

Genetic Tracking Charolais in an Ever-Changing Industry

By Taylor Greenstreet,
reviewed by AICA Staff



The American-International Charolais Association, co-hosted along with the University of Illinois and the National Program for Genetic Improvement of Feed Efficiency in Beef Cattle, the Charolais on Feed Field Day which offered an opportunity for breed enthusiasts to learn about emerging technologies that could soon benefit producers. The event was held on August 22, in Champaign, IL and was attended by Charolais breeders, commercial cattle producers and other beef industry leaders from across the United States along with visitors from the Charolais Association in Mexico.

“Producers need to be engaged and incorporate technology to be successful in the beef industry nowadays,” said Dr. Douglas Parrett, Extension Specialist and Interim Head of the University of Illinois, Department of Animal Sciences illustrating that cattle producers in the ever-changing world of research and

technology need to adapt to be successful. This proved to be the theme of the day.

“Events like this expose us to ‘outside the box thinking,’ knowing that universities are trying to improve the industry,” said Robb Creasy, the AICA Treasurer from Macomb, IL. “It also gives producers the chance to learn from others,” he added.

Daphne Davis, Charolais breeder from London Mills, IL, commented on the importance of this field day to the Charolais breed, saying “It makes cattlemen more aware of the breed across the state.”

The morning began with a tour of the University of Illinois’s beef research farm, which opened in 2004.

“I was very impressed by the facilities and the staff including the graduate students at the University of Illinois”, stated Dr. Randy Perry, chairman of the AICA Breed Improvement Committee and faculty member at the Jordan College of Agricultural Sciences & Technology,

California State University, Fresno.

Producers were shown the Metabolism Research Barn; where researchers are able to take samples directly from the rumen of fistulated cattle in order to conduct digestibility and nutrition trials. Dr. Dan Shike, Assistant Professor of Animal Sciences at the University of Illinois, explained that they are then able to pair the digestibility trials with feedlot growth to answer changes in the performance of the animals. Dr. Shike also stressed the importance of good documentation, “We need good data! We must collect good information, document practices, look for profit opportunities, and be ahead of the curve.”

AICA Director of Breed Improvement, Dr. Robert Williams said that “This project and the collection of phenotypic data from birth through harvest which includes individual feed intake are critical to moving the industry forward in regards to a better understanding of efficiency an incorporating genomics

into our selection tools.”

One of the interesting features of the farm is its’ GrowSafe System. This system allows researchers to simultaneously collect individual feed intake data on 900 cows or feedlot cattle. Each animal has its own electronic ear tag – allowing for individual intake data to be electronically transferred into a computer system and analyzed.

Other highlights of the tour included a feedstuff discussion with University of Illinois farm manager, Tom Nash, and an overview of the working facilities. After the tour was over, producers had a chance to look at the Charolais sired calves on feed and examine the corresponding feedlot data being collected at the farm.

Dr. Perry noted that “Our breed was well represented by the quality of the crossbred calves that were being fed.”

The second half of the day consisted of presentations by leaders of the five million dollar, multi-institutional feed efficiency project. The goal of the project is to develop genomic-based tools to estimate the genetic merit of cattle for feed efficiency to create genomic enhanced EPDs to deliver to the beef industry, according to Dr. Jerry Taylor, the Animal Science Wurdack Chair of Animal Genomics Professor at the University of Missouri-Columbia.

Dr. Jon Beever, Animal Sciences Professor at the University of Illinois, explained to producers the art of animal breeding as a science. Dr. Beever said the main tools for selection are phenotype, in terms of measured performance and uniformity, breeding values (EPDs) for targeted performance, and the relatively new tool, DNA genotypes. This new tool allows producers to look at the DNA of a specific animal and try to predict its genetic merit - possibly accelerating producers’ chances of creating the best offspring.

He explained that changes in the gene sequence can significantly change the outward appearance of an animal. In the cattle genome, there are three billion base pairs of DNA, of which, about 2% are contained in about 24,000 genes which can influence the growth and appearance



of an animal. For instance, changing the sequence for one pair of genes (cattle have one copy of each gene inherited from each parent) can control the color of the animal. Think of the silver gene, which controls whether an animal is black or white. In comparison, changing just one gene pair at the myostatin locus can result in 4-6% more muscle in an animal.

There are two types of traits: simple, which is 100% gene controlled, and complex/quantitative, which the environment can influence. Each gene has a small effect on phenotype and genetic merit is controlled in a cumulative fashion. Dr. Beever explained that researchers are attempting to define what is environmental versus genetic to help producers select the best parents.

Heritability is the proportion of variance that is due to genetics, examples include ribeye area and marbling score which have moderate heritabilities in the range of 30 to 40%. Dr. Beever described one of the reasons selection takes so long is due to an imperfect heritability. When we select animals that have the best phenotypes, they do not necessarily have the best genotypes. He said that researchers are attempting to improve the accuracy of selection by increasing

the accuracy of genetic prediction by using DNA markers to identify animals with the best genetic merit.

Dr. Beever stated that producers will need to be familiar with these technologies in order to take full advantage of them as well as understand the relationship between these traits and phenotype when it comes to picking sires and dams.

Dr. Matt Spangler, Associate Professor and Beef Extension Specialist for the University of Nebraska-Lincoln, presented the results of the Weight-Trait Project (WTP), an integrated outreach project that began in 2009. This project includes participation from 24 seedstock producers representing 7 major beef breed associations. This resource, which now includes over 30,000 DNA samples, has been used to evaluate the efficacy of this technology and to advance statistical methodology for the inclusion of genomic predictors into EPDs.

Dr. Spangler emphasized that the benefit of this technology is through the incorporation of Molecular Breeding Values (MBV) into EPDs in order to increase the accuracy of EPDs, particularly for young animals. He went on to emphasize that even in the context of genomic selection, routine phenotypes



are critical to collect.

Dr. Spangler also added that visualization aids in technology adoption. That is why the WTP began with weight traits, as producers can visualize them. The project has continued to evolve as part of the USDA Feed Efficiency project, continues to serve as a field demonstration to illustrate the efficacy of research results.

The project also has educational benefits, according to Dr. Spangler, because it allows the producer to make more informed decisions. “Some of the future directions,” he said, “include feed intake/efficiency, sequence data, and marker assisted management.”

Genomically enhanced EPDs and Selection Indexes were the topics of the presentation by Dr. Bob Weaber, Associate Professor and Extension Specialist at Kansas State University. He explained to the producers that by averaging the dam’s EPD and the sire’s EPD you get the pedigree estimate of a calf’s EPD. This is a good starting point, but Dr. Weaber emphasized that we want to get the estimate closer to the true progeny difference. Data collection, whether from phenotypic records or genomic information, helps to inform the EPD predictions thereby adding

accuracy.

DNA markers can be a helpful source of information for improving the accuracy values of EPD; especially for traits that are hard or expensive to measure, such as disease resistance, feed intake, stayability, and reproduction. DNA markers are very useful for parentage ID and pedigree validation for seedstock producers, as well as when working with qualitative traits with an economic impact, such as horned vs. polled, color, etc.

Dr. Weaber explained that a DNA marker test only provides information on part of an animal’s genetic merit for a trait since the causal variants that directly contribute to variation in a trait are not yet identified. On the other hand, the markers tag the genomic regions in which these variants reside and an EPD estimates the cumulative effect of all genes on a trait. A genomic-enhanced EPD (GE-EPD) provides producers information that increases the accuracy of the EPD and subsequent selection indexes as early as at the birth of the animal when DNA can be collected.

Dr. Weaber then illustrated the flow

of this information beginning with the producer, who collects the DNA sample and sends it to the breed association. The breed association then sends this sample to a genotype provider who uses the DNA sample for genotyping and MBV prediction. The information is then given back to the genetic evaluation service provider to be incorporated into GE-EPDs which are then given back to the producer to be used as a selection tool.

Dr. Weaber concluded by telling producers “We have to change which bulls make it to the development pen.” Simply using the technology to market a few select bulls from your herd doesn’t effectively change the genetic trend of the population,” said Weaber. Using the technology to identify the bulls to develop for marketing accelerates the rate of genetic improvement.

Dr. Shike, talked to the attendees from a different angle, sharing the findings from feed efficiency studies at the University of Illinois. He explained how variation in



feed efficiency leaves room for selection opportunities and improvement.

“Producers and feeders are interested in profit, and the traditional focus has been on outputs. However, we need to look at inputs and see where there is room to improve,” said Dr. Shike.

According to Dr. Shike, the best measure for feed efficiency depends on whether you are talking about a feedlot or a cowherd and whether you are focusing on selection or research.

Dr. Shike agreed with the other presenters that there is a need to continue to collect phenotypes in order to understand the relationship of traits and then geneticists will determine the best tools for selection.

Dr. Taylor of the University of Missouri Columbia was the final speaker of the afternoon. He explained that through genomic selection, one can take a group of animals with an economically important phenotype and can then genotype them with an assay and try to estimate their genetic value/merit. So far, they have genotypes for over 5,000 animals from six breeds with high-density SNP genotype data.

Dr. Taylor clarified that genomic selection accomplishes the molecular estimation of breeding value via the estimation of genomic relationships. Researchers can genotype animals and estimate how genetically related they are

to animals for which data exists. If there is no relationship, then the accuracy of molecular estimates of EPDs will be zero. This explains why genomic selection does not work across breeds.

By the end of 2013, they hope to have a total of 6,000 animals genotyped. This information provides data for building models which will, in turn, be given to the breed associations to aid producers. In the future, the project could become an international tool by exchanging feed intake and genotype data with other countries.

J. Neil Orth, AICA Executive Vice-President, said this research “helps to strengthen the accuracy of Charolais genetic information, which gives commercial producers more confidence in selection based on tools.”

He said that the AICA will continue to gather data to develop GE-EPDs. Mr. Orth further explained that AICA is in the process of building a database of 50K genotypes on 1,000 animals from members and hope to complete this by 2014.

Jerry Maltby, a producer in attendance and owner of Broken Box Ranch in Williams, California, stressed the importance of this technology to both purebred breeders and feedlot operations. Mr. Maltby raises Charolais cattle and runs commercial cow/calf and feedlot operations, in addition to rice production.

He said that this new technology

affects the feedlot heavily, because producers can select calves from Charolais bulls with high feed efficiency in order to improve profits. “Feed efficiency is the new ‘buzz word,’ and feedlots know this,” said Maltby.

“To develop ways to identify these animals is critical to the whole industry in terms of profitability,” Maltby continued.

“Adding proven feed efficiency to our ability to grow and grade, with the reasonable calving ease on commercial cows, will keep the breed a viable choice” stated Bill Zimmerman. Zimmerman is the owner of One Penny Ranch, Foley, Minnesota and went on to say that he was “overwhelmed and pleased by the number of participants. Several people made the comment that we need to do more things like this”.

“I was reluctant as any and I think we have been prudent to move into this area cautiously. However, when practically-minded scientists like we heard here tell you these things work it’s time to get on board” said Dr. Perry.

Dr. Perry added “genomics are going to enhance our ability to find better genetics at a younger age and thereby increasing our ability to improve or increase the rate of genetic progress.”

Summarizing the meeting Gregorio Farias Mateos with the Charolais Charbray Herd Book of Mexico said “More tools for producers equals more answers for their questions.”

Visit www.charolaisusa.com and click on the link to the field day proceedings.

The Charolais on Feed Field Day presented producers from across all segments of the beef industry the opportunity to come together to network and learn more about the developing technology that could soon be an impactful tool in the beef industry. Knowledge of this up-and-coming technology could soon prove to be a game-changer in both the herd and in the pocketbook, making events like this even more helpful to producers of all ages.