

DNA markers for the Australian beef industry

DNA technologies are beginning to change the way breeding animals are genetically selected and might soon determine how production animals are managed to better meet specific market requirements.

The technologies themselves have rapidly changed over the past decade, and this has forced changes in understanding by both the research community and livestock industry.

This document was developed by the key research groups responsible for developing and commercialising DNA marker technologies in Australia. It represents our collective understanding and the likely implications of recent findings from a number of research projects including the "Collaborative Research and Commercialisation Agreement" (the CRA) projects, the "SmartGene Project", Beef CRC research and other research activities in the field, to inform public comment on DNA markers for the Australian beef industry.

Research and development results point to:

1. DNA markers with large effects will be the exception rather than the rule for most production traits (a notable exception in meat Tenderness);
2. Most technical experts in the field of animal genetics now recommend that all markers be incorporated into the national genetic evaluation system (e.g. BREEDPLAN) so that their effects can be estimated accurately. Work to progress this is proceeding, and the first direct result of this will be seen in BREEDPLAN EBVs for Tenderness.
3. Utilisation of markers by industry, including inclusion into BREEDPLAN EBVs, will require estimates of the value and utility of any new markers that come onto the Australian market. These estimates will likely be updated from time to time, as occurs with traditional EBVs.
4. As DNA technology develops, it is likely that markers will be used in combinations (known as "panels"). Under this circumstance, the statistical significance of individual markers will be less important than that of the combined effect of a panel of markers when used for either breeding or management decisions.
5. Of the markers now available commercially in Australia:
 - a) Out of four GeneSTAR tenderness markers examined so far, two have consistently shown significant effects in British and three have shown effects in tropically-adapted cattle. The markers that showed significant effects will be incorporated into marker-assisted estimated breeding values (MA-EBV) by October 2008 by the SmartGene Project. The Beef CRC, MLA, Catapult Genetics (a business of Pfizer Animal Health) and other research organisations will be working together to refine and expand the value of these markers as described below.
 - b) The current set of commercial markers for marbling adds limited additional value to selection decisions where EBVs are available. There is insufficient data from cattle of any breed in the Australian databases to test the value of the markers for the very long fed markets. Catapult Genetics will shortly release new markers for marbling and the data to support their effects in Australian cattle populations. In addition, the company will be referencing marbling marker effects against EBV's in over 30,000 animals in Australia and the United States. MLA and the research community are keen to work with them to evaluate these new technologies in the context of Australian beef enterprises.
 - c) Analysis of feed efficiency markers also showed insufficient evidence for their use in trial marker-assisted EBVs (MA-EBVs) for NFI. As is the case for the current

BREEDPLAN trial EBVs for NFI, the feed efficiency markers should be regarded as experimental.

Delivering DNA marker technologies to industry

The parties to this document are all committed to research, development and delivery of DNA marker technology to benefit the Australian beef industry. Some initiatives individually and jointly being progressed include the following.

At the highest level, the MLA and Beef CRC Boards have jointly commissioned a review of the industry structures and processes needed to underpin the future beef industry. The DNA Marker Commercialisation Committee is responsible for identifying the technical and strategic requirements of the commercialisation system, and consulting with the key groups impacted by commercialisation of DNA markers. Development of a large-scale animal resource (a “Beef Genetics Information Nucleus”) for discovery and validation of DNA marker technologies is part of this strategy. More information about this initiative is available from Dr Robert Banks of MLA.

DNA markers used in BREEDPLAN EBVs. The SmartGene Project will deliver an MA-EBV for tenderness through BREEDPLAN for some breeds. It will work with various stakeholder groups to ensure this new EBV is well understood by industry. Project results will be thoroughly tested by the scientific community for efficacy before being disseminated to the beef industry. More information about this initiative can be obtained from Dr Hans Graser of AGBU in Armidale.

DNA markers adding value down the beef supply chain. MLA, Catapult Genetics, the Beef CRC and other research organisations are aiming to deliver value from the DNA markers further down the beef value chain. For example, the impact of GeneSTAR tenderness markers on consumer experience of steaks is the focus of new work that aims to include DNA markers in Meat Standards Australia. This could lead to more cost effective handling of carcasses and greater consistency of meat eating quality. More information about this initiative can be obtained from Professor John Thompson of UNE in Armidale.

Adoption of new technologies. The Beef CRC, Catapult Genetics, MLA and the State Departments of Primary Industries will each be working to integrate DNA marker technologies, and the benefits that can be derived from them, into information packages for the beef industry. These packages are currently being developed and will be available through the above organisations at a later time.

International collaboration essential to rapid and effective development and validation of DNA technologies. The Beef CRC has embarked on a major program of collaboration with US and Canadian research organisations to significantly speed up delivery of beneficial DNA markers to the beef industries of the collaborating countries by expanding the animal resources available to each country. This will enable discovery and validation of DNA markers to a much higher standard than has been available in the past. Further information on this initiative can be obtained from Dr Heather Burrow of the Beef CRC in Armidale

Catapult Genetics reaffirms its strong belief in the promise and value of DNA marker technology for the cattle industry. Catapult Genetics is committed to increased investment in leading edge genomics technology, and to making the fruits of that research available to value-add the Australian beef industry in the form of improved DNA marker panels and associated information services.

Supported by:

Parties to the Collaborative Research and Commercialisation Agreement

Catapult Genetics Pty Ltd

CSIRO Livestock Industries

Meat and Livestock Australia Ltd

NSW Department of Primary Industries

Queensland Department of Primary Industries and Fisheries

University of New England

Parties associated with the SmartGene Project

Animal Genetics and Breeding Unit (AGBU)

Beef CRC Ltd

Breedlink Pty Ltd

Catapult Genetics Pty Ltd

Meat and Livestock Australia Ltd

Queensland Government

24 June 2008