

Commercially Available Genetic Tests and Markers for Parentage and Breed Validation, Coat Color, Polledness, Carcass Merit and Freemartinism

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Introduction

There are a number of genomics companies offering genetic tests for a variety of genetic conditions including parentage and breed validation, black vs non-black (red) coat color, polledness, marbling, cutability and tenderness, and freemartinism (heifers born twin to bulls).

In addition to these, there are also tests for scrapie susceptibility in sheep and goats (scrapie is thought to be a close relative of BSE), muscling and fecundity in sheep, and milk production components and structural defects in dairy cattle. A complete discussion of marker use can be found in the TCE electronic bulletin E-352 [Texas Adapted Genetic Strategies for Beef Cattle - XI: Marker Assisted Selection for Beef Improvement](#) (<http://tcebookstore.org>).

The following is a noninclusive list of companies that currently conduct some of the genetic tests for beef cattle. The websites for the companies offering the tests are listed when they are first discussed.

Parentage Validation, DNA Traceback and Breed Composition

The benefits of a DNA-based parent verification system include easily reproducible and cost effective with high accuracy (>95%, depending on whether one or both parents are included), use in multi-sire herds, ease of collection and storage of samples, and can be used at any time in the animal's life (even at birth). DNA traceback can be used for product tracking, tracing product back to a location, and determining product composition. Breed composition could be used by branded beef programs using breed specific designations.

Parentage Validation

Parentage and Identity Tests - Genaissance (<http://www.genaissance.com>)
SireTRACE - Genetic Solutions (www.geneticsolutions/au) and U.S. partner Bovigen (www.bovigen.com)
Igenity ParentMATCH - Merial, Inc. (www.igenity.com)
MMIG Parentage and Identification - Metamorphix, Inc. (www.metamorphixinc.com)
Parentage - Viagen, Inc. (www.viagen.com)

DNA Traceback

SureTRAK.- Genetic Solutions and Bovigen
Igenity DNATrace - Merial, Inc.
Breed Identification and BreedSure - Viagen, Inc.

Breed Composition

AngSure and Inducator (Angus and Brahman, there are markers for other breeds) - Viagen, Inc.

Color and Polledness

The gene for black coat color is dominant to the gene for red and the gene for polledness is dominant to gene for horns so, unless an animal is red and horned, its actual genotype for these two conditions is unknown without time consuming and costly progeny testing. The genetic tests for black vs non-black (red) coat color and polledness vs horned were among the first to be developed and marketed commercially. Black coat color has economic value to buyers due to a perception that it represents higher marbling in the beef and is required by some marketing programs. Therefore buyers seek cattle, especially bulls, that have two black genes so that their offspring can only be black. Polledness is sought by buyers to reduce bruising and to increase safety when handling cattle. Bulls with both copies of the polled gene have value to those buyers.

Black/non black

Premium Black - Genaissance \$14.00

Red Factor - Genetic Visions (www.geneticvisions.net) \$40.00

Homozygous Black - Metamorphix, Inc

MMIG Homozygous Black tests for three different conditions:

Homozygous Black – The animal will always pass on a black gene to its progeny.

Heterozygous Black/Red Carrier – Although the animal is black-hided it may pass on a red gene to its progeny

Heterozygous Black/Wild Type Carrier – Although this animal is also black-hided it may pass on the wild type gene to its progeny. Progeny receiving one copy of the wild type gene will exhibit the color of the gene inherited from the other parent.

Cost is \$35.00 per sample

Polled/horned

Tru-Polled - Metamorphix, Inc. The results are reported as:

Homozygous polled = two copies of the polled gene.

Heterozygous polled = one copy of the polled gene and one copy of the horned gene.

Horned = no copies of the polled gene, two copies of the horned gene.

Inconclusive = the test cannot determine if the animal has copies of either the horned gene or the polled gene (there is no charge for these results).

Only polled animals should be tested as the genotype of horned cattle are known.

Breeders can expect inconclusive results for 10 to 15 percent of the animals tested.

Cost is \$110.00 per sample.

Carcass Merit

Currently there are a number of genetic tests or markers that are available for use in testing for carcass merit (marbling, tenderness and cutability). These markers have been widely promoted, used and some have been validated by numerous laboratories. However, not all of these markers are useful in all breeds, especially in *Bos indicus* cattle.

Marbling

GeneSTAR Marbling - Genetic Solutions and Bovigen

Igenity-L - L-tt (both coding for thymine) tend to be higher quality grading, Merial, Inc.

Cutability

Igenity-L - L-cc (both coding for cytosin) tend to be higher yield grading, Merial, Inc.

Tenderness

Beef Tenderness (mu Calpain) Premium Test - (potential for use in Bos indicus cattle)

Genaissance

GeneSTAR Tenderness1 and 2 - Genetic Solutions and Bovigen

TenderGENE - Merial

Other Genetic Tests

Some chromosomal abnormalities, known as Robertsonian translocations, is the result of the joining of two non-homologous chromosomes. These translocations lead to abnormal segregation of chromosomes during production of ova and sperm and can cause reduced fertility and increased return to service. Translocations in cattle frequently involve chromosomes 1 and 29 (1/29 translocation) and chromosomes 14 and 20 or 21 (14/20 or 14/21 translocation). A study of Charolais cattle in France reports that 3.8% of animals are carriers of the 1/29 translocation. The frequency in American Charolais is not known. Translocations can be detected by chromosome screening procedures.

About 92% of females born as twins to males are infertile and are called "freemartin" heifers. At one time it was thought that since the male fetus develops earlier than the female, male hormones affect the development of the female. Although the cause of infertility is not fully understood, it is associated with the exchange of cells between twin fetuses via fused blood vessels of fetal placental membranes (placental anastomosis). Freemartins have both female and male cells in their blood. The test requires a blood sample from the female twin. Calves can be tested at any age after birth.

The College of Veterinary Medicine at University of California at Davis currently conducts both of these genetic tests.

Summary

There are a number of genetic tests available to beef cattle producers (and other livestock producers) to determine part of their genetic make-up. Some of these validate important (or what are considered important) production traits while others can be used to prove parentage or purity. In the future, there will be many more tests available for use for beef producers.