in Brazil.

In providing genetic predictions for performance traits, not just single marker genetic conditions, two strategies are employed. One strategy is to develop a targeted panel comprised of a reduced panel of markers that focus on a few traits. The goal of the targeted panel is to meet a price-point for a commercial producer consistent with the value that can be obtained from that knowledge. The customer may be interested in marker-assisted

management or marker-assisted selection. The second type of product utilizes a substantial number of markers at a higher price-point that enables greater explained genetic variation. This type of panel is commonly used by an elite seedstock producer that will rely on gene flow through multiple generations. The high density panel predictions can become more cost effective by use of a smaller imputation panel that predicts genotypes of the high density panel from the low density. The most common example of this strategy is the Illumina Infinium® BovineLD BeadChip used to impute the BovineSNP50 BeadChip for US dairy predictions. Both the targeted panel approach and the high density marker predictions can be used to generate a direct genomic value or can be incorporated into a genetic evaluation program to produce genomic breeding values.

Pfizer Animal Health has made a commitment to support genomic technology users with customized analysis of their operations through our Genetics Technical Services Team. This team focuses on the education of the customer, very similar to the role of Technical Services in support of the Pfizer Animal Health portfolio. We believe that this is a critical component for ensuring that the information generated from a genetic analysis delivers added value and economic impact to the customer.

Providing Dairy Genetic Products in the US

The commercial dairy industry in the US has made substantial genetic progress in efficiency and productivity. In 2007, the US dairy population produced 34% more milk with 48% fewer animals than in 1960 (Van Tassel et al, 2007). In 2007, several artificial insemination (AI) companies joined with USDA-ARS to develop the first genomic selection project in dairy cattle. The goal of the research was to identify prospective sires earlier in life and eliminate the need for extensive progeny testing of genetically inferior bulls (http://aipl.arsusda.gov/reference/genomic%20prediction.html). The original genomic predictions were developed in April 2008, and became official in January 2009. The genomic test was originally dependent on the BovineSNP50 BeadChip and was targeted to males and elite females (Weigel et al., 2010); however, with the development of a low density chip utilizing imputation, the technology became more accessible and affordable to commercial producers for use on cows.

In 2010, Pfizer Animal Genetics began offering the imputation product for dairy females developed by USDA-AIPL with data supplied by the Council on Dairy Cattle Breeding. The current version of the Illumina BovineLD BeadChip, with 6,909 markers, imputes the Illumina BovineSNP50 chip with an accuracy of over 97% (Boichard et al., 2012). Customers submit animal ID, birth date, and sire and dam ID with the animal's tissue sampler to Pfizer. Pfizer genotypes the female with the Illumina BovineLD BeadChip and submits the genotypes to AIPL.

Results from analysis of genomic predicted transmitting abilities are provided in a report to the customer that is easy to manipulate and can be uploaded into traditional on-farm software programs (https://animalhealth.pfizer.com/sites/pahweb/US/EN/Products/Pages/Clarifide.aspx). Pfizer also launched an educational learning module targeted to commercial producers who have not previously had the tools to identify a heifer's genetic ability at birth beyond a pedigree index. Pfizer provides one-on-one consultation with customers through our Technical Services program to provide customers with a personalized return-on-investment strategy for their operation.

Providing Beef Genetic Products in the US

In the beef seedstock segment, Pfizer Animal Genetics developed a Bovine50K BeadChip product for purebred Angus cattle. The genomic test predicts 18 traits that are integrated into the Angus Genetics, Inc (AGI) genetic evaluation platform offering genomic EPDs. This collaboration has led to the development and introduction of a targeted panel called GeneMax™ that is designed for commercial producers to increase the efficiency with which Certified Angus Beef® is produced.

Providing Nelore Heifer Fertility Products in Brazil

Pfizer developed a targeted panel aimed at predicting female fertility in Brazil based on Nelore cattle bred and raised under local conditions. At the time the product was launched, there was no imputation product, and market research suggested that the Bovine SNP50 BeadChip pricing would not be acceptable to the customer. The internal R&D team developed a set of predictions in collaboration with a Brazilian scientific team. The product, CLARIFIDE® Nelore, predicts eleven traits including: heifer pregnancy rate, age at first calving, cumulated weight of calf weaned, stayability, weights at 120, 365 and 450 d, scrotal circumference at 365 and 450 d, ribeye area, fat deposition and a reproductive performance index. The percentage variation explained across these traits in an independent population ranged from 12 to 48%. In March, ANCP incorporated these direct genetic values into their genetic evaluation program, producing the first genomic breeding values for Nelore in Brazil (http://www.marcadorespfizer.com.br/).

Genomic Enhancement to Genetic Evaluation

One of the opportunities of the technology is the development of within herd genetic evaluation programs designed for the specific goals of the operation. Today, Pfizer Animal Genetics works with the North Australian Pastoral Company (NAPCO) to create genomic breeding values tailored to their operation. NAPCO owns over 200,000 head operating out of 14 cattle stations in Australia. The operation has utilized a within-herd genetic evaluation program for many years. Using historical DNA samples, collected over the last decade for parentage verification, calibration has been completed for the traits under selection. The first animals will undergo genomic-enhanced selection beginning in 2012. The technology provides an opportunity to reduce the risk of early selection and provide new tools for genetic improvement under unique environmental conditions.

Future Opportunities

Pfizer Animal Health will continue to license, develop and commercialize products that create value for livestock customers in collaboration with scientists and organizations that serve producers. Future products will tie the genetics portfolio to the classic Veterinary Medicine Research and Development (VMRD) products of diagnostics, biologicals, pharmaceuticals and bio-pharmaceuticals. Future areas of interest include health and welfare of animals as well as improved livestock performance. As the science unfolds new insights, Pfizer will be poised to provide the link from discovery to implementation at the farm level.

The genetics team will continue to provide tools and information to assist producers to use the technology to their most economical advantage. In this age of increasing information, managing and interpreting the pertinent information will become an increasing

challenge. It is our goal to provide the tools and education to maximize the potential of new technologies.

Summary

Pfizer Animal Health is committed to providing products that assure a safe, sustainable global food supply from healthy animals. To meet the needs of the future, Pfizer will be working to commercialize products in the traditional areas of biologicals, pharmaceuticals and bio-pharmaceuticals, as well as in genetics and diagnostics. This approach to provide a total solution will contribute to the rational use of appropriate products and insights into new ways to provide value to our customers and to their customers.

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