
Limousin Breeders Are Utilising DNA Technology

Advances in DNA technology are providing seedstock producers with an ever increasing range of new tools to help them to achieve their breeding goals.

An indication of the rapid advances being made is that the mapping of the cattle genome using the cow Dominette 01449 took six years of international effort at a cost of USD \$50 million with details published in April 2009. With current technology the DNA of an animal can be sequenced very quickly for about USD \$50,000.

The most basic use of DNA technology is for the verification of the parentage of calves to ensure that the pedigree of animals in breed society breed registers is accurate. The calculation of Estimated Breeding Values (EBVs) relies on accurate parentage. The Limousin breed association requires DNA typing of all sires and embryo donor dams to enable random checks of parentage of calves.

Nearly every breed has one or more recessive genetic defects which can be fatal if the calf inherits two copies of the defective gene. Most of these defects can be identified by DNA testing so it is possible to identify carrier animals and therefore avoid the breeding of diseased calves.

Limousin cattle exhibiting the genetically based disease, protoporphyria, are now a rarity because of a DNA testing program implemented in the mid nineties. All AI sires must be tested but the testing of cows is voluntary.

There is a demand for black animals by some segments of the market for Limousin bulls. About 20 percent of registered Limousins are black. Black is a dominant gene which has been inherited from Angus cattle in the grading up process to Purebred Limousins. It is advantageous to be able to identify those black animals which carry two copies of the black gene as they will produce 100 percent of black progeny when joined to red cows.

Some Limousin breeders have been DNA testing their black cattle for red and black genes since the early nineties. Animals carrying two copies of the black gene are termed homozygous black. If two homozygous black animals are mated then the progeny will always be homozygous black so do not require testing.

Development of a DNA test for the polled gene has proved to be much more difficult than anticipated. Like the black gene the polled gene is dominant so an animal only has to carry one copy of the gene to be polled. It is advantageous to identify homozygous polled animals which produce 100 percent of polled progeny when joined to horned animals. Just over 50 percent of Limousins bred in Australia and New Zealand are now polled

A test for the horn/poll gene has been available from USA based genomic companies, MMI and Igenity since 2001 but it is expensive at \$88US to \$120US and is only about 90 percent accurate.

A new horn/poll test developed by the Cooperative Research Centre for Beef Cattle in Australia has recently been made available by the University of Queensland Genetics Laboratory in a development phase. The test was developed for Brahman cattle and is currently not very accurate in Limousin cattle which have inherited the polled gene largely from Angus cattle. With further research the test may become more accurate in Limousin cattle.

The F94L muscling gene is almost unique to the Limousin breed. Animals carrying two copies of this gene produce 19 percent more retail beef and are six percent more tender than animals which do not carry any copies of the gene.

The frequency of the F94L gene in French Pure Limousin cattle is 98.5 percent and close to 90 percent in graded up Purebred Limousin cattle. A test for the F94L gene is available from the University of Queensland Genetics Laboratory.

Development of DNA marker tests which predict the genetic value of an animal for traits controlled by many genes such as growth, feed efficiency, marbling and tenderness has proved to be more challenging than predicted by most molecular geneticists.

The early development of marker tests by Catapult Genetics (now owned by Pfizer) has proved not to be informative for feed efficiency and marbling. The markers for tenderness explain significant amounts of genetic variation in Brahman cattle but only small amounts of genetic variation in British and European breeds.

The focus is now on DNA tests which measure 50,000 single nucleotide polymorphisms (SNPs) in each animal. A SNP is a very tiny piece of DNA which exhibits variation between animals which may influence a trait. A 50K Angus test has been released in North America by Igenity and a 50K Angus test was released by Pfizer Animal Genetics in Australia and New Zealand in April this year.

It is expected that a 50K Taurus test and a 50K Indicus test will become available from Pfizer in the foreseeable future.

However, even the ability to measure 50,000 SNPs is explaining well less than the target of 50% of the genetic variation for traits such as growth, feed efficiency, marbling and tenderness.

The release of a test by the US company, Illumina which measures 850,000 SNPs in cattle is eagerly awaited.

The most logical way of presenting the results of marker tests such is to incorporate the results into EBVs. The accuracy of the EBVs will be higher than if calculated only from a pedigree and performance measures.

The increase in accuracy of the EBV depends on how much genetic variation is explained by the DNA markers and how accurate the EBV already was using pedigree and performance information.

The results of the 56 marker test available from Pfizer are currently incorporated in the EBV for tenderness in Brahman cattle in Australia and the results of the Igenity 50K test are being incorporated into EBVs for some traits for Angus cattle in the USA. Information from the Pfizer 50K Angus test is likely to be incorporated into EBVs for Australian and New Zealand Angus cattle in the near future.

Before marker information can be incorporated into the EBVs for a particular breed the amount of genetic variation being explained by the marker results must be calculated. The Australian Limousin Breeders' Society which includes Limousin cattle in Australia and New Zealand has embarked on two ambitious projects to provide the data to allow this calculation.

The Limousin Information Nucleus project which is a progeny test program utilising ten to 15 Limousin bulls mated to British breed cows each year for three years. All birth, growth, carcass and eating quality traits will be measured on each drop of calves which will be finished for 100 days in a commercial feedlot after backgrounding on pasture or oats.

Calves from the first cycle have just been born and the second cycle of the project will incorporate a New Zealand bull, Glencairn York. The \$1.6mill project is partly funded by the Meat and Livestock Australia Donor Company.

A second project to collect semen straws from 250 Australian and New Zealand Limousin sires with high accuracy EBVs is also underway. DNA extracted from these semen straws will be tested with the 50K DNA test and the test results correlated with the high accuracy EBVs of these sires.

Article compiled by Alex McDonald, August 2010