Myth: All calves are created equal---only selling pounds at weaning

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Abstract

The value of commercial cattle, both feeder cattle and replacement females, has traditionally been imperfect as it was basically based on weight and it did not realize the potential value differences of those pounds. Historically, the "reputation" of cattle was limited without facts and true value for the system of beef production. Characterization of cattle genetic merit in the commercial cow herd today allows value differentiation. No longer are calves valued strictly on a weaned calf-weight and price. Selection tools that were typically associated with breed organizations and purchases of registered seedstock can be extended to quantifying genetic value in commercial herds. The use of genomic technology provides metrics for growth and carcass traits to better describe genetic potential for commercial calves. Allied industry delivers DNA tests that can assist commercial producers improve calf crop genetics and value-based marketing options for calf crops. Veterinarians can play a key role in assisting their clientele with sample collection, cow-herd record assessment, and interpretation of genomic results as part of a complete whole-herd management system.

Key words: beef cattle, genotype, genetic evaluation, parentage

Résumé

La valeur des bovins commerciaux, tant les bovins en engraissement que les taures de remplacement, a été traditionnellement mal évaluée car elle était simplement basée sur le poids et non pas sur la valeur potentielle de la différence de ces livres. Historiquement, la 'réputation' des bovins était limitée car elle n'était pas fondée sur des faits et leur vraie valeur dans le système de production de bœuf. La qualification de la valeur génétique des bovins dans un troupeau commercial de vaches permet aujourd'hui une différentiation de la valeur. La valeur des veaux ne s'estime donc plus simplement qu'avec son poids au sevrage et son prix. Les outils de sélection qui étaient normalement restreints aux associations d'éleveurs de race et à l'achat de géniteurs enregistrés peuvent aussi servir pour quantifier la valeur génétique dans les troupeaux commerciaux. L'utilisation du génie génétique offre des mesures de croissance et de caractéristiques de la carcasse qui décrivent mieux le potentiel génétique des veaux commerciaux. Les industries connexes offrent des tests d'ADN qui peuvent aider les producteurs commerciaux à améliorer la génétique de leur production de veaux et offrir plus d'options pour la commercialisation à valeur ajoutée de la production. Les vétérinaires peuvent jouer un rôle clé en offrant de l'assistance à leurs clients pour la cueillette des échantillons, l'évaluation des dossiers de vaches dans le troupeau et l'interprétation des résultats génomiques dans le cadre d'un système de gestion complet de tout le troupeau.

Introduction

A myth that continues to remain in today's beef industry is that all calves are valued equally. Essentially the misconception is that beyond live animal weight, a separation of commercial cattle value under the hide does not exist. Today's consumer preferences for a consistent, high-quality product and the willingness to pay for that product has driven the transition to branded beef programs and coordinated production systems to supply that demand. Animal identification systems and genetic selection tools have evolved over time to dispel such a myth, providing the means to tie the value difference at the consumer level to the value of a weaned calf in the marketplace. Today's cow-calf producer can access and implement genetic selection tools for better breeding and culling decisions. This application of new techniques, particularly in the genomic technology area, provides a mechanism to add value through economically relevant traits to a calf crop beyond individual or gross animal weights. The objective of the presentation is to describe potential ways for characterizing genetic merit of beef cattle to generate profitability while targeting industry and consumer demands.

Genetic Improvement in Beef Cattle Populations

Selection tools in the form of expected progeny differences (EPDs) and index values are traditionally thought to be limited to purebred or seedstock populations. Sire searches and individual look-up websites for registered animals are readily provided by many beef cattle breed associations. The EPDs are a prediction of how future progeny are expected to perform and provide a relative ranking among animals in the specific breed or population.[13] These EPDs do not predict actual performance, but instead characterize genetic differences in future offspring for a specific trait.

Traditional genetic evaluation systems utilize performance measures in proper contemporary groups and ancestral pedigrees to provide the backbone for generating breeding values. One-half the breeding value is referred to as an EPD. The EPDs are reported with a corresponding accuracy value ranging between 0 and 1.00. The accuracy serves as a risk management tool for use with the EPDs. Young sires and natural service sires utilized in breeding programs tend to have lower numeric accuracies. In contrast, artificial insemination (AI) sires that have been used extensively to produce large calf crops across many herds have higher numeric accuracies, and less numerical change in the sire EPDs are expected as additional data are added to the genetic evaluation.

The fundamentals behind EPDs and their application in genetic improvement in the seedstock industry has been documented.[2] Breed organizations report genetic trend tables and graphs to illustrate directional genetic change for traits of economic importance. The expected progeny difference for various traits across all breeds has been reviewed and reported in annual Beef Improvement Federation meetings.[6]

One of the approaches to make genetic progress in a simpler fashion, particularly for commercial bull buyers faced with studying a list of trait EPDs, is to use EPDs and economic weightings as components of a targeted selection index. This index approach has a long history in other species, such as swine, dairy and poultry.[9] Only in the last decade have these index values been provided and adopted as part of the selection tools provided by beef cattle breed organizations.

Recent developments and cost reduction in genomic technology have led to the addition of genomic information into the genetic evaluation systems. Known purebred genetic populations have been genotyped for use in the calculation of molecular breeding values. These values have been utilized as correlated traits in the genetic evaluation models to generate genomic-enhanced EPDs for young animals with only pedigree information.[10] Further work in the use of genomic results considered the direct incorporation of the animal single nucleotide polymorphism (snp) genotype into the mixed-model methodology to generate EPDs.[7,11] Early implementation reports of utilizing snp genotype results in the genetic evaluation was demonstrated in the Santa Gertrudis breed.[5]

Genotyping costs have decreased in recent years. The value of this cost has been found in Australian studies to increase selection response, although this impact varies depending on the type of selection index in practice and the marketing route for calves.[20] Justifying the test cost against genetic benefits also varies in the beef-supply chain.[21] Much of the uptake in genetic testing purchases has taken place in the seedstock sector, and to a lesser extent in the commercial cow-calf herd.

Commercial Genetic Evaluations

With the appropriate genetic evaluation procedures available to utilize various sources of information such as performance, pedigree, and genomic data, it is feasible to generate selection tools for commercial cow herds to add value and marketing potential to future calf crops. This approach stretches beyond the commercial producer selecting sires of known genetics using EPDs and selection index values. Advanced commercial cow-calf operators have the potential to document their genetics, capture phenotypic data, utilize genomic results to build pedigree relationships, and now place selection pressure on the female side in identifying specific marketing targets for calves.

Established genetic evaluation procedures using mixed-model methodology with a relationship matrix is used to generate EPDs for beef cattle breed organizations.[2] The mathematical models can be augmented to include snp genotypes.[7,8] This approach can be applied to commercial cattle populations in the same manner.

Increasing Value in Commercial Cattle

Only in recent years has documentation surfaced on the impact of genetic selection tools, particularly genomic-enhanced values. Return on investment for such technology was summarized for various species.[1] Limited evidence for commercial cow herds has been reported. Yet commercial females with genomic test results are becoming more prevalent throughout the United States. The genomic technology impact on heifers sold through the University of Missouri Show Me Select Heifer Program has been summarized as more producers consign replacement females with DNA testing. Sale heifers that had been genomic tested and designated as Show-Me-Plus heifers received an average $200 per head premium through the program's sales.[4]

Quality grade premiums are available in today's beef cattle marketplace. Commercial producers have the potential to capitalize on these premiums when breeding strategies are aligned. The interest in high quality cattle with marbling genetics to meet branded program specifications goes beyond annual cattle market trends. Last year the beef industry produced nearly 1.6 billion pounds more beef in the US Prime and branded beef categories compared with the year 2004, and the availability of high-quality product has tripled in the last 13 years.[16] This added supply is tied to unequaled demand for the premium product, evidenced by the consistent premiums paid for cattle meeting these specifications. The profit potential available provides a compelling justification to utilize the technology and selection tools in the commercial beef production system.

Availability of Genomic Tests for Commercial Cattle

Initial uptake of genomic technology has been associated with its use in breed organizations. Yet genomic companies serving livestock species offer trait test and genotyping for commercial producers and private entities.[14,19] Commercial cattle can be characterized with molecular

breeding values for various traits. The genomic values are based upon prediction equations derived from databases of genotypes and phenotypes, sometimes referred to as training populations.[19] A calibration of snp marker effects is the backbone of the predicted molecular breeding values and requires updates or recalibration as more information for the animals of interest is available.

Genomic companies and some breed organization also deliver these genomic results as a numeric score or percentile ranking relative to the population of tested animals. This approach relies on company personnel and the commercial producer to interpret the results. Also, private entities can provide an interface to calculating and delivering selection tools to commercial producers.

Test offerings are typically targeted toward growth and carcass traits, since these traits are moderately to highly heritable. Reproductive traits are more lowly heritable, making data collection, analysis, and application of selection tools more challenging with slower genetic progress.[15]

Progressive commercial cow herds have already made genetic progress with targeted sire selection. Parentage assignment is provided in many cases with the DNA test offerings today. Producers that have made breeding decisions using EPDs and index values for AI sires and natural service bulls can document calf genetics for growth and quality grade to add marketplace value. Known parentage sparks interest in potential buyers for the placement of specification genetics to beef industry segments. The concept of sire documentation and cattle valuation is already available for commercial feeder calves.[3,17,18] Genomic testing of the females in a commercial herd can be translated to assess the genetic merit of their steer herd mates when finishing or marketing those calves.

Producers with interest in applying genomic selection tools in their cow herd must first begin with good sample collection. The DNA samples are collected at the ranch level by the producer, veterinarian, or allied industry support. Sample quality is important whether the sample is a blood card, tissue collector, or hair card collector. Veterinarian service and consultation are ideal ways to simplify DNA sample collection and subsequent genotype quality success.

Conclusions

Genomic technology is available to commercial cattle producers for characterizing the genetic potential in market and breeding stock. Veterinarians can play a key role in assisting clients with sample collection and data interpretation as part of a herd management system. Cattle value as a result of existing end-product merit premiums extends beyond the value of an animal by the pound. Genetic evaluation procedures typically associated with breed populations can be extended to commercial cattle datasets. Proper understanding of the use of selection tools at the commercial level and marketing strategies is essential to reap benefits from new DNA technologies.

References

1. Amen TS, Bishop M, Eggen A. Genomics: return on investment - Fact or Fiction? Available at: https://www.asi.k-state.edu/events/2016bif/16_BIF-Proceedings.pdf. *Proceedings* Beef Improvement Federation 2016; 166-176. Accessed May 09, 2017.
2. Beef Improvement Guidelines. Available at: http://beefimprovement.org/content/uploads/2013/07/BIFGuidelinesFinal_updated0916.pdf. Accessed May 09, 2017.
3. Brink JT, Walter ST. Evaluation of cattle earning top grid premiums. 2015. Available at: https://www.agweb.com/livestock/beef/qualitybeef/. Accessed May 27, 2017.
4. Decker JE. Genomic ROI: Early returns suggest premium for Show-Me-Plus Heifers. In A Steak in Genomics. 2016. Available at: http://blog.steakgenomics.org/2016/02/genomic-roi-earlyreturns-suggest.html. Accessed May 09, 2017.
5. Genho J. Updates on implementation of genomic-enhanced national cattle evaluation. 2014. Available at: http://www.bifconference.com/bif2014/documents/PowerPoints/41-BIF2014-GP-SantaGert.pdf. Accessed May 09, 2017.
6. Kuehn L. 2016. Available at: http://www.bifconference.com/bif2016/documents/2016-ABEPD-press-release.pdf. Accessed May 27, 2017.
7. Legarra A, Christensen OF, Aguilar I, Misztal I. Single step, a general approach for genomic selection. *Livestock Sci* 2014; 166:54-65.
8. Lorenco D, Tsuruta S, Fragomeni BO, Masuda Y, Aguilar L, Legarra A, Bertrand JK, Amen TS, Wang L, Moser DW, Misztal I. Genetic evaluation using single-step genomic best linear unbiased predictor in American Angus. *J Anim Sci* 2015; 93:2653-2662.
9. MacNeil MD. Genetic evaluation of an index of birth weight and yearling weight to improve efficiency of beef production. *J Anim Sci* 2003; 81:2425–2433.
10. MacNeil MD, Northcutt SL, Schnabel RD, Garrick DJ, Woodward BW, Taylor JF. Genetic correlations between carcass traits and molecular breeding values in Angus cattle. *Proceedings.* 9th World Congr. Genet. Appl. Livest. Prod. 2010
11. Misztal I, Tsuruta S, Lourenco AL, Masuda Y, Aguilar I, Legarra A, Vitezica Z. Manual for BLUPF90 family of programs. 2016. Available at: http://nce.ads.uga.edu/wiki/lib/exe/fetch.php?media=blupf90_all5.pdf. Accessed May 09, 2017.
12. Misztal I, Legarra A, Aguilar I. Computing procedures for genetic evaluation including phenotypic, full pedigree, and genomic information. *J Dairy Sci* 2009; 92:4648–4655.
13. NBCEC sire selection manual. Available at: http://www.nbcec.org/producers/sire.html. Accessed May 09, 2017.
14. Smith T. Scaled-down DNA test provides assistance in keep-cull decisions. 2013. Available at: http://www.rangebeefcow.com/2013/summaries/CAB-ZoetisKentAndersen.html#.WSgvXOvyuUk. Accessed May 09, 2017.
15. Spangler M. Traditional genetic selection for fertility: Indicator traits and potential antagonisms. 2016. Available at: http://www.appliedreprostrategies.com/2016/proceedings/18-spangler-229-233.pdf. Accessed May 09, 2017.
16. Speer N. Prime, branded beef: more product, steady premiums. Available at: http://www.beefmagazine.com/beef-quality/prime-branded-beef-more-product-steady-premiums. Accessed May 09, 2017.
17. Townsend W, Kemp C. International genetic solutions feeder profit calculator. Available at: http://www.simmental.org/site/index.php/assf-golf-tournament/item/219-international-genetic-solutions-feeder-profit-calculator. Accessed May 27, 2017.
18. Wilkes DL. Technical review of the genetic merit scorecard. 2014. Available at: http://reputationfeedercattle.com/wp-content/uploads/2015/06/RFC-Technical-Paper-22APR15.pdf. Accessed May 27, 2017.
19. Van Eenennaam AL. Use of genetic marker information in beef cattle selection. 2016. Available at: http://www.appliedreprostrategies.com/2016/proceedings/19-van-eenennaam-234-241.pdf. Accessed May 09, 2017.
20. Van Eenennaam AL, Van der Werf JHJ, Goddard ME. The value of using DNA markers for beef bull selection in the seedstock sector. *J Anim Sci* 2011; 89:307-320.
21. Van Eenennaam AL, Drake DJ. Where in the beef-cattle supply chain might DNA tests generate value? *Anim Production Sci* 2012; 52:185-196.