eBEEF newsletter No. 5: July 2017 View this email in your browser

What's happening with eBEEF?

Since the last newsletter, the eBEEF team has been developing and posting additional frequently asked questions (FAQ) videos. The eBEEF team was heavily involved with the recent Beef Improvement Federation meeting in Athens, GA and several articles in this newsletter are from some of those presentations. Traffic to the site has continued to increase and we are getting the occasional online question. These inquiries are greatly welcomed and often result in a fact sheet or the development of a new FAQ. As a reminder, all of the information on the website is meant for the public and we encourage its duplication and usage. We are continually trying to expand our library of videos that deal with FAQs, conference videos and tools; your ideas and suggestions are certainly welcome!

In this newsletter you will find:

- FAQ update
- Video update
- Update on current genomics projects
- Featured articles
- Upcoming events

Go to the FAQ section to find answers to some common beef genetics questions. You have the option to click and read the text or watch a video with the answers. We have recently added new FAQs to the website, bringing the total to 49. Go to: http://www.ebeef.org/faqs.html.

We currently have 146 videos of various formats in our YouTube library. These include answers to FAQs, introductions to fact sheets, extension educational presentations and scientific presentations. These videos can be found at: https://www.youtube.com/channel/UCw8zZL_EaBRC6Pa-4V0OYrA/videos

Research Project Updates

Beef Fertility Project

Dr. David Patterson is currently leading a USDA-NIFA project investigating fertility issues in beef cattle. Researchers have been hard at work discovering candidate loss of function (LOF) alleles. LOF alleles are mutations that "break" a gene and can cause early embryonic mortality, and thus, negatively impact fertility in beef cattle. At the recent Beef Improvement Federation meeting held in Athens, GA, several researchers (Dr. Jerry Taylor and Dr. Alison Van Eenennaam) on the project presented updates on the status of the research and its progress. You can access those presentations here. The project's website can be reached through the eBEEF homepage (link on the top right) or directly through http://beefreproduction.org/. On the website, you'll find a variety of short educational videos covering genetics topics related to the project. These are continually updated, so please check back often!

Water Intake Project

Dr. Megan Rolf has been leading a project on water intake in beef cattle. Water is an essential, but often forgotten, nutrient. There has been little research to quantify the amount of water individual cattle consume under various environmental conditions and to determine how water impacts other economically important traits in beef cattle. At this year's BIF meeting, graduate student Cashley Ahlberg of Kansas State University presented an update on a USDA-funded water intake and adaptability project. She has been working with data on several hundred beef steers with feed and water intake records collected on individual animals using an Insentec system. Her work on test duration, how environmental parameters influence water intake, and water efficiency is ongoing, but you can find an update here. She will also be using genomic data to obtain prediction equations and preliminary heritability estimates as well as further exploring the adaptability of these animals to adverse environmental conditions in the future. If you are interested in heat stress in cattle, please also take a look at the National Cattle Comfort Advisor and videos related to this project at http://beefclimate.org/, or you can directly access the advisor at http://cattlecomfort.mesonet.us/ .

Adaptation Project

Dr. Jared Decker presented an update on the "Identifying Local Adaptation and Creating Region-Specific Genomic Predictions in Beef Cattle" USDA grant. The purpose of this research is to match cattle's genetics to their environment. The team is looking for signs in the DNA of cattle that point to selection to cope with environmental stresses. In analyses of Simmental data, they do find evidence for selection to different regions of the United States. These analyses will be repeated in

Red Angus, Gelbvieh, and possibly other breeds. Ultimately, the team will be using this information to create region-specific genomic predictions. Rather than EPDs for the entire country, EPDs will be tailored to progeny performance in specific environments, such as the Fescue Belt, Gulf Coast, or Rocky Mountains. Research has also shown that hair shedding is a predictor of a cow's performance in hot environments. Decker's USDA grant is developing genomic predictions for hair shedding (for more information, see the fact sheet published on eBEEF.org). A copy of Decker's PowerPoint slides are available at the BIF Conference website: http://www.bifconference.com/bif2017/documents/ProApp-Decker-slides.pdf.

Featured Articles

(These articles can be reproduced for other publications)

Changing the Rhythm of Genomic Selection—Moving from Two Steps to One

Matt Spangler
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All major beef breeds in the U.S. are undergoing a change relative to the way genomic data are incorporated into National Cattle Evaluation (NCE). The change in moving away from "two-step" or "multi-step" procedures to "single-step" evaluations. Two-step methods included estimating SNP effects, applying these effects to newly genotyped animals to get Molecular Breeding Values (MBV), and then producing genomically-enhanced EPD by either fitting the MBV as a correlated trait in NCE or by blending it with traditional EPD using an index-based approach. Moving forward, genotypes will be included directly along with pedigree and performance data in NCE to produce GE-EPD. This change improves efficiency of the entire process and has the potential to more appropriately leverage the growing body of genomic data and enable more accurate selection decisions. Although all breeds are moving in this general direction, there are differences in the statistical models and computing software that will be used. In either case, this evolution represents an exciting change to NCE whereby our utilization of genomic data are continuing to improve. The links below highlight presentations from the recent Beef Improvement Federation meeting that discuss the evolution of genomic selection in the beef industry and new single-step methods that will be used moving forward.

http://www.bifconference.com/bif2017/documents/GS1-Lourenco-slides.pdf
http://www.bifconference.com/bif2017/documents/GS1-Spangler-Van-Enennaam.pdf
http://www.bifconference.com/bif2017/documents/GGP-Miller-slides.pdf
http://www.bifconference.com/bif2017/documents/SD-Mahdi-Saatchi-slides.pdf

Darrh Bullock
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Selection indices have been around for a long time, but only recently gained increased adoption in the beef industry. Today most beef breeds are computing selection indices as a selection tool for their breeders and commercial customers. The nomenclature associated with indices usually includes the word index or has a $ in the acronym.

In order to make wise selection decisions cattlemen are encouraged to define breeding objectives based on their management and market. Factors such as when and how the cattle will be marketed, retention of replacement heifers, feed quality, availability and cost, and other management practices all play a role in determining breeding objectives. Breeding objectives give cattlemen a target to shoot for with their selection program.

Economic selection indices are a means of making selection decisions based on the economic impact of several traits simultaneously and assist in making genetic progress towards increased profitability. In some cases, it allows for the selection of animals based on a single number that reflects the genetic contribution to its offspring's economic potential. In the best-case scenario, all of the EPDs of economic importance to the specific management and marketing scheme are included in the index. If profitability is the goal in the beef industry, then economic selection indices are the best selection tool available to achieve this end.

More information on selection indices can be found at:
http://articles.extension.org/pages/73372/beef-cattle-economic-selection-indices
http://www.bifconference.com/bif2017/documents/GS2-Bullock-slides.pdf
http://www.bifconference.com/bif2017/proceedings/05-bullock-brown-keenan.pdf

What the beef industry can learn about genomics use from other industries

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Leaders in all segments of the beef industry, from researchers to producers to allied industry partners, gathered this June to discuss and guide the improvement of the beef industry at the 2017 Beef Improvement Federation (BIF) Research Symposium and Convention.

During this first general session, Dr. Tom Lawlor began by asking, "What can the beef industry learn from a $251,000 dairy heifer sale?" that was sold in Australia, flown to Canada and bought by Sexing Technologies, USA. Genomics has allowed the dairy industry to make faster genetic gains than ever before. Ten years ago, the

average Net Merit ($NM) gain was $47.95/year and today it has increased to $87.49/year. However, the genomic transition has not been easy and not without its opponents. Lawlor showed a post from a popular industry website, www.thebullvine.com, titled "How genomics is killing the dairy breeding industry." With both views in mind, Dr. Tom Lawlor, Executive Director of Research and Development at Holstein USA and technical advisor to the U.S.'s Council on Dairy Cattle Breeding (CDCB), walked the audience through the dairy genomic journey, pointing out the challenges along the way.

The science of utilizing genomic information

The BovineSNP50 genotyping chip became available in 2008 and the first unofficial genomic predictions were provided to owners of genotyped animals. Routine evaluations began in 2009. "The availability of genomic information has changed the dairy industry forever," Lawlor explained. The drastic increase in the amount of genomic data has provided both challenges and opportunities for those willing to adapt.

The first challenge was the **management and storage of the growing database** and the fact that running a complete genomic evaluation requires a large time commitment. This was resolved by commercializing the national genetic evaluation system to be run by the CDCB (privately funded), in place of the USDA (publically funded). Breeders now pay for the genotyping service and the genomic evaluation. The evaluation prices vary based upon the sex of the animal and the amount of data contributed by the farm or organization to the national database.

Furthermore, the need for **research into the modeling of genetic evaluations** is more important than ever to avoid issues such as genomic pre-selection bias.

One of the greatest opportunities that has come with an increase in genomic data is the ability to **improve lowly heritable traits** and expensive-to-measure traits. Lawlor referred to the present as a "Renaissance Period," citing rapid gains in health, fertility and production traits. The SNP effects for estimating Productive Life (PL) are the equivalent of 80 extra daughters. In addition to genomic evaluations, the dairy industry is using the genotype data for parentage verification and/or discovery, identification of desirable and undesirable alleles and indication of breed purity. This information is being used to keep undesirable genetic disorders at a low level and improve herd management.

It is important to note that **acceptance, utilization and accuracy of genomic information vary** across the dairy industry. As of May 2017, Holstein's have 1.5 million genotypes, while their closest competitor, Jersey's have only 0.2 million genotypes. The Holstein breed is genetically "pulling away" from the other breeds. The average $NM of genomically-tested young bulls is almost $200 more for the Holstein breed ($635) than for the Jersey breed ($445).

The business of genomics

"Genomic testing allows farmers and countries to jump ahead of their competition," Lawlor stated. How can the US as a whole and individual breeders stay ahead then? Both need to *use* the best genetics in the world to *develop* the best genetics

in the world. The US quickly adopted genomic selection and has continued to invest heavily in it. As a result, 80% of the top Total Performance Index (TPI) genomic sires are from the US.

The increased genomic investment is not only from AI companies but seedstock breeders and farmers as well. For seedstock breeders the question is now, “What’s your genomics program?” Today’s breeders are faced with several new questions as to whether to use:

- Younger and genetically superior, genomically-tested bulls or older bulls with milking daughters?
- Participate in genomic testing, and if so to what extent?
- Advanced Reproductive Technologies (ART) - sexed semen, embryo transfer (ET), *in vitro* fertilization (IVF), etc.

The impact of these decisions not only affects the herd’s rate of genetic improvement but also their ability to provide elite genetics and remain sustainable. Consequently, there is a greater difference than ever before between progressive and less-progressive herds. In 2016, the “high” herd (using genomic testing, ET, IVF and sex-sorted semen) made $1,012 more lifetime profit per cow than the “low” herd (using older bulls and little genomic testing). Seedstock breeders are adding IVF facilities to their farms, negotiating their own contracts with AI companies, consulting with geneticists and even studying consumer and economic trends to try to predict where the industry is headed.

The future of genomics

“The current time in the business of genetics is quite exciting,” shared Lawlor. Information from sequencing, especially the 1000 Bull Genome Project, has led to the identification of informative SNPs linked to causative genetic variants. Researchers are investigating the “expected progeny distribution” to better understand and predict the ratio of a sire’s calves that will be average compared to either high or low extremes. There is even the potential for personalized nutrition to match the genotype of the consumer to a dairy product that best fits their needs.

In summary, the dairy industry has faced major changes due to genomics. However, with “some planning…followed by adjusting, adapting and competing” they are now making faster genetic gain than ever before. There have been “winners and less-than winners,” but those willing to adapt have reaped the benefits. The bottom line is that the acceptance and utilization of new technologies, genomics included, is dependent upon its cost effectiveness, long-term sustainability and consumer acceptance.

Upcoming Events

FOOD EVOLUTION, a new documentary from Academy Award®-nominated director Scott Hamilton Kennedy (The Garden), producer/writer Trace Sheehan, and narrated by well-known science communicator Neil deGrasse Tyson, addresses the emotions

and evidence surrounding the controversy over GMOs and food. The film features farmers, scientists, experts and icons, including Mark Lynas, Alison Van Eenennaam, Jeffrey Smith, Andrew Kimbrell, Vandana Shiva, Robert Fraley, Marion Nestle, and Bill Nye. FOOD EVOLUTION travels the world from Hawaii to Uganda, using narrative storytelling to draw on viewers' emotions while highlighting the science around this controversial topic. Funded by the nonprofit Institute of Food Technologists, the film began its limited theatrical release on June 23rd in New York City and has been reviewed by the New York Times, Forbes, LA Weekly, HuffPost, The Washington Post, and others. See the film at a theater near you, request a screening, or preorder the DVD to delve into the central question of the film for yourself, "Amongst all this conflict and confusion around food, how do we make the best decisions about how we feed ourselves?" (Watch the movie trailer here.)

Additional information continues to be added to the website so please come back often and see what is new!

Yours sincerely,
The eBEEF team