



The future of South African horse breeding

By Johan Griesel, geneticist, SA Stud Book

SA Stud Book is joining hands with local horse breeders to unlock an exciting opportunity to deepen the genetic understanding of South Africa's equine population and to build scientifically sound breeding regimens. Such an approach can help breeders combat genetic diseases and rear animals of superior genetic merit, supported by a clearer understanding of the underlying genetics.

At present, genomic technology and genetically informed breeding programmes remain underutilised in South African horse breeding. Those who adopt these strategies are likely to gain a competitive advantage.

From microsatellites to genomics

Microsatellite technology gained global traction in the early 1990s and was marketed as 'DNA testing', even though it does not examine the DNA sequence itself. Instead, it measures the length of specific DNA regions, known as microsatellite regions. By comparing the lengths of these regions, geneticists can deduce parentage (and identity) through deductive reasoning.

While this approach has served the industry well, it has become outdated worldwide. Manufacturers are phasing out the hardware and software required for testing. Over the past two decades, SNP-based genomic methods have become the global standard.

SNPs (single nucleotide polymorphisms) are markers that occur at specific positions in the DNA sequence and differ frequently enough among individuals to be reliably used to track DNA regions, genes, and ultimately heritage (and parentage). Unlike microsatellite markers, which measure DNA length, SNP data reflects the actual genetic code at a specific location. Knowing the genetic code at a specific point on an

animal's DNA can reveal much about the surrounding DNA.

Enter equine testing

SA Stud Book introduced genomic testing in 2013. In equine testing, the Illumina Equine 80K Select BeadChip is used, reading approximately 80 000 SNP markers – far more than the 42 microsatellite markers traditionally used in equine testing. This substantial increase makes the test significantly more reliable and far less likely to fail. Because SNPs represent direct sequence data, it is also more useful and concrete than length-based data derived from microsatellite testing.

Traditional DNA testing can struggle to resolve parentage among closely related animals, such as when potential sires are father and son, or full- and half-brothers. It also requires samples from both parents and the progeny and can only exclude parentage with certainty. Furthermore, it provides limited insight into the gene content of an animal and has little use in broader population studies. Separate tests are needed to identify specific genes, and microsatellite data are generally incompatible with genomic data, limiting its usefulness in future parentage verification.

By contrast, genomic tests can resolve closely related parentage cases with high certainty, requiring only one parent's genomic data. If a parent's genome is already on record, parentage discovery via genomics becomes possible even without prior identification. SNP markers are also future-proof and compatible with whole-genome sequencing technologies that read every letter of an animal's genetic code. This ensures that current data remain relevant for future analyses and follow-up testing.

SNP markers can also be used for detecting beneficial and disease-causing

genes as part of standard parentage testing. Unfortunately, attempts to utilise microsatellite to SNP imputation technologies have often been met with failure. The international community has indicated that they will be transitioning away from microsatellite DNA technology to SNP-based genomic technology; hence, animals that have already been DNA tested will have to undergo genomic testing.

Improving animal competitiveness

At SA Stud Book, genomic testing methods are scientifically validated and admissible in court. Even in well-managed breeding programmes, human error occurs more often than breeders may realise. In response, many other species' breeder societies are considering mandatory genomic parentage verification to protect the integrity of pedigrees, and safeguard the reputations of breeders and valuable animals and bloodlines.

Relatively little is currently known about the genetic composition of South Africa's horse population. As a result, some animals are likely carriers of deleterious genetic conditions without breeders' knowledge, and certain pedigrees may contain inaccuracies. Participation in a genetic breeding programme, supported by genomic testing, is therefore essential. All data provided is confidential; however, it can be used by geneticists to guide breeding programmes that reduce harmful genes while promoting superior genetic stock.

While parentage verification and harmful gene screening lay a strong foundation for equine breeding, it must be remembered that they represent only the beginning. As more data accumulates, so too will insights into the landscape, and the future, of the South African horse industry. **SF**

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For enquiries, send an email to the author at Johan.g@studbook.co.za or visit www.studbook.co.za

