
Conservation of the Tswana cattle breed in Botswana

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Key word: *Animal genetic resources, Characterisation, Genetic improvement, Utilisation*

Summary

The Tswana cattle breed is indigenous to Botswana. Its popularity and numbers in the national herd is declining due to crossbreeding. This paper presents results of work done so far to characterise the breed for milk and beef production and describes the current breed conservation program. Suggestions on more characterisation work and improvement on the conservation program are given.

Résumé

La race bovine Tswana est une race indigène du Botswana. Sa popularité et son nombre dans le cheptel national est en diminution à cause des croisements réalisés. Cet article présente les résultats du travail réalisé pour caractériser la race du point de vue de la production de lait et de viande, et décrit également le program actuel de conservation de la race. On présente aussi les suggestions sur d'autres travaux de caractérisation et l'amélioration du program de conservation.

Introduction

Botswana is a country in Southern Africa. It lies between longitudes 20° and 29° East and latitudes 18° and 27° South. The mean altitude is 1000 meters above sea level. The climate is characterised by sporadic and unreliable rain. The average annual rainfall varies from about 650 mm in the north east to less than 250 mm in the extreme south west. The rain season is in November to

March with no rain for the rest of the year. The temperatures range from 10° C to 20° C from April to August and from 8° C to 38° C from September to March (Sims, 1981). Approximately 80 percent of the country is covered by Kgalagadi sands and scrub savannah. The main ecological zones are the western Sandveld and the eastern Hardveld. The Sandveld has lower average rainfall than the Hardveld. Because of this and poor soil fertility, little agricultural activities are found in the Sandveld.

There are two beef production sectors in Botswana; the traditional and commercial sectors. The total cattle population is about 2.7 million of which the traditional sector has about 82 percent (Masokwane, 1995). The traditional sector keeps the indigenous Tswana breed mainly for both purebreeding and crossbreeding. The cattle are used primarily for beef production and their other uses include milk production and draught power. The commercial farmers use the Tswana breed mainly for crossing with foreign beef and dairy bulls. Although the commercial sector accounts for only 18 percent of the total cattle population, the livestock offtake rates are higher (17 percent) compared to 8 percent in the traditional sector (Masokwane, 1995).

The reasons for conservation are cultural and economic coupled with a need to maintain genetic diversity. Breeding work done in the 1970's (APRU, 1976) revealed the special qualities of the Tswana breed, an example being adaptability to local climatic conditions. It also demonstrated that beef herd productivity can be increased by crossbreeding the Tswana with foreign sire breeds. This was followed by widespread



Photo 1. Tswana cow with calf.

crossbreeding in both the Commercial and Traditional Sectors. Such widespread crossbreeding can result in the purebred Tswana population being threatened by extinction as evidenced by the European experience. About half of all breeds which existed in Europe at the turn of the century have disappeared and a third of the remaining breeds are in danger of disappearing within the next 20 years (Concar, 1992). The popularity of the Tswana breed, as determined by bull and semen requests, is declining. This is what prompted work on conservation of the Tswana breed.

Conservation involves identification, characterisation, preservation, development, improvement, and utilisation of a given gene pool of species over time. This paper gives the results of characterisation work that has been done, characterisation work that is ongoing, and suggests further characterisation studies that should be carried out. There are various methods of breed preservation which include storage of semen, embryos or

live animals. The method used for the Tswana cattle is maintenance of purebred herds on government ranches. A program to improve these herds genetically through selection for economically important traits is described and a plan on how to disseminate superior genetic material from these herds is given.

Characterisation of the Tswana breed

Three definitions of a breed given in Clutton Brock (1987) are:

- a) A group of animals that has been selected by man to possess a uniform appearance that is heritable and distinguishes it from other groups of animals within the same species.
- b) A separately identifiable population or group of interbreeding domestic animals. Identification will usually be based on common physical characters such as colour, size, shape and also shared genetic and historical origins.

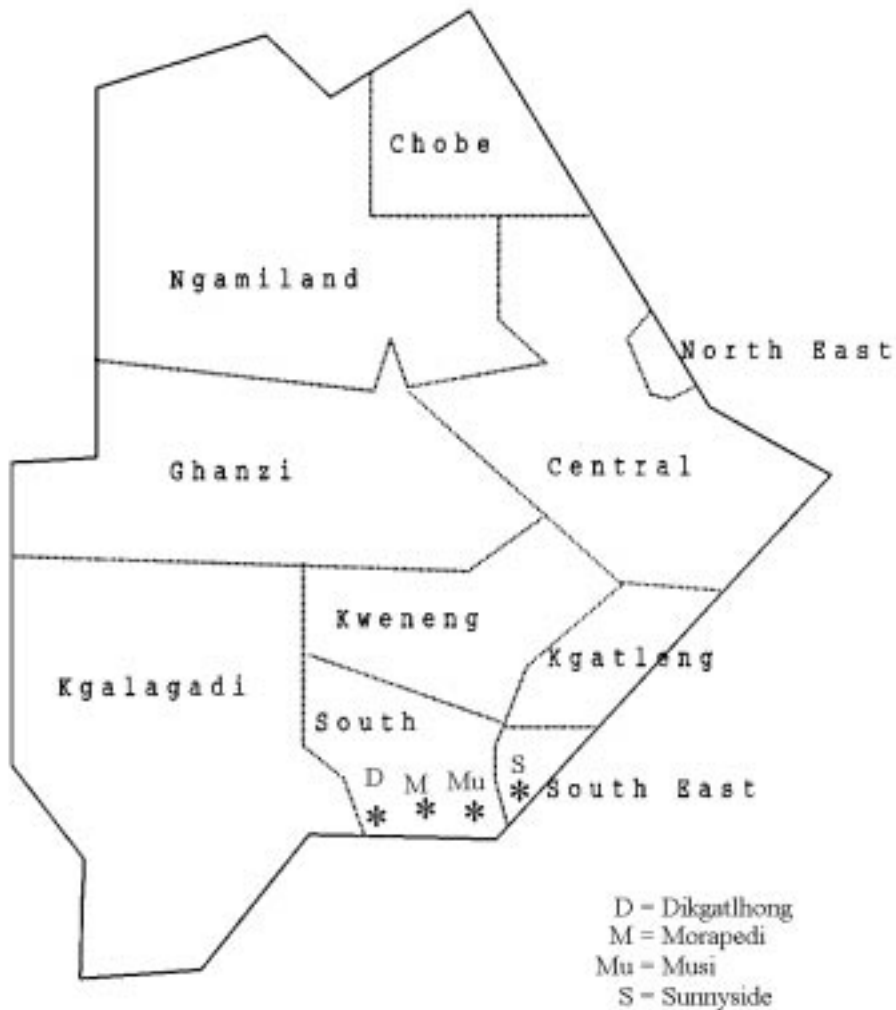


Figure 1. Republic of Botswana showing districts and some government stations.

- c) A breed is usually associated with a particular ecological zone, geographical area and farming system. Some breeds may, however, be present in several countries or localities.

It is, therefore, important to collect and document information which can be used to describe the Tswana cattle as a breed. This information should include production traits. Characterisation studies for the breed have been conducted since the 1970's and

further characterisation can be done using the population described later on, as well as other herds on government ranches and the national herd.

Physical appearance

There is no documentation on physical characteristics of the Tswana breed (breed definition a and b). Body measurements can be collected from the base population of the

Table 1. Performance of Tswana cattle compared to that of various breeds and Tswana 2-way crosses for beef cattle production traits.

Genotype*	Calving rate (%)	Weaning weight (kg)	Weight at 18 months (kg)
Pure Tswana ^a	76	177.2	284.4
Pure Africander	67	170.1	270.6
Pure Bonsmara	85	173.5	283.3
Pure Brahman	n. a.	176.1	291.8
Pure Tswana ^b	80.3	179.1	293.5
Tuli/Tswana	81.2	178.5	293.0
Bonsmara/Tswan	82.1	193.6	303.0
a			
Brahman/Tswana	83.1	189.9	319.7
Simmental/Tswa	84.9	199.0	324.9
na			
Pure Tswana ^c	88	179.3	265.8
Tuli	86	173.1	247.5
Bonsmara	68	190.2	273.8
Composite	90	190.5	286.3

* sire breed given first
Source: a - APRU, 1976
b - Lethola, Buck & Light, 1984
c - Mpofu, Mosimanyana & Setshwaelo, 1996 (for weaning weight and weight at 18 months)
na - not available

Tswana herd described later on. The Tswana breed has many colour patterns of black, brown, grey and white. The cattle have horns, although animals born on experimental stations are dehorned.

Milk production

The dairy breeding program at Sunnyside ranch (figure 1) compares milk production and lactation length of pure Tswana cows with crosses of Tswana and various foreign breeds such as Simmental. The average daily yield per cow was 1.4 kg for purebred Tswana cows compared to 2.2 kg for Simmental/Tswana crosses under the same management (APRU, 1986).

Beef production

Some of the beef production characteristics of the Tswana breed are known (table 1). The breed was compared with purebred

Tuli, Brahman, Africander and Bonsmara and various crosses (APRU, 1976). Current research work compares a composite breed developed in Botswana with various breeds including the Tswana (Mpofu *et al.*, 1996). The Tswana outperformed other Southern African breeds like the Tuli and Africander for growth traits but had lower growth rates than the Bonsmara, the Botswana composite breed and crosses of Tswana with foreign sire breeds. The genetic improvement program described later on is expected to provide more information on beef production characteristics of the Tswana.

Molecular genetics studies

The Tswana breed is found only in Botswana (breed definition c). It is not certain how and if the Tswana differs from other breeds found in the region or in Africa in general, such as the Nguni in

South Africa and the Tuli and Nkone in Zimbabwe. The Tswana is, therefore, one of the breeds to be studied in the molecular genetics studies on African breeds (Rege and Teale, 1995). The study will characterise the breeds genetically and estimate the diversity within African cattle populations. Genetic distances among these populations will be determined and the breeds classified into distinct genetic groups. The cattle used in this study include the cattle assembled at government ranches as well as cattle from the national herd.

Genetic improvement program

The Tswana breed was compared with various exotic breeds and their crosses in breeding research work done in the 1970's. Although the breed's performance for various traits was lower than that for some breeds (table 1), its performance can be

considered satisfactory. This is because the other breeds used in the study had gone through generations of selection for improved production while there had never been a formal selection program for the Tswana breed.

Hence, it was felt that the Tswana had great potential for beef production. Consequently, an improvement program for the Tswana was set up with the following objectives:

- a) To improve economic beef production from Tswana cattle raised on range.
- b) To improve the competitiveness of the Tswana breed thus improving its popularity and its use in the beef producing sector in order to reduce the chance of it becoming extinct.
- c) To improve the rural income through the development and distribution of genetically superior Tswana stock.



Photo 2. Supplementation of dicalcium phosphate and salt (1:2 ratio).

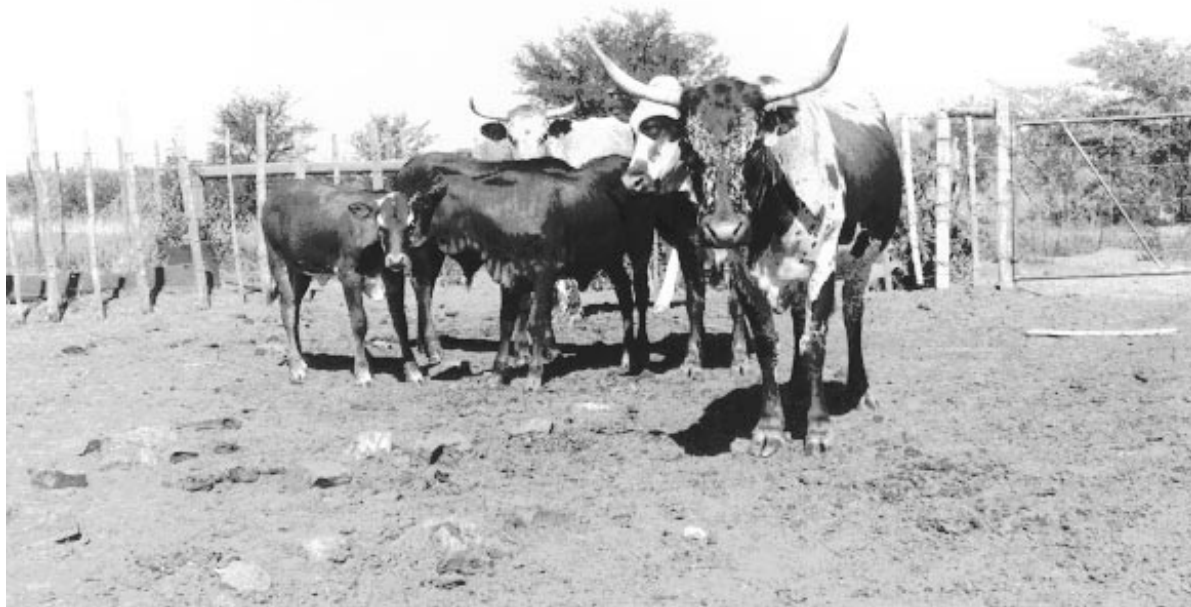


Photo 3. Tswana cattle - various colour patterns.

Assembling the foundation herd

The base population was assembled at the Dikgatlong and Morapedi ranches and later moved to Musi ranch (figure 1). The herd was built up using different strains of Tswana cattle of various ages purchased from traditional farmers in the major agricultural districts of the country, i.e. Kweneng, Kgalagadi, Southern and Central regions (figure 1). Due to operational limitations, no animals were obtained from the Ngamiland district although there are large numbers of Tswana cattle in that region. The aim was to assemble a population with a broad genetic base to provide enough genetic variation for the genetic improvement program. The program started in 1988 with the purchase of 290 cows. The first mating was during the 1989 breeding season. Most heifers produced from the 1989 to 1992 breeding seasons were retained to build the herd up to 600 breeding cows.

Herd management

The Musi herd is managed by the Animal Production and Range Research Unit (APRU), a division in the Department of Agricultural Research, Ministry of Agriculture. The management practices applied include; fencing to control breeding herds and to reserve fodder for the dry season, supplementary feeding using either bone meal and common salt (1:1 ratio) or dicalcium phosphate and common salt (1:2 ratio), free access to water at reasonable distances of grazing area, and routine veterinary care.

The breeding season starts on January 1st and ends on March 31st. Bulls are separated from the cows at the end of the breeding season. Pregnancy diagnosis is done in June each year. During late pregnancy, cows are brought near the handling facilities for observation and assistance if necessary. Calving starts in October through January. At birth, the date, colour, dam identity, sire identity, sex and weight of a newborn calf are recorded and

calves are eartagged. Abortions, stillbirths, sicknesses, and any treatments and vaccinations given to the calves are recorded. The cows are weighed within 24 hours of calving and their present and previous parous status recorded. Calves are allowed to receive all the milk from their dams till weaning. All livestock are weighed monthly. At seven months of age, calves are dehorned and later weaned and branded and then separated according to sex. They remain in the herd until ready for selection. All mortalities are recorded.

Selection criteria

Two selection lines, Line 1 and Line 2 with 300 breeding cows each were formed from the 600 cows referred above. The selection criteria for the two lines are:

- Reproductive Performance:** For both lines, heifers which do not conceive at first breeding and cows which do not conceive for two consecutive breeding seasons are culled. Males are selected on fertility test results.
- Growth Rate:** For Line 1, selection is for improved weaning weight (adjusted to 210 ± 14 days) while for Line 2 selection is for improved 18 month weight (adjusted to 540 ± 14 days). Heifers which serve as replacements in the female breeding herd and the males used as sires in the next generation are selected on either their weight at 7 months (Line 1) or their weight at 18 months (Line 2).
- Maternal Performance:** Preweaning growth of calves is determined partly by the dam's ability to produce enough milk for her calves. For both Lines 1 and 2, the aim is to improve maternal performance for increased preweaning growth. Therefore, only cows that wean

Table 2 Calving rate and mortality for the two lines before selection.

Line	Year	Calving rate (%)	Mortality at 7 months (%)	Mortality at 18 months (%)
Line 1	1989/90	85	6	7
	1990/91	75	9	9
	1991/92	76	4	4
	1992/93	74	4	8
Line 2	1989/90	74	5	5
	1990/91	65	4	4
	1991/92	63	9	9
	1992/93	60	9	11

Source: APRU, 1993

heavy calves are retained and culls are replaced with heifers selected using criterion (b) above.

- Calf survival:** For both lines, cows are culled on calf survival.

Selection procedure

Each line has 300 breeding females served by a total of 10 males. The bulls used to sire the first calves were from a genetically improved pool of Tswana animals that had been maintained in government ranches for over a period of 20 years, thus giving the herds an initial genetic lift. These males are being replaced by their sons. From each group of progeny, the top 10 percent of males are selected to be used as sires of the next generation. The top 50 percent of the heifers are retained to serve as replacements. Selection started with the 1993/4 calf crop after attaining the 600 breeding cows required. The expected selection intensity per line is 1.78 for the males and 0.835 for the females, giving an average of 1.307 for the two sexes.

Estimation of genetic parameters

Information on the genetic and nongenetic factors which affect the traits listed above are not available for local cattle populations.

This genetic improvement program will also provide such information and genetic parameters such as genetic and phenotypic variations and covariation, and heritabilities for various traits.

Estimation of genetic progress

No control line is maintained for the purposes of estimating genetic progress made. Intra-year regressions of offspring phenotype on offspring generation coefficients will be used to estimate genetic progress per generation of selection. The offspring generation coefficients will be estimated using the methods described in Koch, Gregory and Cundiff (1974). Tables 2 and 3 give the performance of the base population. Since the two base populations were derived from the same genetic pool, the performance of the progeny from the two populations is similar .

Utilisation and promotion of breeds

The best performing animals from the genetic improvement program have to be used within the Musi herd as replacements. The next best will be made available to the national herd through artificial insemination (AI) scheme and the bull subsidy scheme. With the AI scheme, bulls are collected by the Ministry of Agriculture and semen collected from them. This semen is then used at AI camps where farmers (mainly traditional) bring their cows to be inseminated. The farmers are charged for each insemination done. Semen is also sold to commercial farmers. With the bull subsidy scheme, bulls are made available to all farmers at a subsidised rate.



Photo 4. Tswana cattle - various colour patterns

Table 3. Birth weight, weaning weight and weight at 18 months for Tswana young stock before selection.

Line	Year	Birth weight (kg)	Weaning weight (kg)	Weight at 18 months (kg)
Line 1	1988/89	26	169	260
	1989/90	33	160	289
	1990/91	31	169	252
	1991/92	33	172	270
	1992/93	30	176	268
	Mean	31	171	269
Line 2	1988/89	29	164	---
	1989/90	32	181	287
	1990/91	32	161	223
	1991/92	31	166	238
	1992/93	30	183	271
	Mean	30	166	248

Source: APRU, 1993

Future research work

- Suggestions for future work include:
- Using research herds at Sunnyside and Musi ranches to collect information on physical characteristics of the breed, e.g. body measurements.
- The same herds in (a) above should be used to further characterise the Tswana breed for milk and beef production traits. Such traits should include carcass and meat quality, milk compositional quality, herd life and some economic aspects of production.
- Characterise the breed for disease resistance.
- Characterisation for production traits to be conducted under field conditions to complement the characterisation work which was and is still being done on experimental stations.
- The relative importance of the traits selected for the genetic improvement of the breed should be determined and a selection index developed.

Collaborating institutions

The Botswana government does not have all the required infrastructure and personnel to do all the research/characterisation studies. Some of the research can be done in collaboration with other institutions within and outside Botswana.

Carcass evaluation

Slaughter of cattle is done by the Botswana Meat Commission. The Commission provides carcass mass and carcass grade for all cattle slaughtered. There are no facilities to do detailed carcass studies. For some experimental animals, arrangements are being made to do such carcass evaluations at the Animal Improvement Institute in Irene, South Africa.

Molecular genetics studies

These studies are being done by the International Livestock Research Institute (ILRI), and in Botswana, the collaborating institution is the APRU.

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