Genomics for Beef Production

Progressing Rapidly but the Fundamentals Have Not Changed

There is little doubt that genomic based information for beef production traits is a rapidly progressing field which is being spurred on by large research organisations (e.g. Beef CRC) and multinational companies (e.g. Pfizer or Merial). In recent times the technology has progressed from reporting individual DNA markers (e.g. stars) associated with production traits to reporting breeding values (e.g. Molecular Value Predictions - MVPs or Molecular Breeding Values - MBVs) based on panels involving hundreds if not tens of thousands DNA markers (normally markers known as SNPs).

It has recently been reported that the Pfizer Animal Genetics stable has released a new high-density 50k panel (i.e. based on 50,000 DNA markers) which is Angus specific and provides MVPs for 13 economically important traits. Also reported is that Pfizer is likely to shortly release generic *bos taurus* and *bos indicus* MVPs based on the high-density 50k panel. The progression can be overwhelming; however the fundamental questions to ask before investing in this technology have not changed which are:

1. **How big of an effect does the MBV have on the trait of interest (for my breed)?** Genomic companies usually publish the amount of genetic variation (GV%) which their marker panel explains for specific traits based on their own discovery and validation populations. Other independent research organisations may also publish this information based on different cattle populations. Past research has shown that results will vary depending on the cattle population (e.g. breed, country). This may become less of an issue with “denser” marker panels which include a higher number of DNA marker, however Charolais breeders should still ask “how much genetic variation is explained by the marker panel for Australian Charolais?” If this data is not available then are you comfortable inferring the outcome from results based other populations (e.g. Charolais in a different country or a different breed).

2. **Does the effect provide a cost-benefit?** As with all breeding value information, such as EBVs or MBVs or a combination of the two, you need to ensure that selecting on specific traits will have a positive effect on the profitability (short and long term) of your herd and, most importantly, the profitability of the herds of your clients. This is through genetic gain for the trait(s) that affect the bottom line for specific production system and market-end points. For example, increasing marbling through genetic selection is not economically important for all market-end points. Once you recognize the traits of economic importance you need to ensure that selecting on those traits through genomic information such as MBVs will provide returns through genetic gain that are greater than the cost of obtaining the MBVs (e.g. sampling, testing, analysis and result reporting). The reported cost of the Pfizer Angus Specify high-density 50k panel is around $180 per sample.

3. **What level of accuracy will the MBV provide?** One of the main potential benefits of genomic information is the ability to select animals at a young age with a level of accuracy not obtainable at that young age through our current EBVs based on pedigree and performance recording. The ability to select animals at a young age with an appropriate level of accuracy for use in the breeding program theoretically allows genetic gain to increase by shortening the generation interval. This is currently being realized in the Dairy industry, but can the same be said in the beef industry? For this benefit to be realized in the beef industry, the reported MBV must, at least, provide higher accuracy for the trait of interest than is available from EBVs based on pedigree alone (i.e mid-parent EBV = half sire EBV + half dam EBV). The accuracy values (i.e BREEDPLAN accuracy) acquired from MBVs are generally published from independent research organizations (see point...
4), while the genomics companies will publish reliability values. A good description of the differences between reliability and accuracy is available at: [http://animalsciences.ucdavis.edu/animalbiotech/Outreach/Marker_Assisted_Selection_in_Beef_Cattle.pdf](http://animalsciences.ucdavis.edu/animalbiotech/Outreach/Marker_Assisted_Selection_in_Beef_Cattle.pdf) As in point 1, Charolais breeders should ask “what level of accuracy, relative to a BREEDPLAN EBV, is obtained from the marker panel for Australian Charolais?”

4. **Has the effect of the MBV been independently validated and published?** In Australia, the Beef CRC in association with the Animal Genetic and Breeding Unit (AGBU) provides an independent validation service for marker panels. They are able to offer this service as they have developed large phenotypic databases based on Australian populations for a range traits and breeds (but unfortunately not including Charolais). Genomic companies are not obliged to validate their panels through the independent validation process, however to date, this has occurred to the benefit of our industry. If the independent results are published they are generally available on the Beef CRC website at [http://www.beefcrc.com.au/Aus-Beef-DNA-results](http://www.beefcrc.com.au/Aus-Beef-DNA-results). The recently approved Charolais Beef Information Nucleus program will provide a high quality database of phenotypes and facilitate marker panel validation (also known as calibration) specific to Australian Charolais.

5. **Has the MBV information been incorporated into Charolais GROUP BREEDPLAN EBVs?** Genomic experts in the livestock sector agree that the best way forward is for genomic based information (i.e. MVPs) on relevant traits to be incorporated into the GROUP BREEDPLAN analysis for each relevant breed with a flow through effect into the breeds Selection Indexes. This process is supported by all sectors of industry including breed societies and the genomic companies. At this point in time, the only Australian breed to produce trial EBVs with the addition of genomic data is Brahman with a Tenderness EBV. Similarly, the American Angus society is producing Carcase EPDs with the addition of genomic data from Merials DNA marker panel. Other Australian breeds will undoubtedly incorporate genomic data into their genetic evaluation in the near future, with Australian Angus being the next most likely candidate with the current release of the Angus specific high-density 50k panel from Pfizer. Again, the recently approved Charolais Beef Information Nucleus program is likely to assist in this outcome for Australian Charolais.

Further information on the progression of genomics for beef production is available from the Charolais SBTS Technical Officer, Christian Duff on 02 6773 2472 or christian@sbts.une.edu.au

*Article compiled by Christian Duff in the June 2010 Charolais Magazine*