



Breed Improvement Article

Genetic Progress and New Types of Data

By Sean McGrath

The world of genetic improvement is undergoing a revolution of sorts. The advancement of technologies such as DNA is occurring at an unprecedented pace, with new tests being offered on a weekly basis. New types of data such as feed intake are also being collected, and enhanced genetic evaluation techniques and methodologies are being developed.

Many seedstock breeders look at this plethora of technologies and are discouraged or confused. Others look at the new developments and pick out one or two technologies as the “silver bullet”. These approaches represent the two extremes in reaction, and in cattle breeding (as with a lot of things) the danger lies in the extremes.

There is no silver bullet in breeding cattle. The key lies in having a firm direction, with the recognition that in some cases direction may be equivalent to maintaining where you are at. The old technologies such as visual appraisal and pedigree analysis are still important, however as they are no longer the sole source of information on an animal, they must be balanced with performance and genetic evaluation.

The idea that we can replace weighing of calves, or scoring traits like docility still lie far out in the future. In fact, the new technologies make collecting this type of traditional data even more important. Tried and true methods such as ultrasound are an integral part of a balanced breeding program with a commercial industry focus.

In addition to existing technologies, DNA testing has burst onto the scene. Contrary to some popular opinion DNA technology does not replace other proven technologies, however it does serve to augment the data. In other words, we still have to weigh cattle, and scan cattle, and score cattle, but with DNA we can add accuracy to genetic evaluation at a relatively early age. These core datasets are needed to assist in the development of DNA technology and the groups with the best foundation datasets are in a position to achieve the greatest gains from developments in the DNA field.

Part of this growth has been the development of lower cost options for parentage verification. The introduction of SNP* technology, which the CLA has endorsed provides a platform for this. Accurate pedigree is the first important component of good genetic evaluation, and empowers both seedstock breeders and their customers to accurately identify their genetics.

Currently SNP technology is being used to interpret the average effect of an animal's contribution to its offspring for a variety of traits. An example that may be familiar to CLA members would be the Igenity panel. As new SNP markers are developed for a trait they are added to the panel and the evaluation becomes more informative. This also means that the evaluation may change. Currently traits may have anywhere from 1 or 2 SNPs to 30 or more available. If you are DNA testing it is important to ask how many SNPs are used for each trait.

Development is ongoing in this field with a new chip now available that assesses 50,000 SNPs per animal and this may increase to over 300,000. If we have trouble dealing with 10 or 12 EPD, imagine 50,000 individual pieces of DNA information.

The only way we can handle this information to positively impact genetic selection, is to relate it to performance and pedigree information and include it in genetic evaluation. Fortunately, much of the development going on in genetic evaluation involves how to incorporate this new SNP information into the system. The ultimate end result will be genetic evaluation using pedigree, performance and SNP data to produce high accuracy EPD on young animals, even those without progeny.

Further work is ongoing in the field of selection index. This an old and extremely effective technology that applies both output and related input costs to a production scenario to select for the most profitable genetic combinations (not necessarily the highest EPD).

What are the Implications for Breeders?

Breeders will continue to be inundated with new information and a sometimes confusing array of products and service providers. It is important to develop a basic level of understanding of some of these techniques, both new and old so that they can be applied expeditiously in a breeding program.

Having breeding goals is now more important than ever. Because of the tremendous power inherent in combining traditional and new technologies in decision making it will become possible to achieve genetic gains and/or screw up at a faster pace than ever before. Using all the available information on available breeding stock will become increasingly important.

Unfortunately, there is no silver bullet and new technology must be built on doing the fundamentals right. This means accurate pedigree and performance data recording, ultrasounding and careful application of DNA technology.

It appears that the end result of SNP technology will be EPD available on more traits, including hard to measure traits such as feed efficiency, as well as greatly increased accuracy on traits we already report. The addition of more traits to genetic evaluation means that the proper application of selection index will become more important as well, to objectively sort through the available information.

It is perhaps the most exciting time in the history of beef cattle selection, as new tools are rapidly emerging and are becoming extremely cost effective. Having a direction to the breeding program and staying generally aware of these tools is becoming ever more important to maintaining a successful program.

*SNP = Single Nucleotide Polymorphism – a variation in one of the base pairs in a small piece of DNA. These small differences are passed on to offspring by their parents and may be associated with a variety of characteristics expressed by the animal.