



Genomics in ACTION

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The South African Santa Gertrudis breeders have taken full advantage of the second round of the Beef Genomics Program (BGP2). From the very first year of BGP2, the breed has set the pace by exceeding their allotted genotyping quota by over 250 animals and achieving an impressive 150% compliance rate. The momentum continued in year two, with the breed exceeding their quota by 111 animals and reaching a 120% compliance rate! With year three around the corner, the expectations are high and the trajectory is clear. This has allowed the breed to grow their genomic reference population to more than 2000 animals. Several herds from breeds registered with SA Stud Book have adopted genomic testing as an essential breeding and management tool. **This**

level of adoption reflects a clear understanding of the long-term value of genomics, allowing the breeders to reap the full benefit of the latest technology.

Polledness

The two POLLED mutations that can be tested for genomically, are the Celtic (P_c) and Friesian (P_f) variants. The more recently discovered Mongolian (P_M) and Guarani (P_G) mutations, which also cause polledness, are being investigated by the SA Stud Book team to be provided via a genomic test soon. Figure 1 below, indicates that both the Celtic and the Friesian POLLED variants are both segregating in the South African Santa Gertrudis population.

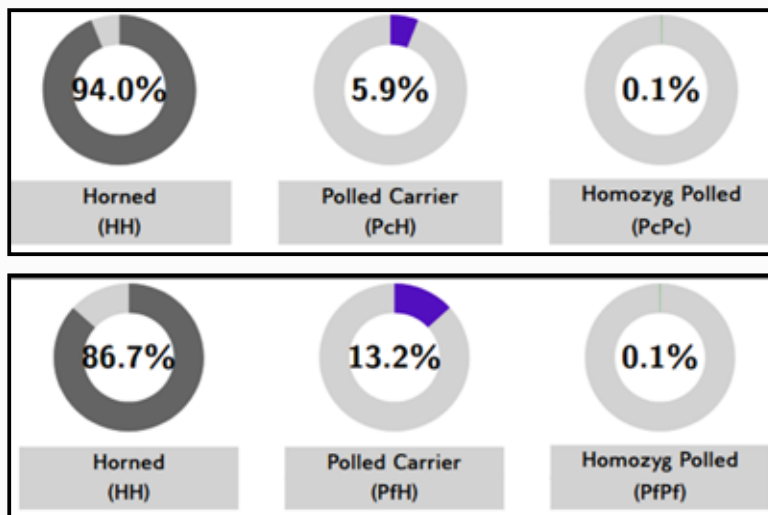


Figure 1. POLLED variants detected in the South African Santa Gertrudis breed.

What must be noted, is that when mating a PcH (carrier of the Celtic polled variant) bull and a PfH (carrier of the Friesian polled variant) cow, there is a 75% guarantee of getting a polled calf. Animals that carry one copy of any of the POLLED variants, meaning they are genetically PcPf, have been observed and are considered homozygous polled. This is explained in Figure 2 below.

Double Muscling

E226X is the new double-muscling variant that has been found in the South African beef cattle population. Although described as Beef



Figure 3. Double muscling gene variants found within the Santa Gertrudis population.

This highlights a need to screen these animals to reveal their double-muscling status prior to considering them, with the added benefit of genomically enhanced breeding values assisting the prediction of their breeding potential.

Detrimental Recessive Mutations

Genetic disorders such as Crooked Tail, Osteopetrosis, and Mule Foot cause distinctive phenotypic abnormalities, often mistaken for general weakness or poor health in calves. **Glycogen Storage Diseases** (GSD, including Pompe's disease), resulting from mutations that impair glycogen storage, is a mutation that is currently being monitored to eradicate this recessive mutation from the South African beef cattle population. Retinitis Pigmentosa (*RP1*) is an ocular disorder that causes complete blindness in animals, but

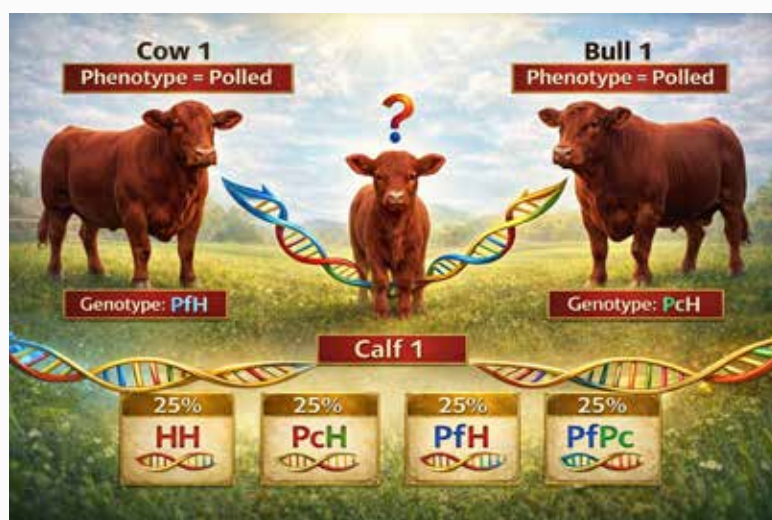


Figure 2. All potential combinations in a calf when mating of PcH with PfH.

is only exhibited in animals over four years of age, meaning it is a progressive degeneration of the photoreceptors. Maple Syrup Urine Disease (MSUD) is a lethal genetic abnormality, with two variants observed within the South African beef cattle population. Affected calves are unable to break down complex amino acids due to a defective enzyme. The build-up of these complex amino acids causes lethal brain damage, affected calves are typically born without symptoms, but by 2 to 4 days old become slow, dull and eventually recumbent. The calf will often throw its head back and lie on its side, unable to rise. To reduce the risk of these disorders, genomic testing of sire bulls is essential to exclude carriers and ensure herd health. Santa Gertrudis breeders are hereby asked that if a calf seemingly exhibits one of the above mentioned recessive disorders, that a hair sample of the calf is taken in order to confirm if it is indeed a recessive genetic disorder.

Genomic Positioning of the Breed

The (3-dimensional) Principal Component Analysis (PCA) plot (Figures 4 and 5), simply referred to as a “GeneBox”, illustrates the genetic relationship of the South African Santa Gertrudis breed relative to other South African breeds. Each dot represents an individual animal, and clustering reflects shared genetic similarity across thousands of genomic markers. Two GeneBoxes have been included from different angles to encapsulate the three-dimensional aspect of the plot. The Santa Gertrudis cluster (dark red cluster in the middle of both pictures) forms a distinct, well-defined cluster with clear separation from the other breeds. The Santa Gertrudis cluster sits halfway between the Beef Shorthorn cluster (light blue cluster at the bottom of the first image and on the right hand side on the second image) and the Boran cluster (orange). Although the Boran is not part of the historical ancestry of the breed, the Brahman that is included in

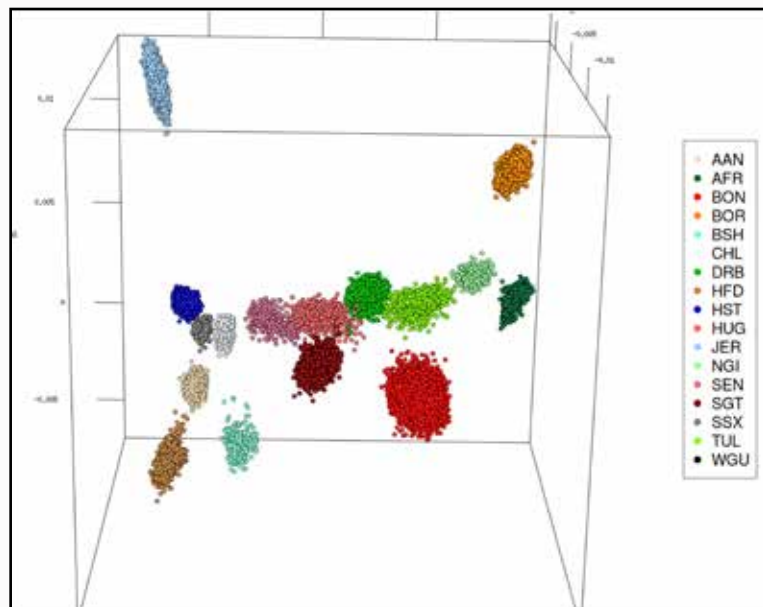


Figure 4. GeneBox to show the Santa Gertrudis genetic relatedness to other breeds, Angle 1.

the breed’s make-up is expected to cluster close to the Boran due to shared *Indicine* ancestry and can be used as a reference. Unfortunately, Brahman cattle are not included in the plot. As more genotypes for each breed are added and the genetic reference populations per breed are expanded, the genomic relationships between the clusters will become even more apparent.

The integration of genetic testing into the breed provides an increasingly powerful framework for managing the Santa Gertrudis breed. The GeneBox highlights the breeds’ distinct yet composite

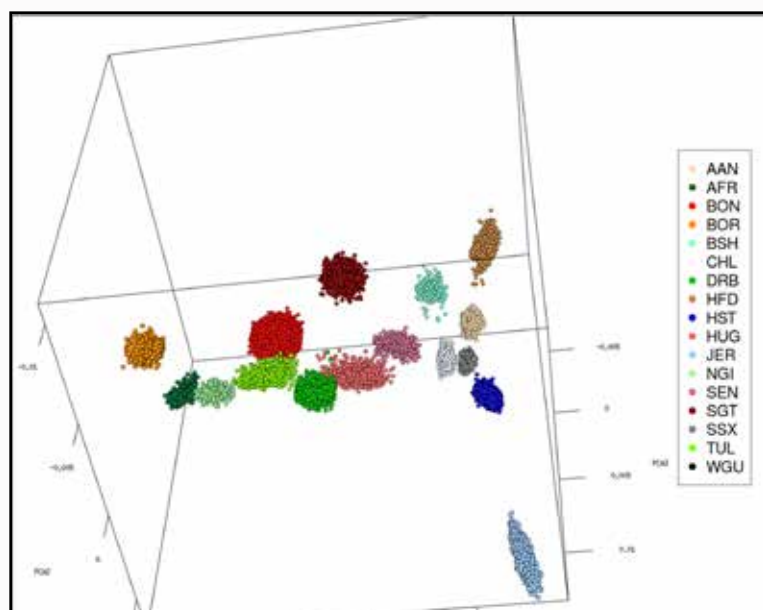


Figure 5. GeneBox to show the Santa Gertrudis position in relation to other breeds, Angle 2.

genomic architecture. At the same time, the detection and management of detrimental mutations remain critical to safeguard the long-term fitness of the population.

These latest “Geneboxes” are a part of the ongoing development of the Breed Composition Purity Key. SA Stud Book will launch the newest

Breed Key in 2026, introducing this as an added feature when genomically testing animals, and will allow for accurate tracing of upgrading, as well as identifying the breed history in contributing to a composite or admixed animal.

Cattle Genetic Testing



Identity:

- DNA Profile and Parentage Testing
- 50K Illumina Bovine BeadChip

Characteristics:

- Polled
- Milk Production

Single Mutation Tests:

- Congenital Myasthenic Syndrome (CMS)
- Pompe Disease
- Myostatin (F94L, nt821, Q204X)
- Bulldog Dexter



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