

SHOULD ANGUS BREEDERS BE USING DNA MARKER TECHNOLOGY?

Angus Australia fully supports the incorporation of useful DNA information to improve the accuracy of genetic evaluation. It is likely that the rate of genetic improvement in the profitability of Angus cattle will be enhanced in the near future by more accurate selection based on the combined use of performance records and DNA information.

There is currently a large amount of research directed at the development of DNA markers for traits of economic importance in beef production. Australia is at the forefront of this research, particularly through the efforts of the Co-operative Research Centre for Beef Genetic Technologies (Beef CRC). In addition, there is a considerable amount of public and privately funded DNA marker research being conducted internationally, particularly in the USA.

Angus breeders have benefited greatly from the widespread adoption of performance recording and the use of BREEDPLAN for genetic improvement. As useful, independently validated DNA information becomes available it will be incorporated into the BREEDPLAN system to expand the range of traits with Estimated Breeding Values (EBVs) and improve the accuracy of selection. DNA technologies offer greatest potential to provide information that will improve the accuracy of selection for traits that are difficult to measure in breeding animals (such as feed efficiency and meat quality), or expressed later in life (such as female fertility and longevity).

The methodology for the incorporation of DNA information into BREEDPLAN has been developed by the Animal Genetics and Breeding Unit (AGBU). It has already been implemented for the calculation of trial marker assisted EBVs for shear force (tenderness) in Brahman cattle. This was possible because informative DNA markers that explained variation in shear force were available for the Australian Brahman population. This DNA information was combined with shear force and flight speed measurements to produce trial marker assisted EBVs.

Before DNA information can effectively contribute to the calculation of EBVs the genetic associations between the specific DNA markers with various economic traits need to be established. To date, the existing commercially available DNA markers, or marker panels, appear to explain insufficient phenotypic variation in Angus cattle for their incorporation into BREEDPLAN. It is expected that this situation will change in the future as additional DNA markers are discovered and independently evaluated to show that they explain a useful amount of genetic variation in the Angus population.

At the outset of the current Beef CRC program it was anticipated that DNA technology could explain up to 50% of the genetic variation for economically important traits in the Australian beef industry by 2012. As a result of the early research findings, including the 'SmartGene for Beef' project (www.beefcrc.com.au/SmartGeneforBeef), the Beef CRC has now set a less optimistic target of explaining at least 15% of genetic variation by 2012 (see www.beefcrc.com.au/BeefBulletin). An important finding of the 'SmartGene for Beef' was that DNA markers shown to be associated with genetic variation in

“discovery” populations do not always prove to be useful when evaluated in other populations. This research showed that before particular DNA information can be confidently used in genetic evaluation it needs to be first carefully evaluated in industry populations.

Independent, third-party evaluation of DNA markers is conducted in the USA by the National Beef Cattle Evaluation Consortium (NBCEC, www.ansci.cornell.edu/nbcec). In Australia, evaluation of DNA tests has been conducted by the Beef CRC (www.beefcrc.com.au/Aus-Beef-DNA-results). Results of these evaluations are published on the respective websites for these organizations. Angus Australia is closely monitoring the discovery and independent evaluation of DNA information. We are working with the scientific community and commercial DNA test providers (e.g. Pfizer Animal Genetics, Merial Igenity) to identify opportunities to incorporate DNA technology into Angus BREEDPLAN as soon as possible.

Arrangements are in place with Pfizer Animal Genetics for GeneSTAR Molecular Prediction Value (MVP) profiles from DNA samples submitted through Angus Australia to be loaded onto the Angus database for future incorporation into BREEDPLAN analyses. Similar arrangements will be made with other DNA test providers when they offer services in the Australian market. It is essential that samples for DNA testing be submitted through Angus Australia to ensure the highest quality assurance standards are maintained for results to be included on the Angus database.

A limitation to the application of DNA information in breeding programs is the lack of suitable phenotypic (performance) data to adequately evaluate the utility of particular DNA tests in industry populations. In particular, there is a lack of good quality net feed intake (efficiency) and carcass data on large contemporary groups. Angus Australia is planning a large progeny test program to establish a suitable data resource for the future evaluation of gene markers in Angus cattle. This project will be part of the “Beef Information Nucleus” concept being supported by Meat and Livestock Australia.

Most economically important traits such as growth, meat quality, fertility and feed efficiency are the result of complex biological processes that are influenced by the combined action of many (probably 100’s) of genes. Existing DNA tests are only measuring the genotypes of individual animals for a small number of these genes. However, the technology is rapidly developing, and it is likely that more comprehensive DNA marker panels which explain useful amounts of genetic variation will soon provide an important complement to performance recording to deliver improved rates of genetic improvement. The greatest beneficiaries of this technology will be those early adopters who carefully invest in DNA tests as soon as they are shown to add value to their genetic improvement programs.

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