THE CONTRIBUTION OF RESEARCH, PERFORMANCE RECORDING AND BREED SOCIETIES TO THE CONSERVATION OF GENETIC RESOURCES

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INTRODUCTION

There is a very important difference between Africa and Asia on the one side and other new world or colonial continents such as the Americas, Australia and New Zealand. These continents had no indigenous livestock at their disposal and had to rely entirely on imported material to establish a livestock industry. Africa, in contrast was richly endowed with a large number of indigenous livestock breeds (Scholtz, 1988).

Recording of animal performance is essential to provide the necessary information for sound decision-making, both at policy and farm levels, and to establish key input - output relationships (FAO, 1998). It is also particularly important to provide the comprehensive and consistent information that is necessary to fairly compare indigenous versus exotic germplasm and to support long-term genetic improvement towards an appropriate bio-economic development objective. Such benefits will accrue to farmers, through increased income, better management of risk and the maintenance of a vital, expanding rural economy; to consumers, through improvements in quantity and quality of animal products at affordable prices; and to governments through enhanced national food security, more favourable trade balances involving animal products and greater social and environmental stability (FAO, 1998; Scholtz & Matjuda 2001).

Due to a lack of performance recording during the period of colonolization, the performance of indigenous livestock of Africa was regarded as being inferior, This perception was the result of African man living in a symbiotic

relationship with his animals. His animals were invaluable as they provided for most of his needs (Matjuda, 2005). In addition the status value of animals resulted in more animals to be kept and overstocking became the order of the day (Scholtz, 1988). A second reason for the earlier ignorance of indigenous livestock stemmed from the variety of colours and colour patterns often encountered amongst animals of the same breed. These wide ranges of colours and colour patterns are in sharp contrast to the general tendency in the Stud Breeding industry to emphasize uniformity. As a result of this, the Stud Breeding industry was unable to identify the much emphasized antiquated breed standards (Bonsma, 1980), and regarded these animals as an indiscriminate mixture of breeds (Scholtz, 1988).

In South Africa, this perception of inferiority led to the promulgation of an Act in 1934 in which indigenous breeds and types were regarded as scrub (non descript). Inspectors were appointed to inspect the bulls in communal areas (in possession of black people) and to castrate them if regarded as inferior. Fortunately this Act was applied effectively only for a few years, since it was very unpopular (Hofmeyr, 1994). During the first part of the previous century little or no attention was paid to the improvement or study of the potential of indigenous cattle breeds in South Africa, except for the Afrikaner. It was only when a Beef Cattle Improvement Scheme was introduced in 1959 in South Africa that the performance of indigenous beef cattle was properly recorded and evaluated.

A Committee was also appointed in 1949 to conduct a survey on the nature and number of indigenous cattle breeds and their conservation. The Committee recommended that immediate steps are taken to arrest the deterioration of indigenous cattle in black ownership (native reserves), as a result of the infusion of exotic blood and the use of inferior sires. Their second recommendation was that a pure-bred cattle herd of not less than 500 Nguni breeding stock be established to investigate the potential of the breed (Bonsma et al., 1950). The Bartlow Combine Breeding Station in KwaZulu-Natal was established in 1954 to accommodate the Nguni herd and this herd played a significant role in the development of the Nguni breed and forms the foundation of the initial Seedstock industry (Kars, 1993). However, initial research results on the potential of the Nguni breed were only published in the early 1980's (Scholtz, 2005) and resulted in a revived interest in the breed.

CONTRIBUTION OF RESEARCH

Research conducted included tick resistance of the Nguni (Spickett et al., 1989; Scholtz, et al., 1991), the potential of the Nguni as a dam line (Scholtz, *et al.*, 1992) and the meat quality of the Nguni (Strydom, 1998). Counts of engorged female ticks on naturally infested cattle over a 2 year period, showed that Nguni cattle harboured significantly fewer ticks during periods of peak abundance than either Bonsmara or Hereford cattle. Fewer abscesses, associated with tick bite, were also present in the Nguni cattle. The consistently large percentage of Nguni cattle showing high tick resistance according to index determinations indicates a superior level of natural immunity in this breed.

The evaluation of the Nguni as dam line in terminal crossbreeding with the Charolais, Simmental and Chianina did not result in any calving difficulties. While the average birth weight was 10% below the mid-parent value, the average weaning weight was 6% above the mid-parent value. The post weaning growth rate of the crosses was 43% higher than that of Nguni, while the feed conversion ratio was 10% better than that of the best purebred. Despite the suppression on birth weight below that of the mid-parent value, the weaning weight and growth rate of the different crosses are close

to that of the larger parent. The negative maternal effect on calf birth weight due to the smaller cow, therefore, does not seem to persist up to adult life, which makes the Nguni one of the ideal dam lines in terminal crossbreeding.

The study conducted by Strydom (1998) showed that the indigenous southern African breeds (Afrikaner, Nguni) have meat tenderness characteristics similar to, or exceeding that of some exotic breeds. A breed such as the Nguni also showed higher proportions of total weight and meat in the high priced cuts compared to exotic breeds at the same subcutaneous fat level.

CONTRIBUTION OF PERFORMANCE RECORDING

Information collected by the National Beef Cattle Improvement Scheme (NBCIS) of South Africa as well as the genetic trends for some selected traits, estimated from the EBV's will be used to demonstrate the value and role of performance recording in conservation of genetic resources. The trait definitions are given in Table 1.

Results obtained from the NBCIS for the periods 1976 to 1985 (Scholtz, 1988) and 1993 to 1998 (Scholtz, et al., 1999) are used to compare the performance of the Nguni with that of 12 other beef breeds in South Africa presented in Table 2. It should be noted that comparison of performance results across breeds and years must be done with caution, since the results reflect both genetic merit and environmental influences (Scholtz, et al., 1999). However, for purposes of this study such comparison can be justified.

When looking at the first period (1976 to 1985) the Nguni is the most fertile beef breed of all cattle breeds. Its growth rate compared well with that of other breeds such as the Afrikaner and Brahman, which is rather low. Its efficiency (feed conversion ratio), however, exceeded that of many breeds, and compared well with that of the Bonsmara, South Devon, Pinzgauer and Simmentaler.

TABLE 1 : Definitions for Breeding Values (EBV) predicted for some traits in the Nguni in South Africa

Category	EBV (Unit)	Trait Definition
Fertility	Calving tempo (calves / 100 daughters	Is an indication of fertility as well as the retention of a bull's female progeny. In order for a bull to receive a high breeding value for calving tempo his daughters must regularly calve up to 6 years of age. Bulls with low breeding values do not necessarily have fewer daughters, but they may have poor retention
Growth / Production	Weaning weight - Direct (kg)	Reflects the animal's own ability to grow up to weaning
	Weaning weight - Maternal (kg)	Reflects cow's genetic ability to create an environment in which her calves can achieve optimal growth. A weaning maternal EBV for a bull indicates the maternal potential of his daughters
	18 Month weight (kg)	Reflects not only the growth ability of an animal, but also to a degree the mature weight of an animal
[illegible]	[illegible]	[illegible]

TABLE 2 : Summary of the results obtained from the NBCIS for the periods 1976 to 1985 and 1993 to 1998

Breed type	Breed	Cow Weight		Calculated Calving %		Calf weaning weight		Average Daily gain (g)		Feed conversion ratio	
		76/85	93/98	76/85	93/98	76/85	93/98	76/85	93/98	76/85	93/98
Sanga/ Indicus	Afrikaner	459	461	72	77	173	185	1 130	1 267	7.77	7.05
	Brahman	477	491	79	79	197	209	1 156	1 325	7.20	6.99
	Nguni	396	375	87	87	164	155	1 206	1 150	7.07	6.88
Sanga/ Indicus derived	Bonsmara	466	499	81	86	197	214	1 449	1 613	7.02	6.69
	Drakensberger	482	487	72	80	200	206	1 385	1 544	7.32	6.96
	Santa Gertudis	483	502	75	78	209	225	1 494	1 715	6.95	6.44
British	Angus	455	507	84	88	192	215	1 457	1 804	7.28	6.55
	Hereford	479	507	84	91	183	204	1 422	1 811	6.95	6.27
	South Devon	522	541	79	86	206	241	1 569	1 716	7.00	6.62
	Sussex	555	557	82	88	201	218	1 419	1 598	6.90	6.66
European	Charolais	632	593	75	83	228	232	1 761	1 940	6.69	6.13
	Pinzgauer	474	530	83	85	204	232	1 571	1 779	7.04	6.67
	Simmentaler	507	544	77	85	221	240	1 655	1 898	7.00	6.60

When the second period is studied, the results look somewhat different. For example, the calving percentage of all breeds increased except that of the Nguni. Cow weight increased or stayed the same for all breeds except for the Charolais and the Nguni. In the case of the Charolais the decrease is probably the result of selection for adaptability. In the case of the Nguni this coincides with the development of Nguni Stud Breeding.

The genetic trends for the traits are given in Figures 1 to 4. Unfortunately not all Stud animals are subjected to performance recording (current participation is only 37% compared to 78% ten years ago). The genetic trends may therefore be biased, except in the case of calving tempo which is available for all Stud bulls. A time frame that is of particular importance is the period between 1980 (start of commercial interest) and 1987 (establishment of a Breeders Society). During this period there was no effective control and it is postulated that aspiring Stud breeders collected any Nguni, no matter how inferior. One of the reasons for this is that the traditional custodian of the Nguni hardly ever makes the better quality animals available for sale (Kars, 1993).

See figures on page 63 & 65.

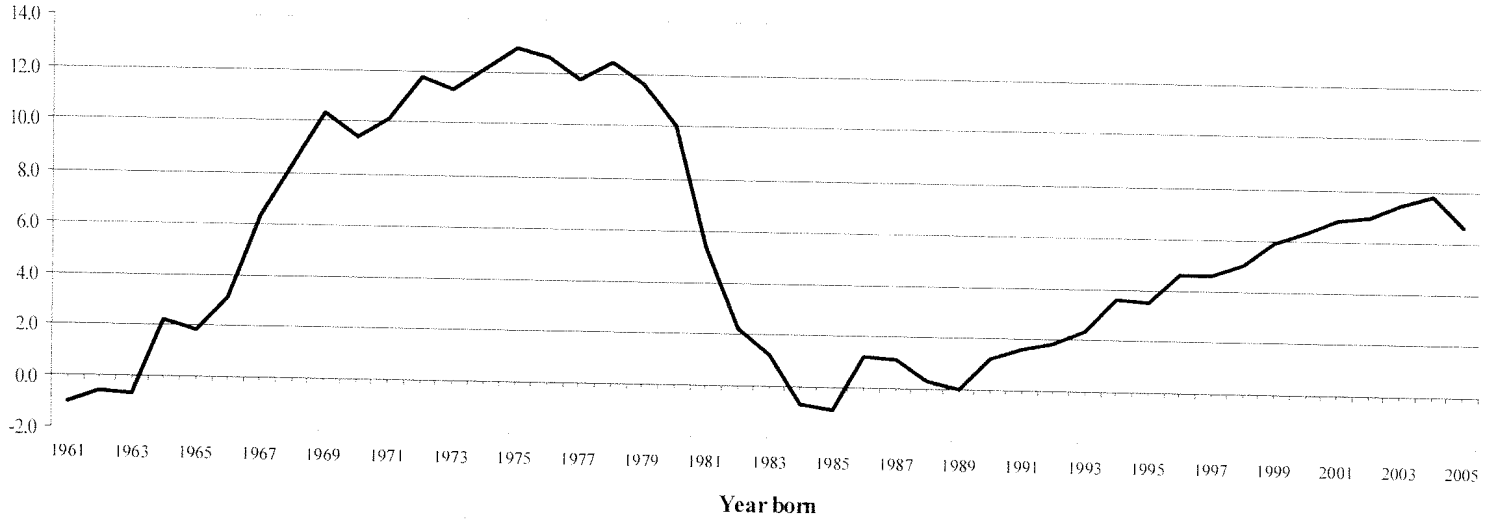


Fig. 1
Nguni - Calving tempo
(calves / 100 daughters

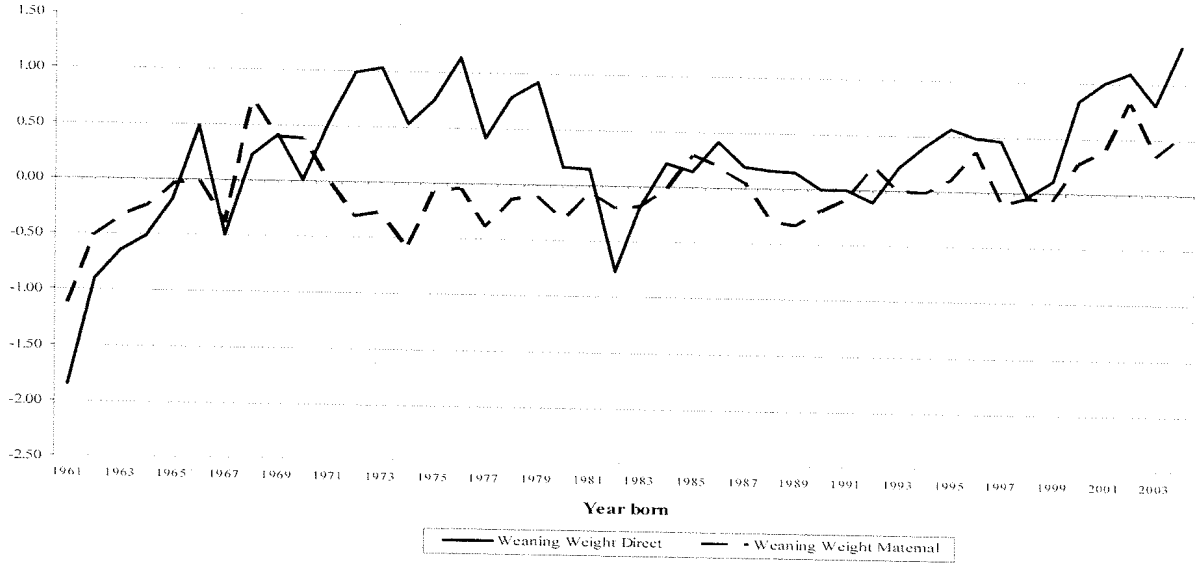


Fig. 2
Nguni - Weaning weight
direct and maternal (kg)

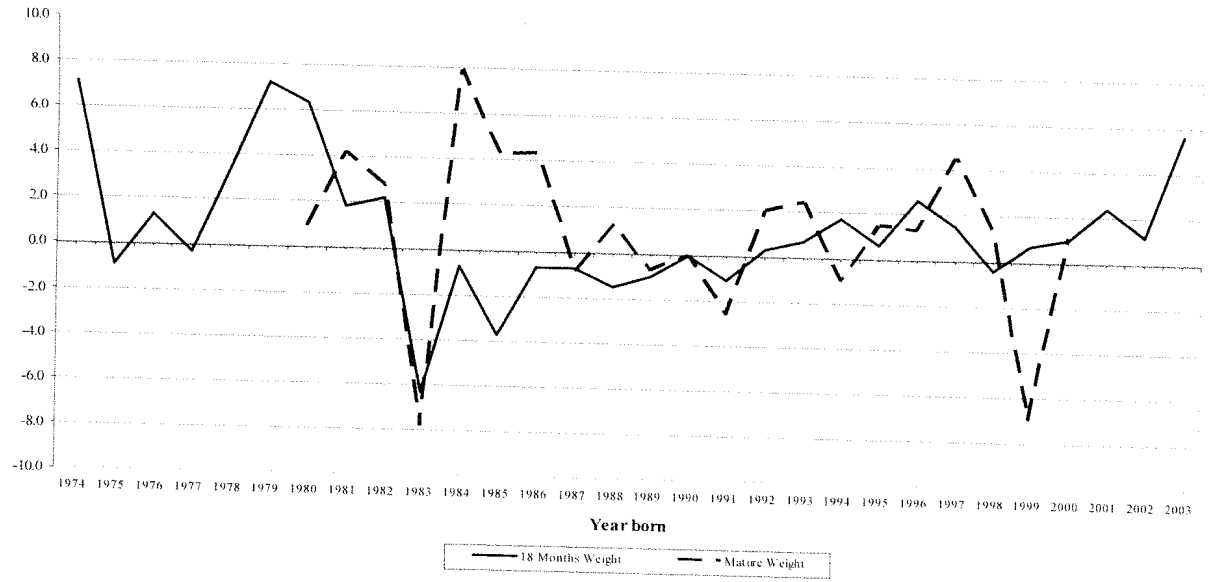


Fig. 3
Nguni - 18 Month and mature weight (kg)

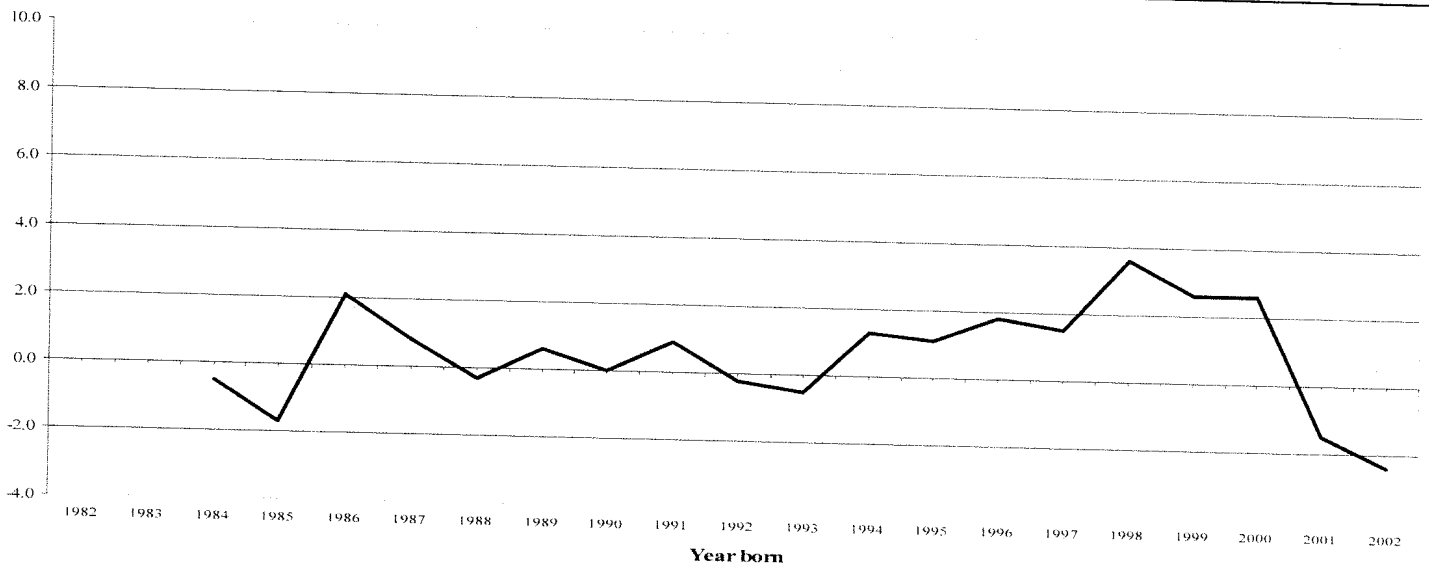
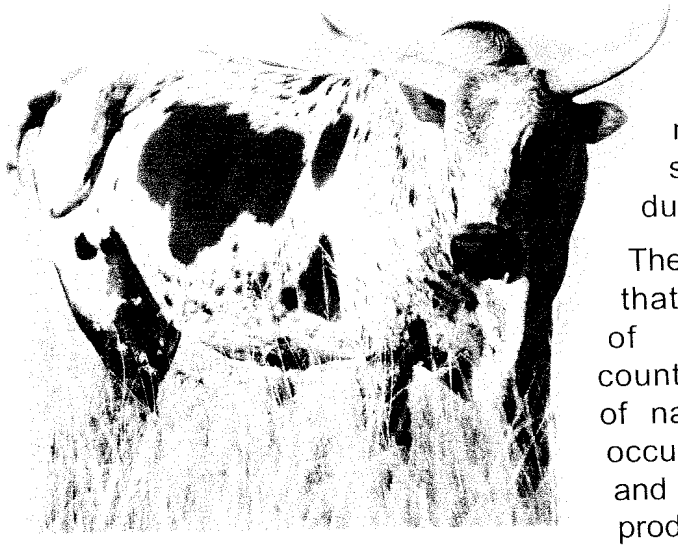


Fig. 4
Nguni - Shoulder height (mm)

ROLE OF A BREED SOCIETY

An important issue at stake here is whether the establishment of the Nguni Cattle Breeders Society in 1987 resulted in effective control, and in this way removing the inferior animals from the breed, resulting in the genetic trends returning to the original levels. Alternatively, the Seedstock owners of these inferior animals may have stopped performance recording so as to hide the inferiority of their animals. If the latter is the situation the genetic trends that are approaching the original performance levels are artificial, and are not a true reflection of what is happening in the breed.

Traditionally Stud Breeding emphasizes uniformity and breed standards, whether their cattle are showed or not, and the Nguni Cattle Breeders Society is no exception. Currently all Nguni Seedstock animals are inspected to assure they comply with the minimum breed standards. The minimum breed standards are based on reproduction records and visual appraisal for genetic defects and conformation. It is important to note that there are no minimum breed standards for production traits.



There is always a danger that an over emphasis of appearance may counteract the good results of natural selection that occurred over centuries and resulted in a highly productive breed. In most cases the Nguni Cattle Breeders Society is still maintaining a good balance. However, since not all animals are performance recorded, the effect of the current actions can not be quantified.

Epstein (1971) and Oliver (1983) described the conformation of heat adapted cattle as having long heads of moderate width, prominent orbital arches over the eyes to protect them from sunlight, an oval shaped trunk to increase the surface area for head dissipation, while a smaller area of the back is in direct sunlight to reduce heat absorption, excessive skin area to increase the area for heat loss, etc. Any artificial changes to these conformation attributes will affect adaptability to hot climates. According to Oosthuizen (personal communication) approximately 20% of the Nguni bulls submitted for inspection fail their inspection on breed standards. However, this represent only 30% of the bull calves born, since the breeders seem to cull 70% even before inspection. Of particular concern is the over emphasis on sheath length. If the reduction of sheath length is accompanied by a reduction of excessive skin over the rest of the body, the Nguni is going to loose some of its adaptive attributes.

The Nguni Cattle Breeders Society is claiming that (Nguni Journal, 2005) :

(1) "there should be no need to improve the breed that has been selected by nature without the interference of man", and that they

(2) "maintain breed standards ..... without altering the unique inherent traits of the breed"

It is therefore a matter of concern that this Society exposes the Nguni breed to the highest culling level (intensity of selection) on bulls of all beef breeds in South Africa; with only 24% of bulls born being approved for registration. In the case of the Bonsmara,

which is known for high selection pressure on bulls, this percentage is 35% (Hoogenboezem, Personal Communication).

GENETIC RESOURCE MANAGEMENT

The term "Conservation" has different meanings to different people. For purposes of this paper in situ conservation is regarded as a collective word for keeping (1) animals in their natural or pure state, (2) sustainable utilization and (3) global or commercial adaptation.

Traditional communities have been the custodians of indigenous breeds for many centuries and they tend to keep animals in a "pure" state. For them animals fulfill religious, ritual and subsistence purposes (Köhler-Rollefson, 2004). Hence the genetic material they conserve is not influenced by the modern breeding programmes, artificial Seedstock breed standards or pressure for commercialization or adaptation. Modern agriculture caused livestock breeds to be dynamic rather than static entities, and they undergo continual change, depending on the needs and priorities of the breeders (Köhler-Rollefson, 2004). This puts the different concepts of conservation into conflict, with a third option of global adaptation.

The concept of sustainable utilization acknowledges that with globalization, many breeds will only survive if they remain or become competitive. Hence there is a need to improve them genetically through selection. Such selection will not result in the loss of the survival and fitness traits that made these breeds attractive in the first place, as long as this selection is undertaken not out of context, but within constraints of the actual environment and production system (Köhler-Rollefson, 2004). This is probably the only strategy that will ensure the long term conservation of livestock genetic resources.

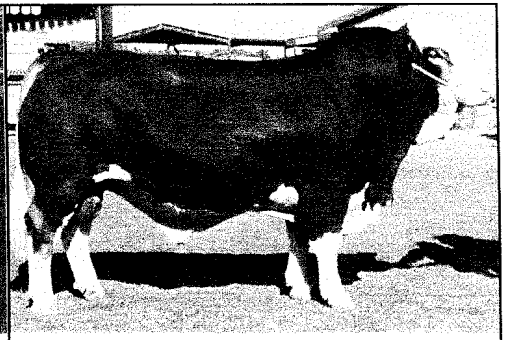
Global or commercial adaptation is where breeds have been moved outside their natural areas and climatic conditions, and have been selected for specific characteristics to increase its commercial value for specific production systems. An example of such a breed is the Angus, that is currently the most abundant beef breed in the world and which is present on all continents, and in production conditions that are vastly different. Artificial selection is also very prevalent and may result in peculiar characteristics, such as double muscling in the Belgiun Blue. Whereas this option makes commercial sense, its role in the in situ conservation of livestock genetic resources in its original state is limited and where it does occur, it is mostly incidental.

Both breed standards as emphasized by Stud Breeders and global or commercial adaptation is normally accompanied by drastic changes in the conformation of the breed. The pictures on page 71 demonstrate such changes in the Angus, Hereford and Simmentaler breeds.

CONCLUSION

The initial research resutos and the information from beef cattle recording (NBCIS) resulted in a keen interest in the Nguni. There has also been revived interest in the Nguni from the emerging / small scale sector. It is now generally accepted that the research and performance results that were published saved the Nguni from the possible threat of extinction. The Nguni has now grown numerically to the sixth largest Stud beef breed in South Africa. The Stud animals currently consists of over 18 000 females with an estimated 1.8 million Nguni type animals in South Africa (Ramsay, personal communication). This clearly demonstrates the important role the production characterization of indigenous livestock can play in in situ conservation.

First Simmental bull to be imported to South Africa 100 years ago (courtesy of Landbouweekblad)

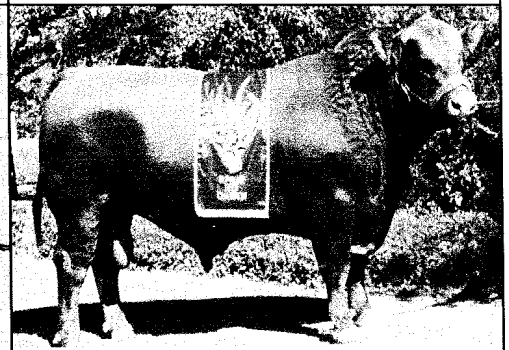


Modern champion Simmental bull in South Africa (courtesy of Landbouweekblad)

Show Hereford cow in America, 1966 (Bonsma, 1980)

Modern Hereford cow in South Africa (Scholtz *et al*, 1999)

Grand champion Angus bull, Rand Easter Show, 1964 (courtesy SA Angus Society)



Modern champion Angus bull in South Africa (Scholtz *et al*, 1999)

A Breed Society can play a pivotal role in the sustainable utilization of livestock genetic resources, since it can act as the modern custodians for the sustainable utilization of such breeds. However, they should move away from the antiquated over emphasis on uniformity and artificial breed standards, while ensuring that such breeds remain or become competitive. This will necessitate proper pedigree and performance recording in order to identify any undesirable genetic drift and to ensure competitiveness through proper breeding programmes designed for local conditions.

NOTE : This article combines the information that was presented at the following International events:

i. 4th All Africa Conference on Animal Agriculture. Arusha, Tanzania, 20 to 23 September 2005.

ii. 6th Global Conference on the Conservation of Domestic Animal Genetic Resources. Magalies Park, South Africa, 9 to 13 October 2005.

These proceedings still needs to be published.

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