
Is Genetic Technology Keeping Up?

Beef producers at both a seedstock and commercial level now have access to a greater range of genetic technologies than ever before. Access to this vast array of genetic technologies provides all beef producers with the opportunity to significantly improve the genetic merit of their animals and ultimately, improve the profitability of their beef enterprise.

The Genetic Technologies Available

1. BREEDPLAN

BREEDPLAN is a modern genetic evaluation system for beef cattle which uses the world's most advanced genetic evaluation system (based on Best Linear Unbiased Prediction (BLUP) technology) to produce Estimated Breeding Values (EBVs) of recorded cattle for a range of important production traits.

BREEDPLAN has been available in Australia since 1984 and is now utilised by members of approximately 27 Australian Breed Societies. Use of the BREEDPLAN technology has also increased internationally with uptake in New Zealand, Namibia, Thailand, the Philippines, the United States, Canada, United Kingdom, Hungary, South America and South Africa.

BREEDPLAN currently publishes EBVs for 18 different traits on Australian animals. These traits include:

Weight	Fertility	Carcase	Other
Birth Weight	Scrotal Size	Eye Muscle Area	Docility
Milk	Days to Calving	Fat Depth	
200 Day Growth	Gestation Length	Retail Beef Yield	
400 Day Weight	Calving Ease Direct	Intramuscular Fat	
600 Day Weight	Calving Ease Dtrs	Carcase Weight	
Mature Cow Weight			

Further expansion and development of the EBVs available is continuing with Trial EBVs now available for Net Feed Intake (x2) and Flight Time, and Trial EBVs for Structural Soundness (x6) and Tenderness anticipated shortly.

2. Selection Indexes

Selection Indexes combine the BREEDPLAN EBVs for an animal with an economic weighting (based on costs of production and returns on outputs) to produce a single value of an animal's overall genetic merit for profitability in a particular production scenario and market. Selection Indexes are calculated using sophisticated software known as BreedObject.

Selection Indexes enable cattle producers to make "balanced" selection decisions, taking into account the relevant growth, carcass & fertility attributes of each animal to identify the animal that is most profitable for their particular commercial enterprise. Selection Indexes reflect both the short term profit generated by a sire through the sale of his progeny, and the longer term profit generated by his daughters in a self-replacing cow herd.

Standard Selection Indexes are now available for most of the larger Breed Societies in Australia. The standard breed specific Selection Indexes have been designed to cater for the commercial production systems of general relevance in each particular breed. These Selection Indexes are intended for both seedstock & commercial producers.

At the time of writing, the following Selection Indexes were available for Australian animals:

Breed	No.	Selection Indexes
Angus	4	Supermarket, CAAB, Jap B3, Northern Terminal
Hereford	4	Supermarket, Grass Fed Steer, Grain Fed Steer, EU
Shorthorn	4	Domestic Supermarket, Domestic Restaurant, Export Maternal, SB3 Carcase
Limousin	3	Domestic (Terminal), Steer (Self Replacing), Steer (Terminal)
Charolais	2	Domestic Supermarket, Export
Murray Grey	2	Supermarket, Long Fed
Simmental	2	Self Replacing Supermarket, Japan (Terminal)
Santa Gertrudis	2	Domestic Production, Export Production
Brahman	1	Jap Ox

3. TakeStock

TakeStock is a powerful benchmarking tool that was made available to the seedstock industry in 2008. TakeStock collates all available BREEDPLAN and Selection Index information to provide beef cattle breeders with a tool that enables them to assess and improve the rate of genetic progress in their herd.

TakeStock uses the pedigree and performance information that has been recorded with each Breed Society to:

- ❑ Provide a range of statistics relating to the genetic structure of the breed and individual herds.
- ❑ Evaluate the rate of genetic progress that has been made by the breed and the individual herds within it. To do this, TakeStock assesses the genetic progress that a herd has made for each Selection Index and benchmarks the individual herd's progress with the genetic progress that has been made by the breed as a whole.
- ❑ Determine the key factors that explain significant differences in the rate of genetic progress between herds within a breed across a given period of years. These factors are known as Key Performance Indicators (KPIs). The KPIs help breeders identify the type of factors that had the greatest impact on the rate of genetic progress made by herds within their breed. Herds are rated for their performance against each KPI to benchmark the performance of their breeding program.

4. Internet Solutions

"Internet Solutions" is the title given to an extensive range of internet based services that are available to both seedstock and commercial beef producers. Internet Solutions enables beef producers to access and utilise the BREEDPLAN and Selection Index information that is available on an animal in the most effective and efficient manner possible.

Services available under the banner of Internet Solutions include:

- ❑ Member/Animal/EBV Enquiry: This facility enables producers to access member, animal & EBV information as it is recorded on the relevant Breed Society database. A powerful search engine allows producers to undertake a wide range of functions that aid in quick & easy access to information.
- ❑ Sale Catalogues: Online sale catalogues can be accessed for single-vendor auction, multi-vendor auction & private treaty sales. As with the member/animal/EBV enquiry facilities, a powerful search engine allows producers to quickly source superior genetics for use within their breeding program by searching both within a particular catalogue and across different catalogues.
- ❑ Semen Catalogues: Online semen catalogues can be accessed providing a valuable service to the AI industry. This service has similar functionality to the sale catalogue facility.
- ❑ Mating Predictor: A simple EBV calculator provides producers with ability to predict the outcome of a specific mating or range of matings by calculating the expected EBVs of the progeny.

Internet Solutions also includes extra facilities that can be utilised by the seedstock sector such as the ability to submit pedigree and performance information, and access the updated BREEDPLAN information of their animals from a secure file download area.

5. Total Genetics Resource Management (TGRM)

Total Genetics Resource Management (TGRM) is a mate allocation tool available to seedstock producers. TGRM enables seedstock breeders to nominate the sires and dams that are available for use within their breeding program and the software program will allocate the animal matings that will produce the greatest gain towards the herd's breeding objective, while minimising inbreeding.

Widespread adoption of TGRM is currently limited, however increasing the utilisation of TGRM offers an opportunity for seedstock producers to significantly increase the rate of genetic improvement being achieved in their herd.

Future Developments in Genetic Technologies

1. Data Audit

The quality of the pedigree and performance information that is recorded for an animal has a considerable influence on the quality of the BREEDPLAN EBV and Selection Index information that is calculated for that animal. "Data Audit" is a tool currently under development that evaluates the quality of the pedigree and performance information that has been submitted to BREEDPLAN by each seedstock herd.

It is anticipated that Data Audit will:

- ❑ enable seedstock producers to assess their performance recording practices and ensure the quality of the performance information that they record is maximised.
- ❑ enable commercial producers to assess the likely quality of the performance information that has been submitted by a particular seedstock herd.

Data Audit is likely to evaluate the quality of a seedstock herd's pedigree and performance data for such things as completeness of recording, quality of phenotypes and effectiveness of recording (eg. contemporary group structure).

2. Genomics / Marker Assisted EBVs

The next generation of genetic technology undoubtedly relates to the field of genomics. A significant advantage of the genomic technology is the ability to identify the genetic merit of animals for hard to measure traits and the ability to evaluate the genetic merit of animals at an early age. However, while having several advantages, the genomic technology does come with some significant challenges.

At the time of writing, producers could test their animals for 12 gene markers (4 x marbling, 4 x feed efficiency, 4 x tenderness) that are commercially available from Catapult Genetics. Gene Markers identify the chromosome location of individual genes that influence a trait. In isolation, they only account for a small amount of the phenotypic variation expressed for the trait. Over the coming months, it is anticipated that both the number of gene markers available and the number of companies offering gene marker tests will increase significantly.

While individual gene marker tests are currently available, the most effective application of genomic technology to the beef industry is likely to be through combination with the traditional genetic technologies such as BREEDPLAN. Research is currently underway to develop methodology whereby the accuracy of Estimated Breeding Values (EBVs) could be enhanced by incorporating gene marker information with the performance information already available on an animal and its relatives. The combination of both sets of information will result in the calculation of Marker Assisted EBVs. It is envisaged that the first Marker Assisted EBVs may be available by the end of 2008.

3. Multibreed EBVs

Currently, all Australian Breed Societies conduct a separate BREEDPLAN analysis and so the BREEDPLAN EBVs available on an animal can only be directly compared with other animals of the same breed. Feedback has been received from commercial producers that it would be beneficial if animals of different breeds could be included in the same BREEDPLAN analysis so that the EBVs of animals can be compared across breeds. While researchers are investigating this capability, the success of developing an across breed genetic evaluation is ultimately dependent on the availability of suitable data.

As the first step in developing multibreed EBVs, a conversion table has been developed that enables producers to adjust the within breed EBVs of their animals with the within breed EBVs of another breed. The conversion table enables adjustment of the Gestation Length, Birth Weight, 200 Day Growth, 400 Day Weight, 600 Day Weight and Carcase Weight EBVs for Angus, Hereford, Limousin and Simmental animals.

4. International Evaluations

Research is currently being performed to enable the calculation of international genetic evaluations. An international genetic evaluation would enable the direct comparison of animals with other animals of the same breed anywhere in the world.

A feasibility study into running an international genetic analysis for the Hereford breed is nearing completion. The analysis includes 5 traits, 9 countries and approximately 6 million pedigree recorded animals. Results will be presented at the upcoming World Hereford Conference in mid 2008.

Limousin Australia is investigating the potential for a joint genetic analysis with South Africa. This analysis would include herds from Australia, South Africa, New Zealand and Namibia. Several other Australian Breed Societies are also discussing the development of international evaluations for their breeds.

Future Challenges for Genetic Technologies

There is clearly a comprehensive range of genetic technologies available to assist beef producers. This range of technologies is likely to further increase over the coming years. The challenge to both seedstock and commercial beef producers is how to most effectively apply the genetic technology within their breeding program.

A recent analysis of one of the Selection Indexes available for a leading Australian Breed Society illustrated that there was \$4.90 per cow mated difference in the rate of genetic improvement being made per year between the top and bottom seedstock herd. Furthermore, there was a \$2.50 per cow mated difference in the rate of genetic improvement being made per year between the top herd and the average of the breed. This difference clearly identifies that there is a huge potential for beef producers to increase their rate of genetic improvement through better adoption of the genetic technologies that are available.

To assist both seedstock and commercial producers with their use and understanding of the different genetic technologies, comprehensive assistance is available through Southern Beef Technology Services (SBTS) and Tropical Beef Technology Services (TBTS). Further information about both the different genetic technologies and the assistance available can be accessed from either the SBTS (<http://sbts.une.edu.au>) or TBTS (<http://tbts.une.edu.au>) websites.

Article compiled by Andrew Byrne for inclusion in the 2008 Beef Improvement Association (BIA) Conference Proceedings "Beef in a Changing World".