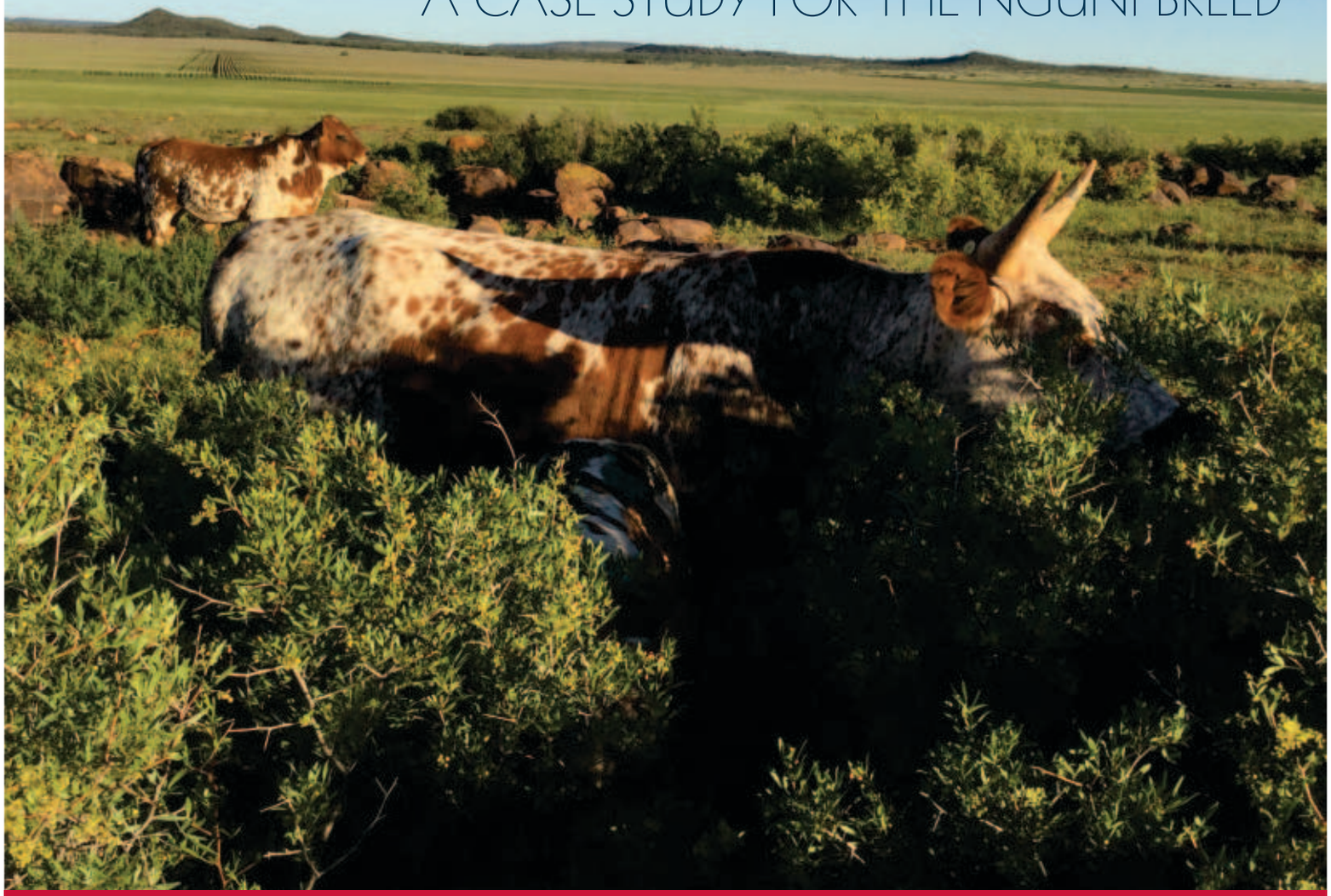
COW VALUES,

A COMBINED GENETIC SELECTION INDEX FOR SOUTH AFRICAN BEEF CATTLE BREEDERS: A CASE STUDY FOR THE NGUNI BREED



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BACKGROUND

Yolanda Venter from the Nguni Society participates yearly in the conference of the South African Society of Agricultural Technologists where she presents a (poster) presentation on the sciences underpinning livestock breeding, with special emphasis on Nguni cattle. Her presentation received top honours in the category: Animal Lecture.
This article reflects the contents of the poster with some less technical explanations.

INTRODUCTION

The use of BLUP breeding values for the identification of differences in the genetic merit among breeding animals is well established. Setting and application of breeding goals, based on independent culling levels for individual traits is challenging due to the many traits for which BLUP breeding values are available; The establishment of selection indices, based on the additive genetic variance (heritabilities) and covariance (genetic correlations) structure and the economic value of the different traits with BLUP breeding values has led to easier assessments of the suitability of animals as replacement candidates or parents for the next generation. These collective (selection) values are furthermore sub-divided in so-called 'sub values' (also referred to as 'ERTs' or Economical Relevant Traits) that enable breeders to apply a measure of assortative or non-assortative (corrective) mating. This gives practical assistance to breeders to not only use the main selection index in making selection decisions, but also to, for example, set minimum values when considering an animal for selection. The Cow Value, developed by the S A Stud Book and Animal Improvement Association and its sub values are described in Table 1 (adapted from the explanation in use on sale catalogues).

TABLE 1: The Cow Value and its sub values.

Subvalues of Cow Value	Breeding values in subvalue and % contribution to Cow Value*	☆		General guidelines for selection						★★★★★	
				<70	80 ★★	90 ★★☆	100 ★★★	110 ★★★☆	120+ ★★★★		
Calving Ease	Birth weight (0.3 %)* Maternal birth weight (0.2%)*	More difficult calving (Heavier birth weight)									Easier calving (Lighter weight)
Calf Growth	Weaning weight (26.5%)*	Lighter weaner									Heavier weaner
Milk	Milk (16%)*	Less milk									More milk
Maintenance	Mature Weight (20%)*	Higher maintenance (heavier cows)									Lower maintenance (lighter cows)
Fertility	Age at first calving (10%) Intercalving period (ICP) (27%)	Less fertile	X								More fertile

*** Values vary according to breed**

***Negative weighing on the BLUP EBVs (but positive on the Breeding value indices) for these traits as lower values are more desirable.**

#Positive weighing on the BLUP EBVs (also positive on the Breeding value indices) for these traits as higher values are more desirable.

MATERIAL USED AND METHODS APPLIED

Results obtained from the South African Nguni genetic (BLUP) evaluation conducted by SA Stud Book in May 2015 were used as the basis of the study. Results for the Cow Value as a complete selection index plus the contributing sub-indices (ERTs), namely calving ease, pre wean growth, milk, female fertility and cow mature weight were used in the analyses. All additive genetic merit values (BLUP breeding values) are expressed as values deviating from the mean of the active breed population. The population mean additive genetic merit has been set to a value of 100 with a standard deviation of 13 units. In layman's terms this is generally referred to as 'Breeding Value Indices'.The genetic trends for these indices, defined as average geneticindex value per birth year were calculated. To furthermore quantify genetic change over time, linear regressions were fitted on average values over birth year. These linear lines therefore depict the trend of change over time and account for misrepresentation due to shorter term deviations. The genetic trends are presented in a line graph format.

RESULTS

Figure1 reflects the genetic trends for animals born between 1990 and 2015 for the different sub-indices:calving ease, pre wean growth, milk, female fertility, mature cow weight; and ultimately the combined index: Cow Value (and its linear regression) of the Nguni breed.

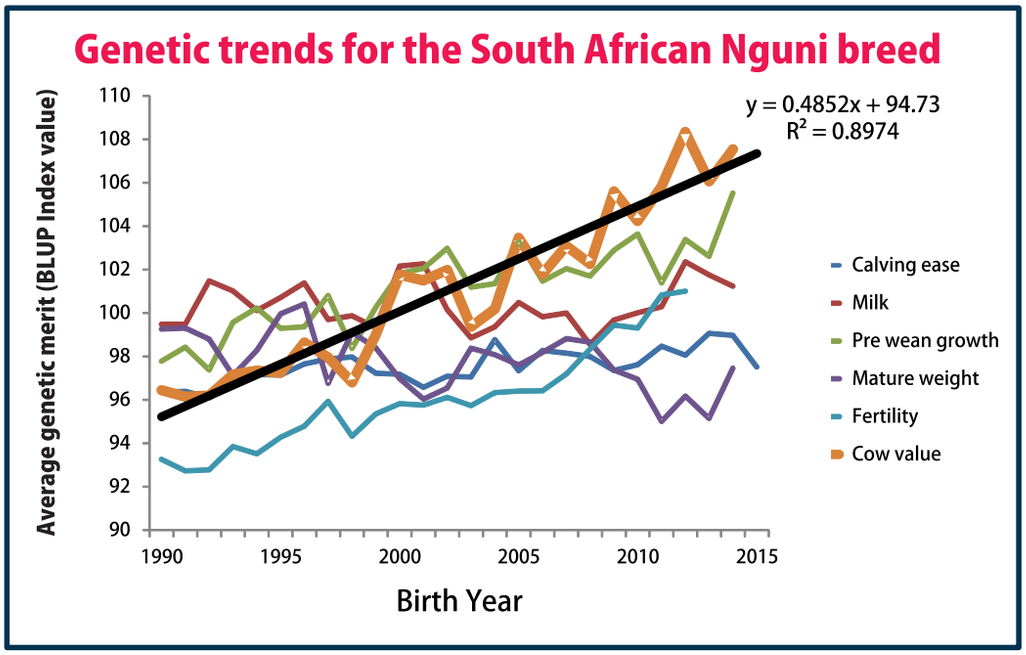

Figure 1: Genetic trends for the South African Nguni breed

The equations for the linear regressions (and their respective R^2 values, depicting the 'goodness of fitting the line'), expressing genetic changes, genetic changes in standard deviation units over a ten-year period for the sub-indices and Cow Value are presented in Table 2.

TABLE 2: The equations for the linear regressions expressing genetic changes.

Index	Slope	STD unit change in 10 years	R^2
Calving ease	0.072	0.056	0.50
Pre wean growth	0.237	0.182	0.75
Milk	0.015	0.012	0.50
Female fertility	0.334	0.257	0.90
Cow mature weight	- 0.110	- 0.085	0.33
Cow Value	**0.4852**	**0.373**	**0.897**

DISCUSSION AND CONCLUSION FROM THE CALCULATIONS

The genetic changes show substantial progress in Cow Value over time. The linear fit (R^2 = 0.897) for Cow Value show that the average Nguni has improved genetically by 0.37 standard deviation units (b = 0.485 per year) in terms of monitory value compared to animals born 10 years ago.

This achievement was mainly the result of genetic changes in pre wean growth rate (0.18 STD units; R^2= 0.75) and female fertility (age at first calving and calving interval) (0.33 STD units; R^2 = 0.90). No substantial genetic changes took place in calving ease (birth weight direct and maternal) (b = 0.072; R^2 = 0.50), milk (wean maternal) (b = 0.015; R2 = 0.50) and mature cow weight.

> THE GOOD THING ABOUT SCIENCE IS THAT IT'S TRUE WHETHER OR NOT YOU BELIEVE IN IT.
>
> Neil deGrasse Tyson

FINAL NOTES

The Nguni breeders can take note of the results from this study. A substantial increase in the profitability of recorded Nguni cattle took place during the last 10 years of breeding and selection, mainly due to maintaining cow (mature) weights while increasing pre wean growth rate and female fertility. As cow efficiency is also dependent on genetic merit for milk, this trait can also attract more attention in selection programs in future. ■