

Animal breeding is not an exact science, but the study of genetics is. Many cattle stud breeders are excellent stockmen, but despite breeding very good animals to common standards, precious little genetic science is applied in their breeding policy. When asked to reproduce their feats or explain the methods used to achieve the desired outcome, the answers are often vague. This could be described as the 'BEST' philosophy, where one breeds the best with the best and hopes for the best!

The Nguni cattle breed is unique in the sense that the foundation stock for today's stud breeding was established through natural selection. By contrast, many other breeds are so-called man made breeds that have been subjected to decades and centuries of human selection to enhance the qualities required for human consumption, or to conform to the fashion trend of the time.

When the 'BEST' philosophy is applied to this foundation stock, we are merely increasing the number of animals in the breed, without necessarily enhancing what we have or deleting unwanted genes from the gene pool.

The Nguni Cattle Breeders association strives to maintain the phenotype and breeding standards of the Nguni breed and it is these qualities and standards that we want to enhance in the breed, or at the very least, preserve in the following generations. In some cases, we also want to establish a unique identity within our own herd according to traits that we find desirable. Fertility ranks high on any list of desirables, but early maturity, milk qualities, pigmentation, longevity and uniformity can all form part of the end goal of a breeding plan.

Most breeders unknowingly follow a policy of out crossing by introducing completely unrelated bulls to each successive generation in the thinking that 'fresh blood' would enhance the qualities of the herd. The result of this is increased genetic variability as the genes are diluted with each successive generation and the progeny becomes less predictable with each new generation. This also has severe consequences in terms

of unwanted genes, which will be explained later in this article.

In order to build an identity around one's product and to market it as such, one needs to be able to predict what one is going to breed and be able to repeat that performance in order to satisfy continued demand. With out-crossing this is almost impossible as each new generation will represent a variable cross-section of genetics that is difficult to quantify and almost impossible to reproduce. Consumers appreciate consistency and feel safe with predictability and it is no different with cattle.

To achieve this, every stud breeder needs to have a breeding plan with well-defined goals and a clear

picture of what the end product should look like and how it should perform. One has to form an identity and a reputation around one's specific herd that is sustainable over many generations – and not just produce

occasional genetic wonders, which in turn produce average offspring.

Homozygosis is the term used to define this concept. In genetic terms, it means that genes are concentrated through very selective breeding on highly selected parent animals, to produce sustainable predictability in successive generations. A parent animal that then breeds these desirable genetic traits into its offspring is said to be prepotent for those traits and a process of line breeding is followed to achieve these results.

Practically this means that the breeder aims to narrow the range of variation, making the population more uniform by concentrating the genetic impact of a single excellent individual throughout that population.

Line breeding is a form of inbreeding and can vary from very close to distant inbreeding. Close inbreeding could be achieved through mating full siblings or parents to offspring and distant breeding could be mating cousins to cousins and half siblings to each other. Line breeding works when we produce offspring that have the same desirable traits as their parents.

## Linebreeding: science or alchemy?

(Article adapted from [www.nguni.info](http://www.nguni.info) by Chris van der Merwe)

Inbreeding has negative connotations for some breeders, but one must remember that the genetics are inherent to each animal and that each animal has recessive genes in its DNA makeup. A breeder cannot create bad genetics, but by concentrating these genetics into offspring through line breeding, these recessive traits can surface and present as an unwanted trait. By doing so, the breeder is actually exposing the unwanted genes. The dilemma then is to decide to live with the unwanted trait, or to cull the animal. The other weakness of line breeding is general loss of vigour and reproductive performance, generally known as inbreeding depression. To prevent this, rigorous culling should always be part of any line breeding program.

By concentrating genetics and exposing unwanted, recessive genes, these can be eliminated from the genetic pool, instead of being diluted and spread throughout a whole next generation – which is exactly what happens in the case of out-crossing.

Line breeding can therefore give you the predictable results that you desire in your breeding program, on a sustainable basis. This comes at a price, though, given the associated risks. However, the same holds true for reckless out-crossing of animals and a haphazard spreading of genetics simply for the sake of increasing the population.

A successful line breeding program starts with careful planning to achieve a very specific outcome. Diligent record keeping that goes beyond the normal studbook

requirements is necessary to capture the finer selection criteria and performance data, which guide the breeder in the selection of the ‘perfect’ animal whose genetics will be concentrated into the line breeding program. The performance data will also assist in revealing the first signs of inbreeding depression.

Wright’s formula, which calculates the Coefficient of Inbreeding (COI) is a tool that can be used to determine the extent of inbreeding and these calculations are done by the ARC and SA Studbook. By careful planning, one can increase the relationships in the offspring’s ancestry without significantly increasing the COI.

A further positive effect of line breeding can be achieved by line crossing, which enables a breeder to achieve heterosis, or hybrid vigour, within a given breed. This process can also be used to offset some of the negative effects of line breeding. By crossing two lines, the dominant gene of the one line can mask an unwanted, recessive gene in the other line.

A carefully managed and considered line breeding programme offers the stud breeder significant value. Applying scientific thinking to the way in which genetics are combined

can unlock and concentrate desirable qualities within a herd, thereby strengthening the breeder’s brand building and marketing efforts.

