BIF Symposium HIGHLIGHTS

Progressive beef producers and academia attended the 2011 Beef Improvement Federation (BIF) Research Symposium.

by ***Troy Smith***

It's been hinted at, diplomatically suggested and occasionally declared in bold accusations. It's been said that genetic evaluation for beef cattle and the application of tools for genetic selection have too long emphasized traits related to increasing revenue from production, while paying too little attention to traits important to controlling costs of production. Rising input costs have forced the issue; however, and there is evidence of a shift in thinking.

It showed in many of the presentations delivered during the 2011 Beef Improvement Federation (BIF) Research Symposium, hosted June 1-4 in Bozeman, Mont. Much of the discussion about recent, current and planned research focused on the incorporation of DNA technology into national cattle evaluation.

Ultimately, geneticists want to develop genomic-enhanced expected progeny difference (EPD) values affording increased accuracy prediction for a variety of important traits, including traits important to controlling production costs. Researchers have devoted considerable effort to the study of animal health and feed efficiency traits. Plans call for more.

Genetics and health

In his presentation, Colorado State University geneticist Mark Enns said the industry has focused on managing for increased performance in a given environment. Vaccination, early disease detection and treatment, and, more recently, low-stress cattle handling methods have been emphasized, but little serious thought has been given to genetic improvement of health.


Mark Enns

Enns said genetic selection for health traits will benefit producers through reduced cost of production, lower treatment and mortality rates, and reduction in the incidence of poor performance associated with sickness in cattle.

According to Enns, opportunity for improvement through genetic selection likely exists for three "types" of diseases. These include: 1) diseases resulting from a defect in genetic composition, 2) diseases resulting from non-transmittable environmental challenges and 3) vector-related diseases.

The industry has enjoyed considerable success in selection against genetic defects, Enns said. He also noted success in dealing with certain environmental diseases, including the high-altitude problem of "brisket disease." Enns described the Colorado State University research that determined variation and heritability of pulmonary arterial pressure and its use in predicting whether an animal is likely to develop brisket disease in a high-altitude environment.

Unfortunately, progress with regard to vector-related diseases remains elusive. As reasons, Enns listed the absence of genetic tools and a lack of knowledge about hard-to-evaluate traits such as health. A general lack of focus may be another reason.

"I wonder," asked Enns, "if we've tried hard enough?"

The existence of genetic variation means that disease resistance is a heritable trait, according to Alison Van Eenennaam. In comments made during the BIF conference, the University of California-Davis genomics and biotechnology specialist talked about efforts to develop tools for selecting for increased resistance to bovine respiratory disease (BRD). She said the concept certainly isn't new, explaining how the dairy industry selects for mastitis resistance and poultry breeders select for resistance to specific diseases.

Van Eenennaam said recent research has revealed a genetic link between animals with higher resistance to BRD. The link is rather weak, but it exists. Van Eenennaam said there exists another challenge to application of selection for BRD resistance. It is primarily a feedlot disease and typically does not pose problems for the cow-calf sector. The question is whether there will be economic incentives for seedstock and commercial breeders to select for resistance to a disease that may not directly affect their herds.


Alison Van Eenennaam

"If disease-resistance traits are to become a crucial decision-maker for the seedstock producer or commercial cattleman, there needs to be a price signal moving back to those producers to help pay for these traits."

"Producers will need to ask themselves how to compare the value of a disease-resistance trait with all the other EPDs available, like marbling, weaning weight, birth weight, etc.," she said. "If disease-resistance traits are to become a crucial decision-maker for the seedstock producer or commercial cattleman, there needs to be a price signal moving back to those producers to help pay for these traits."

South Dakota State University geneticist Michael Gonda talked about studies of individual animal response to vaccination against bovine viral diarrhea (BVD), as measured by blood antibody levels. Gonda's research has also investigated vaccine response differences among calves by different sires. Results suggest a link between sire and calf vaccination response — strong evidence that the response was at least partially controlled by genetics.


Michael Gonda

Gonda has also investigated a link between vaccine response and a polymorphism in the leptin gene. It has already been determined that leptin plays multiple roles. It has been associated with regulation of feed intake, energy expenditure and body weight, as well as reproduction. According to Gonda, it is also believed to play a role in immune function.

The objective was to determine whether producers might have inadvertently selected for lower disease immunity when making selections based on this leptin polymorphism. However, results suggest there is no association with BVD vaccine response. Gonda said the study represents a first step toward development of a DNA test for vaccine response, but there are questions still unanswered.

"One question is whether measurement of antibodies explains all of the vaccine response. My guess is that it does not and other factors are involved," Gonda said. "I want to build a resource population to collect phenotypes that can be used for DNA testing."

Gonda also wants to determine the genetic correlation between vaccine response and disease susceptibility, as well as the correlation to other economically important traits. After discovery of DNA markers associated with vaccine response, these associations will need to be confirmed in an independent gene mapping population. The next task, Gonda said, will be to develop a selection tool based on DNA markers.

Feed efficiency research

Also heard during the BIF conference was Texas A&M University animal scientist Gordon Carstens' report on studies of animal feeding behavior as indicator traits for genetic evaluation of feed intake. Carstens explained how measurement of residual feed intake (RFI) is used to identify cattle capable of converting feed more efficiently — cattle that perform as well or better than others but with less feed.


Gordon Carstens

The advantage of selection for feed efficiency based on RFI, rather than traditional feed-to-gain ratio, is that selection for improved RFI is not accompanied by increased mature size. Selection on this basis could help producers control feed costs.

University of Alberta research geneticist Stephen Moore talked about efforts to develop marker-assisted selection for feed efficiency as measured by RFI. Moore said frequent measurement of individual animal feed intake and weight has become easier with application of recent technology. However, season of testing and animal maturity have been shown to influence RFI estimates. Time and equipment costs also make phenotypic measurement for RFI expensive. The lower cost of a DNA testing and the ability to make RFI estimates while animals are very young has spurred interest in developing marker-assisted selection tools for RFI.


Stephen Moore

Moore said a number of studies have attempted to develop marker panels for feed efficiency, including Canadian research which identified 23 gene markers associated with RFI.

"We believe they explain about 18% of the phenotypic variation (for RFI) in the discovery herd, and validation is under way in a different cattle population," Moore said.

A factor common to previous studies is that markers generally performed better in the discovery herd than in other populations used to validate the markers.

"We have validated about half of the markers, but we still expect a much lower size of effect (in validation herds)," Moore admitted. "We should know in six months or so."

According to Moore, the availability of higher-density marker panels for genotyping cattle will aid in finding markers for traits such as RFI and should increase the potential for application across breeds as well as for evaluating cattle of a given breed.

Development of DNA-based technology for predicting genetic merit for feed efficiency in beef cattle will be the focus of a new multidisciplinary research project. According to Iowa State University geneticist Dorian Garrick, a $5 million U.S. Department of Agriculture (USDA) Agriculture and Food Research Initiative grant will fund the collaborative project involving researchers from eight land-grant universities and USDA, including scientists at the U.S. Meat Animal Research Center at Clay Center, Neb.

"We'll look for reasons why some animals are more efficient by sampling animals that are superior as well as [those that are] inferior for feed efficiency," Garrick explained.

Researchers will focus on identification of factors influencing feed efficiency and development of tools for selecting cattle that require less feed to deliver acceptable levels of performance. Garrick said reducing the feed resources required per unit of beef produced offers benefits beyond reduction of production costs. It would reduce competition with humans for feed grains and could also reduce the beef industry's environmental impact.

Research will involve collection of phenotypic data on 8,000 animals representing eight breeds. Feed intake will be measured in addition to performance and carcass merit. Researchers will evaluate differences in feed efficiency relative to different diets, whether grain-based or forage-based. Animal DNA samples will be collected for gene mapping and the search for DNA markers associated with feed efficiency.

"Animals will be genotyped with the high-density 700,000 [marker] chip to identify genomic regions accounting for variation in feed efficiency," Garrick added.

He explained how, after sufficient data is collected and markers are validated, the next step is development of genomic EPD values that cattle breeders can apply to selection for more efficient cattle.

"It's a five-year project, national in scope, involving multiple institutions, which undertakes basic and applied research to identify factors that impact feed efficiency," Garrick stated. "It represents a shift from being output-based to being efficiency-based."

Weight Trait Project

The Weight Trait Project, started in 2009, will continue as part of the national research effort, and research leader Matt Spangler of the University of Nebraska will continue his involvement. Spangler told a BIF committee audience about the Weight Trait Project's investigation of the reliability of marker-based predictions across beef breeds. The project also provides a data resource helpful for determining methodology for incorporation of genomic information into national cattle evaluation calculations with marker-assisted EPD values as the goal.


Matt Spangler

Spangler said marker-assisted EPDs promise increased accuracy of prediction for young animals – animals for which there is little or no phenotypic data.

"Genomic information holds the promise to not only increase the accuracy of EPDs but also add new and novel traits to our suite of traits included in national cattle evaluations," Spangler explained.

According to Robert Williams, American International Charolais Association director of breed improvement, there is no doubt that genomic information will be incorporated into genetic evaluation. The question, he said, is how to use it most efficiently.


Robert Williams

Williams lamented the many and separate "islands of data" which exist, respective to breed. Various industry entities are researching genetic improvement in search of the same things, but they do not share resources. Williams suggested cooperation in creating an information infrastructure to support research, technology development and partnerships, which will help improve the beef industry as a whole. That approach, he said, fits the mission of BIF. HW


Dorian Garrick

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