A COMPARATIVE STUDY ON THE BIOLOGICAL PERFORMANCE OF PROGENIES OF WESTERN SANGA X AFRIKANER CROSSBRED AND BONSMARA CATTLE IN THE SOURISH MIXED BUSHVELD OF THE NORTH WEST PROVINCE

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ABSTRACT

The study compares the biological performance of progenies of the Afrikaner x Western Sanga crossbred (small frame) and the Bonsmara (medium frame) cattle on the following traits: calving and growth rates as well as mortalities. The study was conducted in the Sourish Mixed Bushveld of the North West province. The objective was to identify a low-care cattle breed, which can withstand unfavourable conditions under which most farmers in the North West Province operate.

The results of this study indicated that, under good management, the Bonsmara cattle have higher growth rates compared to the Sanga cattle. There were statistical differences with regards to birth, pre-wean and wean masses, ($P < 0.0001$). Sanga cattle however were able to maintain higher calving rates under all varying conditions (Bonsmara 77% average and Sanga 84% average). The Sanga, due to its lower nutritional requirements, on average requires 15% less of the surface area required by the Bonsmara. Sanga cattle also returned better yields in terms of kilogram weaned calf per LSU and per hectare. With regard to herd mortalities, there was no significant difference ($P = 0.03329$).

CHAPTER 1

INTRODUCTION

Africa was fortunate to be well endowed with a diversity of indigenous breeds that have proven remarkably suitable to survive and produce under the prevailing environmental rigors as a result of natural selection (Scholtz, 1988).

The importance of using livestock breeds adapted to specific environments cannot be overemphasized. This is particularly so for tropical environments where, in the absence of resources for substantial improvement of the production environment, the most viable and widely available option is the utilization of adapted animal genetic resources (Rege, 1993a).

Although most indigenous African breeds are adapted to local environments, they have not been specifically selected for high productivity (on a per animal basis). Fortunately some breeds with common genetic heritage to the majority of African breeds do exist and provide opportunity for increasing productivity, exploiting specific adaptive traits (Rege, 1993a).

The severe drought of 1980 emphasized the need for a hardy cattle breed in the parts of Bophuthatswana relevant to this study, which now form part of the North West Province.

In addition the Tswana cattle (Western Sanga), that form part of the Sanga group, were able to survive and even reproduce under conditions where other breeds (mostly exotic) simply perished. With these facts in mind an appeal was made to the Government of Bophuthatswana to conserve this valuable resource, the hardy animals of unique genetic origin, at the Genetic Conservation Breeding Scheme farms of Radobil and Klipkuil in the former Bophuthatswana (Crossley, *et.al.*,1992).

The development of the livestock industry in the former Bophuthatswana was identified as a high priority. Therefore a good strategic plan had to be designed to promote the development of the livestock industry so that it could become a contributor to the economic welfare of the people of the Bophuthatswana.

The proposal was submitted to the top management of the Department of Agriculture of the former Bophuthatswana Government. This led to the development and establishment of the Genetic Conservation Breeding Scheme farms at Klipkuil, Radobil and Wesselsvlei, thus ensuring the conservation and purification of valuable genetic material for the future.

A committee was formed to run this project and the author was appointed as farm manager at the Klipkuil farm. Data were collected and recorded on a daily basis.

The Tswana cattle (Western Sanga) have adapted to local conditions and practices because they have been selected in Africa itself. They form part of the Sanga group that includes other closely related breeds such as the Eastern Sanga, Nguni, Pedi, Nkone, Mashona and others.

The importance of indigenous cattle rests both in their adaptation and in their local availability and abundance. In fact, sustainable livestock improvement cannot be guaranteed for most parts of Africa without utilization of the adaptive traits of the indigenous cattle breeds.

Market pressures and public perceptions are forcing changes in the beef industry. Competition from other beef producing countries and other livestock products continue to intensify and public awareness of environmental, food safety and health related issues continue to increase. In order to remain competitive in the foreseeable future, beef producers will have to adopt methods and practices that are environmentally sustainable and that produce the desired product at the price that the market will be prepared to pay.

The objectives of the Genetic Conservation Breeding Scheme farms included the following aspects:

- To use the farms as centers of guidance and encouragement for development of a stud stock industry in the former Bophuthatswana.

- To produce superior breeding material that could be made available to satellite breeders who in turn, multiply the superior quality, hardy animals and sell them to local farmers thus improving the national herd.

- To re-establish and conserve environmentally adapted and functionally efficient livestock types (rare indigenous breeds) within the farms.

- To put the average livestock farmer in a fundamentally sound position by assisting him or her in the production of meat at prices the consumer can afford. Therefore, encouraging him or her to farm with well-adapted animals such as the Western Sanga, that can use available resources to produce meat of desirable quality and quantity to feed the nation.

The livestock centers continue to pursue the same aims in the North West Province.

1. THE PROBLEM AND ITS SETTING:

Most of the farmers in the former Bophuthatswana shifted from the use of indigenous breeds to synthetic and imported breeds. This shift was promoted by the perception that other breeds out perform indigenous breeds without taking cognizance of the production environment.

Livestock producers in the area do not realize the full economic benefit that can potentially be derived from livestock production. The reasons for this are numerous but can be ascribed to two main factors.

- Firstly, the viability of livestock production in the North West Province is currently threatened by a progressive deterioration of the grazing resource.

- Secondly, the livestock sector is resource poor in respect of many of the resources required for effective livestock production.

Grazing land is a very scarce resource and most emerging livestock farmers conduct their farming practices on tribal and communal land where proper gazing management is extremely difficult if not impossible.

Sanga cattle are known to be “low–care” cattle due to their adaptation and seem to be the answer for such areas. However, there is resistance among livestock farmers against farming with indigenous breeds like Sangas.

As the objectives of the Bophutatswana Department of Agriculture and those of the current North West Province Department of Agriculture, Conservation and Environment are similar concerning this issue, the area will now be referred to as the North West Province.

1.1 THE PROBLEM STATEMENT:

The Southern part of the African continent has a large number of beef breeds, comprising indigenous, exotic (imported over the years) and a number of composite breeds (approximately twenty six) (Ramsey, 1992). This poses a big challenge to livestock farmers in the North West Province when deciding on which beef breed to farm with.

In today's red meat industry it is important to produce quality meat and other animal products as economically as possible. In order to achieve this, the livestock farmer has to keep input costs as low as possible while maintaining a competitive level of production. In the North West Province rainfall is relatively low and seasonal and long-term droughts are frequent.

Due to the environmental and climatic nature of the area, livestock production forms the mainstay of the emerging farming community. It is however, essential that farm animals are adapted to these conditions to ensure sustainable red meat production.

The purpose of this study is to evaluate the biological performance of the progenies of Sanga x Afrikaner crosses and the Bonsmara breed by comparing and analyzing their production performance data in order to identify a suitable cattle breed for extensive beef cattle ranching in the North West Province.

1.2 SUB PROBLEMS:

1.2.1. Why has the local livestock farmer in the North West Province shifted from the use of indigenous cattle breeds to exotic and composite breeds?

1.2.2. Can livestock farmers in the North West Province have sustainable beef production without using the adaptive traits of the indigenous cattle breeds such as the Sanga?

1.2.3. Local markets, including feedlots, regard indigenous cattle breeds as inferior, why?

1.3 THE HYPOTHESIS

1.3.1 Progeny from a Sanga X Afrikaner cross breeding system will return a better gross margin per hectare in the medium and long term than those from a Bonsmara pure breeding system managed under identical conditions, on the same farm.

1.3.2 Progeny from the Sanga x Afrikaner cross will at least equal the biological performance of purebred Bonsmara cattle when exposed to the same managerial programme.

1.4.1 LIST OF ABBREVIATIONS

ADG	Average daily gain
Ad lib.	Free access
B. M.	Birth mass
c	cent (monetary unit for RSA)
^{O}C	degree centigrade / Celsius (temperature)
cm	centimeter
CP	Crude protein
DL	Di-calcium phosphate salt lick
E	East
E.P.D.	Expected Progeny Difference
FCR	Kg feed intake/ kg Mass gain
g	gram
G I	Generation Interval
Ha	hectare
I.C.P.	Inter calving period
Kg	kilogram
Km	kilometer
LSU	Large Stock Unit
M	the mean of sample
mm	millimeter
N	the number of observation of sample
Mo	month
R	Rand (monetary unit of RSA)
RSA	Republic of South Africa
S	South

SD	**Selection differential**
SE	Standard error
X	the mean of sample of observation
*	numbers non-significant

1.4.2 DEFINITION OF TERMS

ADAPTABILITY	:	The ability to maintain an acceptable level of reproduction and production under varying climatic and environmental conditions.
BIRTH WEIGHT	:	Calf's birth weight determined within 24 hours of birth.
ADJ. 205 WEIGHT	:	Animal's weaning weight adjusted to 205 days.
ADJ. 365 WEIGHT	:	The animal's own yearling weight adjusted to 365 days.
FORAGE	:	Plant material on the land and still growing, for grazing or browsing animals to feed on.
HARDINESS	:	To sustain and survive and continue reproducing although at reduced rate under extremely difficult conditions.
HERITABILITY	:	The extent to which a characteristic is conveyed to the next generation by means of genetic transferal expressed as a percentage

HYBRID VIGOUR	:	Occurs when individuals of genetically divergent breeds are mated. It is an increase in growth, fertility and various other traits of hybrid progeny over the average of both parents. Alternatively it is the genetic ability of a breed that, due to its biological uniqueness, can complement any other breed through cross breeding.
EASE OF CALVING	:	Inherent ability of the female animal to limit pre-natal growth which also leads to low birth mass. The characteristic sloping rump formation also facilitates the birth process.
EFFECIENCY	:	Kg Calf produced per 450 cow unit.
ECONOMICAL SELF SUFFICIENT		Low veterinarian costs enjoyed with extensive pasture land results in minimum financial inputs.
CROSSBREEDING	:	Mating animals of different breeds
MEAN	:	Total weight of all animals/number of animals
STANDARD DEVIATION	:	The square root of the variance
VARIANCE	:	The square of the sum of each deviation of every measurement from the mean

SELECTION DIFFERENTIAL	:	The difference between the mean performance of the selected group of animals and the original group they were selected from.
SELECTION INTENSITY	:	The proportion of animals chosen from the original group of animals.

1.5 ASSUMPTION

Western Sanga x Afrikaner crossbred cattle can be as productive, if not more productive than, purchased Bonsmara cattle when managed identically when evaluations are based on a unit of measurement that is comparable e.g. ha or Large Stock Unit (LSU) rather than on a head basis. The former accommodates differences in maintenance and production requirements arising from differences in unit live weights. This is not the case when breeds are compared on an animal basis (De Brouwer, 1998).

1.6 DELIMITATION

The study was conducted at the farm Klipkuil in the North West Province. The study area was 5400 ha in size and the vegetation comprised of the Sourish Mixed Bushveld (veld type 19 and 13c: Acocks, 1953). The farm is situated 26^0 43'E 25^0 S at an altitude (Thabazimbi 2426 map) 1088m. The study covers only the Sanga x Afrikaner crossbreed and the Bonsmara purebred cattle and not the small stock (goats and sheep) and game also utilizing the farm.

1.7 THE IMPORTANCE OF THE STUDY

During the 1970's and 1980's the use of breeds such as the Brahman and other exotic breeds were widely advocated based on research results. The use of indigenous breeds was often not an issue simply because very little research information was available at the time.

The results of this study will be used to help farmers in deciding on which cattle breed best suits their environmental conditions.

Since cattle have a relatively long generation interval, breeding decisions need to be made several years in advance of the required outcome. There is an element of prediction required as to the type of cattle that will satisfy the needs of the producers, processors and the consumers in several years time.

This research deals with some of the principles involved in breeding cattle that are suited to the hot, semi-arid regions, that meet current market requirements and that have the potential to achieve relatively high productivity in future production systems. It is envisaged that production systems will become progressively more extensive (ranching), requiring low inputs as these costs continue to rise.

Experience with other livestock species indicates that commercial beef producers will be forced to reduce the amount of time and money they can devote to any individual animal. The need for "easy-care" cattle is increasing.

It is always advantageous to farm with cattle that are free from physical defects that affect production and that have a desirable temperament and cows that will calve and rear calves to weaning without assistance form the core of the beef cattle industry. The most important factor in any livestock production system is reproduction. This ensures that a

product is delivered that can be channeled into various “value adding processes”. In the beef industry the latter refers to growth potential and the realization thereof. The calf must first be born and weaned before the growth can be exploited. No calf – no product.

Commercial cattle must be well adapted to their production environment and have the mature size that is optimal for the environment and for the market for which they are destined. All of these attributes have to be considered in any genetic improvement program aimed at improving the long- term efficiency of beef production. In addition to being “ easy care”, commercial cattle must also have a level of productivity that is commensurate with the environment in which they are reared, and produce meat of the quality required by the markets for which they are destined.

According to R.S.A performance test scheme results the Sanga has proved to have a short inter-calving period (421 days) and a high cow efficiency rate (43.1 %)(Bosman, 1994).

Sangas are able to produce milk and meat for the family and are used as draft animals for transport. They are as much a part of this country as people and have played an important role in tribal traditions culture and rituals.

Whilst capital investment in the livestock sector is clearly necessary, it is only a means to an end for human capital development. Therefore, the emphasis of a livestock development strategy should be on the investment in human capital.

In so far as this philosophy would lead to higher levels of education and attitudinal change, it is possible that the contradiction between short-term rational livestock keeping practices and long-term irrational livestock behaviour in this regard would be resolved in the long-term.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

All indigenous cattle in Africa, even when kept under optimum conditions, are fairly small in size, probably indicating that the environment is such that it cannot support large animals over long periods (Scholtz, 1984). Taylor & Murray (1987) indicated that under conditions of periodic feed shortage small breeds have an advantage over large breeds. For that reason, it is of no use to select for growth rate or body mass above a certain optimum level, as it might result in animals that are not adapted to prevailing conditions.

Klosterman (1972), Roux, Warwick & Cobb (1996), as mentioned by Scholtz (1984) stated that when breeds or lines of different sizes are tested over equivalent physiological periods, or equivalent degree of maturity, they will show equivalent efficiency. Halbrook & Brown (1986) of Arkansas found no economic justification for selecting heavier mature beef cows and indicated that a premium price for calves from larger dams would be necessary to justify the expense of providing more feed for their maintenance. If large cows are kept, it will be necessary to provide more feed per cow in order to ensure optimal reproduction and lactation, which is impossible in most areas of Africa.

The bottom line is that any system producing large offspring for slaughter from small dams will be more efficient than a system with large dams. The gain in efficiency can be attributed to the smaller feed requirement of the smaller dam.

Limited genetic potential of indigenous cattle has often been quoted as a major constraint for beef and milk production in Africa.

According to Hofmeyr (1974) the standard of husbandry and management and the attitude of cattle farmers are such that productivity is often extremely low and little or no increase in production is possible through the introduction of potentially more productive breeds until these traditional methods of husbandry have been changed.

Therefore, it is not the genetics of the indigenous breeds that is suspect, it appears to be more an environmental limitation on these breeds' ability which has created the perception that they are inferior to exotic or imported cattle.

Indigenous cattle breeds such as the Sanga, which evolved in Africa are well adapted to the prevailing conditions and have an important, and maybe even vital, role to play in animal production systems as a result of natural selection. The indigenous cattle should form the basis of the cattle industry under the prevailing managerial and environmental conditions of the African continent. They are hardy, disease resistant and multifunctional, supplying not only meat products but also milk and dung. In many instances their use is expanded to that of draft animals that also impacts on nutrient requirements in the long-term.

2.1 THE ORIGIN OF THE BONSMARA AND THE SANGA AND THE HISTORY OF THE AFRIKANER CATTLE BREEDS

Cattle have been an integral part of everyday agricultural life for thousands of years. A partnership has been built up where cattle supply the human race with different products in return for protection and a guaranteed feed supply. Hence, both partners benefit from the association although humans are the dominant species (Rege, 1993b).

Cattle have spread all over the word, but the achievement of this situation has taken thousands of years and considerable human assistance. The common ancestor of the cattle family began life in Asia and gradually spread to Africa, Europe and North America. During this

long period, different varieties of cattle were emerged and became adapted to their new habitats through natural and artificial selection (Rege, 1993a).

There are approximately 30 beef cattle breeds in South Africa at present (Bosman, 1994). These include a number of indigenous breeds, under which the Sanga and Afrikaner resort, composite breeds where-under the Bonsmara resorts and exotic breeds imported mainly from Europe and Asia. In the last grouping some of the well-known breeds include Simmentaler, Hereford and Brahman.

2.1.1 THE ORIGIN OF THE BONSMARA

Before the Second World War, a need was identified for a beef cattle breed that could produce economically in the sub-tropical regions of South Africa. Most of the cattle breeds present at the time, such as the Afrikaner, did not have the desired growth potential.

Also they were relatively late in reaching puberty and many cows did not calve regularly although their adaptability was, and is still, excellent.

On the other hand, the exotic British breeds present at that time performed well in the more temperate environment but could not adapt well in the hotter environment.

Due to their rough coats with long hair, they were susceptible to tick-borne diseases and could not tolerate severe heat stress in the sub-tropics.

The Mara research station in the Northern Province of South Africa, with an altitude of 900m and average annual temperature of 19 °C

(attaining 40°C during the summer months), was acquired in 1935, (Bosman,1986).

During 1937 an extensive crossbreeding program started at Mara under the guidance of Prof. J.C. Bonsma, who followed in the steps of his brother Prof. F.N. Bonsma. Four hundred selected Afrikaner cows were divided into five groups of 80 cows each and mated to bulls of five British beef breeds, viz., Hereford, Red Angus, Red Poll, Shorthorn and Sussex and the progeny were performance tested (Bosman, 1986).

From early results it became obvious that tropical degeneration was nothing but chronic malnutrition caused by hyper-thermia in animals that could not successfully dissipate excessive metabolic heat.

According to Bosman (1986), Hereford and Shorthorn crosses (exotic E) with Afrikaner (indigenous, A) were superior and other crosses were eliminated from the project. Eventually three-quarter Afrikaners were mated to first cross progeny to obtain progeny with $^{5}/_{8}$ Afrikaner and $^{3}/_{8}$ Hereford or Shorthorn blood.

An imitation of the successful $^{5}/_{8}$: $^{3}/_{8}$ blood ratio of the Santa Getrudis, the combination of $^{5}/_{8}$ A : $^{3}/_{8}$ E was decided upon for the development of a new breed as follows:

1st step : Exotic (E) bulls x Afrikaner (A) females
Progeny : ½ E : ½ A

2nd step : A bulls x ½ E:½ A females
and ½ E:½ A bulls x A females
progeny :¼ E: ¾ A

3rd step : ½ E:½ A bulls x ¼ E:$^3/_4$ A females
¼ E:$^3/_4$ A bulls x ½ E:½ A females
progeny:$^3/_8$ E:$^5/_8$ A

4th step : $^3/_8$ E:$^5/_8$ A bulls x $^3/_8$ E:$^5/_8$ A females
progeny: BONSMARA

Observations based on body measurements, body temperatures, pulse and respiratory rates, hair counts per square centimeter and tick counts were done. The results were valuable criteria in the selection process.

The first calves of the $^5/_8$ Afrikaner $^3/_8$ Hereford or Shorthorn general profile were born during 1943. Strict selection was also directed at improving adaptability, growth rate, fertility and milk production. All animals were dehorned.

According to the results, average weaning weights of 195kg at 240 days were achieved (about 20% higher than those of the three parent breeds).

In addition, higher calving percentage was obtained and calf mortality was much lower than in the British beef breeds and similar to that of the more adapted Afrikaners.

Different lines were developed, viz., the Edelheer, Roodebos and the Wesselsvlei lines. The animals used in this study were derived mainly from the Wesselsvlei bloodline.

The animals referred to are the original Red Poll crosses that were transferred from Mara during 1949 to the Department of Native Affairs and the development programme of the breed was continued on the farm Wesselsvlei near Kuruman. Some of those animals were transferred to Klipkuil breeding station in the Mankwe / Groot Marico area.

The Bonsmara has been scientifically bred and developed with strict selection for economical production traits useful in the extensive cattle grazing areas of South Africa. The breed has gained popularity and it has grown to be one of the largest beef breeds in South Africa, within a short period of time.

The name “Bonsmara” was suggested by Mr. EA Galpin, one of the co-operative breeders, as a tribute to Prof. JC Bonsma, the man who played a vital role in the development of the breed, and “Mara” the name of the farm on which the animals were bred.

2.1.2 ORIGIN OF THE SANGA

According to historians the origin of the Sanga cattle can be traced back to around 1600 B.C. in the region of present-day Ethopia and Somalia. They are the result of crosses between the humpless Hamitic Longhorn and the Zebu. The two main distinguishing features between the Zebu and Sanga cattle are the size of the horns and the position and shape of the hump. Most Sanga cattle have long or very long horns, which are often lyre or crescent shaped while the Zebu's horns are shorter and thicker (Rege,1993a).

The hump of the Sanga is situated in front of the withers, more on the neck (cervical) and that of the Zebu tends to be square above the forelegs (thoracic). In addition the Sanga's hump is generally smaller than that of the Zebu. As indicated by Ramsay (1986), the Zebu is characterized by an acrocentric Y- chromosome and a fatty thoracic hump. This distinguishes Zebu cattle (*Bos inducus*) from other cattle (*Bos taurus*). The Sanga has a sub-metacentric Y-chromosome and a muscular cervico-thoracic hump. The former is associated with *Bos taurus* (European) cattle, resulting in the Sanga being neither simply *Bos taurus* nor *Bos inducus*. Sanga humps do not fall over to one side as is sometimes seen in large Zebu humps.

Rock paintings found in Libya and the Sahara desert, estimated to be nearly 8000 years old, depict Sanga-like, long-horned cattle. This places new perspective on the arrival of the European humpless longhorn, the progenitor of the Hamitic longhorn previously set at about 5000 B.C. (Felius,1985) as quoted by Bothma & Kraupner (undated).

Sanga cattle migrated southward, together with their owners, along three different routes:

1. South westerly to present day Namibia (Ovamboland) and Botswana

2. Southerly to present day Zimbabwe, Northern Province and Mpumalanga

3. South easterly to present day Mozambique and Swaziland (Robey, 1985 & Opperman, 1986) as mentioned by Bothma & Kraupner (undated).

It is believed that isochronal maps, based on cattle remains on which dating has been done, clearly illustrate the wave-like movements of the cattle and their owners from the Sahara via East Africa to Southern Africa. Recent research has indicated that the Sanga's origin could be entirely African and they were on the road to extinction.

TABLE 2.1 Classification of African Cattle (Maule, 1990).

Zebu (*Bos indicus*)		
1.	North Sudan Zebu	Baggara, Begeit, Butana, Kenana
2.	East African Shorthorned Zebu	Arsi, Murle, Somali, Gassara, Garre, Boran, Karamajong, E.A. Zebu, Angoni, Malawi, Zebu, Nuba Mountain Zebu
3.	Madagascar Zebu	
4.	West African Short – and medium-Horned Zebu	Azaouak, Maure, Shuwa, Sokoto, Gudali, Tuareg, Adamawa, Diali
5.	West African lyre horned	Senegal Fulani, Sudanese Fulani, White Fulani, Red Bororo, Fellata.
SANGA		
A.	Sudan and Eastern Africa	
1.	Nilotic	Dinka, Nuer, Abigar
2.	Danakil	Danakil, Galla-Azabo
3.	Ankole	Bahima, Watusi, Bashi
B.	Southern African Longhorned	
1.	Setswana	Barotse, Tswana, Tuli, Matabele, Ovambo
2.	Nguni	Nguni, Bapedi, Landim, Nkone
3.	Africander	
C.	Southern African Shorthorned	
1.	Mashona	
2.	Tonga	
3.	Basutu	
4.	Drakensberger	
SANGA X ZEBU		
1.	Ethiopia	Arado, Fogera, Horro
2.	East Africa	Tuni (Jiddu), Nganda, Alur, Sukuma
HUMPLES CATTLE OF W. AND N. AFRICA		
1.	West African Longhorn	N'Dama, Kuri, Namchi (Namji)
2.	West African Shorthorn	
	i) Savanna type	Baoul'e, Bakosi, Ghana Shorthorn, Savanna Muturu, Somba
	ii) Dwarf type	Gambian dwarf, Forest Muturu, Lagune, Manjaca
3.	North African Shorthorn	Egyptian (Damietta), Libyan, Brown Atlas
HUMPED X HUMPLESS		
1.	Zebu x N'Dama/Dwarf Shorthorn	Djakore, Bambara, Borgu (Keteku), Biu
2.	Zebu x Kuri	Jorkoram, Kanem
BOS TAURUS X BOS INDICUS		Bonsmara, Rana, Renitelo, Mpwapwa

TABLE 2.2. Sanga Cattle in Southern Africa (Maule,1993)

Recognized basic breeds	Related breeds and varleties	Countries/Areas
AFRIKANER		S.Africa and all neighbouring countries
		Lesotho
BASUTU	Nguni	Swaziland
NGUNI	Swazi*	Mozambique
	Landim*	Transvaal
	Bapedi*	N E Transvaal
	Bavenda (Sibasa)	
		Matabeleland
NKONE	(Syn: Manguni)	Zimbabwe
	Govuvu	
		Mashonaland,
MASHONA	Kavango	Zimbabwe
		Namibia
6. OVAMBO	Caprivi	Namibia
	Koakoveld (large variety of Ovambo)	Namibia
		Zambia
7. TONGA	(Syn: Shorthorned Sanga)	
	Tswana, Batawana, Mangwato	Botswana
8. TSWANA	(Ngwatu)	N.W. Botswana
	DAMARA*	**E. Botswana**
	Western Sanga	**Namibia**
		Bophuthatswana
* Indicates separate breed status.		

FIGURE 2.1 Possible migration routes of domestic cattle in Africa (Oliver, 1983).

2.1.3 THE HISTORY OF THE AFRIKANER

The history of the Afrikaner cattle in South Africa is closely associated with the history of the country's people (Nicholas, 1996). It is often categorized under the *Bos indicus* group and one of the most important indigenous cattle breeds.

Thoracic humped cattle (Zebu) are not indigenous to the Southern African sub- continent, (Schoeman, 1989).

The Afrikaner was the first cattle breed encountered by Jan van Riebeck on his arrival in the Cape. Although little is known about the origin of the breed, it is believed that in its most primitive state it originated on the Steppes of Asia from the wild cattle of that time. Since then, it has descended from the lateral-horned Zebu without any infusion of foreign blood.

The Afrikaner crossed into Africa about 2000 years ago and during successive centuries, gradually migrated southwards, with only the animals best adapted to arid desert conditions, extreme heat, tropical diseases and both endo- and ecto- parasites finally reaching the southern tip of the continent.

Portuguese sailors reported as long ago as the 15th century, that the Hottentots in the South western region of the country already owned herds of these cattle. However, the Afrikaner's outstanding qualities were appreciated by most of the South African farmers and it was the first breed to be registered in 1912. Due to the efforts of Alex Holm, a studbook was formed so that planned breeding could take place to control the breed's development.

The Afrikaner almost became extinct due to outbreak of Rinderpest (1890's) and the South African wars. As a direct result, various exotic breeds were imported to build up the country's depleted cattle numbers (Nicholas, 1996).

2.2 COMPARATIVE PRODUCTIVITY

Schultheiss (1992), argued that “The extensive beef cow breeding herd remains the main source of beef for the ever growing consumer population and failure of the cow to conceive annually is the biggest constraint on optimum beef cattle production”.

Sufficient evidence exists in literature to prove that, under conditions in which indigenous cattle breeds are kept, specialized imported breeds would be incapable of equal performance. Studies done on improved production by Schutte (1935), Bonsma (1949), Buck *et. al* .(1982), Moyo (1990) and Vilakati (1990) as mentioned by Rege (1993b), have shown that indigenous cattle breeds can be as productive, if not more productive, than exotic cattle breeds, especially if account is taken of viability and maintenance requirements as measured in terms of live-weight.

A study by De Brouwer (1998) compared the production of large framed exotic cattle to small framed indigenous cattle in a number of different fodder flow or wintering systems. When managed similarly and with equal reproductive performance there is no difference between these disparate breeds in terms of yield per hectare or per LSU.

The excellent productivity through high fertility, adaptability and low mortality rates of indigenous breeds, is frequently overlooked as a result of the vigorous promotion of exotic breeds. This often occurs to the detriment of producers and development projects. Both heterosis and complementarities can be utilized to increase the productivity of the indigenous breeds significantly without sacrificing their adaptive ability.

2.2.1 FERTILITY

Van Zyl, Maree &, Seifert, (1993) argued that environmental influences are probably the main determinants of calving percentage given the low heritability (hz =0.11) of cow fertility. Lactational anoestrus has been identified as an important component of differences in low fertility. Afrikaner cows are likely to be affected by this phenomenon. The illustration in Table 2.3 supports this:

TABLE 2.3 Fertility and comparative income from Sanga, Afrikaner, Hereford, Simmentaler and Santa Gertrudis cattle under extensive range conditions without supplementation (Barnard & Venter, 1983)

BREED	AV CALVING % (6 YEARS)	AV CALVING INTERVAL (DAYS)	NET INCOME (AFR = 100)
Afrikaner	74	460	100
Hereford	78	462	97
Sanga	92	372	141
Santa Gertrudis	78	420	103
Simmentaler	78	416	88

As argued by Maree & Plug (1993), fertility, milk production, mortality rates and fluctuations in body weight are main criteria in the evaluation of adaptability to the environment. Under proper management the fertility of indigenous cattle breeds is excellent. In a trial with stocking rates at comparable biomass and comparing productivity of Afrikaner, Santa Gertrudis, Hereford, Sanga and Simmentaler cattle, the Sanga herd was by far the most efficient. This is due to their excellent calving rate (92%) and relative weaning weights (weaning weight as a percentage of maternal weight).

According to research into the production potential of indigenous cattle with special reference to the Sanga, Nguni cows tend to be comparatively fertile under extensive conditions when compared with other breeds (Van Zyl, *et.al,* 1993). The reason could be that they do not go into anoestrus when nursing their calves. On average, a herd of Nguni cows will produce more calves than a herd of equal numbers of other breeds of cows kept under similar conditions.

2.2.2 MATERNAL INFLUENCES ON BIRTH WEIGHTS

According to Van Zyl, *et.al.,* (1993), Sanga and Zebu dams exhibit a unique feature of relatively light calves at birth, that reduces the chances of dystocia. The low birth weight of Sanga and Zebu breeds, as well as that of their cross-bred progeny, that is generally below the mid-parent value of the parental breeds, (with the exception of Brahman-sired progeny), is a guideline to the application of these breeds as dam lines in crossbreeding systems.

In a study conducted in the USA, Brahman cows mated to Brahman bulls gave birth to calves weighing an average of 30.1kg. When mated to Hereford bulls, the birth weight of calves averaged 30.4kg, an increase of less than one percent. It is speculated that a large maternal negative additive influence may be responsible. In crosses between Charolais bulls and Nguni cows the birth weight of the progeny was higher than that of pure-bred Nguni calves (34 versus 25kg), but lower than the mid-parent value of 37kg. This indicates a similar negative maternal influence.

The relative birth weight of different types of cattle does not show a large variation. This indicates that absolute birth weight may only be partially responsible for the occurrence of dystocia. The sloping rump of Sanga females creates a larger opening in the birth canal and facilitates easier parturition.

2.3 GENETIC VALUE AND INHERENT CAPABILITIES

Under ranching conditions the Sanga cow is reputed to be a fertile and biologically efficient beef animal. It has also been reported that the feed conversion ratio of the Sanga on a high energy and concentrate diet compares well with that of the improved foreign breeds (Scholtz & Hofmeyr, 1992). In addition, Sanga cows show the following attributes:

- Early sexual maturity
- Exceptional fertility
- Excellent foraging ability coupled with on-veld growth potential
- Heat and drought tolerance
- Ease of calving
- Placid temperament
- Resistance to ticks and tick-borne diseases
- Longevity

2.3.1 Nutritional Aspects

The basic resource of the livestock producer is feed, with natural grazing being the most economical and most widely available in South Africa. The ability of the animal to convert this feed into money is dependent on its genetic composition.

One of the factors playing a role in the amount of nutrient required to enable an animal to perform the daily physiological processes

necessary for its survival is body size. The larger the size, the higher the maintenance requirement. Cow size is therefore important since maintenance of the breeding herd accounts for a large proportion of the total costs of beef production and approximately 50% of the total feed requirements (Dickerson, 1984) as quoted by Setshwaelo (1993).

According to Tainton (1981), selective defoliation is affected by the size of the animal and its physiological and anatomical adaptations. That this is so is predictable from current theory on the veld - herbivore relationship.

According to Cartwright (1984) as mentioned by Setshwaelo (1993), some simulation studies demonstrated that in situations where nutrition was limited, the breed with lower production potential was more efficient in total herd off-take per unit of energy used. However, as the level of nutrition improved the larger body sized, faster growing breed tended to be superior. This effect is illustrated in the Figure 2.2 [Cartwright (1984) as quoted by Setshwaelo (1993)].

FIGURE 2.2 The relationship between body size, level of nutrition and production. Cartwright (1984)

Results from work done in Botswana have clearly demonstrated that :

- when cow size is included as one of the parameters in estimating efficiency values, breeds with larger body size are highly disadvantaged irrespective of the calf growth rates.

- in marginal production environments, where feed availability is not only seasonal but also limited, cows with larger size are likely to suffer more reproductive impairments than those of smaller breeds whose maintenance feed requirements are lower (Setshwaelo, 1993).

The results on which these conclusions are based, are shown in Tables 2.4 and 2.5

Table 2.4. Reproductive and growth performance of breeds which differ in mature sizes. (Setshwaelo, 1993).

Breed	Calving (%)	Birth weight (KG)	Weaning Weight (kg)	18 Month weight (kg)
Afrikaner	67	31	175	276
Brahman	72	28	187	309
Tswana	80	31	180	294

TABLE 2.5 Least–squares means for RR, WR, and BEP (Setshwaelo,1993).

	Trait			
Breed	**RR**	**WR**	**BPE**	**Cow weight**
Afrikaner	43.5 + 1.50	77.3 + 2.80	1.35 + 0.03	440
Brahman	54.9 + 1.60	91.5 + 2.90	1.37 + 2.90	450
Tswana	65.6 + 1.50	113.1 + 1.50	1.31 + 2.80	420

Reproductive rates (RR) = $\frac{\text{Cumulative cow pregnancies}}{\textbf{Total number of years in herd}}$

Weaning rate (WR) = $\frac{\text{Cummulative weight of calves weaned}}{\text{Total number of years in herd}}$

Beef production efficiency (BPE) = $\frac{\text{Average weight of calf weaned}}{\text{Average cow metabolic weight maintained p/yr}}$

Most of the indigenous cattle breeds have low maintenance requirements and in addition to that, a small body size is often overlooked as the most convenient size for rapid disposal in environments with inadequate transport networks and freezing facilities.

Taylor & Murray (1987) indicated that small animals have an advantage over large animals under conditions of sparse feeding or low nutritional levels. In such conditions, selecting for body weight above certain optimum levels might result in animals becoming less adapted.

2.3.2 Blood values

According to Frisch & Vercoe (1991) as mentioned by Heyns, Hoogenboezen & Swanepool (1993), *Bos taurus* cattle have a lower capacity to recycle blood urea back into the rumen than Brahman and Brahman crosses. As pointed out by Bothma & Kraupner (undated), studies conducted by Linington & Osler (1992) have shown that Nguni cattle have significantly higher plasma urea nitrogen levels than Brahman and Bonsmara cattle. The results of the studies are presented in Table 2.6.

TABLE 2.6. Blood urea nitrogen levels for three different cattle breeds (Linington & Osler, 1992)

Group	No. of animals	Plasma urea N Mg N/100 ml	SD	Plasma urea (reM)	SD
Bonsmara	6	4.26	1.98	1.52	0.71
Brahman	8	4.58	2.64	1.63	0.94
Nguni	31	7.34	4.22	2.62	1.47

The reasons for the higher plasma urea N levels remain theoretical at this stage. There are a few explanations, viz.:

1. The Nguni could have a system of recycling urea in the body that may also involve an altered kidney function, and less urea would be excreted via the urine.
2. Lower N requirements
3. The Nguni cattle select a diet to include sources with higher protein content.

2.4 TOLERANCE TO CLIMATIC STRESS, PARASITES AND DISEASES

Heyns,et.al., (1993) argued that breeding cattle in the tropics or other stressful environments complicates genetic improvement. Under most tropical and sub-tropical conditions beef cattle play a major role in the utilization of grassland areas unsuitable for crop production. The rainfall in these areas is erratic, the soils are poor and infestation with internal and external parasites is rife, all of which combine to seriously limit beef production. Ordonez (1990) as mentioned by Heyns, et.al.(1993), argues that the degree of modification of a natural environment is determined by the value of increased production relative to the cost of improving the environment. As a result, most research suggests that long-term solutions would not include radical environmental modification but rather breeding the proper genotypes.

The animal's body size determines the productive adaptability in a hot and stressful environment. Environmental stress reduces growth rate, primarily through the depression of feed intake, but also by affecting digestion and metabolism (Vercoe & Frisch, 1982) as sited by Bothma & Krauper (undated). In stressful environments breeds such as the Sanga, which are more resistant to stress, have higher growth and lower mortality rates.

The body size-adaptability phenomenon is responsible for systematic genotype-environment interaction. This emphasizes the antagonistic relationship between adaptive and productive traits (Horst, 1984 quoted by Heyns *et.al.,* 1993).

Some indigenous Sanga cattle types such as the Nguni, Barotse and Angoni have evolved under conditions of high temperature and humidity, often with poor quality roughage as an additional stressor. Consequently, these breeds and their crosses are the ideal choice for such areas and their maternal lines should be employed because of their superior adaptive characteristics (Van Zyl, *et.al.*, 1993).

Temperature is most important in determining which type of animal to keep in a particular region. In areas where the atmospheric temperature is high and where the annual isotherm is high, un-adapted animals will degenerate (Lofgreen,*et.al.,*1975) as quoted by Rege (1993b). Few exotic breeds such as cattle of European origin can thrive in areas where the average annual isotherm is above 18,3 ^{o}C. If it exceeds 21.1 ^{o}C, they will suffer from tropical degeneration. Stunted growth, low fertility and hyper-thermia, characterize tropical degeneration (Bonsma, 1980).

The physiological system of the animal can be affected by these factors. It is important to take into consideration the unique harsh characteristics of the African cattle production environment when making decisions regarding breeds, production systems and management, especially, nutritional programme.

The indigenous breeds thrive well under extreme heat. This exceptional characteristic can be attributed partly to the large surface area of their hides, which also has many more sweat glands than the exotic breeds. This loose hide gives a favorable weight to area ratio that aids in the dissipation of excess heat (Bonsma, 1980).

Studies on the effect of heat stress on different animal breeds dates several decades. The pioneering studies were based in the Southern United States and in Australia.

The work done by Bonsma (1949), include not only heat tolerance but also effect of heat on draft ability and effects of coat type on heat stress.

According to studies done by Bonsma (1949), Afrikaner cattle were found to be more heat tolerant and could withstand water deprivation longer with less weight loss and better draft ability than exotic breeds. Results have pointed to differences in adaptability to climatic stress not

only between the tropical and temperate breeds, but also among breeds indigenous to the region.

The hide of the Afrikaner serves to protect it from the hardships of nature as it is thick with a good blood supply, which assists in the rapid healing of wounds.

External parasites are less able in succeed to sucking blood and are less able to find a grip on a short smooth coat. The hide possesses numerous sweat glands that assist in cooling down the body through evaporation with latent heat acquired from the body.

Numerous sebacious glands secrete sebum, keeping the hide oily and glossy. This prevents dehydration and this secretion repels ticks and flies. The glossy appearance of the coat also helps to reflect sunlight, reducing external heat build up. The coat is smooth, hence it does not accommodate ticks. Woolly cattle, like most of European cattle, suffer from tropical degeneration (Bonsma, 1949).

One of the most commonly cited adaptive attributes of the Sanga cattle breeds is their resistant to tropical parasites and diseases. There is evidence that proves that the *Bos indicus* breeds are more resistant to a number of parasites, including ticks than Bos taurus breeds, (Seifert, 1971; Strother, *et.al.*,1974).

Indigenous African cattle are reported to be resistant to horn fly (*Haematobia irritants*) and to mosquitoes (Steelman *et. al.*, 1973).

2.4.1 Tick resistance

In any group of cattle that run together all are equally exposed to ticks. It is believed that the same number of ticks will be attached to each animal. However, some animals will be covered with ticks and others will have very few. The reason could be that those animals with few ticks have the ability to secrete a substance contained in the sebum that has a profoundly adverse effect on the ticks. Most ticks do not feed properly and consequently don't develop properly. The few that do survive lay few viable eggs thereby contributing very little to the future tick population.

In the South African region, the Nguni has been shown to be one of the most tick resistant breeds (Spickett, De Klerk, Heyne, Enslin & Scholtz, 1984). Maule, (1990) considered the east African Zebu to exhibit a degree of immunity to East Coast Fever.

TABLE 2.7 Relative percentage of animals within each of the three cattle breeds in the low, medium and high resistance class after one and 2 years of exposure to natural infestation,(Spickett *et.al.*, 1984).

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

The indigenous Nguni cattle showed high resistance to tick infestation (55% high resistance class) while the exotic Hereford cattle showed low resistance to infestation (11% in high resistance class). The Bonsmara, a composite derived from both exotic and indigenous had intermediary tick resistance (27% in the high resistance class). To derive maximum benefit in terms of low care, tick resistant animals the ideal breed for South African conditions should contain a larger percentage of indigenous blood (Table 2.7).

Bonsma (1980) started tick counts as long ago as 1937 at Mara research station. According to the counts *Bos indicus* cattle had far lower tick counts than *Bos taurus* cattle. The lower tick counts on the

Bos indicus were attributed to their smooth coats, skin sensitivity and well-developed subcutaneous muscles together with the long mobile tails, ear movements, licking and rubbing.

Similar work done by Kostrewski (1988) on the Afrikaner, Nguni, Bonsmara and Simmentaler demonstrated the superiority of the Nguni as far as tick resistance is concerned. The Nguni carried the least number of ticks regardless of the tick species or season of the year Spickett *et. al*,(1984).

Productivity of the Nguni cattle was not significantly influenced whether they were dipped or not but the Bonsmara and Hereford cattle showed significant drops in the weaning mass of calves when no dipping was done (Scholtz, *et al*, 1984). Tick loads of the different breeds are shown in Table 2.8.

TABLE 2.8 Percentage individuals of 3 breeds classed into resistance level. According to 2 weekly field counts of engorged ticks (Spickett, *et. al.*, 1984)

	LEVEL OF RESISTANCE		
BREED	**LOW:>47TICKS**	**MEDIUM:47-15 TICKS**	**HIGHER:<15 TICKS**
Nguni	0	22	78
Bonsmara	45	22	33
Hereford	100	0	0

According to Table 2.8, the Nguni is more resistant against ticks than the Bonsmara and Hereford.

Ticks can cause a considerable weight loss. As argued by Scholtz, Spickett, Lombard & Enslin, (1991), weight loss that a weaner will

suffer as a result of tick infestation when the dam is not dipped will differ according to the breed.

According to Scholtz *et.al.* (1991) loss of 29,5 kg, 17.6kg and 4.4kg per weaner calf were recorded for undipped Hereford; Bonsmara and Nguni dams respectively, as opposed to dipped dams. These results are presented in Table 2.9.

TABLE 2.9 Comparison between the weaning mass (kg) of calves in a non-dipping situation and when dipped every three weeks (Scholtz *et.al.*,1991)

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

** = significant at 5% level

* = significant at 10% level

[a] = calculated from weaning masses of both the Nguni experimental and control groups since the treatment was the same.

Disease plays a tremendous role in livestock production and a lack of adaptability causes animals to be more susceptible to various diseases.

2.5 PERFOMANCE TEST AND CARCASS EVALUATION

2.5.1 Comparative performance

According to the figures presented in Table 2.10 it is clear that the Nguni is one of the most productive breeds in South Africa although it is relatively small with a low comparative feedlot growth rate (ADG) (Scholtz & Lombard, 1992).

TABLE 2.10 Performance of beef breeds in South Africa (Scholz & Lombard, 1992).

	Cow	Calving	Cow	Wean	Feedlot[2]	
Breed	**mass**	**%**	**prod[1]**	**mass**	**ADG[3]**	**FCR[4]**
Afrikaner	459	72	27	173	1.13	7.8
Brahman	477	79	33	197	1.16	7.2
Nguni	396	87	36	164	1.21	7.0
Bonsmara	466	81	34	197	1.45	7.0
Drakensberger	482	72	30	200	1.39	7.3
S.Getruidis	483	75	33	209	1.49	7.0
A.Angus	455	84	35	192	1.46	7.3
Hereford	479	84	32	183	1.42	7.0
S.Devon	522	79	31	206	1.57	7.0
Sussex	555	82	30	201	1.42	6.9
Charolais	632	75	27	228	1.76	6.7
Pinsgauer	474	83	32	204	1.57	7.0
Simmental	507	77	34	221	1.66	7.0

1 kg calf weaned/100kg of cow mated
2 140 day intensive feedlot test
3 post weaning average daily gain (kg)
4 feed conversion ratio (kg feed/kg mass gain)
n mean number of observations/ breed

Table 2.11 shows the comparative figures of a number of South African beef breeds with reference to reproductive performance (Scholtz, 1988).

TABLE 2.11 Cow mass and reproductive performance of cattle breeds (Scholtz, 1988)

BREED	COW MASS (Weaning) (kg)	AGE AT FIRST CALVING (months)	CALVING INTEVAL (days)	CALVING PERCENTAGE
Afrikaner	459	41	469	72
Nguni	396	36	412	87
Bonsmara	466	34	434	81
Hereford	479	35	423	84
Charolais	632	33	456	75

On all parameters measured the Nguni out-performed the other breeds showing that it is a highly fertile breed (Scholtz, 1988).

Nguni cattle tend to grow well on good veld. Bulls, calves and steers on veld with phosphate lick supplement will increase mass by ± 800 grams daily up to weaning, ± 700g daily from weaning to 12 months and 500g daily from 12 to 18 months (depending on a season) i.e. a 180 kg weaner, a 280 kg yearling and a 350 kg long weaner. This type of animal can be finished off to give an excellent 200 kg carcass at the abattoir.

2.5.2 Feedlot Performance

The results on the comparison of different breeds done by Majuda & Scholtz (1994) on feedlot performance (F.C.R) and cow performance have proved that the Nguni is among the superior breeds. The figures are presented Table 2.12.

TABLE 2.12 Performance of young bulls on central standardized 112-day feedlot test (1992-1994) and cow Performance (1980-1992) for 22 breeds (Majuda & Scholtz, 1994)

TYPE		Performance of young bulls		Performance of cows		
	BREED	112 day feedlot test				
		n	FCR LSMEANS	n	EFFICIENCY	CALVING %
Sanga/zebu	Afrikaner	180	6.935	35808	138	76.0
	Brahman	179	6.312	55129	160	81.7
	Ngui	120	6.779	14538	168	87.7
Synthetic Development	Bonsmara	1240	6.362	364033	172	85.5
	Drakensberger	177	6.505	53019	157	79.9
	S. Getrud	335	6.159	29301	172	81.3
Synthetic Developing	Beefmaster	*	*	11330	177	82.6
	Simbra	52	6.263	4816	196	89.9
British	Hereford	100	6.143	24460	163	87.1
	SA Angus	23	6.319	18283	177	88.2
	Shorthorn	42	6.765	5662	183	86.3
	S Devon	*	*	8784	155	84.7
	Sussex	158	6.243	17238	157	87.5
European	Brown Swiss	30	6.816	1351	161	84.5
	Charalais	63	5.950	3942	153	82.8
	Gelvbvieh	38	6.195	1711	156	81.7
	Limousin	72	6.335	979	123	85.9
	Pinsgauer	214	6.173	4880	172	85.5
	Simmentaler	722	6.188	48355	172	86.6

Growth rate was recorded by Van Zyl, *et.al.*, (1993) to account for 81% and carcass quality for only 19% of the difference in gross income from

Hereford and Afrikaner x Hereford F1 steers. In spite of the non-conventional shape of the hindquarters of Zebu cattle, studies have shown little difference in yield between them and conventionally shaped *Bos tauras* breeds. Furthermore, there is little scope for changing muscle distribution (conformation) and, therefore, carcass yield.

TABLE 2.13 Feedlot performance of different breeds (Scholtz, 1988)

BREED	Birth mass (kg)	WEANING MASS (KG)	A D G ($g\ day^{-1}$)	F C R ($kg : kg^{-1}$)
Afrikaner	32	173	1130	7,77
Nguni	28	164	1206	7,07
Bonsmara	35	197	1449	7,02
Hereford	35	183	1422	6,95
Charolais	42	228	1761	6,69

Sanga cattle, represented in Table 2.13 by Afrikaner and Nguni, are early carcass maturing types that are usually slaughtered at a higher class (more subcutaneous fat) than the leaner beef breeds (Charolais). Although the traditional Hereford was also an early carcass maturing type the use of semen imported from the USA has changed the maturity type considerably. Similarly, the Bonsmara breed also favoured larger frame animals for an extended period of time, making the breed move closer to the lean beef breeds. This contributes to the apparently unfavourable FCR figures of the indigenous breeds in Table 2.13.

2.6 MOTHER LINE

In order to produce the maximum beef per unit area it is essential to have highly fertile cattle producing many weaners. High fertility in female stock means regular oestrus, normal ovulation, ready conception, a normal gestation period, normal parturition and giving birth to a viable calf that survives to be weaned at an acceptable weight (Schultheiss, 1992).

The Nguni tend to be an ideal dam line due to the following attributes: fertility; mothering ability, ease of calving, low maintenance requirement, hybrid vigour, longevity and adaptability (Scholtz, *et al*, 1984).

The results of trials done at Irene indicated that no dystocia or perinatal deaths occurred in 29 Charolais x Nguni , 17 Simmentaler x Nguni and 17 Chianina x Nguni cross bred calves. These results are shown in Table 2.14.

TABLE 2.14 The performance of different breeds and their crosses (Scholtz & Lombard, 1992)

Trait	Breed type			% deviation from mid parent
	Nguni	**Charolais**	**Cross**	
N	301	40	29	
BIRTH MASS	27	47	32	-14%
WEAN MASS	183	222	215	+6%
ADG	1.12	1.77	1.65	12%
FCR	7.5	6.6	6.4	-9%
	Simmentaler	**Crosses**		
N	*	17		
BIRTH MASS	46	31		-15%
WEAN MASS	227	215		+5%
ADG	1.17	1.55		+10%
FCR	7.8	6.6		-14%
		Chianina	**Cross**	
N		6	17	
BRITH MASS		34	30	-2%
WEAN MASS		199	214	+12%
Overall mean	**Nguni**	**Large European**	**Cross**	
BIRTH MASS	27	42	31	-10%
WEAN MASS	183	216	215	+13%
ADG	1.12	1.17	1.60	+12%
FCR	7.5	7.2	6.5	-12%

*-breed average adjusted to be comparable

It can be seen from Table 2.14 that while the average birth mass was 10% below the mid-parent value, the average weaning mass was 6% above the mid-parent value. The post weaning growth rate of the crosses was 43% higher than that of a Nguni while the feed conversion ratio was 10% better than that of the best breed.

It seems that calving difficulties will be negligible if the Nguni is used as a dam line. There was no difference in the percentage of calves surviving from birth to wean between the Nguni and its crosses, or in the re-conception rates of Nguni cows that suckled pure or crossbred calves (Scholtz & Lombard, 1992).

Work done by Majuda & Scholtz (1994) proved that the Nguni compares well with other beef breeds as far as cow productivity is concerned. This is illustrated in Figure 2.3 where the cow productivity of breeds is compared by measuring kg weaner produced per livestock unit mated.

FIGURE 2.3. Cow Productivity (kg weaner/ LSU mated) of breeds participating in the National Performance Testing Scheme (Majuda & Scholtz, 1994).

CONCLUSION

Cattle imported from Europe and other countries do not easily adapt to Africa and require constant, costly medication to provide them with some degree of immunization against diseases (Gittens,1990). Due to harsh climate and high incidence of diseases (Scholtz, 1988), most African countries have stressful environments for cattle production. Managing breeding programs requires accurate assessment of the socio-economic and biophysical parameters of the environment as well as germplasms, which may be useful in this context. Indigenous livestock represent the choice on which to predicate such programme.

Nguni cattle seem to be among the smallest of the beef breeds. To those farmers obsessed with size, the Nguni has nothing to offer. However, due to its size its maintenance requirement is lower than that of other breeds, hence Ngunis are no less productive than the larger breeds.

The climate of South Africa is harsh for cattle. The large tracts of land covered by hot, dry, disease–ridden bushveld are the harshest of all, to the extent that in these environments many breeds cannot compete and simply perish. In those harsh conditions Nguni cattle have much to offer. They are easy-care animals, requiring relatively little attention, with high fertility and growth. They calve without difficulty, they are long-lived, docile and easily handled and with a growing market.

As indicated by Scholtz (1984), breeds such as the Nguni seem to be ideally suited as dam lines, especially in terminal crossbreeding since the following attributes can be enjoyed: lower feed intake resulting in an increase in total herd efficiency; limited calving difficulties; larger offspring for slaughter from smaller dams and the desirable feedlot performance of F1-crosses.

It is evident that the utilization of terminal crossbreeding using the indigenous breeds of the African continent deserves more attention in order to increase output from beef enterprises.

The commercial value of a beef cow must be measured by the output via the calf or meat per large stock unit for cows over a given time span (Dickin , 1996).

In agreement with Schultheiss (1992) gross margin in any beef cow operation is directly determined by performance and cow reproduction.

CHAPTER 3

DESCRIPTION OF THE STUDY AREA

3.1 FARM DESCRIPTION

Data for this study were collected at the farm Klipkuil in the Mankwe / Groot Marico district of the North West Province of South Africa. The data used was collected from 1990 to 1996.

3.1.1 Location and size

The co-ordinates of the farm are 26^0 43'E and 25^0 S. The farm is situated at an altitude of 1080m above sea level and covers an area of 5400ha.

The geology of the area in which this farm lies, is very complex with norite and quartzite outcrops that cause the soil types to be mixed.

The geology of the area is characterized by bronzitite, harzburgite, and norite with quartsite ridges. Igneous rocks weather to soils with high a clay content. The rocks are associated with the Pretoria Super Group of Transvaal Sequence (Visser *et al*, 1984).

The geology of the farm is estimated to be 40% red plains, 20% red slopes, 20% black plains and 20% quartzite ridge.

3.1.2 Veld type and vegetation

The plant types show the same tendency as the soils and a wide variety thereof is present in the area. According to the descriptions by Acocks (1953), the following veld types are found on the farm.

- Veldtype 13a: Other turf thornveld, specifically Norite Black Thornveld on limestone to which the report refers to as veld on black turf.

- Veldtype 19 : Sourish mixed bushveld to which the report refers to as veld on red soil slopes and plains.

- Veldtype 20: Sour bushveld to which the report refers to as veld on quartzite ridges.

Low & Rebello (1996) list the above mentioned veld types as Clay Thorn bushveld (14), Mixed bushveld (18) and Waterberg Humid Mountain Bushveld (12).

3.1.2.1 Grass component

The dominant grass species are: *Aristida congesta, Cymbopogon plurinoidis, Digitaria eriantha, Eragrostis lehmaniana, Eragrostis rigidor, Panicum maximum, Setaria nigrirostis, Themeda trianda* and *Urochoa mosambicensis*

3.1.2.2 Bush component

The botanical composition of the bush component varies between the vegetation units found in the different veld types and the dominant tree species are the following: *Acacia tortillis*, *Acacia millefera*, *Acacia nilotica* and *Grewia flava*.

3.1.2.3 Usage and Potential of grazing

Based on the botanical composition and structure of the bush and grass components of the vegetation, it is clear that the pastures are suitable for both cattle and goat farming. Most shrubs and trees can be browsed.

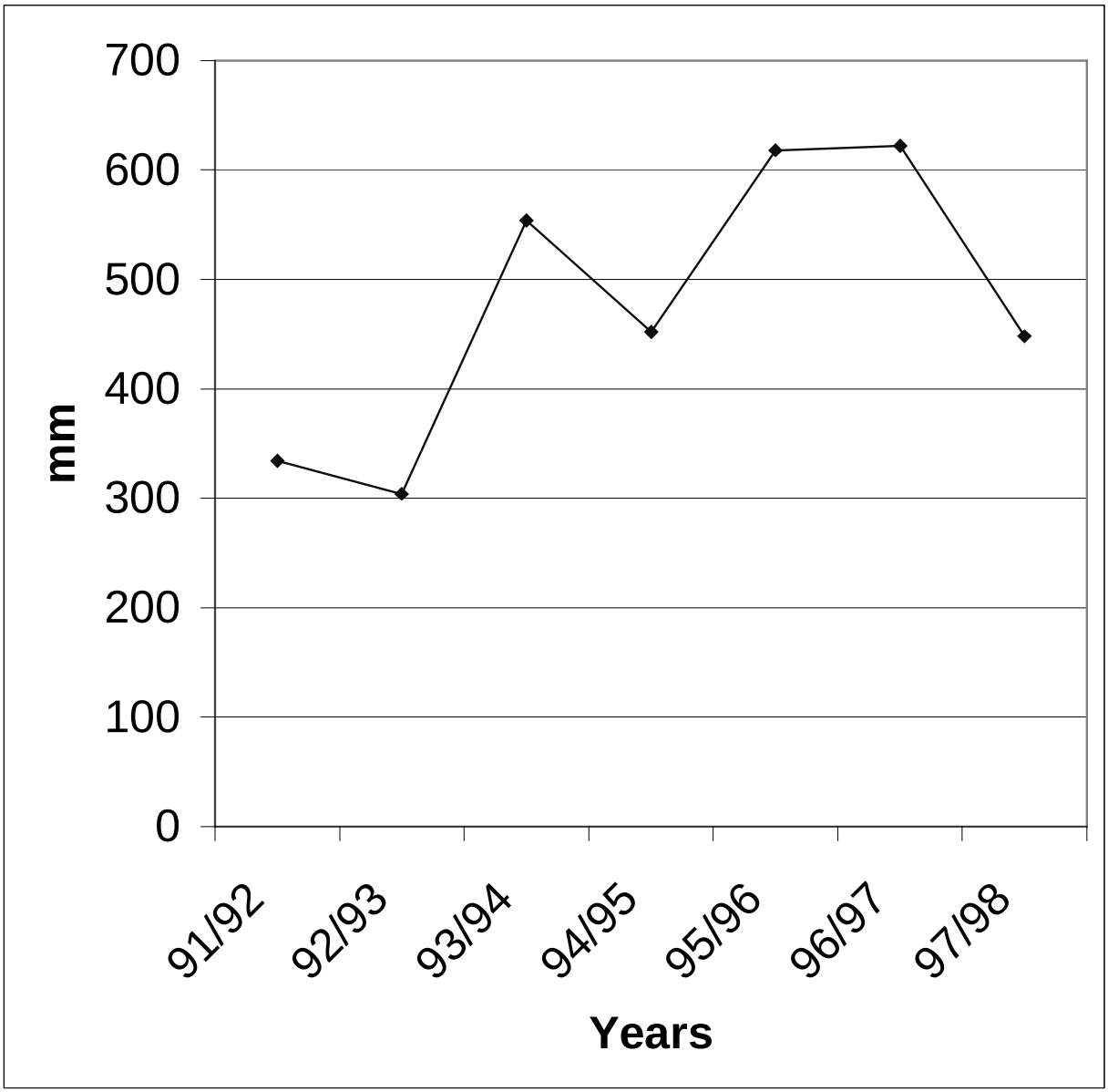
3.1.3 Climate

Rainfall has an effect on pasture quality (De Brouwer, Visser, Schutte & Postma,1993). The tendency is that above average rainfall will increase the quantity of forage availability but that it will be of lower quality and vice versa. In favourable conditions grass grows rapidly with a high fibre content.

The average annual rainfall of the area is 493mm with an average temperature of 31-32.ºC mid-summer and 10 ^{O}C mid-winter. The highest incidence of rain is usually from October and lasts until January. December is normally the month with the greatest average precipitation. During the other summer months rainfall is less frequent although the season ends during May.

Total annual rainfall figures recorded at the farm Klipkuil are shown in Figure 3.1

FIGURE 3.1 Rainfall at Klipkuil farm from 1991 to 1998.



3.2 DESCRIPTION OF TRIAL ANIMALS

The Bonsmara is a composite breed and both the Afrikaner and the Western Sanga belong to the Sanga group, as referred to by Mason & Maule (1960) as mentioned by Moyo & Beffa (1993). The name Sanga refers to all eastern and southern African cattle with small cervio-thoracic humps.

During 1988/89 Nguni bulls were used on the Afrikaner cows to produce the F1 cross, which were then exposed to Nguni bulls. Bonsmara bulls were used on the Bonsmara cows. 100 Bonsmara and 75 Sanga cows were used for the study.

3.3 ANIMAL MANAGEMENT

Both breeds were subjected to identical management programme under the same environmental conditions on the same farm. Fertility was the primary selection criterion for culling. Animals were grouped according to age and sex. Herd composition was as follows: weaners (both sexes in one group); heifers; nursing cows and dry cows; young bulls and breeding bulls. Each group was allocated four camps. The animals were grazing together in the same camps (both the Sangas and Bonsmaras) for a period of 9 months and they were only separated for a period of about 2,5 months i.e. during breeding season.

The breeding season started in mid December with heifers and the beginning of January for cows and extended to the end of February. A ratio of 25 breeding cows per bull was maintained. All breeding animals were ear-notched, tattooed and branded for accurate identification. Breeding bulls were routinely clinically examined. Semen evaluation and sheath washes were performed by state veterinarians before the mating season.

Calving commenced during October, just prior to the start of spring. More that 50% of calves were born during November. During the calving season both calves and dams were weighed and mass recorded within 48 hours after the birth of the calf. Calves were weaned at an average of 7months of age.

All animals were giving access to natural grazing at a rate of 8ha/LSU unit with lick supplements. Only a di-calcium-phosphate salt lick was fed during summer (mating and lactation) and during winter (gestation) animals received a protein-containg winter lick. The composition of both these licks is provided in Table 3.1

Table 3.1 Composition of summer and winter licks fed to cattle on veld at Klipkuil

INGREDIENT	SUMMER %	WINTER%
Dicalcium phosphate	50	
Feed grade urea		12.5
Yellow maize meal		25.0
Stock grade salt (NaCl)	50	37.5
Kimtrafos 12P		25.0

Preventative and health measures included immunization against the following diseases: calf parathyphoid; anthrax; black quarter; botulism; brucellosis and Rift Valley fever. All animals were screened annually for tuberculosis and the females bled for C.A tests. Those that were positive would be culled and removed from the farm.

Fortnightly dipping throughout the year controlled external parasites and all animals were de-wormed once every six months.

Animals were weighed using an Avery scale with a 1000kg capacity. They were put in the kraals a day before to obtain their fasted body

mass (approximately 16 hours without feed and water although calves could nurse).

3.4 GRAZING MANAGEMENT

Myburgh (undated) argued that for the highest long-term profit it is essential to farm in harmony with the environment. Applying a realistic stocking rate is absolutely essential and a pre-requisite for the implementation of sound veld management.

Each herd was managed in a four-camp rotational grazing system with camps from each vegetation unit allocated to each of the herds. As stated it was only during the mating season that the breeds were separately. This was to ensure that camp allocations would not contribute to any differences that may arise between the comparative groups.

The carrying capacity norm of 8ha /LSU (for the region) was applied. Average camp size was 345ha.

CHAPTER 4

COW PERFORMANCE

4.1 INTRODUCTION

Fertility is the most important factor in beef production efficiency and nutritional levels are closely related to the level of fertility manifested in the beef herd (Penzhorn, 1975; Odhuba & Charles, 1990 as quoted by De Brouwer, 1998).

Van Zyl, Maree & Seifert, (1993) argued that a beef production system should aim at achieving long-term production suitable for the particular environment; sustained productivity and a high productive yield per unit area and not necessarily per animal.

To ensure that a farmer can realize a profit margin, it is expected that every cow must calve every season. Bonsma (1980) indicated that high fertility in female stock means regular oestrus, normal ovulation, ready conception on mating or artificially insemination, normal parturition, birth of a normal calf and eventually weaning a good, healthy calf.

As could be expected, the main effect of breed (frame) size, was the overriding factor regarding animal mass. The Bonsmara breed is regarded as a medium frame breed while the Sanga breed is a small frame breed (Anonymous, 2000).

In this chapter, the following points will be focused on:

- cow reproduction
- maternal ability
- milk yield
- survival of the calf
- calf mortality
- cow efficiency.

4.2 MATERIAL AND METHODS

Variables that were measured are the followings: calving percentage (from 1993-1996); weaning percentage; weight gained from birth to 90 days (pre-wean); weight gained between pre-wean and wean; cow mass change from parturition and weaning and herd mortalities.

Statistical analysis

The General Linear Models Procedure of the Statistical Analysis System version 6.2 (SAS, 1996), was used to analyse data. Data were analysed in 2 x 7 factorial design representing two cattle breeds over a period of seven years.

4.3 RESULTS AND DISCUSSIONS

Table 4.1 provides the analysed results of the calving rates of Bonsmara and Sanga cows, pre-wean mortality and weaning percentage of the Bonsmara and Sanga calves at Klipkuil farm for the years 1990 to 1996.

TABLE 4.1 Reproductive traits of the Bonsmara and Sanga cattle at Klipkuil farm.

Trait	LSM + SE Bonsmara	LSM + SE Sanga	Level of Significance
Calving % (1)	77 +0.01	84+0.01	0.017
Pre WM(2)	10.2+0.03	8.7+0.03	0.7662
Wean % (3)	67	75	

$$(1)\ \text{Calving \%} = \frac{\text{Cows calved}}{\text{Cows exposed}} \times \frac{100}{1}$$

$$(2)\ \text{PreWM} = \frac{\text{Calves died}}{\text{Calves born}} \times \frac{100}{1}$$

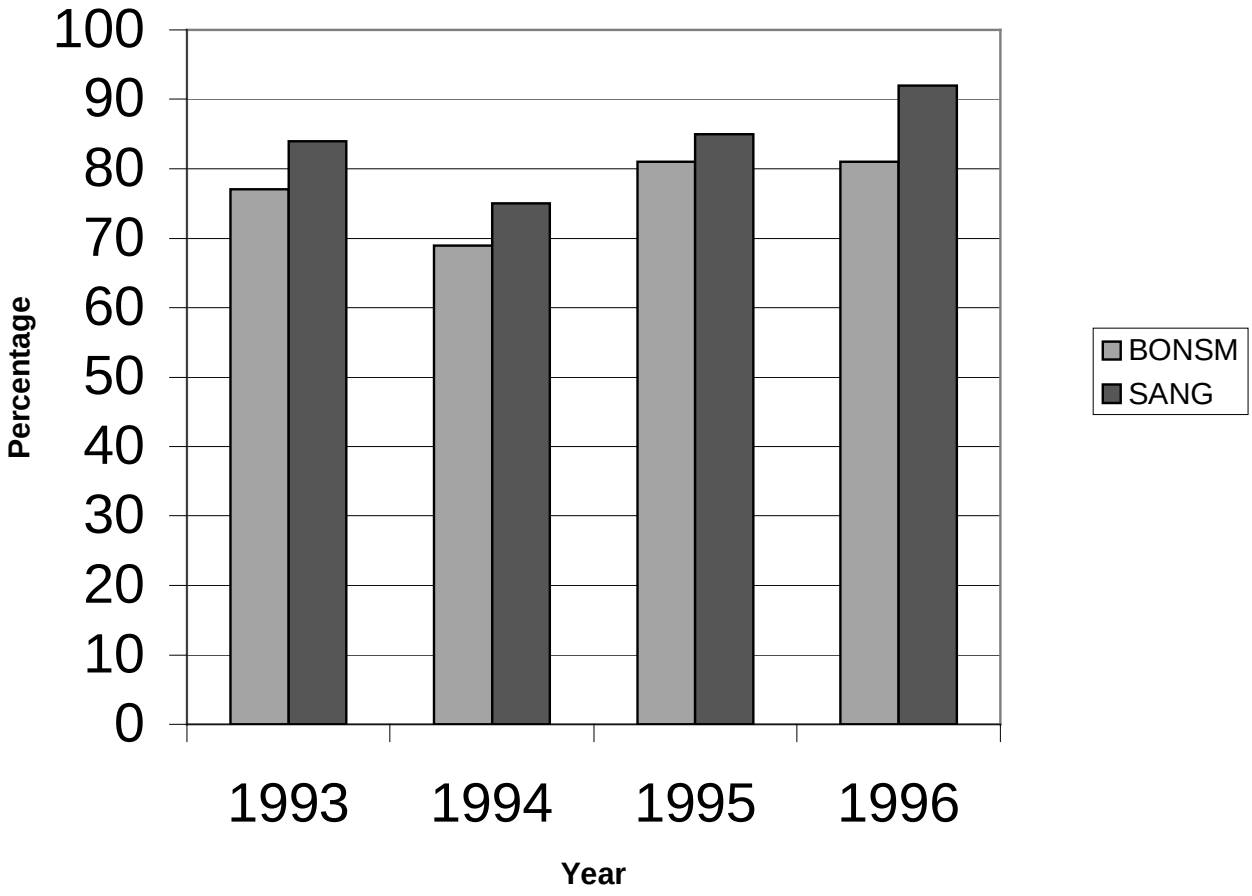
$$(3)\ \text{Wean \%} = \frac{\text{Calves weaned}}{\text{Calves born}} \times \frac{100}{1}$$ (not statistically analysed)

The difference in calving percentage was significant (P= 0.017) with an average of 77 percent for the Bonsmara (medium frame) and 84 percent for the Sanga (small frame).

According to Figure 4.1, the Sanga had a high calving percentage in all seasons. Calving percentage for both breeds dropped slightly in 1994. This is ascribed to insufficient forage resulting from veld fires in that year. The difference between the two breeds was largest in the 1996 season (11% units) and smallest in the 1995 season (4% units).

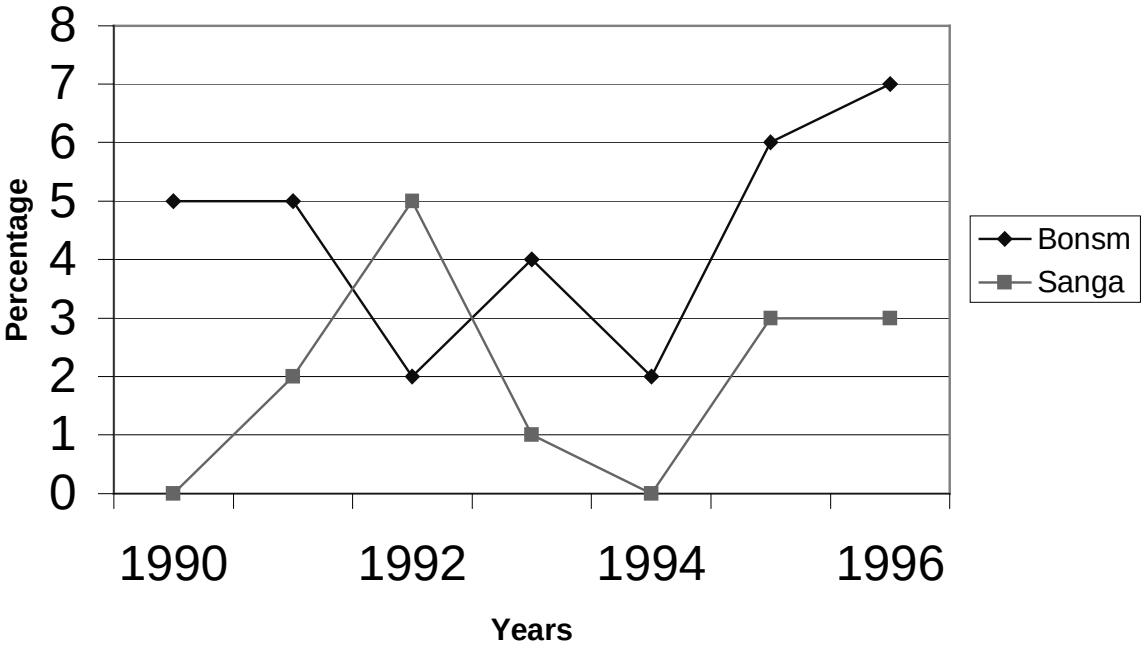
These results also indicate that heavier framed animals are more prone to changes in climate (rain) and the resulting feed availability as illustrated by variable calving rates. Small frame animals maintain higher reproductive rates under less favorable conditions due to their lower nutritional requirements (Casey & Maree, 1993). The results are presented graphically in Figure 4.1

FIGURE 4.1 Calving rate of Bonsmara and Sanga cows



According to Table 4.1, there were no significant differences between the breeds (P =0.7662) pre wean mortalities (associated with tick-born diseases). This can be due to the controlled environment (frequent dipping) and a fixed inoculation programmed. Although the results showed a non-significance, it can be seen from Figure 4.2 that the Bonsmara calves had a tendency to be more susceptible to tick–borne diseases when compared to Sanga calves

FIGURE 4.2 Pre wean mortalities caused by tick-borne diseases of Bonsmara and Sanga calves



Weaning percentage (though no statistically analyses) was higher for the Sanga (75%) and lower for the Bonsmara (67%) (Table 4.1).

Bonsmara and Sanga calves were also evaluated on weight gained from birth to 90 days (pre wean) and weight gained from pre-wean to weaning (205 days) (wean). According to Table 4.2 there were statistical differences (P =0.0001) and (P = 0.0011) for both traits respectively. With regards to weight gained from birth to 90 days, Bonsmara calves gained 78kg and Sangas 65kg, whereas between pre wean and wean they gained 82.6kg and 72.8kg respectively.

Table 4.2 provides the analysed results of the cow mass change of the Bonsmara and Sanga between parturition and weaning; calf weight gained from birth to pre wean and from pre wean and weaning as well as herd mortalities.

Table 4.2 Mass changes of Bonsmara and Sanga cows and calves and herd mortalities.

Trait	LSM + SE Bonsmara	LSM + SE Sanga	Level of Significance
Pre - WR (kg)	78+1.00	65+1.57	0.0001
Wean R (kg)	82.6+1.58	73+2.51	0.0011
Cow MC (kg)	42+2.93	37+5.66	0.4825
T H Mort (%)	5+0.00	2+0.00	0.0329

Pre-WR = weight gained from birth to 90 days
Wean R = weight gained from pre wean to wean
Cow MC = cow mass change between parturition and weaning
T H Mort = herd mortalities

The weight gain was high for the Bonsmara calves for both traits and this can be partially attributed to milk yields of the Bonsmara dams. It must be borne in mind that a considerable difference exists in the frame sizes of the two breeds which results in sizable differences in 205 day weaning weights. This implies frame–related or genetic effects in growth rate that are independent of milk production. The results are presented graphically in Figures 4.3 and 4.4.

FIGURE 4.3 Weight gained from birth to pre-wean (90 days) by Bonsmara and Sanga calves

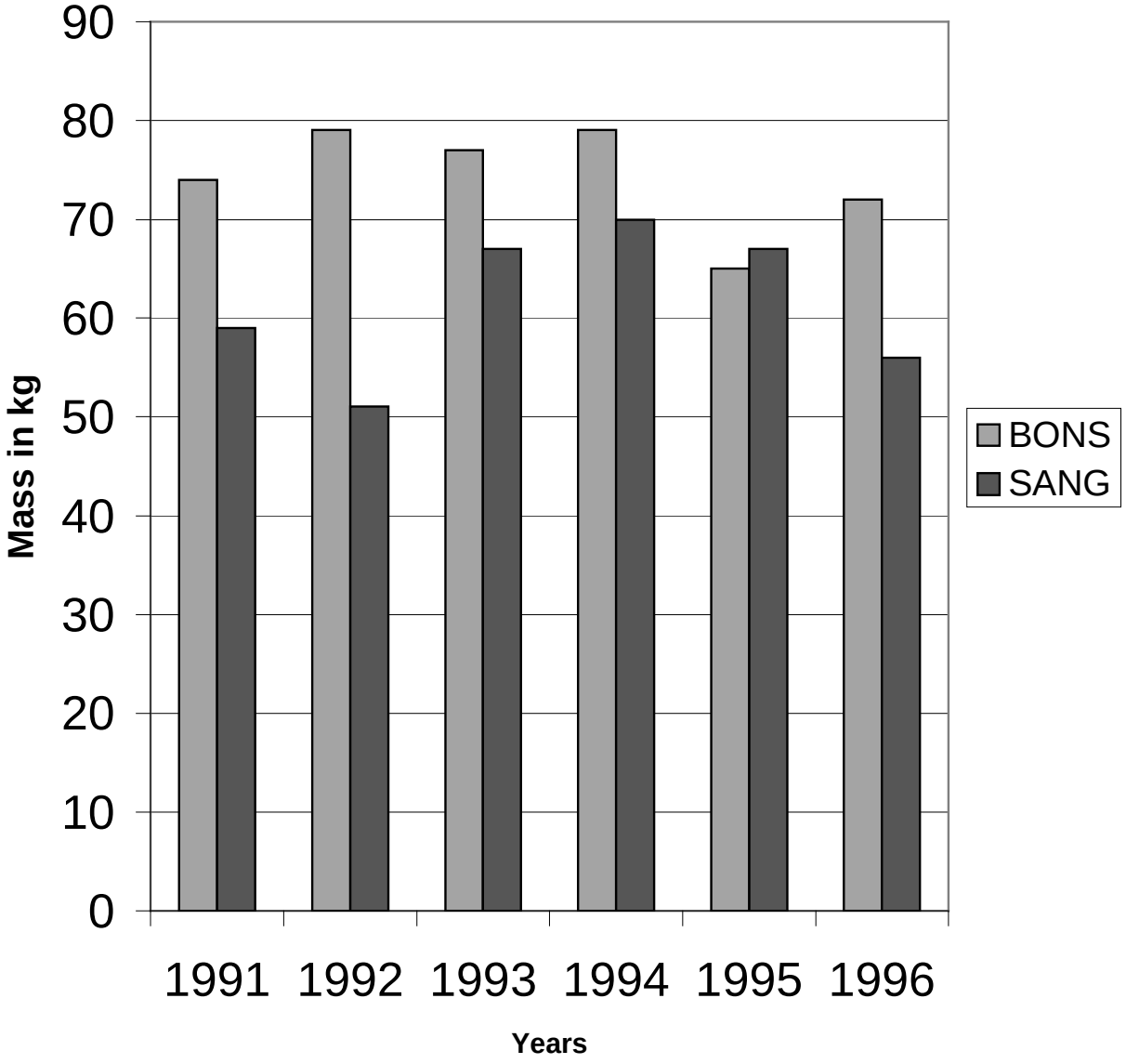
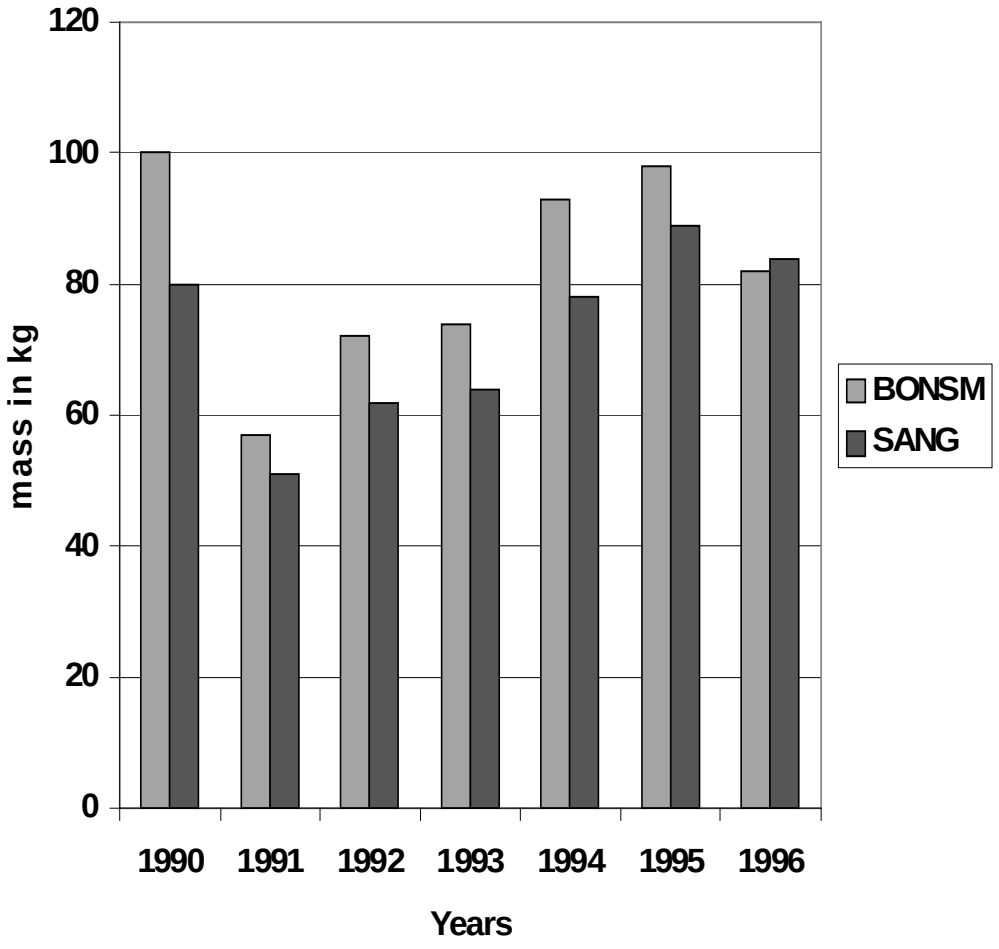


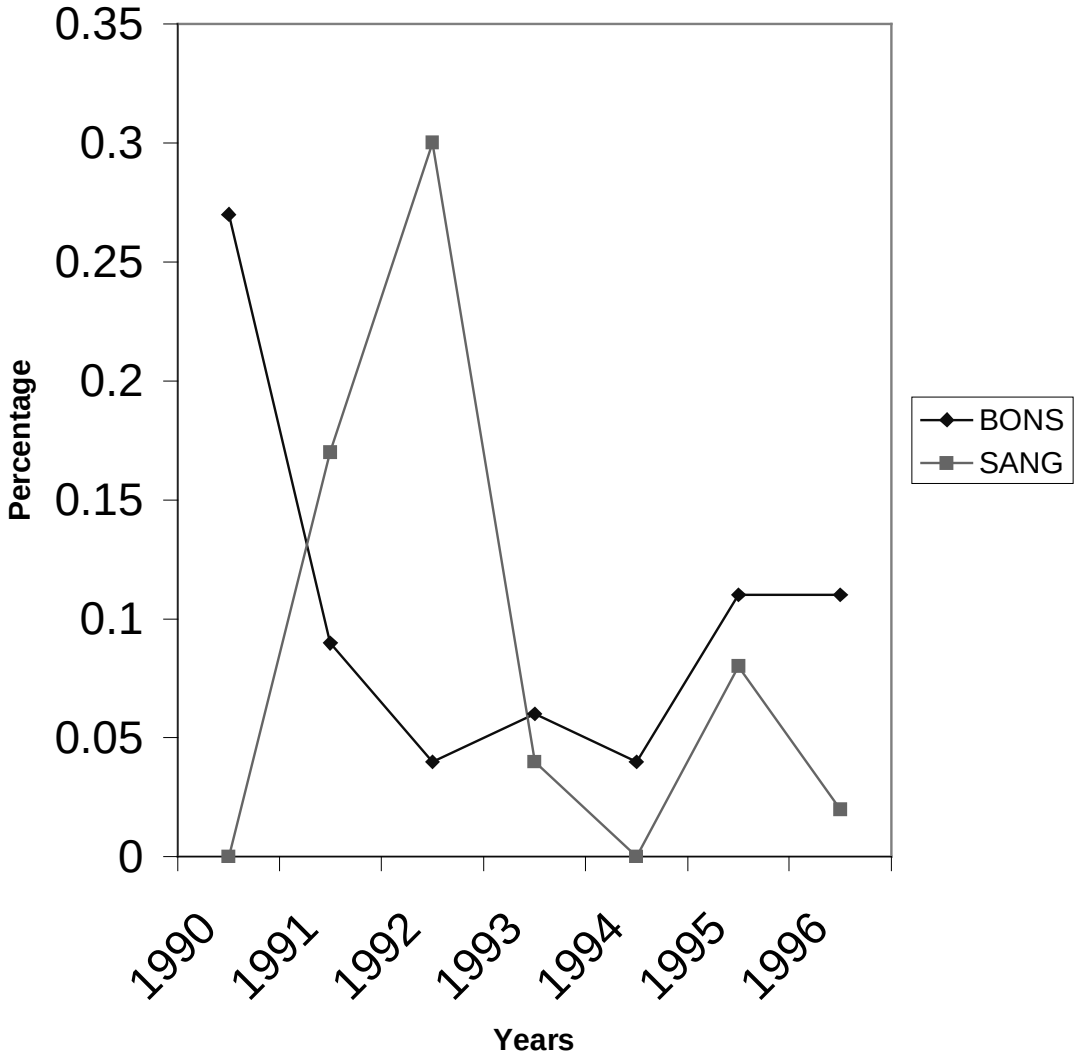
FIG 4.4 Weight gained from pre-wean to wean by Bonsmara and Sanga calves



According to the results presented in Table 4.2, there was no significant difference (P = 0.4825) between Bonsmara and Sanga cows with regards to mass change between parturition and weaning. Nursing cows usually lose weight during the lactation period but the results have indicated that dams from both herds gained weight during lactation. Cows in this study calved during spring, synchronizing the reproduction phase, which requires high nutritional inputs for lactation conception with the high production phase of the feed source, viz., veld. On average the Bonsmara cows gained 42 kg and Sanga cows 38 kg, a difference of only 4kg. The weight gain can be attributed to the fact that there were more heifers (which have the capacity to grow) than older cows.

Herd mortalities (%) of Bonsmara and Sanga cattle due to natural causes are illustrated in Figure 4.5 It is evident that there were more Bonsmara cattle dying than Sanga cattle between 1990 and 1996. Table 4.2 shows a significant (P =0.0329) between the two herds with 5 percents and 2 percents for the Bonsmara and Sanga respectively. This is primarily ascribed to adaptability of Sanga. Mortality was most often due to plant poisoning, as confirmed by post mortem examination by the local state veterinarian. This is an aspect of adaptability to the environment.

FIGURE 4.5 Herd mortalities (1990 -1996)



CHAPTER 5

CALF PERFORMANCE

5.1 INTRODUCTION

Calf performance is measured in terms of growth and survival rate. In the case of breeding stock, the focus can also be on replacement heifers ensuring that the animal meets the required standard within an expected period, i.e. to reach a target mating mass by a predetermined age.

5.2 MATERIAL AND METHODS

Calf data include birth mass, (BM taken within 48 hours), pre-wean mass (90days), weaning mass (7 months), post wean mass (18 months) and weight gained from weaning to post wean (18months) as well as weaning. Fasted body mass was taken for post wean as well as for every second month for all the animals.

Weaners from both cattle breeds (Bonsmara and Sanga) were kept on veld in the same camp and were subjected to the same general management.

Statistical analysis

Data were analysed as a 2 x 7 factorial design using General Linear Procedure of Statistical Analysis System, Version 62 (SAS, 1996).

5.3 RESULTS AND DISCUSSIONS

Birth mass, calf mass at 90 days (pre-wean), 205 days mass (wean) and 540 days (post wean) are given in Table 5.1. Mass change from wean to 18 months is also presented.

Table 5.1 Mass at different stages and mass change of Bonsmara and Sanga calves at Klipkuil farm (1990 – 1996).

TRAIT	LSM + SE BONSMARA	LSM + SE SANGA	LEVEL ON SIGNIFICANCE
BM	32 +0.19	27 + 0.36	0.0001
A1 MASS (kg)	111 +1.03	92 + 1.62	0.0001
A2 MASS (kg)	194 +1.33	165 + 2.37	0.0001
B1 MASS (kg)	329 +2.59	285 + 4.64	0.0001
MCW-P %	139 +2.86	118 + 0.03	0.0001

A1 mass = Calf Pre-weaning mass (90days)
A2 mass = Calf weaning mass (205 days)
B1 mass = Post weaning mass at 504 days
MC W-P= Mass change from wean to post wean

The results in Table 5.1 show that the breeds differed significantly ($P<0.0001$) for all traits analysed. This is due to the fact that different frame size animals were being compared (medium and small framed).

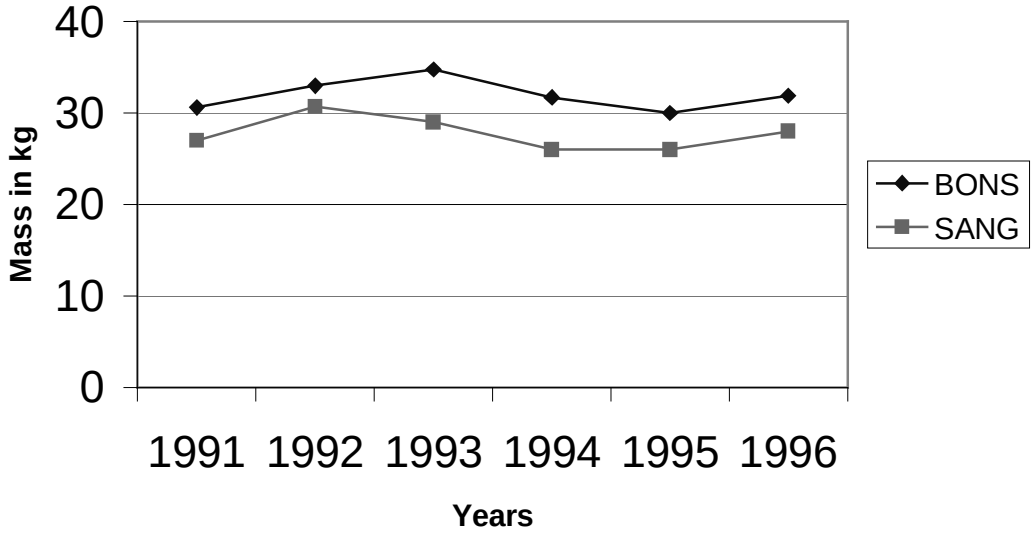
Figure 5.1 indicates the average birth mass of the Bonsmara and Sanga calves.

The calves in this study averaged 32 kg for the Bonsmaras and 27 kg for the Sangas. Birth mass was lower for the Sanga calves than for the Bonsmara

calves. The difference between the two breeds was largest in 1990 with the Bonsmara averaging 34.8 kg and the Sanga 28 kg.

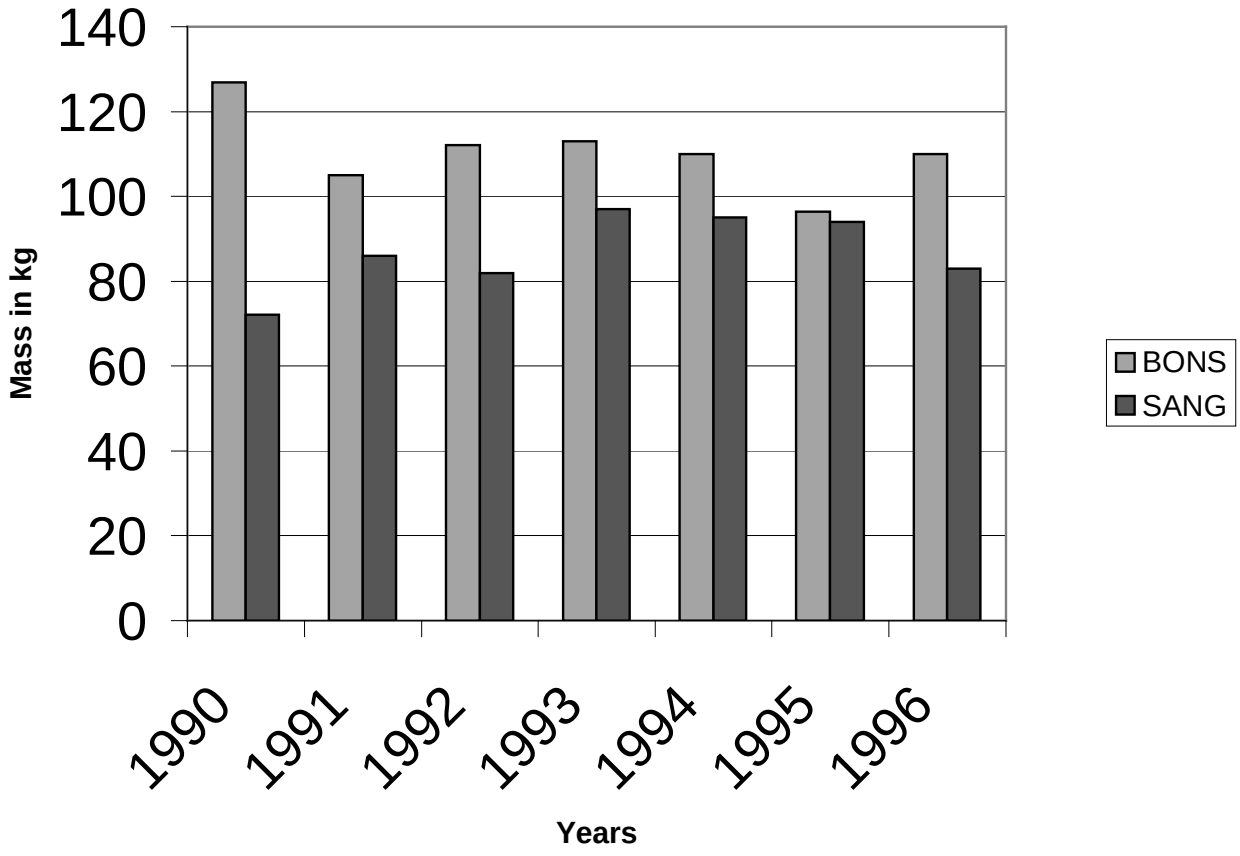
Figure 5.1 illustrates that the Bonsmara calves had a higher average BM in all season. This can be ascribed to the medium frame of the breed but the BM obtained here is lower than the national breed average (36kg). This may be due to the fact that cows are also lighter than the breed national average. It is expected that large cows produce large calves, which is ascribed to a genetic maternal effect.

FIGURE 5.1 Average birth mass (kg) of Bonsmara and Sanga calves



At pre-wean (100 days) the weigh difference between the two breeds, although highly significant ($P < 0.0001$), was only 19 kg. This is actually 14 kg as BM difference was 5 kg showing that milk production was not dissimilar if one takes frame size into consideration. Figure 5.2 illustrates that pre wean weights differed for all years although the magnitude of the difference was not equally big for all years. Again this probably reflects on the ability of the small frame Sanga dams to buffer calves from less favorable conditions.

FIGURE 5.2 Average pre-wean (90 days) mass of Bonsmara and Sanga calves



The smallest difference was noticed in 1995 where Bonsmara calves averaged 96 kg and Sanga calves 94 kg, a difference of only 2 kg. This could be the effect of veld fires on the availability and quality of forage during that season.

It is evident from Table 5.1 that the statistical difference was highly significant ($P < 0.0001$) for the average weaning mass of the Bonsmara and Sanga calves. The Bonsmara calves returned an average weaning mass of 194 kg, 29 kg higher than the Sanga that weighed 165 kg on average. This can be

ascribed to good mothering ability of the Bonsmara cows in the optimum environment and their inherent growth rate.

Figure 5.3 illustrates the different average weaning weights of both the Bonsmara and the Sanga calves for the different years.

FIGURE. 5.3 Average weaning (205 days) mass of Bonsmara and Sanga calves

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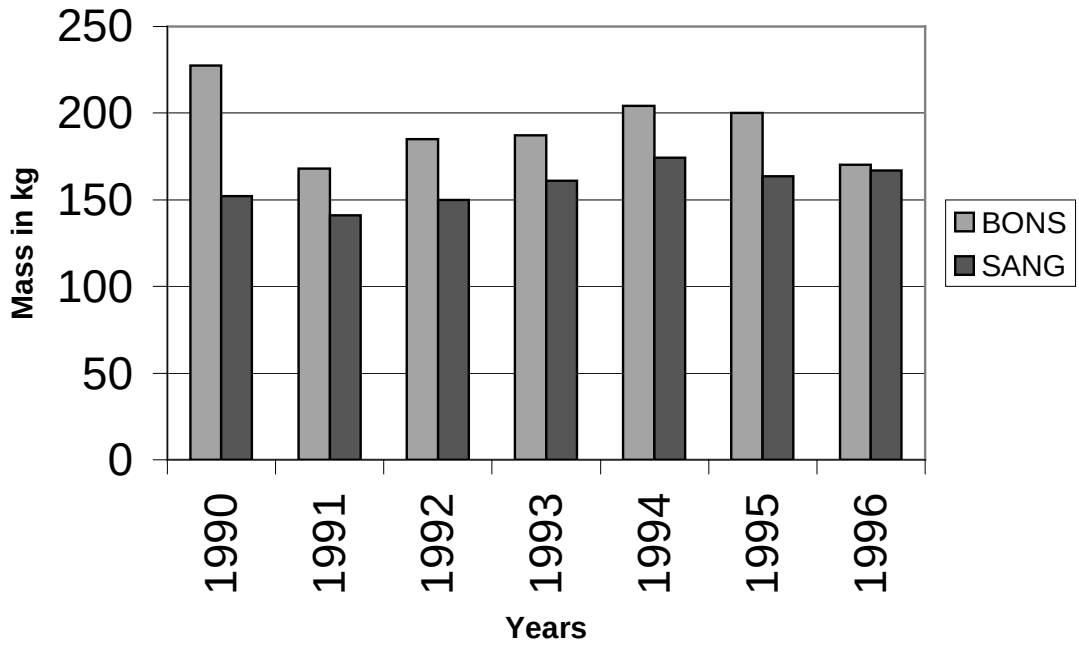
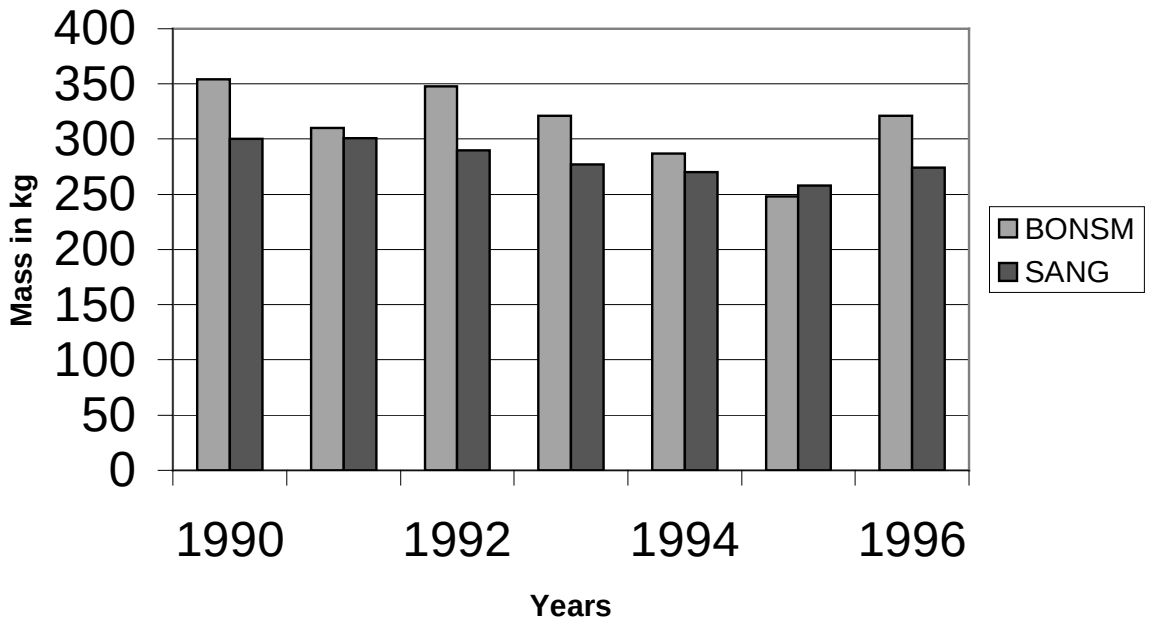


When studying the histogram in Figure 5.3 it appears that there was less of a fluctuation in the weaning mass of the Sanga calves over the years than there was for the Bonsmara calves. This again supports the theory that the small frame Sanga dam is able to ameliorate the effects of variable seasons on her offspring, especially during less favorable seasons.

Average post wean mass was in favour of the Bonsmaras for all years except in 1995. The averages were 329kg and 285kg for the Bonsmara and Sanga respectively (Table 5.1). The statistical difference was great (P < 0.0001). The results are graphically presented in Figure 5.4.

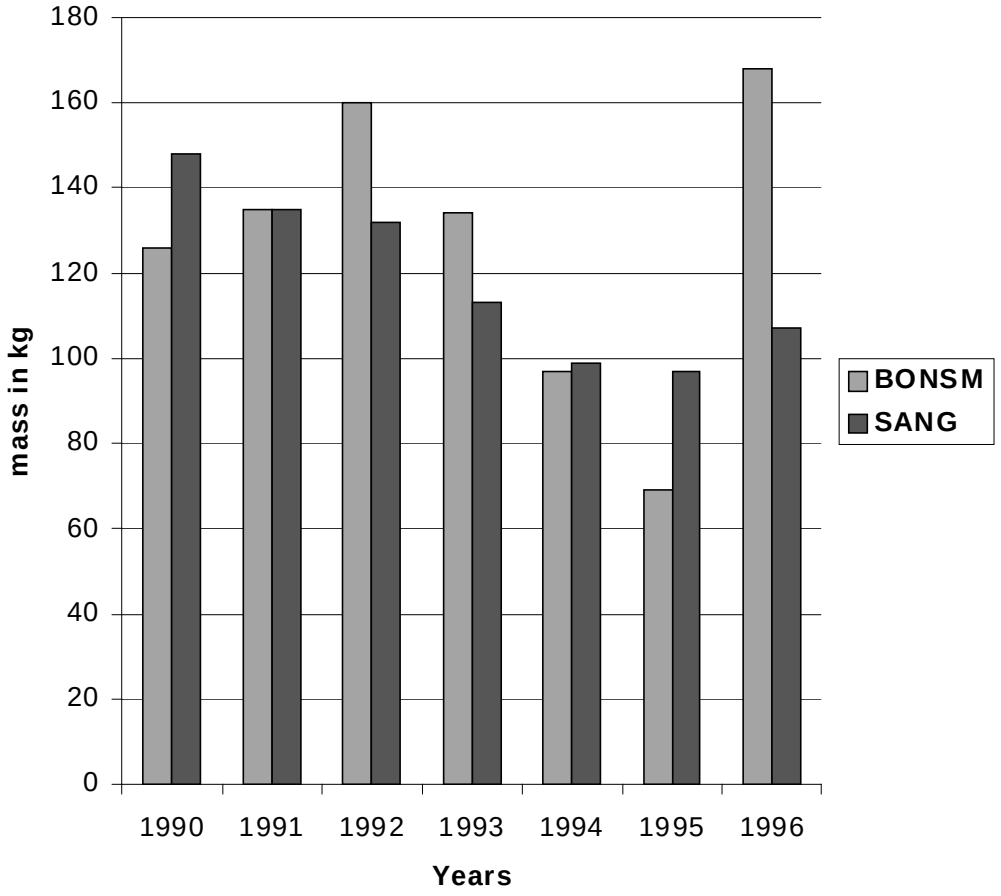
FIGURE. 5.4 Average post wean (540 days) mass of the Bonsmara and Sanga cattle



The results of the comparison of the two cattle breeds on weight gained from wean to post wean mass (18 months) shows a significant difference (P =0.0001) with an average mass gain of 139kg for the Bonsmara and 117kg for Sanga cattle (see Table 5.1).

Data for different seasons is shown in Figure 5.5. The results are quite interesting in the sense that for 1991, the weight gain by both breeds was the same (135kg). This could be attributed to the low rainfall resulting in poor forage.

FIGURE. 5.5 Weight gained from wean to post-wean by Bonsmara and Sanga cattle



For 1994 and 1995, the weight gain by the Sangas was slightly higher than that of the Bonsmaras. Sanga cattle returned 99 kg; 97 kg and the Bonsmaras 97.7 kg; 69 kg respectively. This proves that the Sanga (small frame) has the ability to perform better than the Bonsmara (medium frame) in conditions where grazing is inadequate. These unexpected results for specific years are likely to be primarily due to season, as stated, but some heterosis may also be involved as Nguni bulls were used on Afrikaner cows initially. The heterosis effect will, however, be limited as both breeds are indigenous Sanga-types.

The variations in annual rainfall, which have an impact on quantity and quality of pastures may also explain these fluctuations in average weight gained for both breeds, i.e. season has a sizable impact on growing performance post wean as the animal only then relies completely on a feed sources other than the dam's milk.

Where weaning mass is largely determined by the dams milking ability (70%) the individual animals' growth potential is demonstrated during the post wean phase (De Brouwer, 1998).

CHAPTER 6

PRODUCTION COMPARISON

As it was stated in the problem statement in Chapter 1, the large number of beef breeds available in South Africa poses a problem to local farmers when they have to choose a suitable breed to farm with. Most farmers in the North West Province farm in marginal areas that require breeds that can withstand unfavourable conditions.

In this chapter the comparison between the Bonsmara and the Sanga cows with regards to production performance will be discussed.

6.1 PRODUCTION PERFORMANCE

A Nguni cow that raises a calf (small frame) represents 1,2 LSU for a year and a Bonsmara cow that raises a calf (medium frame) represents 1,4 LSU for a year (Meissner *et. al.*,1983). The carrying capacity of the trial area (Klipkuil) is 8 ha /LSU.

Data on production performance of the two breeds (Bonsmara and Sanga cattle) is presented in Table 6.1.

TABLE 6.1 Comparisons of the trial results obtained with Bonsmara and Sanga cattle on Klipkuil farm.

	BONSMARA	SANGA
LSU/cow (1)	1.4	1.2
LSU/100 cows (2)	140	120
Ha / 100 cows	1120	960
Weaning rate %	67	75
Weaning mass (kg)	194	165
Total Prod (kg) (3)	12998	12375
Kg weaned calf / ha	11.6	12.9
Kg weaned calf / LSU	92.8	103.1
Weaned calf / ha (4)	R63.80	R70.95
Weaned calf / LSU (4)	R510.40	R547.5

(1) LSU/ cow = Large stock unit per cow

(2) LSU/ 100 = Large stock units per 100 cows

(3) Total Prod. = Weaning mass x weaning percentage

(4) Weaner calf sold at R5,50/kg livemass.

From Table 6.1 it is clear that the Sanga cattle return higher yields in terms of kg weaned calves per ha (103,1kg) than the Bonsmaras (92,8kg). This is due to the fact that a Sanga require less surface area for maintenance compared to a Bonsmara. The production performance of the Sanga would be better than that of the Bonsmara since the farm Klipkuil can accommodate a greater number of the Sangas than of the Bonsmaras. Klipkuil farm is approximately 5 400 ha in size which means that 563 Sangas and 482 Bonsmaras can be kept on the farm if only breeding cows are kept.

The Sangas wean 75 %, i.e. 422 calves, while the Bonsmaras wean 67 %, i.e. 323 calves. This shows the potential magnitude difference between the breeds in terms of numbers.

Table 6.1 also shows the gross income per ha and LSU of the two breeds. If one bears in mind that the smaller framed animals require less lick (De Brouwer, 1998) and are low care in terms of dipping and dosing it becomes clear that Gross Margins, although not directly calculated here, will favour the small-framed Sanga cattle.

The progeny of the Sanga, being an early carcass maturing type, are also ideal for finishing in extensive systems without expensive inputs.

Cow efficiency of the Bonsmara and Sanga was also studied from 1993 to 1995
and this formula was used.

$$\text{Cow efficiency} = \frac{\text{Average weaning mass}}{\text{Average Dam mass at weaning}} \times 100$$

The results are presented in Table 6.2.

TABLE 6.2 Cow efficiency of Bonsmara and Sanga cattle (1993-1995).

YEAR	BREED	PERCENTAGE
1993	BONSMARA	35
	SANGA	42
1994	BONSMARA	34.6
	SANGA	43.6
1995	BONSMARA	39
	SANGA	44

Sanga (small framed) cows have proven to be more efficient than the Bonsmara (medium framed) cows throughout.

CHAPTER 7

CONCLUSIONS

Gross margin in any beef cow operation is directly determined by cow performance and hence cow productivity, (Schultheiss, 1992).

Although the growth rate of the Bonsmara cattle (medium frame) was superior than that of the Sanga cattle (small frame), the reproduction performance of the Sanga (with special reference to calving percentage) was higher than that of the Bonsmara. The Bonsmara cattle were negatively affected by the adverse environmental conditions that resulted from veld fires during 1994. The lower calving percentage of the Bonsmara can be ascribed to its higher maintenance requirement compared to the Sanga, and during the 1994 season, grazing was scarce. Tierney *et al*, (1992), as mentioned by De Brouwer (1998), argued that large frame animals require high maintenance in less favourable environments. Higher reproductive rates in the indigenous Sanga shows that for livestock farmers in the North West Province to reap maximum benefit from the beef enterprises they should seriously consider the use of these breeds. The adaptive traits have to be utilized to make beef production more cost-effective in terms of reduced input costs and increased unit sales.

A smaller maintenance requirement may signify an advantage in coping with the adverse environmental conditions in which cows are simultaneously stressed by lactation and by pregnancy during the feed-scarce dry seasons Maule (1993).

The calving rates results of the study, were supported by the results obtained from Table 2.9 in Chapter 2, of “Performance of beef breeds in South Africa” (breed averages from the National Performance Testing Scheme), wherein

calving percentage of the Nguni was better than that of the Bonsmara (87% for Nguni and 81% for Bonsmara).

As indicated by Casey & Maree (1993), Sanga dams exhibit a unique feature of producing relatively lighter calves at birth, which reduces the chances of dystocia.

It is evident that the Bonsmara cows weaned heavier calves than the Sanga, but both breeds do qualify as weaner producers. This is supported by the results obtained from the work done by Majuda & Scholtz (1994) in comparing cow productivity (kg weaner per LSU mated) of different breeds participating in the National Beef Cattle Performance Testing Scheme (Figure 2.3 in chapter 3). The Nguni compared well with other beef breeds. As the Sanga breeds generally wean lighter calves at 7 months, in relation to their frame size, the feedlots are not very keen to buy them as feeders. This can primarily be ascribed to the fact that Sangas are early carcass maturing, limiting the time spent in the feedlot as they attain slaughter condition rapidly. Being well-adapted to harsh environments has, to a certain extent, limited the Sang's ability to adapt to very favourable conditions. In such conditions they are somewhat more prone to develop nutritional laminitis which may affect performance. However, the North West Province is an extensive environment and these cattle can reach slaughter condition from feeds normally regarded as inferior for growing beef cattle, i.e. summer veld and cultivated pastures, again attesting to their low care requirements.

Farmers have been lead to believe that "bigger is better" and that everything that come from overseas must automatically be better than the local product. This false impression has been strengthened by the demand for a specific type of weaner calf, alluded to earlier. The Sanga does not fit the description of the ideal feedlot calf completely and many farmers have opted to farm with the bigger, lean beef European type cattle that are not truly adapted to the sub-continent's harsh environment. This is part of the reason why beef production is seen to be unprofitable – because these less adapted cattle

require higher inputs and more sophisticated management, reducing the farmers' income.

The higher weaning mass of Bonsmara calves at Klipkuil farm could also be attributed to management (regular dipping and de-worming).

With regards to weight gained from wean to 18 months, the mass difference was 44 kg, demonstrating the frame size difference. It is clear, however that both breeds were able to reach the target mating mass for heifers, despite the difference in growth rates, by the age of 18 to 20 months. The target mating mass for Bonsmara heifers is approximately 330 kg and that of Sanga is approximately 280 kg.

In fact, this means both breed heifers could be exposed to bulls at 18 months, but it would mean that they calf in winter, which is not desirable under extensive ranching conditions. For this reason, heifers were mated slightly later (at approximately 24 months) to maintain a summer breeding programme.

Figure 5.5 showed that in most seasons, mass differences were in favour of the Bonsmaras but in favour of the Sangas only during 1995 where there was insufficient forage. All these results support the theory that small frame cattle are able to "ride" unfavourable conditions more successfully than medium and large frame animals.

Diseases play a major role in livestock production, therefore poor adaptability will increase the chances of susceptibility to diseases. With regards to calf mortality (from birth to wean), there were no significance difference between the Bonsmara and Sanga calves but this was due to the controlled environment e.g. fortnightly dipping and programmed immunization a variety of diseases.

In Chapter 2 Table 2.8, in a comparison between the weaning mass (kg) of calves in a non-dipping situation and three week interval dipping indicated that

the Bonsmara cattle showed significant decreases in weaning mass when no dipping was done. The weaning mass for the Bonsmara calves was 166.5 kg and that of the Nguni was 164.7 kg whereas when dipped, the Bonsmaras weaned heavier calves (average of 184 kg) than Nguni calves (169 kg). This result supports the results obtained in this study where a dipping programme was implemented. Secondly, the productivity of the Sanga was not significantly influenced by whether they were dipped or not (Scholtz *et al,* 1991).

According to Figure 4.1 in Chapter 4, Sanga cattle have proven to be one of the most productive breeds despite its size.

In conclusion, it can be stated that

- the progenies of the Afrikaner x Western Sanga crossbred out-performed the reproductive rate of Bonsmara cattle,

- the hypothesis of this study was proven by Table 6.1 in Chapter 6, whereby the Sangas with their low maintenance requirements, were able to return more kg weaned calves per hectare and per LSU.

- On a given area the small framed Sanga can produce more kg weaned calf than the Bonsmara under the conditions that prevailed during the trial. On Klipkuil the Sangas could produce 69630 kg weaned calf annually compared to the 62662 kg weaned calf produced by the Bonsmara.

As argued by Frisch (1997), to remain competitive, at least for the foreseeable future, beef producers will need to adopt practices that are environmentally sustainable and that produces the desired product at a price that the market is prepared to pay.

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