

GUIDE TO GENETIC TOOLS FOR BEEF PRODUCERS

Modern genetic tools allow cow–calf producers to make more informed breeding and management decisions. From verifying parentage to accelerating genetic progress, these tools can improve profitability, reduce risk and support marketing goals. The following guide outlines some available genetic tools, how they are applied and the benefits they provide to commercial cow–calf operations.

Parentage Testing

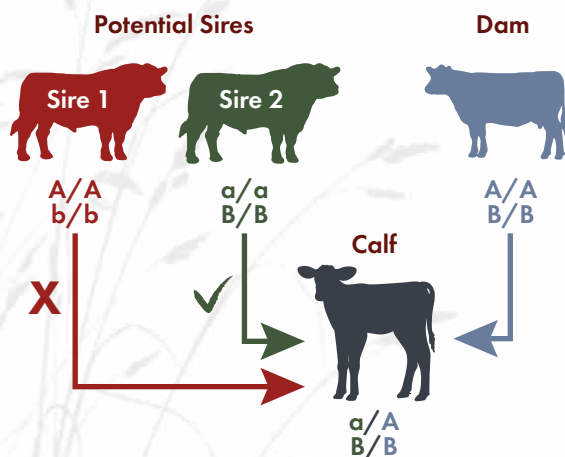
Parentage testing uses single nucleotide polymorphism (SNP) markers to match calves to their biological sire and dam. DNA can be collected using tissue sampling units, hair follicles or blood samples.

Common Uses

- Identifying sires in multi-sire breeding pastures
- Comparing bulls for real-world performance such as:
 - Number of calves sired
 - Calving distribution (early vs. late calves)
 - Calf value at weaning
- Resolving unknown or incorrect pedigrees
- Verifying parentage claims for seedstock or value-added programs

Key Benefits

- Identifies the most and least productive bulls under commercial conditions
- Helps shorten calving seasons by selecting bulls that sire earlier born calves
- Improves accuracy of replacement heifer selection through sire identification



Depicted above: Parentage testing uses SNP markers to identify each calves biological sire and dam.

Abnormality (Defect) Testing

Abnormality testing focuses on gene mutations associated with known genetic defects within specific breeds. These tests identify carriers or affected animals before problems appear in the calf crop.

Examples

- Arthrogryposis multiplex (curly calf syndrome)
- Chondrodysplasia (dwarfism)
- Syndactyly (mulefoot)
- Hypotrichosis (hairlessness)

Common Uses

- Prior to purchasing or using seedstock bulls or females
- When making breeding decisions
- When a suspected genetic condition appears in a herd

Key Benefits

- Prevents carrier-to-carrier matings that result in affected calves
- Protects herd reputation and buyer confidence
- Reduces calf losses, veterinary costs and welfare concerns
- Maintains eligibility for breed association sales and programs

Marker-Assisted Selection (MAS)

Marker-assisted selection (MAS) in beef cattle uses DNA markers to identify animals with desirable genes for traits associated with growth, fertility and carcass quality. These traits are not observed until later in life.

Examples

- Leptin
- Double muscling or myostatin variants

Common Uses

- When the trait has a clear and direct market value
- If buyers prefer a specific physical characteristic (e.g. black coat colour, polled calves)

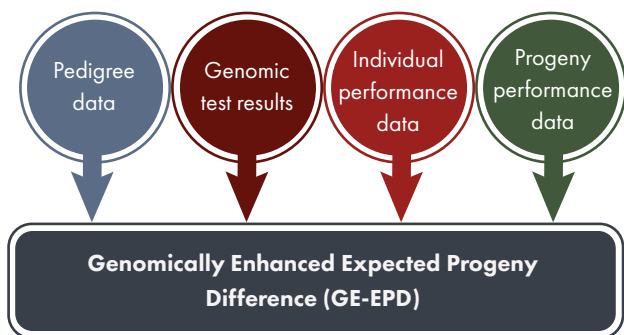
Key Benefits

- Allows fast and reliable selection of specific traits
- Eliminates unwanted characteristics (e.g., horns) without long selection timelines
- Works alongside expected progeny differences (EPDs), which are better suited for complex traits like growth or fertility



Genomically Enhanced Expected Progeny Differences (GE-EPDs)

GE-EPDs combine DNA information with traditional pedigree and performance data to improve the accuracy of expected progeny differences, especially in young animals with limited records.



Depicted above: The types of data that inform GE-EPDs.

Common Uses

- Purchasing bulls, particularly yearlings
- Comparing animals across different herds or geographical regions
- Replacement heifer selection
- Designing more precise breeding programs

Key Benefits

- Reduces selection risk by increasing prediction accuracy the same amount as having added performance information from seven to 23 offspring
- Accelerates genetic progress across economically important traits
- Enables more confident selection for fertility, growth, carcass value and maternal performance
- Improves the usefulness of selection indexes when making selection decisions

Genomic Profiles (Multi-Trait Genomic Tests)

Genomic profiles evaluate thousands of DNA markers simultaneously and generate scores or indexes for multiple traits. These tests are commonly used on heifers and cows and often include parentage verification and breed composition.

Common Uses

- Bull selection
- Selecting and retaining replacement heifers earlier in life
- Aligning females with long-term breeding objectives
- Sorting heifers into different mating or management groups
- Adding value to bred heifers or replacement females for sale

Key Benefits

- Enables earlier and more accurate selection decisions
- Improves herd uniformity and consistency
- Speeds progress in maternal, fertility and efficiency traits
- Strengthens marketing claims for replacement females and bred heifers