THE NGUNI: A CASE STUDY

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1. Introduction

This case study examines a project designed to introduce the adapted genetics of the Nguni into communal farming systems where erosion of the breed has occurred.

Iron Age nomads first introduced the Nguni cattle breed into South Africa in about 600 AD. These low maintenance cattle were ideally suited to the communal farming systems of the settlers and, as far as can be established, remained relatively unaltered during the next millennium. The advent of European colonization in the middle of the 19th century and the subsequent acceptance of the colonial farmer as a role model led to the introduction of exotic breeds that eventually diluted and depleted the original gene pool of adapted livestock. This change was exacerbated by additional factors such as a change in the political arena, of urbanization, of the erosion of cultural beliefs and practices and of natural disasters. Prior to 1970 a demand for apparently superior breeds in the rural communities led to the haphazard introduction of exotic breeds into communal areas, but with little success.

During the 20th century a structure was developed in the country that allowed the Nguni breed to enter the growing commercial sector and extensive recording facilitated breed improvement. Thus, whilst the breed was improved in the commercial sector, it was being eroded in the rural areas. Fortunately, the inherent hardiness of the breed allowed it to survive and purebred animals are still found in limited numbers in rural communities.

The Nguni is now seen as a source of genetic material well suited to the management style and needs of the emergent black farmer who requires a relatively low maintenance and relatively high output animal. This case study attempts to show the value of the Nguni, gives examples of how the breed, after value adding in the commercial sector, is being reintroduced into communal cattle farming systems and highlights some of the problems.

2. Background

2.1 History

Until recently it was thought that the domestication of *Bos primiginius* that gave rise to modern African cattle breeds took place in the Near East about 8 000 BP (Epstein, 1971) although archaeologists had speculated on the likelihood of an area of domestication in North Africa (Plug, 1994). Recent DNA studies strengthened this hypothesis and showed that the Nguni of South Africa could be considered an African taurine with a slight Zebu admixture that probably originated from bulls imported from the Arabian peninsula (Hannote, 1998).

African records of domesticated cattle show that they were present in the Nile Valley by 400 BP (Epstein, 1971). Cattle migrated southwards from the northern regions of Africa with their owners as a result of stressors such as environmental pressure, war and barter as shown in Figure 1. By 300 BC cattle were found in the Luangwa Valley in Zambia and by 300 AD settled communities with cattle were living in southern Africa, in areas of eastern Botswana, in Gauteng as far as the Hartebeespoort dam area, the eastern lowveld and the coastal region of Natal ((Plug, 1980).

Figure 1. Dispersal of domesticated cattle

Hanotte, 1998.

During their passage from the north of the continent the animals were exposed to the harsh extremes of climate and the tropical diseases of Africa. Natural selection favoured those animals genetically suited to this hostile environment. Two separate migrations occurred in the country, bringing the cattle into the eastern and western regions respectively. Adaptations to the climate of these areas resulted in the development of different ecotypes. Both Nguni ecotypes and landrace breeds such as the Afrikaner can be separated on the basis of their genetic distancing (Kotze, 2001) (Addendum VI).

A second phase of introduction into South Africa occurred during the 16th to the 17th centuries when settlers brought their European farm animals into the country.

The colonists often regarded the cattle owned by the Nguni people as inferior. They appeared to perform poorly; probably a result of overstocking, and appeared less uniform due to a wide range of colours and colour patterns that gave the breed the appearance of an indiscriminate mixture of breeds. This perception of inferiority was adopted by the Nguni people who viewed the high input, highly productive exotic breeds as superior to their own, and adopted the colonists' farming practices as their role model. The fact that the Nguni was able to survive with minimal care was of secondary importance as resources were seemingly endless and supplementary feeding and stock remedies were relatively inexpensive.

This perception of inferiority led to the promulgation of an Act in 1934 in which populations of indigenous breeds and types were regarded as scrub (nondescript). Inspectors were empowered to inspect bulls in communal areas and to castrate them if regarded as inferior. Fortunately the Act was only applied effectively during the first few years of its existence, as it proved unpopular with stockowners. It was only later that the value of the animals was realised and, in 1985, a committee was appointed to report on the desirability of having an *in vitro* germplasm bank for indigenous livestock and on the control of imported semen from exotic breeds (Hofmeyr, 1994).

It was only recently that scientific evidence showed that the Nguni performed well under optimal conditions whilst the exotics performed poorly under the prevailing management practices of communal systems (Scholtz, 1988). In 1992 the Convention of Biological Diversity was ratified, South Africa becoming a signatory in 1995. The focus of the conservation and utilization of this valuable resource of adapted livestock species, eminently suited to the farming systems of the communal farmer, has led to a SADC/FAO/UNDP initiative that has made possible the rescue and development of indigenous livestock breeds in the region.

2.2 The Nguni breed description

The Nguni is a small to medium in size depending on the prevailing nutritional conditions. Their depth is good and is accompanied by a moderate width. Mature cows have fairly short legs with good feet. The dewlap is medium-sized, thin and refined. The cervico-thoracic hump is hardly noticeable in the mature cow but is fairly well developed in the full-grown bull. The barrel of the Nguni is of good length and strength and the rump is inclined to droop towards the tail and the rear quarter is light. The head is of good size with a flattish poll; it has a broad dished forehead being the widest between the eyes. The face is wide and straight to slightly convex in profile. The muzzle is broad and the ears are refined-looking being small with a sharp apex. In cross section the horns are usually round and are, in the mature cows, noticeably lyre shaped. Coats are soft, fine and glossy. The udder and teats are small to moderate (Brown, 1956). Nguni's are unicoloured or multicoloured white, black, brown, grey, red. There are 80 different colour patterns that are either uniform, spotted or pied (Schroeder, 1994).

2.3 The Nguni profile

Please see Appendix I

2.4 The Nguni characteristics

The profile of the Nguni shows that it developed under a process of natural selection in a highly challenging environment and that it has the genetic potential to perform better in optimal production environments. It is a medium frame animal with a measure of tick tolerance and disease resistance. The summer rainfall area of South Africa is characterised by major seasonal changes in both composition and quantity of grazing. Smaller animals have a lower maintenance requirement which is more easily met by the available veld (Frisch, 1973).

The mechanisms involved in tick tolerance are, as yet, not clearly understood although there is clear evidence of the adaptation (Spickett et al., 1989). The movement of ears and tails may dislodge insects. Brown et al., 1956 noted that Nguni cows moved their ears vigorously when flies irritated them in the region of the head. The flexible and long tail with a well-developed switch also materially assisted in removing irritating insects. In the same publication he investigated the possibility that skin thickness and hair concentration had an effect on tick infestation but with inconclusive results. Norval et al. (1988a) estimated that the mean damage caused by each adult female *Rhipicephalus appendiculatus* (brown ear tick) counted on an animal in Africa to be 4.4 ± 0.8 g loss in live mass gain. This was confirmed by Spickett et al. (Appendix II). As seen in Appendix II the Nguni, with its tolerance of ticks, shows less difference in weaning weight between dipped and undipped cattle (Scholtz et al., 1991). Even a small measure of tick tolerance benefits the emergent cattle farmer as regular dipping to prevent tick infestation is a costly exercise.

The Nguni has a greater ability to maintain its condition in winter. This may be due to the maintenance of a high blood urea when the nitrogen content of the pasture drops. As seen in Appendix II, the Nguni maintained a level of 13% in winter whilst the blood urea levels of the Simmentaler fell to 7 mgs%, approaching the minimum for proper N balance (Osler, et al., 1993). However, the authors note that the ability to maintain body condition may be due to adaptation to one or more stress factors.

As a selective grazer and browser, the Nguni is able to obtain optimal nutritional value from the available natural vegetation thus enabling it to survive under conditions which would be counterproductive to bulk grazers such as the European cattle breeds. Temperamentally, the Nguni is very docile – another characteristic of an animal in harmony with its total environment (Ramsay, 1985).

Other factors adaptive traits such as walking ability, enable the Nguni to walk long distances in search of grazing and water. They are also reported to be tolerant of extreme temperatures.

3. Problem statement

There is a general lack of adapted genetic material suited to the needs of the resource poor cattle farmer. This problem is particularly acute in the Eastern and Northern Provinces where the original stock was predominantly Nguni or Nguni type cattle. Recent Participatory Rural Appraisal (PRA) in communal communities in these provinces showed that the bull/cow ratio was too low, that the quality of bulls was substandard and that calving percentages were low. These problems were due to an erosion of the original adapted stock as a result of haphazard replacement or crossing with unsuitable high maintenance exotic breeds. Exotic breeds tend to lack the adaptive traits necessary for survival and production in the rigorous environment of the communal farmer. These traits include tolerance of stressors such as ticks and tick borne diseases, heat, drought and poor grazing. Furthermore, socio-economic restrictions have forced cattle farmers to buy their stock at slaughter-stock auctions. Established commercial farmers sell these cattle as slaughter animals because they have no value as breeding stock. The introduction of this inferior stock into communal farming systems is causing a serious degradation of the genetic resource base. An additional causative factor was poor nutrition, due mainly to bad management practices that had resulted in degraded pastures and soil erosion. Finally the lack of an organised infrastructure prevented the transport of stock to markets where the animals could be sold at realistic market prices.

Historically, the low production and quality of calves in rural communities gave rise to a general lack of commercialisation, as the numbers and quality of slaughter stock was not suitable for the commercial market. Farmers are thus forced to sell in local markets where prices are not market related or to sell at low prices to speculators who feedlot the animals before sale in the commercial market at market related prices.

Long term animal recording will allow for the identification of elite animals and general genetic improvement thus reversing the present tendency to introduce inferior genetic material. This will provide the market with breeding bulls and cows. Combined, these benefits will result in increased production and productivity.

4. Objectives

The objectives of the project are to

- establish a superior genetic resource base
- facilitate the establishment of effective community management institutions
- develop agricultural production, marketing skills and opportunities
- provide a lasting improvement in the socio-economy of the rural communities
- conserve of the genetic resource of the adapted Nguni cattle breed through sustainable utilisation

5. Details of the case study

5.1 Bull selection

Successful commercialisation in the communal areas requires a high offtake of early maturing calves. This increased production is dependant on factors such as low mortality and increased vigour. In the main, young bull were selected on the basis of their breeding values. The general criteria for selection was for animals with a low birth weight, a high weaning weight and good maternal values. Progeny of the bulls was expected to be small at birth thus reducing the possibility of calving difficulties. Inherited traits associated with vigour, such as adaptation to the environment, contribute to a higher survival and growth rate resulting in calves with a heavier 12 and 18 month weight than the average communal calf crop. This combination of good genetics and adaptive traits should result in an increased production in the communal environment.

The estimated breeding values, reproduction and characterisation were established at the ARC's Animal Improvement Institute.

Estimated breeding values of the bulls selected to date can be found in Appendix II.

Fertility was established by a general examination of the reproductive organs. Semen analysis was carried out on selected bulls and included values of motility, percentage live sperm and general morphology of sperm. Fertility evaluations of the selected bulls can be found in Appendix III. Semen was collected from each bull and cryopreserved for future use. This will allow for the future distribution of semen from bulls that prove to have a high performance, to the herds of communities where the bulls are less productive.

Parentage of the bulls was confirmed by microsatellite DNA analysis. This analysis allows the identification of individual animals as each DNA profile is individual-specific. Ten to twelve microsatellites were used depending on the breed as specified by the International Society for Animal Genetics (ISAG).

Thirty-three bulls were bought at a cost of R164 827, an average price of R4 995 per bull, for distribution in communities.

A feasibility study and a full needs appraisal carried out in collaboration with GTZ, the ARC and the Provincial Departments of Agriculture identified recipient communities in the Northern and the Eastern Cape Provinces. These were selected using the guidelines of the Community Based Public Works that targeted communities using the following methodology:

- Identify the economic development nodes and the economic development areas using the Local Council Integrated Development Plan
- Identify the locations of poverty pockets, particularly in deep rural areas using the census population/household surveys and local knowledge,
- Select the cluster areas with the poorest poverty pockets

5.2 Criteria for selection of the farmers:

- they must be able to articulate their needs
- they should be organised or be willing to be organised
- they should be able to contribute a minimal amount for payment into a Trust account

5.3 Terms

Farmers should:

- agree to be developed as entrepreneurs
- be organised
- contribute a minimal amount towards the purchase, replacement and maintenance of bulls.
- be willing to participate in the development scheme
- understand that where a bull is fully paid for by an individual/group they are not obliged to make it available to the entire community. Where the donor participates or fully pays for the purchasing of a bull he reserves the right to stipulate how a bull is used.
- understand that a bull will be sold on the commercial market at a market related price if it found unfit or be at the end of its useful life and that the proceeds will be put into the Trust Fund.
- accept that the bull will be replaced at the end of every three years.

The scheme is open for new members: joining at the local level is negotiated with the existing structure.

The study then used further selection criteria that included the number of households involved, the average number of cattle per household, the total number of cattle in the community and the herd composition.

5.4 Distribution of bulls

The finding was that the bull/calf ratio was very low, being in the vicinity of 1:150. It was also found that businessmen were keeping bulls in their kraals for breeding purposes and that these were mainly exotic breeds. Crossbreeding with exotic breeds was therefore common.

Effective distribution of the bulls and monitoring of progress was seen as a prerequisite for its eventual success. Capacity building within the communities in the form of developing organisational and leadership skills was seen as a need, especially in the Northern Province. In order to achieve this, the GTZ, the ARC and extension officers facilitated the formation of commodity groups headed by a chairman who was selected by the group themselves. These structures were already in place in the Eastern Province in the form of farmers associations.

In the Northern Province PRA identified the communities of Mbahela, Tsikonelo and Khomela as suitable recipients as they were organised into livestock commodity groups. In Soetfontein, 20 farmers were encouraged to form a farmers' association to facilitate their participation in the project. Pietersburg West, a town 30 K's from Pietersburg, was identified as an additional peri-urban community. Sixteen bulls were evaluated and distributed in these areas before the mating season.

In the Eastern Cape the Alan Waters community was the first to receive bulls. The problems of accessing the commercial market was addressed by the USAID funded organisation of Agrilink that has facilitated the sale of slaughter stock by bringing buyers in the commercial market in contact with the communities and other small-scale farmers. Their infrastructure provides necessities such as loading ramps and sale pens and also arranges auctions in the communal areas by bringing agents and buyers together when slaughter stock is ready for sale. This arrangement overcomes one of the main problems of rural communal farmers, namely, market accessibility. Other identified communities in this area include Tendergate, the Herschele Democratic Farmers Association, the Quamata Farmers Support Centre, the Cildara Farmers Association and the Kolomama Farmers Association. To date 14 bulls were distributed in this area five in the past and nine more recently. Monitoring of these groups has been initiated. The model of Agrilink was also introduced into the Northern Province during the course of this year.

In all cases communities paid R850 per bull. This allowed them to take ownership of the animals and contributed towards their maintenance. Funds of R0.5 million were donated by the Department of Arts, Culture, Science and Technology under the Poverty Relief Fund. This will supply approximately 35 bulls for the project. In future, the ARC has undertaken to supply ten bulls per annum from their experimental herd at Loskop Suid and additional bulls will become available from the Dohne Research Station in the Eastern Cape Province and from a further four stations in the Northern Province. In a recent development, funding was provided by the Eastern Cape Development Corporation for the purchase of a further 500 bulls for distribution in the Eastern Cape. It is also anticipated that bulls will be introduced into the communities of KwaZulu-Natal in the near future.

5.5 Development programmes

Farmers in recipient communities are expected to participate in development programmes that allow for the monitoring of progress. Simultaneous to the distribution of the bulls in the Northern Province, the ARC are collaborating with the University of Venda, the farmers and staff of the Provincial Department of Agriculture to structure a programme to serve the multiple purposes of monitoring the progress of the project, developing the capacity of the farmers, providing training for university students and giving human capacity to an overextended extension service. It is anticipated that this programme will be functional before the first progeny are born.

5.6 Backup Services

A full range of backup services is available to the communities in the form of a beef package. These services, provided by the ARC, include beef performance recording schemes, genetic evaluation, reproduction, genetic resources, quantitative genetics, genetic services and a foreign service unit. A full description of these services can be found in Appendix IV.

5.7 Exit Strategy

Farmers will not be encouraged to remove or castrate existing exotic breeds in the communal farm systems as it is likely to restrict the project to the short term. Rather they will be left *in-situ* where they are likely to be outperformed by the more adapted, productive Nguni bulls. Farmers are then more likely to accept the superior performance of the Nguni breed which will have a long term effect and address the perception problem namely, that the Nguni is inferior to the larger, more uniform exotic counterparts.

The project is planned as a three-year project. At the end of this period in the Eastern Cape the community will return the bull that will then be placed in a further community. The returned bull will be replaced from the project. In the Northern Province the communities will contribute an amount towards the depreciation value. At the end of the three year period they will therefore be in a position to buy their own bulls which will then become their own property. This empowerment of the community together with the services provided by the beef package of the ARC is designed to result in a long-term reversal of the reduced production at presently endemic to the communal areas.

6. Benefits

Farmers will receive the full spectrum of production enhancement services. They will be able to identify the best management procedures for their environment, which will result in better individual animal management and farmer organisation. Training and education will further improve the capacity of the farmers and allow them to make informed decisions.

Nguni bulls of superior genetic quality are in the process of being bought and will be introduced into 30 selected rural communities. This gives the farmers access to Nguni bulls that will improve the quantity (calving percentage) and the quality (growth, meat quality) of existing herds. In the short term, the structure of the programme will result in the establishment of effective and legitimate community livestock management institutions. The use of improved bulls provides the farmers with the genetic resources necessary to breed slaughter-stock that meets the market demands of high meat and hide quality. The ability to sell stock at market related prices will translate their livestock base into a capital base. Local cattle processing and trading facilities such as abattoirs, tanneries and stock auctions will play a significant role in local economic development and will encourage job creation in the form of farm labour and staff for the trading facilities.

7. Restraints and Obstacles

These restraints and obstacles are problem areas that were envisaged or are those already experienced.

Monitoring

The success of the project is dependant on careful monitoring that is required to measure the performance of the progeny of the bulls. Extension staff at provincial level are required for this monitoring. At present the provinces as a whole are suffering from an acute lack of both human and financial capacity. Monitoring also allows for the early identification of problem areas which, if dealt with timeously, would not cause the project to falter or to fail. Failure of the project in any community would have far reaching effects both in morale of the community and in the credibility of the role players.

Lack of grazing management

There is little grazing management. Poor grazing results in a generally low level of nutrition that is compounded by an excessively high stocking rate.

Herd management

- Non-productive animals are not removed from the system. This is partly due to the traditional practice of maintaining cattle as a form of security and also to a lack of banking facilities in the more remote rural areas. These non-productive animals have the potential to dilute the effect of the introduced bulls that are forced into competition by the excess of inferior bulls. If not corrected this can negate the expected increase in production in the short term. In the long term the impact of the project may stimulate change.

- The high stocking rates have the effect of degrading the pastures and thus reducing their nutritional levels.

- Inferior bulls are not castrated resulting in an excess of bulls. These will dilute the effect of the superior introduced bulls. If this trend is not corrected it will have the effect of negating the expected increase in production.

Lack of reproductive management

- There is often no structured breeding season. This results in the birth of calves in the winter months when the nutritional status of the pasture is at its lowest.

- Cows failing to have one calf per year are retained. This reduces the resources for the productive cows.

Lack of infrastructure

- Most communities lack the fenced camps that make for ease of management. This problem could be alleviated by strategically placed water points, particularly as it is known that the Nguni breed can walk long distances in search of water.

A lack of record keeping

Successful genetic progress depends on animal identification and the keeping of regular records. These tasks are not generally perceived as important by communal farmers who often fail to either tag their animals or to take regular measurements. The onus of monitoring the recording will fall on an already overextended extension staff. In the Northern Province it is anticipated that the collaboration with the University of Venda will provide the necessary manpower to support the extension staff.

A lack of control of parasites and disease

Dipping is no longer mandatory by law. This has resulted in a decrease of dipping frequency due to the expense of the dip. Farmers either do not dip their cattle regularly or dilute the dip until it is no longer effective. Careful monitoring will be necessary to prevent these practices. In addition, veterinary services are not readily available in the more remote areas and the cost of treatments and drugs is often prohibitive. It is hoped that the service offered by the ARC beef package will alleviate this problem.

Community based decisions

As community based decisions are enforced on individuals, it is often difficult to control management such as grazing habits. In addition communities are not always profit driven.

Land tenure

Although development is causing a gradual movement away from the land tenure system it remains a problem. In the tribal system land is owned by the tribal head – therefore individuals have neither the right of possession nor the right of prescription for its use. The degradation caused by poor management is not as important to the tribal head as the mere ownership - irrespective of its condition. Individual farmers therefore have difficulty in applying more progressive farming methods.

Exotic breed influence

Rich businessmen in the communal areas buy exotic breeds such as the Brahman and can afford to supplement during the winter season. These cattle are his security as they provide him with a livelihood. The consequences of this unproductive management does not have an immediate affect on the rich farmer but does on the poorer farmers.

8. Risks and assumptions

- The quality of the animals produced would lend itself to effective marketing
- Resources (land, water, genetics and general infrastructure) will be adequate to effect change
- Extension officers can be sufficiently trained in the process
- There will not be a major drought, disease outbreak or any other disaster during the duration of the project
- Communal farmers will accept drastic changes to their current way of producing animals.

9. The Australian Project

In a further recent development several Australian and South African organisations are collaborating in a new five year project named "Developing profitable beef business systems for previously disadvantaged farmers in South Africa" or the "Australian Project" that was launched in July 2001. This $3 million project will develop indigenous breeds of cattle through the introduction of advanced technologies, facilitation and funding. The Nguni project described in this case study dovetails into this larger concept as one of the indigenous breeds to be benchmarked and developed for the commercial market. The project has a three pronged approach, the first focusing on the social development of farmers and the improvement of their support structures, the second to evaluate indigenous breeds and produce quality animals that are competitive in the commercial market and the third that employs sophisticated technology from Australia to identify and improve carcass traits such as tenderness and marbling.

Stakeholders in South Africa include individual and commercial farmers, National and Provincial Departments of Agriculture, the Agricultural Research Council and universities technikons and agricultural colleges. Australian organisations include the Australian Centre for International Agriculture and the Cooperative Research Centre of Australia. It is certain that many of the communities identified in the bull distribution project will participate in this initiative.

The provision of management skills and training, combined with the benchmarking will not only provide much needed income for the small-scale farmer, it will also generate information and export possibilities. According to the agreement any genes identifying economic traits during the course of the project will remain the property of the owner so that benefits accrue to the communities or farmers that supplied the source material.

10. Conclusion

This case study follows the history of an adapted cattle breed of Africa from its origins in the north of the continent to its current status in South Africa. In the middle of the last century the breed was decimated by government decree. Simultaneously the gene pool of the breed became diluted in the communal sector through cross breeding and replacement with exotic breeds. This was due to the perception that the Nguni was inferior compared to the larger exotics, despite the fact that it was a low maintenance breed ideally suited to

the low input farm systems of the communal farmer. The more recent realisation that this hardy breed was uniquely adapted to the South African environment led to its evaluation and its development in the commercial sector.

The initial evaluation of the Nguni showed its potential as a beef breed in both extensive and intensive farming systems. Cow mass and reproductive performance of the Nguni, when compared to other breeds, showed it to be the most fertile beef breed in South Africa. It was also shown to be ideally suited as a dam line in terminal crossbreeding. In addition its traits of heat, tick and disease tolerance make it an ideal breed for extensive systems.

In the past, projects for the introduction of exotic cattle breeds into the communal sector invariably failed due to the introduction of complex technologies that increased production beyond the point of sustainability. This case study presents an ongoing project that is designed to encourage the reintroduction of the hardy low-maintenance Nguni breed into the communal sector in order to stem the influence of the less well-adapted exotic breeds. This reintroduction is accompanied by support technology to improve management and a marketing system to facilitate the sale of animals at market related prices. In addition, the communities are encouraged to organise commodity groups or farmers' organisations to give an infrastructure allowing decisions to be made based on the common consensus of the community. The combined effect of the project should result in its long-term sustainability. However, it will be necessary to monitor progress in order to circumvent possible restraints and obstacles.

The history of the Nguni breed in South Africa supports the concept of conservation through utilisation in both the commercial and traditional farming sectors.

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Appendix I

The Nguni profile

Estimated distribution of the Nguni Breed in South Africa

Commercial herds

Communal herds

Nguni breed numbers in South Africa

Year of data collection	:	1998*
Population figures based on	:	census at breed level
Reliability of data	:	reliable
No. breeding females	:	12 669*
No. males used for breeding	:	4 686*
Total population	:	17 355*
Population trend	:	stable
% females bred pure	:	90
No. herdbook females	:	12 669*
No. males in AI	:	4
Additional information	:	Additional large numbers of unknown purity in rural areas Data: SA Stud Book and Livestock Improvement Association 70% participation of & in the performance testing (AII)

*Population figures on registered animals only. Additional large numbers in rural areas

Performance data: National Cattle Performance Testing Scheme of South Africa

Herds and Females in the Breed Society and Scheme

Year	Herds			Females (≥2 years)		
	Society	Scheme	%	Society	Scheme	%
1993	103	82	80	6 913	5 982	87
1994	104	68	65	7 079	5 135	73
1995	103	66	64	7 383	5 763	78
1996	123	78	63	7 786	6 027	77
1997	131	83	63	8 832	7 141	81
1998	139	70	50	9 793	6 091	62
Breed average	**117**	**75**	**64**	**7 964**	**6 023**	**76**
National average	**2 821**	**1 408**	**50**	**221 718**	**157 030**	**71**

Scholtz et al., 2000

Birth and Weaner Weights (Male and Female)

Year	Birth Animals	Birth weight (kg)	Weaner Animals	205 day weight (kg)	ADA (g/day)
1993	3 859	39	4 533	235	955
1994	3 637	40	4 203	239	973
1995	3 919	39	4 434	243	992
1996	4 129	40	4 720	244	996
1997	4 092	39	4 696	238	972
1998	3 746	40	4 279	241	981
Breed average	**23 382**	**39**	**26 865**	**240**	**978**
National average	**302 798**	**36**	**385 377**	**215**	**873**

Scholtz et al., 2000

Twelve and eighteen month weights (Female)

Year	12 month Animals	365 day weight (kg)	ADA (g/day)	18 month Animals	540 day weight (kg)	ADA (g/day)
1993	1 190	290	692	823	372	618
1994	942	290	689	765	394	658
1995	769	306	734	655	379	630
1996	980	313	749	779	381	634
1997	1 088	303	724	810	394	658
1998	1 194	299	713	935	383	638
Breed average	**6 163**	**299**	**716**	**4 767**	**384**	**639**
National average	**132 370**	**252**	**596**	**103 819**	**328**	**543**

Scholtz et al., 2000

Age at First Calving and intercalving period

Year	Age 1st calving Animals	Age at 1st calving (months)	ICP Animals	ICP (days)
1993	1 025	31	3 113	430
1994	986	31	3 087	425
1995	1 022	31	3 300	422
1996	1 078	31	3 554	415
1997	1 099	31	3 536	419
1998	972	30	3 169	408
Breed average	**6 182**	**31**	**19 957**	**420**
National average	**82 874**	**34**	**290 607**	**423**

Scholtz et al., 2000

Cow Weights

Year	CW-C Animals	Cow weight at calving (kg)	BW:CW Ratio (%)	CW-W Animals	Cow weight at weaning (kg)	WW-CW Ratio (%)
1993	1 759	529	7.3	2 435	535	46.0
1994	1 855	546	7.4	22 83	546	45.9
1995	1 466	542	7.5	2 120	549	46.8
1996	1 550	554	7.4	2 352	551	46.3
1997	1 812	546	7.3	2 689	541	45.6
1998	1 638	542	7.5	2 508	548	46.2
Breed Average	**10 080**	**543**	**7.4**	**14 387**	**544**	**46.1**
National average	**113 988**	**490**	**7.4**	**178 428**	**501**	**45.2**

Scholtz et al., 2000

Standardised growth tests (Phase C) - Results (male)

Year	Tested Animals	Final weight (kg)	ADG (g)	FCR	ADA (g)	Age (days)
1993	165	520	1 811	6.85	1 317	365
1994	204	524	1 900	6.46	1 319	368
1995	294	521	1 871	6.78	1 331	362
1996	237	529	1 932	6.55	1 337	366
1997	170	528	1 953	6.49	1 333	354
1998	192	523	1 924	6.48	1 298	374
Breed average	**1 262**	**524**	**1 898**	**6.6**	**1 324**	**365**
National average	**8 534**	**455**	**1.653**	**6.68**	**1 149**	**365**

Scholtz et al., 2000

Standardised Growth Tests (Phase C) - Body Measurements (male)

Year	Tested animals	Height (mm)	Length (mm)	L:H Ratio	Skin thick. (mm)	Scrotum circum. (mm)
1993	165	1 236	1 455	1.1‘8	16	376
1994	204	1 236	1 461	1.18	17	379
1995	294	1 238	1 461	1.18	16	376
1996	237	1 242	1 453	1.17	16	378
1997	170	1 246	1 460	1.17	16	378
1998	192	1 236	1 460	1.18	15	374
Breed average	**1 262**	**1 239**	**1 458**	**1.18**	**16**	**377**
National average	**8 534**	**1 214**	**1 403**	**1.16**	**16**	**365**

Scholtz et al., 2000

On Farm Growth Tests (Phase D) - Number Tested (male)

Year	1993	1994	1995	1996	1997	1998	Breed total	Nat. total
Tested Animals	369	436	575	504	547	822	3 253	59 180

Scholtz et al., 2000

Comparison: Birth and Weaner weights: breed average (male and female)

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakens-berger	Hereford	Nguni	Simmentaler
Birth weight	33	35	36	33	40	36	38	26	39
205 day weight	185	215	214	209	220	206	204	155	240
ADA (g/day)	743	881	869	863	881	828	810	629	978

Scholtz et al., 2000

Comparison: Twelve and Eighteen Month Weights (female)

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakens-berger	Hereford	Nguni	Simmentaler
365 day weight (kg)	211	263	248	254	372	231	262	178	299
365 day ADA (g/day)	492	630	583	608	884	541	616	417	717
540 day weight (kg)	290	353	325	330	365	310	336	239	384
540 day ADA (g/day)	470	592	537	552	605	510	554	396	639

Scholtz et al., 2000

Comparison: Age at First calving and intercalving period

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakens-berger	Hereford	Nguni	Simmentaler
Age at 1st calving	37	32	33	35	30	36	34	34	31
ICP (days)	450	408	416	442	420	438	399	414	420

Scholtz et al., 2000

Comparison: Cow weights

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakens-berger	Hereford	Nguni	Simmentaler
Cow wgt. at calving (kg)	444	484	486	491	530	472	468	353	543
BW:Cw ratio (%)	7.5	7.2	7.5	6.6	7.5	7.7	8.2	7.5	7.4
Cow wgt at weaning (kg)	461	507	499	491	515	487	507	375	544
WW-CW ratio (%)	41.6	46.1	45.3	44.0	45.1	44.1	42.0	44.2	46.1

Scholtz et al., 2000

Comparison: Standardised growth Tests (Phase C) - results (male)

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakensberger	Hereford	Nguni	Simmentaler
Final weight	367	467	437	414	495	437	476	321	624
ADG (g)	1 267	1 084	1 613	1 325	1 733	1 544	1 811	1 150	1 898
FCR	7.05	6.55	6.69	6.99	7.13	6.96	6.27	6.88	6.60
ADA (g)	903	1 245	1 098	1 030	1 277	1 088	1 220	790	1324

Scholtz et al., 2000

Comparison: Standardised growth Tests (Phase C) - body measurements (male)

	Afrikaner	Angus	Bonsmara	Brahman	Braunvieh	Drakens-berger	Hereford	Nguni	Simmentaler
Height (mm)	1 208	1 229	1 201	1 244	1 239	1 204	1 265	1 173	1 239
Length (mm)	1 325	1 414	1 390	1 356	1 426	1 385	1 457	1 291	1 458
L:H ratio	1.1	1.15	1.16	1.09	1 15	1.15	1 15	1.10	1.18
Skin thickness (mm)	19	13	16	17.0	15	16	15.0	18	16.0
Scrotum circum.(mm)	337	356	346	290	365	349	344	315	377

Scholtz et al., 2000

Comparative Performance of cattle breeds in extensive and intensive systems (mass in kg; growth in g.)

Trait	Experimental (n)				Breed Averages (performance testing 1976-85						
	N	CN	C-hs	CN/N	Nguni	Char	Afr	Short H	Bons	Simm	Brah
					Mean no. observations/breed = 23 550						
Extensive	27 (127)	34 (23)	47 (40)	1.26	28	42	32	34	35	39	32
B-Mass	179 (52)	205 (7)	211 (22)	1.15	-	-	-	-	-	-	-
W-Mass	193 (67)	232 (14)	234 (18)	1.2	-	-	-	-	-	-	-
Average	186	219	223	1.18	164	228	173	194	197	221	197
ADG B-W	775	900	856	1.16	663	907	688	780	790	888	805
W-Mass male	182 (44)	204 (7)	-	1.12	176	316	208	232	232	267	251
female	211 (39)	252 (9)	-	1.19	-	-	-	-	-	-	-
					Mean no. observations/breed = 630						
Feedlot (male)											
F-Mass	353 (15)	486 (5)	486 (5)	1.38	373	567	407	458	472	554	424
ADG	1121	1652	1765	1.47	1206	1761	1130	1451	1449	1655	1156
FCR	7.45	6.36	6.58	0.85	7.07	6.69	7.77	7.38	7.02	7.00	7.20

Scholtz et al., 1990

Preliminary results on milk production and composition

	Weeks in lactation (n=6)		
	Week 1-3	**Week 4-6**	**Week 7-9**
Milk production (L)	8.34	5.84	6.69
Butterfat content (%)	6.06	5.5	6.61
Protein content	3.31	3.13	3.47
Lactose content	4.35	4.85	5.1

Scholtz, 2001

Mean slaughter live and carcass weights per slaughter group for six different breeds

Breed	Slaughter weight (kg)			Carcass weight (kg)		
	*S1 (75%)	S2 (90%)	S3 (105%)	*S1 (75%)	S2 (90%)	S3 (105%)
Afrikaner	283	338	387	148	181	216
Nguni	249	302	3342	138	171	196
Bosmara	349	412	478	197	236	282
Santa Gertrudis	366	446	514	206	254	296
Pinzgauer	363	424	522	199	236	312
Brow Swiss	401	449	534	222	260	322

*S=Slaughter groups representing slaughter weights of 75, 90 and 105% of the final weight of the Phase C (112 day)performance test for each breed

Strydom et al., 1999

Least square means and standard errors of means (SEM) for sensory meat quality and shear force measurements of the *M. longissimus thoracis* of six cattle breeds and three slaughter groups

	Genotype						Slaughter group		
	Bonsmara	**Pinzgauer**	**Santa Gertruides**	**Brown Swiss**	**Afrikaner**	**Nguni**	**1**	**2**	**3**
Aroma[b]	6.2	6.0	5.9	6.4	6.4	6.1	6.1	6.3	6.1
	(0.04)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.05)	(0.05)	(0.05)
Juciness[c]	4.9	5.4	4.9	4.9	5.0	5.5	5.0	5.1	5.0
	(0.05)	(0.17)	(0.11)	(0.18)	(0.11)	(0.08)	(0.07)	(0.06)	(0.06)
Flavour[b]	5.8	6.3	5.7	5.9	6.3	5.9	5.9	5.9	5.9
	(0.04)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.04)	(0.04)	(0.040
Tenderness[d]	4.9	5.8	5.3	5.0	5.5	5.9	5.2	5.3	5.3
	(0.07)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.08)	(0.08)	(0.08)
Residual tissue[e]	4.8	4.2	5.0	5.1	5.2	5.7	4.8	5.1	5.1
	(0.06)	(0.19)	(0.13)	(0.21)	(0.12)	(0.09)	(0.08)	(0.07)	(0.07)
Shear force (N/25mmΦ)	92.3a	101.7a	116.4b	93.3a	95.5a	91.1a	98.5a	97.6ab	90.4b
	(1.87)	(4.17)	(4.17)	(4.17)	(4.17)	(4.17)	(2.18)	(2.18)	(2.18)

a Means in the same row and within each main effect (breed, slaughter group) with different letters differ significantly ($P<0.05$) Strydom et al., 2000

b Aroma and flavour: 1=extremely bland, 8=extremely intense

c Initial and sustained juiciness: 1=extremely dry, 8=extremely juicy

d First bite and initial tenderness: 1=extremely tough, 8=extremely tender

e Residual connective tissue: 1=extremely abundant, 8=none

Appendix II

Characteristics of the Nguni

Blood urea levels in three breeds of bulls from March to August

Month	Breed		
	Simmentaler	Afrikaner	Nguni
March	21.01	22.31	23.13
April	15.78	18.49	20.27
May	11.51	13.35	16.09
June	0.33	9.89	15.09
July	9.32	12.95	16.54
August	7.96	11.52	13.33

Osler et al., 1993

Relative percentage of animals within 3 cattle breeds in the low, medium and high resistance class after 1 and 2 years of exposure to natural tick infestation

Breed	Sex	No.animals	Percentage of animals per resistance class					
			Low		Medium		High	
			1 year	2 years	1 year	2 years	1 Year	2 years
Nguni		20	30	30	40	15	30	55
	Males	10	30	40	60	10	10	50
	Females	10	30	30	20	20	50	50
Bonsmara		18	56	56	22	17	22	27
	Males	9	55	44	11	22	34	34
	Females	9	56	67	33	11	11	22
Hereford		18	50	56	39	33	11	11
	Males	9	44	56	56	44	0	0
	Females	9	56	56	22	22	22	22

Spickett et al., 1989

Effect of each engorged female tick on weaning mass of calves

Breed	Number of one-host ticks	Number of multi-host ticks	Effect of one engorged female tick (g)
Hereford	3 136.5	164	8.9
Bonsmara	2 029.5	164	8.0
Nguni	430.5	82	8.6

Spickett et al., 1991

Comparison between the weaning masses (kg) of calves in a non-dipping situation and when dipped every three weeks

Breed	No dipping	Dipping	Difference
Hereford	137.2	166.7	+29.5**
Bonsmara	166.5	184.1	+17.6*
Nguni	164.7	169.1	+4.4

Difference calcualted as dipping-no dipping

** = significant difference at 5% level

* = significant difference at 10% level
Spickett et al., 1991

Summary: Averages of cow mass and reproductive performance of different breeds in South Africa from 1976-85.

Type	Breed	Cow mass (Weaning)(kg)	Age at first calving (months)	Calving intervals (1st - 2nd) (days)	Calving intervals (cows) (days)	Calculated calving %
Indicus	Afrikaner	459	41	512	469	72
	Brahman	477	37	462	441	79
	Nguni	396	36	442	412	87
Indicus types	Bnsmoara	466	34	463	434	81
	Drakensberger	482	40	514	469	72
	Santa Gertrudis	483	35	501	458	75
British	Angus	455	34	427	425	84
	Hereford	479	35	428	423	84
	South Devon	522	36	455	441	79
	Sussex	555	34	430	430	82
European	Charolais	632	38	446	456	75
	Pinzgauer	474	34	432	426	83
	Simmentaler	507	34	459	449	77
Mean no. observations/breed		11 119	6 831	3 820	21 294	21 294

Appendix III

Examples of bull selection: Estimated Breeding Values

EXAMPLES OF BULL SELECTION: EBV'S

CALF	SEX	SIRE	DAM	BADD	BMAT	BACC	A2ADD	A2MAT	A2ACC	B1ADD	B1ACC	B2ADD	B2ACC
97117	2	9015	854	-0.7981	-0.9464	74	0.8013	-2.7973	70	-3.0159	37	-1.4921	13
98216	2	9472	11	-1.6118	0.9211	73	1.2701	0.3973	38	-2.9824	18	1.6270	11
98241	2	9472	9411	-1.6443	0.2398	75	1.2064	-2.6521	41	-2.9824	18	1.6269	11
98249	2	9472	8811	-1.0496	0.2529	75	1.2933	1.5054	47	-1.2651	29	1.9657	11
98181	2	94549	959	-0.7438	-0.0972	75	5.5975	-2.1614	40	4.4495	24	1.6320	16
97273	2	93499	8854	-0.7967	0.2419	74	11.2220	-3.9351	71	16.7446	57	0.1604	28
95239	2	8912	92109	1.7789	-0.7565	68	2.6441	-3.1194	67	-0.9103	39	0.9105	25
97205	2	92264	938	0.4663	0.0068	77	-0.5719	-6.3459	55	-4.1924	49	-2.6080	40

Animals bought
Animals bought and used for other purposes

Appendix IV

Fertility evaluations of selected bulls

Current semen evaluations of bulls in the distribution project

Tag no.	Semen examination data					
				Sperm morphology		
	Vol. (cc)	Live sperm %	Progression live sperm %	Normal sperm %	Major abnormality %	Minor abnormality %
9659	4	70	60			
9681	6	80	60			
958	5	80	70			
979	10	80	70			
982	10.5	80	70			
9716	20	80	70			
97159	80	80	70			
9841	9	90	80			
9843	12	70	70			
9846	13	80	60			
975	6	80	70			
94109	2	50	20			
9639	3	80	60	12	31	57
940	5	80	60	92	7	
97104	8	90	70	86	13	1
9817	6	90	70	97	2	
9827	10	80	60	84	2	14
98165	3	90	80	91	7	2
98203	5	90	80	93	0	7
9875	9	80	70	83	11	6
9861	9	90	80	97	1	2

Appendix V

Services. Beef Package

MULTI DISCIPLINARY PACKAGE FOR RESOURCE POOR BEEFCATTLE FARMERS

Elements are listed under the heading of the specific section or division that is responsible for its execution.

(*) Possible involvement of other institutions

1. Beef performance recording schemes and genetic evaluation

- Animal identification and recordkeeping
- Weighing of animals (phases A,B and D) and all other records
- Dataprocessing and indices calculation
- Interpretation of indices
- Breeding objectives
- Selection criteria
- Visual evaluation
- Utilize selected animals
- * Grazing, nutrition and supplementation
- * Health (in co-operation with Bayer)
- * Marketing (commercialization)
- Training in all above mentioned aspects
- Training in economic aspects

2. Reproduction and Genetic resources

- Rectal examination for reproductive soundness of cows and heifers
- Synchronization of females for breeding purposes
- Semen evaluation of breeding bulls
- Pregnancy diagnosis
- Artificial insemination
- Artificial insemination training
- Consultation with reproductive management
- Veterinary support services (Health in co-operation with Bayer)
- Conservation of endangered breeds (where applicable)
- Awareness of alternative breeds (if needed)
- Supply of genetic material

3. Quantitative genetics

- Data processing
- BLUP – EBVs
- Training on the above mentioned aspects

4. **Genetic services**
    - Lidcat/stocktheft
    - Diagnostics
- Multi sire
- Characterization
- Casein identification
- Conventional DNA work
- Training in above mentioned aspects

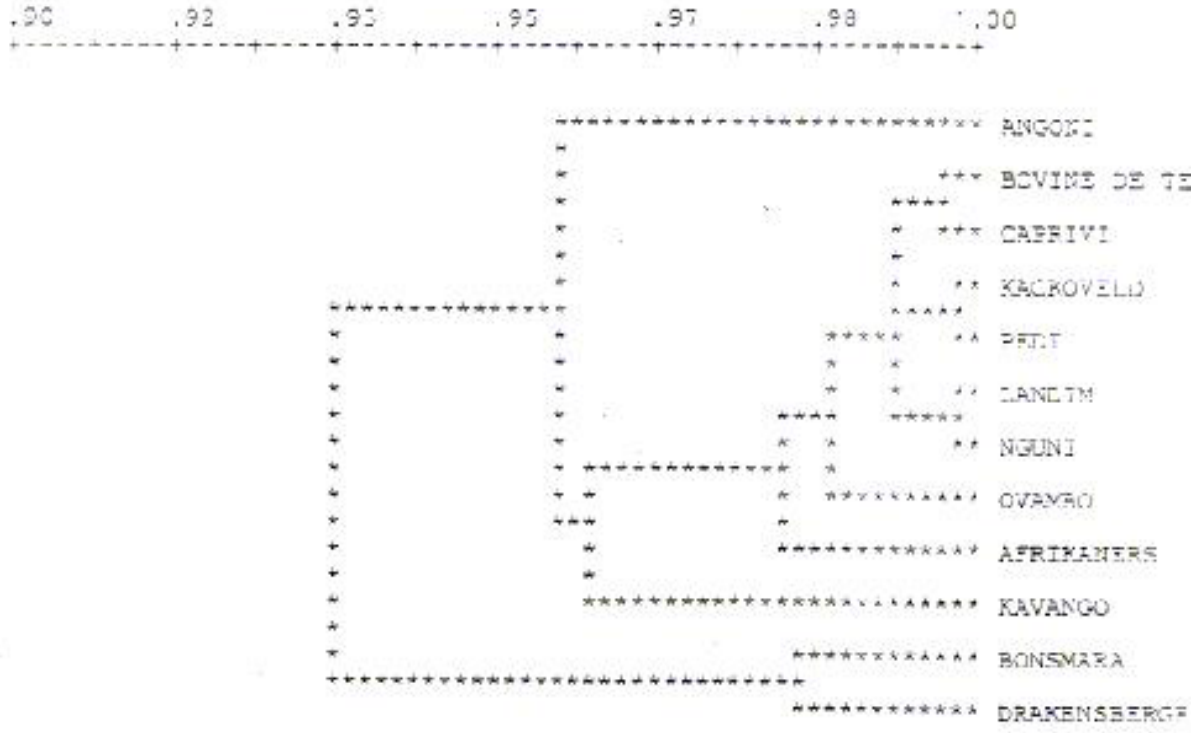
5. **Foreign services unit**

- * Creating a market for animals

Appendix VI

Genetic distances

Dendogram: genetic distances of southern African landrace cattle breeds



Dendogram: genetic distances of Nguni ecotypes