Tips for Genetic Selection

Speakers at Range Beef Cow Symposium XXI share insights on cutting-edge technology in genetic selection.

by ***Kindra Gordon & Troy Smith***

In January we began our coverage of the 2009 Range Beef Cow Symposium with some of the time-sensitive marketing and outlook material. This month we continue with coverage of sessions focused on genetic selection.

The symposium was hosted by the Cooperative Extension Service and animal science departments of the universities of Wyoming and Nebraska, and South Dakota State and Colorado State universities. The biennial symposium features real-world, workable solutions on subjects of nutrition, marketing, health, reproduction, consumer demand and industry issues.

Angus Productions Inc. (API) provides online coverage of Range Beef Cow Symposium XXI, available in the newsroom at *www.rangebeefcow.com.* Posted to the web site are synopses of the presentations, as well as PowerPoints, proceedings and supporting materials as provided by the speakers. While not yet posted at press time, audio files will be added as well.

The University of Nebraska will make available for ordering video coverage of each session. Each presentation is on its own DVD. Cost is $10 for the first DVD and $5 for subsequent DVDs. To request information on ordering, call 402-472-3035.

Taking it to the Next Level

When trying to make change through genetic selection, it boils down to three things — accuracy of the breeding value information, intensity of selection and interval between generations, says Ronnie Green, global director of technical services for Pfizer Animal Genetics.

Green discussed advances in DNA testing technology, its increasing use in genetic selection, and other applications for managing cattle production at the 2009 Range Beef Cow Symposium.

Describing what he called the "evaluation evolution," Green said selection tools began with visual appraisal, followed by the addition of pedigree information. Collection and evaluation of individual and progeny performance data led to the calculation of expected progeny difference (EPD) values for various economically important traits.

►**"Discovery of the full genome sequence has driven innovation at unexpected speed," said Ronnie Green of Pfizer Animal Genetics. "We've moved from a few markers for a few traits to more markers for more traits, and we're moving toward identification of thousands and thousands more."**

Then came methods for considering multiple expected progeny differences (EPDs) simultaneously through the use of selection indices.

The challenge, Green said, is calculating accurate EPDs for young animals lacking progeny data. Interim EPDs based on parental data often change dramatically as actual data becomes available. Another challenge is the lack of EPDs for certain important traits that are difficult or very expensive to measure.

"Now we're moving into an era of selection tools based on DNA markers and panels," stated Green, noting how researchers continue to identify more beef genome locations associated with specific traits. "Discovery of the full genome sequence has driven innovation at unexpected speed. We've moved from a few markers for a few traits to more markers for more traits, and we're moving toward identification of thousands and thousands more."

Green described Pfizer's GeneSTAR® "Molecular Value Predictions" (MVPs) based on the phenotypic effects of specific markers associated with traits of interest. While early DNA testing was based on individual markers affecting a single trait, a marker panel consists of markers affecting multiple traits simultaneously. Just as the addition of more progeny data increases the accuracy of EPDs, Green explained, the addition of more markers increases the reliability of MVPs.

To date, DNA testing for selection has been most applicable to seedstock producers, but Green predicted the coming of practical and affordable application by commercial segments of beef production.

"In my opinion, the biggest value is beyond the seedstock industry, as the technology is used in predicting an animal's phenotypic performance," Green stated, noting feedlot application for sorting cattle into groups that can be managed to optimum end points based on predicted feed efficiency and other performance traits.

"This next decade, I believe, will be the genome-enabled era, when you will see how to get real value from the technology," Green concluded.

— by Troy Smith

Managing Genetic Abnormalities

What causes genetic abnormalities in cattle? And why do they seem to be occurring with greater frequency? University of Illinois molecular genetics specialist Jon Beever addressed those questions and talked about technologies available for managing genetic abnormalities such as arthrogryposis multiplex, neuropathic hydrocephalus, osteopetrosis and others.

While more defects do seem to be showing up, Beever said, they have "been there" for a long time. Caused by a recessive gene, genetic abnormalities can occur when one animal carrying the gene is mated with another carrier. A calf resulting from such a mating will be normal 25% of the time, having received the recessive gene from neither parent. Fifty percent of the time, the calf will receive the recessive gene from one parent and also be a carrier. And there is a 25% chance that the offspring will receive the gene from both parents and exhibit the abnormality.

"The widespread use of animals (sires) of high genetic merit results in more potential carriers among their progeny," Beever explained. "And with increased intensity of selection there is more opportunity for

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mating between carriers. When a recessive gene piles up in the population, we can get some surprises."

Beever said the new DNA technologies allow for management to guide breeding programs away from potential losses due to genetic abnormalities. He likened the use of new DNA tests for abnormalities to the use of vaccines to prevent loss from disease. Several tests to identify carriers of genes associated with specific abnormalities are available, and industry application has been high. Scientifically, the tests are 100% accurate, Beever stated. Functionally, they are as good as the laboratory performing the test.

"Seedstock producers bear the most responsibility for managing abnormalities," Beever said, "but commercial producers can use the tests to manage the replacement female base."

The producer's decision regarding whether or not to use a carrier animal in a breeding program depends on that producer's risk and level of management.

"We can make the management tools," Beever told the symposium audience. "You decide how to use them."

— by Troy Smith

Use Information to Make Informed Selection Decisions

"We are going to have tools for traits we never dreamed of," Matt Spangler of the University of Nebraska-Lincoln's (UNL) Department of Animal Science told symposium attendees. "The future for the beef industry is exciting."

Spangler discussed how genetic selection in the beef industry has evolved from visual appraisal and pedigrees to performance records, EPDs, multi-trait indexes and, now, molecular data. While these are valuable tools, Spangler peppered his presentation with some cautionary advice.

"The key to using index values is to only use the indexes that fit your breeding objectives," he noted. He emphasized the importance of paying attention to accuracies of the EPDs within those indexes.

Spangler advised producers to remember the KISS philosophy — "keep it simple, stupid," particularly when it comes to using the new molecular technology and genetic tests.

This new technological frontier isn't just for seedstock producers, he noted, citing several commercial ranch applications in which genetic testing might be used. Among those listed were identifying problem sires (i.e., for calving difficulty); identifying productive sires (i.e., those who sired 50-60 progeny vs. those who sired 0 progeny); and enabling informed mating decisions, such as potential carriers of genetic defects.

In the future, Spangler said, SNP panel tests for a greater number of traits — and more complex traits — should become more readily available and less expensive.

But with that, he said, the focus is to try and keep the new technology easy for producers to use. Thus, marker-assisted EPDs that will tie EPD data to molecular data will likely be the format adopted by the industry. "This should make EPDs more accurate at a younger age," Spangler explained.

Presently, the American Angus Association is rolling out genomic-enabled EPDs for carcass traits through a partnership with Merial's Igenity® In using this new information, Spangler suggested producers still look at the EPD value and its accuracy in making their decision. He cautioned that tests like this that are breed-specific are best used within the breed for which they were developed.

"There is a tremendous amount of information available from which to make selection decisions," Spangler said, looking ahead. "For producers, it can be confusing, and there needs to be a lot of producer education." He stressed that commercial producers will need to understand the technology as much as seedstock breeders, since the commercial sector is the end user.

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"In bull selection, if you use the wrong thing, you'll be horribly disappointed, and it will take a long time to correct that," Spangler said to illustrate the importance of properly using the selection tools available. "If you still select on raw phenotypes, you will also be disappointed. That needs to end."

He concluded by advising producers to "evolve," but cautioned, "don't fall off the cutting edge. Things will change rapidly, and the road is going to be a bit bumpy for a while, so it's important to stay engaged and informed."

For more information visit the National Beef Cattle Evaluation Consortium web site at *www.nbcec.org*.

— by Kindra Gordon

Selecting for Efficiency Improves Profitability, Sustainability

Why is efficiency important to the beef industry? According to Missouri cattleman Nick Hammett, it's because improvements to efficiency help cattlemen lower costs, increase returns or both. While speaking to producers gathered for the Range Beef Cow Symposium, Hammett said, in short, efficiency improves profitability and sustainability.

Hammett is commercial marketing manager for Circle A Angus, which annually markets more than 400 bulls, 600 bred heifers, 50 registered females and 8,000 finished cattle. He explained how Circle A entered the purebred cattle industry, first concentrating on winning in the showring. Owner Dave Gust, a successful self-made businessman, soon shifted the operation's focus to producing cattle that could help commercial producers improve their profitability.

"In 1996, he formulated the Angus Sire Alliance with the goal of measuring both the costs and returns of a sire's progeny in a real-world, commercial setting to help guide mating and selection decisions based on actual profitability," Hammett said.

With a membership including 51 like-minded Angus breeders, the Angus Sire Alliance collected feedlot and carcass data, becoming the largest contributor of carcass data to the American Angus Association. Missing, however, was any evaluation of production costs, a critical factor in measuring profitability.

Circle A constructed a research facility to test sire progeny for feed efficiency

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based on individual feed intake, Hammett shared. A partnership was formed with ABS Global to market semen from high-profitability sires. Ten to 12 sires are now tested annually utilizing a GrowSafe system capable of collecting individual feed intake measurements on 200 animals simultaneously. EPD values are calculated for birth weight, weaning weight, weaning weight maternal, postweaning average daily gain, marbling score, yield grade and dry-matter intake for inclusion in a profitability selection index.

After more than a decade of using progeny testing, EPDs and profitability indexing, genetic improvement for multiple traits is evident, Hammett said. By also using in-herd EPDs for heifer pregnancy and cow stayability, and calculating a maternal profit index as well as the terminal profit index, improvements have been made to the profitability of all facets of Circle A production.

"For us, the results of profitability indexing include increased fertility, allowing us to breed cows in lower body condition while maintaining pregnancy rates. We have improved feed efficiency and carcass traits, too — all simultaneously," Hammett said.

Circle A has implemented a buy-back program through which it purchases cattle from bull-buying customers. Hammett said feed efficiency data enables Circle A to pay more for those cattle, guaranteeing sellers will receive prices equal to the top of the regional market plus a $25 premium because the cattle were sired by Circle A bulls.

According to Hammett, profitability-based selection indexes currently represent the gold standard by which multi-trait genetic progress is made. He advised producers to seek sources of genetics that are measuring and selecting for a variety of traits that directly affect the bottom line.

— by Troy Smith

Select for Disease Resistance

Researchers at Colorado State University (CSU) are working to determine whether the presence or absence of certain genes determines an animal's ability to resist disease. Colorado State University graduate student Brian Brigham described ongoing studies at CSU's Center for Genetic Evaluation of Livestock.

Brigham said past research involving beef animal resistance to horn flies and ticks showed genetic selection for resistance to parasites is possible. Success in this area has prompted studies related to resistance to bovine respiratory disease (BRD). Thus far, the CSU research has yielded an estimated heritability of up to 0.18.

"That suggests we can start to select for resistance to BRD. We need more data, but there is ample incentive to get it," Brigham said, citing the estimated $3 billion the beef industry spends on prevention and treatment of respiratory disease in cattle.

CSU researchers hope to develop DNA tests for identifying animals that are genetically superior with regard to feedlot health. Year 1 results of the study also suggest animals entering the feedlot at heavier weights are more resistant to sickness, as are those subject to the least amount of processing stress. Animals that do become sick typically perform well below contemporaries that remain healthy. Brigham said temperament also appears to have an affect on average daily gain.

— by Troy Smith

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Limitations, Challenges with RFI

Iowa State University geneticist Dorian Garrick said animal scientists interested in genetic selection have long looked for outstanding animals that exhibit the highest levels of production. However, higher production often requires higher inputs. With beef animals, high levels of production are often accompanied by higher feed intake. That's why, Garrick said, the beef cattle industry is so interested in feed efficiency — the relationship between what an animal produces and what it eats. Most commonly, feed efficiency has been expressed as a ratio of pounds of feed required to produce a pound of gain.

"Efficiency expressed as conversion is not a good evaluation [of feed efficiency], because it doesn't account for feed costs or returns from production," Garrick said.

And neither is residual feed intake (RFI) a good measure of feed efficiency, Garrick said. The subject of considerable study in recent years, RFI is the difference between the actual amount of feed an animal consumes and the amount it was expected to consume. In explaining RFI, Garrick likened it to comparing the actual number of miles a car travels on a gallon of gas with the expected average for that given model.

In the case of beef production, if an animal requires less feed than expected to reach the desired end point, it has a negative RFI value. And that's a good thing. However, Garrick said, RFI doesn't account for economics, making it a poor measure of profitability.

"It doesn't measure output. We need productivity and favorable RFI to be profitable; not just the best RFI," Garrick stated. "We have to consider beef returns relative to feed cost."

Garrick said another problem with RFI is feed intake of individual animals must be measured, and that's expensive. But the most fundamental problem, he added, is that it doesn't account for the cost of feed and therefore offers no economic basis for selection.

"People who get excited about RFI," Garrick concluded, "haven't spent enough time hovering over the data."

— by Troy Smith