



Gateway to Profit

Speakers explore how to bring the science of genetic selection to practical application on farms and ranches.

Themed “Gateway to Profit,” the 2010 Beef Improvement Federation (BIF) Research Symposium and Annual Meeting was hosted in Columbia, Mo., June 28-July 1. More than 500 producers were on hand to listen to the program in which experts from across the United States and abroad discussed leading genetic advancements and offered practical solutions to help attendees adapt technologies to individual operations.

According to event planning committee co-chairman Bob Weaver of the University of Missouri, this year’s committee made a special effort to bring advanced science to a practical level to fit the needs and interests of the audience. General sessions focused on “Genetic Selection to Achieve Your Profit Objective — Using Today’s Tools” and “The Future of Beef Cattle Selection in the United States.”

In addition, BIF’s five standing committees took a deeper, more technical look at advancements within their respective emphases of cow herd efficiency and live animal, carcass and end point; producer applications; genetic prediction; selection decisions; and emerging technologies.

Angus Productions Inc. (API) provides comprehensive online coverage of the symposium at www.bifconference.com. Summaries of the sessions, along with PowerPoints, audio and proceedings are provided in the site’s newsroom. You can also find photo galleries from the pre-conference and post-conference tours in the “Photos” page and announcements of the award winners (published in the August *Angus Journal*) in the “Awards” page. The online coverage is made possible through a reciprocal agreement with BIF and the sponsorship of Biozyme Inc. through its significant gift to the Angus Foundation.

Following are some of the highlights of the conference.

A Systems Approach to Beef Improvement

Maybe it’s time to consider a different approach to beef improvement. That was the suggestion offered by Barry Dunn, South Dakota State University (SDSU) dean of the

College of Animal and Biological Sciences, during the opening session of the 2010 BIF Research Symposium.

“We can’t invest our way to profitability,” Dunn stated. “And past approaches to beef improvement have taken us down that path.”

According to Dunn, the most popular strategies have focused on manipulating gene frequency for economically relevant traits, then diffusing desirable genes into herds as rapidly as possible. Admittedly, those strategies have created change.

“Today, with the same number of cows that we had in 1958, [the U.S. beef industry] produces 1½ times more beef. But we have lost well over a third of the number of producers that we had then,” Dunn said. “If that continues, can the industry survive?”

Dunn likened beef improvement efforts to the assembly of a puzzle whose pieces have included ratios, breeding values, expected progeny differences (EPDs), gene markers and, now, genomic EPDs. He said he wonders if breeders have become dependent on a constant flow of new techniques and technologies for genetic selection targeting increased production.

Increased production has come, but not without tradeoffs and unintended consequences, such as the increased mature cow size that has accompanied selection for heavier weaning and yearling weights. Despite advancements in technology and increased production, profitability for beef producers remains relatively low.

Dunn challenged researchers and producers in the audience to look at beef improvement, not as a puzzle, but as a mystery to be unraveled. He recommended a systems approach emphasizing optimum production rather than maximum production, with consideration for controlling costs as well as increasing revenue. Dunn said each beef operation is a complex system, where all the parts are tightly coupled and “everything affects everything else.”

According to Dunn, interactions between management and genetics are huge. He cited, for example, fetal programming studies that have shown how the nutritional status of pregnant cows can impact the



► “We can’t invest our way to profitability,” said Barry Dunn, SDSU dean of the College of Animal and Biological Sciences.

carcass characteristics of their progeny and the fertility of daughters saved as herd replacements. Creep-feeding calves can improve marbling, but also may decrease the long-term productivity of heifer calves retained. And growth-promoting implants can boost weight gain, but they also can have negative effects on carcass merit.

Rather than waiting for the next new selection tool for maximizing gene frequency, Dunn challenged his audience to consider whether it is more cost-effective to find optimum levels of gene frequency and learn how to turn genes on and off with management. He urged them to consider a creative systems approach.

— by Troy Smith

Focus on Profit, Not Production

Matt Spangler, associate professor at the University of Nebraska-Lincoln (UNL), showed a simple equation to beef producers:

Profit = Revenue – Expense.

“Any questions,” he asked, gesturing he was ready to walk off the stage. It really is that simple, he joked, then offered to expound a bit.

Spangler suggested that too much



BIF's Role in Charting the Beef Industry's Future

A reflection on the past will provide direction for the future, Larry Cundiff, retired research geneticist with the U.S. Department of Agriculture Meat Animal Research Center (USMARC), told participants of BIF's "Gateway to Profit" conference.

Cundiff observed that, over the years, BIF's vision to bring together Extension, research and industry for genetic improvement has been a good model for achieving just that. BIF's symposia, committees and workshops have long provided the fodder needed for discussion.

"This meeting stimulates questions for our research programs. Perhaps the best example is expected progeny differences across breeds. Discussion led to subsequent analyses. We now look at genetic trends to see how breeds have arrived from where they started," he said.

The ninth edition of the *BIF Guidelines* is being completed and updates such issues as uniformity in methods for measuring

traits, recording and analyzing data, and exploring genetic EPDs with both quantitative and molecular approaches. Cundiff says the most changes were made in the molecular approaches area and how those approaches can be implemented. New research includes udder scores, postweaning feed intake and efficiency, behavioral traits and more.

"The beef industry's charge for the future is to keep on doing these things and to provide direction so that we continue to have an impact on genetic improvement," says Cundiff, adding he has concerns. "The decline in funding and support for land-grant universities and the erosion in education for training new scientists and research pose problems. There used to be stations with herds and scientists committed to the projects on those stations. We need to keep funding these projects and maintain BIF as the organization that brings together the associations, the industry and Extension scientists," he says. "I believe this effort will be in good hands."

— by Barb Baylor Anderson



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emphasis has been placed on the revenue side of the equation and not enough on the expenses involved in beef production. To prove his point, he showed a slide that indicated weaning weights and yearling weights have been increasing for the past 10 years.

Spangler then asked the audience, "Is there too much milk production by mother cows? ... Maybe instead of maximizing traits, such as milk production, we should optimize them. Optimizing will be more challenging, but it will be more efficient."

In addition to increasing input costs, high levels of milk production also increase the difficulty to rebreed, especially in rough environments, Spangler noted.

"We have to be concerned with input costs," Spangler said. "We also must fit genetics to the producer's production environment. Cattle cannot be placed in environments that will not work for them."

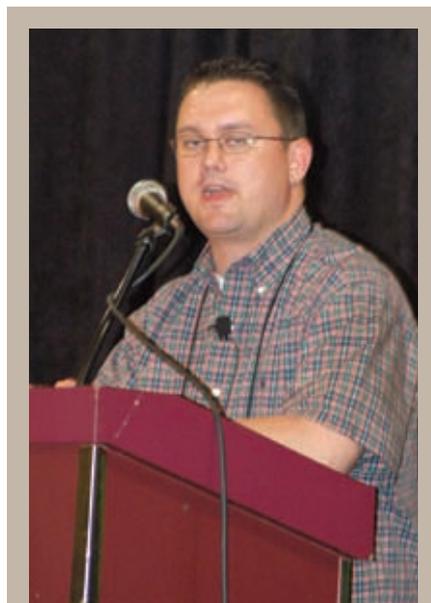
Luckily, Spangler said, we have the tools to decide which cattle fit each producer's environment and concerns. These tools include expected progeny differences (EPDs), especially EPDs for milk, mature weight, weaning weight and yearling weight.

"Watch these EPDs and their distribution curves for your replacement females," Spangler advised. "Cull the ones that fall really low or high on the curve."

The number of EPDs and genetic antagonisms between and among traits can be problematic, Spangler acknowledged.

He suggested using economic index values, such as the American Angus Association's maternal dollar value indexes (\$Values), like weaned calf value (\$W) and dollar energy (\$EN), and terminal \$Value indexes, like the beef value index (\$B).

When using these, or other indexes, Spangler advised producers to use the ones that work best for their individual breeding objectives and to understand the associated



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population statistics and accuracy values.

To continue to move forward, producers must continue to turn information in, Spangler emphasized. "Record and turn in mature weights and body condition scores (BCS)."

He encouraged seedstock producers to track the costs of their commercial customers and practice multi-trait selection.

Spangler concluded by reminding the audience that optimum values, not maximum values, lead to profitability and that economic values are out there for both seedstock and commercial cattlemen to utilize to increase profitability.

"Some breeds will complement each other very well," Spangler said. "Instead of maxing out one or two traits of those breeds, producers could work on optimizing more traits to possibly get a calf that would lead to more profitability for everyone."

— by Mathew Elliott

Evaluating Investment in New Technology

Investment in new agricultural technology can be expensive. So how does a beef producer decide if application of technology will be cost-effective? According to Oklahoma State University (OSU) Agricultural Economist Eric DeVuyst, economic theory-based tools for decision analysis often are mathematically complex and the amount of information required is too great to

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be practical for most farm- and ranch-level applications. Their complexity and information requirements vary with the levels of investment scale, risk and degree of reversibility.



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However, DeVuyst told the BIF audience that simplified decision-making tools with lower information requirements are available for real-world decision makers.

According to DeVuyst, the simplest form of applied decision tool is partial budgeting. This tool is useful when considering small-scale, low-risk and highly reversible decisions. With a partial budget, only changes in revenues and expenses are included.

An enterprise budget projects all revenues, variable expenses, and fixed (overhead) expenses that can be allocated to a given enterprise. Decisions considered may be less reversible, larger in scale and somewhat more risky.

“Whole-farm budgeting builds on enterprise budgeting. Enterprise budgets are aggregated, and unallocated expenses are subtracted from aggregate returns. With the focus on the whole farm, even larger-scale decisions can be analyzed,” explained DeVuyst. “Impacts on the farm’s bottom line are the focus of whole farm budgeting.”

In contrast, cashflow budgeting is focused solely on cash. Calling this tool “a must,” DeVuyst said it is used to project time periods where cash is short or in excess of current cash demands.

Capital budgeting is concerned with investments that are long-lived, addressing revenues and expenses incurred over multiple years. Capital budgeting techniques do not explicitly consider risk and irreversibility.

According to DeVuyst, most land-grant universities have simplified decision tools that are available to livestock and crop producers. However, little is currently available for evaluating how use of DNA technology for selection may affect profitability.

— by Troy Smith

How the Next Generation of Genetic Technologies Will Impact Beef Cattle Selection

Looming on the horizon is a genomic revolution, said University of Missouri (MU) geneticist Jerry Taylor, who told the BIF audience that one of the most useful technology advances shaping the next generation of genetic evaluation is the availability of a genome sequence for beef cattle.

Taylor said geneticists have known about single-nucleotide polymorphisms (SNPs) — points of variation in the DNA sequence responsible for expression and suppression of various traits — but they couldn’t use them until the genome sequence was known. The Illumina BovineSNP50, a 50,000 (50K) SNP genotyping assay has been useful



► The 50K assay has its limitations, said MU geneticist Jerry Taylor. “It takes a lot of genotyped animals within a breed to achieve high-accuracy EPDs, and they won’t work across breeds.” New technology is around the corner, he said.

in discovering SNP effects and initiating development of genomic-enhanced expected progeny difference (EPD) values without pedigree or progeny data. But the 50K assay has its limitations.

“It takes a lot of genotyped animals within a breed to achieve high-accuracy EPDs, and they won’t work across breeds,” Taylor said. “Higher density assays can help us spot effects common to multiple breeds.”

Taylor said two 800,000 SNP assays are becoming available this year. Instead of spending years tracking one gene, high-density assays should allow many genes to be sorted out quickly. Additionally, next-generation sequencing platforms may allow scientists to figure out how chromosomes orient themselves within cells and determine which genes will be expressed. Other advancements should reveal why the expression of certain genes shared by two animals are expressed in one individual but suppressed in the other. Use of genotyping technology will likely become more affordable, too.

According to Taylor, development of all technologies follow a similar “hype curve.” Following discovery is a “peak of expectation” for advancements the technology could bring. Typically, research continues for a period with modest advancements, and the curve dips to a “trough of disillusionment.” Then, as breakthrough enhancements are made, the technology’s development enters a “slope of enlightenment,” followed by a “plateau of productivity” when the technology is put to practical use. Taylor predicted that practical application of genomic selection is near.

“It’s here, really, but we’re still trying to get accuracy up,” Taylor said. “We are climbing the slope of enlightenment.”

— by Troy Smith

Genomic Tools in Cattle Selection

A compilation of genomics research indicates new tools are radically changing dairy breeding decisions and, in the future, may do the same for the beef industry.

“Selection works in dairy. Trends in U.S. milk production show that in 2007 the U.S. produced 34% more milk with 48% fewer dairy cows than in 1960,” says Curt Van Tassel, a research geneticist at the Bovine Functional Genomics Laboratory and the Animal Improvement Programs Laboratory at USDA’s Agricultural Research Service facility in Beltsville, Md.

Traditional selection methods include collecting phenotypic data, estimating the



genetic merit and selecting the superior animals. Now, Van Tassell says, genomics research is revealing how rapidly and more accurately technology will change how producers make selection decisions.

In 2006, Van Tassell and other researchers gathered genotypic data on 3,000-5,000 Holstein cows, 750-1,000 Jerseys and 250-400 Brown Swiss. Holstein data had built-in validation with a historic group of bulls and a prediction group of bulls. Van Tassell says they learned quickly they had significant reliability in the data, as accuracy more than doubled with genomic results. Accuracy improved from 40% to 70% reliability on young bulls.

“The problems we saw were that there was an upper limit on the accuracy of genetic prediction, even in Holsteins, and we questioned what to do with the smaller breeds. Marker effects were not consistent enough to justify across-breed genetic prediction,” he says.

Van Tassell says development of a bovine high-density (HD) SNP assay will help increase accuracy in genetic prediction. With help from Illumina, Pfizer and several research institutions, a bovine HD gene chip should be available next month (August 2010). The promising chip was created to use across-breed information, enhance gene-mapping precision and more. A large

number of the SNPs discovered will become publicly available.

“A low-density assay will be of value, too, especially in the third world, for parentage, traceability in the instance of diseases and to provide genetic prediction and a shortcut to pedigree data,” he says. “The technology is applicable to extensive management practices.”

Lastly, Van Tassell touched on genotype imputation, which will allow prediction of unknown and observed genotypes. Researchers are currently exploring pedigree haplotyping, where a pedigree could be used to reconstruct likely haplotypes and predict the dam from the progeny. It ultimately

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could also help increase the reliabilities of genomic technology.

— by Barb Baylor Anderson



► ARS researcher Curt Van Tassell says genotyping is making considerable impact on genetic decisions in the dairy industry, as it will soon be in the beef industry.

Implementation of Genomic-Enhanced EPDs

The American Angus Association is the first breed organization to provide a suite of genomic-enhanced EPD values as a tool for genetic selection. Association Director of Research Sally Northcutt talked about the development of genomic-enhanced EPDs and the opportunities they offer beef cattle producers.

Northcutt explained how results of DNA testing for genes associated with specific traits, using the Igenity® Profile for Angus are combined with available individual, pedigree and progeny data used to calculate traditional national cattle evaluation (NCE) EPDs. Northcutt said the addition of genomic profile information provides more thorough characterization of economically important traits and improved accuracy on young animals.

“In September 2009 [the Association] began accepting DNA samples submitted by breeders,” Northcutt said, explaining how samples were then sent to Igenity for creation of the genomic profiles for each animal represented. “In October 2009,” she

added, “the first genomic-enhanced EPDs for carcass traits were released.”

The predictions for carcass traits (carcass weight, marbling score, ribeye area and fat thickness) incorporate harvest records, ultrasound scans and genomic results. According to Northcutt, the beauty of using the genomic data as an indicator trait is that even very young animals can have carcass trait EPDs prior to ultrasound scanning. Unlike the phenotypic data, the genomic result requires no contemporaries to enter the genetic evaluation. A genomic profile from animals of any age can be incorporated. If a calf is later scanned as a yearling and eventually accumulates progeny data, each new piece of information may be added to carcass evaluation.

For animals that already have traditional EPDs for carcass traits, the genomic results still have impact. EPDs may move up, down or stay the same, and the accuracies increase on animals having little or no progeny data. Genomic-enhanced EPDs essentially bypass “interim” EPDs based solely on pedigree data.



► Higher-accuracy EPDs available on a weekly basis have been advantages to producers of genomic-enhanced EPDs of the American Angus Association, said Sally Northcutt, director of genetic research.

“A full national cattle evaluation is conducted weekly, and breeders can access updated genomic-enhanced EPDs every Friday morning. Angus dollar value indexes (\$Values) are also updated on-the-fly,” Northcutt stated.

She said the main advantages are the ability to provide more accurate predictions of genetic merit and do it more rapidly. Carcass genomic profile results are incorporated into EPDs without a six-month wait for biannual evaluations. Northcutt said producers are asking when weekly computation and release of genomic-enhanced EPDs for other traits will occur.

“We’re working on it,” she stated. “And we’re working on a predictor of feed efficiency. Through collaborators helping collect feed intake data, we’re working to create a ‘residual average daily gain EPD,’ which eventually would be incorporated into a \$Feedlot selection index.”

The American Angus Association genomic-enhanced NCE EPDs are available at www.angus.org/Animal/EpdPedSearch.aspx.

— by Troy Smith

Raising Beef In a First-World Country

While there are many challenges in the beef industry today, many opportunities also exist. Tom Field, director of producer education for the National Cattlemen’s Beef Association (NCBA) spoke about these challenges and opportunities during the

second general session of BIF’s research symposium.

“My goal is to step back and give you a 10,000-foot view of the industry,” Field said. “There are days where the media and politics and everything else weigh us down, and we all want to bury our heads in the sand occasionally. But, that is not an option.”

Field encouraged attendees by showing some positives: The volume of beef production is up. Productivity per animal is up. And the quality and value of beef is increasing.

He credited genetics for a lot of those improvements, but warned of the consequences of all that productivity.

“Cow herds that have less than 50 head account for 80% of beef enterprises but only 28% of the cow inventory,” Field said. “Less than 15% of cow-calf enterprises rely on cattle as a primary income. That’s neither good nor bad, but it is a challenge we must deal with.”

Another challenge is the amount of producers leaving the beef industry. Field said that since 1987 nearly 250,000 producers have exited the beef industry. That is even with the relatively high level of productivity and profitability from 1998 to 2008. Droughts, increased input costs, negative media perceptions, the decline of rural economies, government regulations, land values and the increased average age of producers all played a part in producers leaving the industry.

Field then shifted gears and looked at the consumers the beef industry will need to focus on in the near future.

“We have to ask what our consumers want,” Field said. “The baby boomers will have the purchasing power, the Millennials want instant gratification, and professional women have a very strong presence in the market. The emerging consumer is watching out for want vs. need, they are more vigilant about their spending and are making tradeoffs. They are not necessarily trading out of beef, but going from a steak to roast or hamburger.”

Consumers want to be more informed about the food production process. Many want a transparent, authentic, healthy, experience.

“We owe the industry and our consumers the freedom of choice,” Field said. “I’m all for natural production, organic production and conventional beef production. There is more opportunity than dread in this situation in my opinion.”

For the beef industry to move forward, Field suggested producers return to professional stockmanship — and the marriage of art and science that goes with it. He encouraged cattlemen to attend a Beef Quality Assurance (BQA) Stockmanship and Stewardship Tour. Visit www.bqa.com for more information on the tour and dates.



► “There are days where the media and politics and everything else weigh us down, and we all want to bury our heads in the sand occasionally,” said NCBA’s Tom Field. “But, that is not an option.”

“Examine your attitude and evaluate everything,” he said. “Everyone from your cattle, to your customers, to the consumer benefit from this. Evaluating will be hard, but we need to assess where we are in the beef industry in family rooms across the nation.”

Partnerships are another valuable tool, Field said. Anything from partnerships with neighbors to state and national organizations can help profit and longevity. Partnerships outside of the beef industry are also very valuable, as they are another way to educate those not in the business.

“We need to engage everyone,” Field said. “We need to tell our positive story; get out of the defensive mode and onto offense. Communication might not be our greatest strength as a group, but we must learn. It’s time to take ownership and commit 24 hours a day, seven days a week, 365 days a year.”

— by Mathew Elliott

