MA-EPDS: PERSPECTIVE FROM AMERICAN ANGUS ASSOCIATION

Sally L. Northcutt
Angus Genetics Inc., American Angus Association

Genomic-enhanced Expected Progeny Differences (EPDs), sometimes called marker-assisted (MA) EPDs, are calculated on animals using the American Angus Association® (AAA) database along with the results from the IGENITY® Profile for Angus cattle to provide more thorough characterization of economically important traits and improved accuracy on young animals. Angus breeders have become accustomed to the rapid feedback of this new endeavor, and updated weekly carcass EPDs have become the norm, to provide timely selection tools beyond the classic interim EPD concept.

Implementation Overview

In October 2009, the AAA released National Cattle Evaluation (NCE) genomic-enhanced EPDs for carcass traits. Nearly two years of research collaboration between Angus Genetics Inc.® (AGI) and IGENITY has resulted in an IGENITY genomic profile specific to Angus cattle. The AAA leadership, through AGI, has a vision to provide Angus breeders with the most advanced solutions to their genetic selection and management needs. AGI is a subsidiary of the AAA and is involved in the development and implementation of new technology for use by the beef industry.

The Association's weekly carcass EPDs are composed of the typical pieces one would expect in the NCE, but also include genomic results (referred to as molecular breeding values) if available on animals. Molecular breeding values from IGENITY are derived from a High Density Whole Genome Scan with 50,000 markers (HD WGS).

Angus breeders submit the DNA sample directly to AGI, located within the parent company of the AAA in Saint Joseph, MO. The identity of the animal is recorded through the AGI system with a barcode. An electronic file with this anonymous animal identification and DNA samples are sent to IGENITY for genomic profiling. In three to four weeks, an electronic file of genomic results is returned to AGI for system upload and subsequent carcass genetic evaluation. Only the Angus-specific IGENITY profiles received through this data flow are incorporated into the carcass EPDs. In a weekly update, typically each Friday morning, the genomic-enhanced NCE EPDs are available at www.angus.org/Animal/EpdPedSearch.aspx.

Carcass Evaluation Model

The weekly genetic predictions for carcass merit encompass carcass harvest records, ultrasound scans, and genomic results, as well as pedigree information. The result of the integrated evaluation is genomic-enhanced EPDs for carcass weight, marbling score, ribeye area and fat thickness. The units of measure remain in carcass trait format, and ultrasound data and genomic results serve as indicator traits. Established genetic relationships between the indicator and carcass traits impact the EPDs and accuracy, with the genetic correlations between the molecular breeding values derived from HD WGS and the economically relevant carcass traits ranging from 0.50 to 0.65.

Opportunities

Key benefits of generating NCE genomic-enhanced carcass EPDs on a weekly basis include:

- NCE EPDs are the best genetic predictions for carcass traits, surpassing ratios, interim EPDs, and profile scores as selection tools.
- Pedigree-estimated interim EPDs for young nonparent animals are short-lived or bypassed to provide the more informative NCE EPDs each week.

- Carcass genomic profile results are incorporated into EPDs without a six-month wait for the traditional biannual evaluations.
- Ultrasound-scanned animals receive NCE EPDs within a week of the scan results being processed by the AAA, for a comprehensive prediction beyond what is available from interim EPDs.

Animal Accuracy Example

The beauty of using the genomic data as an indicator trait is that animals at a young age can have carcass trait EPDs prior to ultrasound scanning. As an example, for an Angus calf out of registered parents with no ultrasound scan record and no genomic profile, the EPDs are simply a parental average EPD, or interim EPD, with a default 0.05 accuracy level. If this calf has a genomic result reported through AGI/AAA, the weekly carcass evaluation produces an EPD with accuracies ranging from 0.28 to 0.38 depending on the carcass trait. Unlike the phenotypic data (carcass, ultrasound), the genomic result requires no contemporaries to enter the genetic evaluation. Thus, the genomic profile can be incorporated from animals of any age.

For animals that already have an EPD in the carcass evaluation, the genomic results still have impact on the carcass traits. EPDs may move up, down, or stay the same, and the accuracies increase on animals in cases where there is not extensive data reported for the animal as a parent thus far. As another example, consider a dam with her own ultrasound scan record from a proper contemporary group and 11 scanned progeny. With the dam's own scan record and progeny information in the evaluation initially, the marbling EPD accuracy is 0.25. After her profile results are included in the weekly NCE carcass evaluation, her marbling EPD accuracy improves to 0.37.

Challenges

- The opportunity to provide rapid, more accurate carcass EPDs to Angus breeders has been accompanied with some challenges. Each time the genomic panels are improved, the correlation between the molecular breeding value and the trait of interest must be statistically re-estimated.
- Animals may have existing molecular breeding values in the evaluation and then additional genomic profiles are subsequently purchased by other breeders. This results in the need for database storage and evaluation procedures to handle multiple molecular breeding values on a single animal.
- Association databases must be flexible to receive varying amounts of genomic results on animals, track the source of such data pieces, and check for duplicate records as well.
- While the most current EPDs are available online and breeders are encouraged to use those tools for up-to-date information, the deadlines for printed material and the understanding of the new technology still generate demand for additional outreach and education from the AAA to its clientele.
- Producer uptake and education is a critical challenge. Genomic values presented to breeders that are outside the realm of EPDs and accuracies derived from NCE create confusion as to which selection tools are best for genetic improvement decisions.

Associations will continue to be challenged to direct breeders to use NCE EPDs as the seamless route for genomic-enhanced selection. This will be particularly important as genomic results are available for traits in which phenotypes are more difficult to collect and quantify.