Beef cattle production performance and farmer profile in a communal environment of the Eastern Cape Province

T Rust[1#], JM Rust[1], NS Nongauza[2], CH de Ridder[1], NA Faku[2], S Moss[2] & M Mpahla[2]
[1] Dohne ADI, Eastern Cape Rural Development and Agrarian Reform, Stutterheim, 4930, South Africa.
[2] Eastern Cape Rural Development and Agrarian Reform, Extension Services, Amathola District, East London, 5200, South Africa.

Abstract

The study was conducted in Gwaba village, Buffalo City Metropolitan Municipality, Eastern Cape Province. The study provides information that can be utilized to track change over time with respect to the livelihood status, livestock asset ownership and the production and reproduction profile of a communal cattle herd. Results from a structured farmer livelihood and agricultural productivity questionnaire indicated that the cattle owners are reasonably educated but old. They list farming enterprises as their main source of income. Animals are managed as one herd and an open mating season is followed. Theft is a concern forcing them to kraal their animals at night. Their biggest constraint is financial aspects followed by infrastructure needs. Animal production and reproduction status were recorded bi-annually. Both male and female animals experienced weight loss during the winter months. Estimated annual calving percentage seemed reasonable during Year 1 at 77%, however only 35% of those females reconceived the following year (Year 2). Phenotypic correlations for age, body condition score (BCS) and reproduction status (RS) were estimated based on annual reproduction data. BCS was important for reproduction success and reproduction in turn had a negative effect on subsequent BCS.

Keywords: small scale, livelihood, husbandry, productivity, reproduction status, body weight, body condition score
[#]Corresponding Author: tinarust@mweb.co.za

Introduction

The distribution of more than 3.1 million cattle of which an estimated 60% are found in the developing areas (mostly communal farming areas), emphasize the fact that animal production and the promotion thereof should be a high priority in the Eastern Cape (Tapson, 1982; National Department of Agriculture, 2018). The developing agricultural sector is faced with a number of serious limitations. These limitations range from inadequate resources, ineffective productions systems and inadequate market access. The efficiency of meat, wool and milk production from communal livestock is estimated to be only a quarter of that in commercial farming due to low levels of nutrition and management in communal grazing areas (Bembridge & Tapson, 1993). The combination of climatic, topographic and geological features in the Eastern Cape limit crop production (Scholtz *et al*., 2008). As a result, 90% of the province consist of rangeland used for communal grazing, commercial livestock production, nature conservation and game ranching (De Wet & Van Averbeke, 1995; CSIR, 2004).

The main purpose of the study is to contribute to baseline information that can be used for analysing and tracking change over time. The baseline study framework places households at the centre of a web of inter-related influences that affect how households create a livelihood for themselves. The purpose of baseline studies are, firstly, to help cattle owners identify what they need to change to improve their performance. Secondly, it should provide a model or principles to guide the implementation of practices and bridge the gap between goals and aspirations (Jack & Boone, 2012). Livestock development without formal planning and unassisted by organized development efforts has in the past largely resulted in the numeric increase of herds and flocks, i.e. an expansion of traditional systems without any productivity improvement (Jahnke, 1982).

The study seeks to provide information that can be utilized to track change over time with respect to livelihood and gender indicators, agricultural production and changes made in cattle farming practices over time (adaptation/innovation). The specific objectives of the study are to determine the livestock asset ownership and the production and reproduction profile of a communal cattle herd.

Materials and Methods

The study was conducted in Gwaba village, Buffalo City Metropolitan Municipality, Eastern Cape Province. Initially baseline information on livestock owners were collected regarding farmer demographics, livelihood status and general livestock husbandry practises using a structured farmer livelihood and agricultural productivity questionnaire. These questionnaires were administered on an individual basis. The study was completed over a 3 year period from 2015 to 2017. Animals were kept on Eastern Cape Thornveld and False Thornveld (Acocks, 1988). At the initial visit to the area, each animal was identified individually and the owner name, the gender and estimated age of the animal recorded. The approximate age of animals were determined by inspecting their incisor teeth. The reproduction status of each post pubertal female was assessed by means of rectal palpitation or by using a real-time ultrasound scan. All animals were weighed. The cattle owners were consulted to establish an inventory of the facilities and resources available to them and a veld assessment of the grazing resources was completed by assessing the basil cover material (grass) on site considering species composition and standing hay material. The benchmark method was used to determine grazing capacity. After the carrying capacity figures were calculated they were rounded to an acceptable average grazing capacity figure for the area measured. The use of the survey data was to evaluate the current state of veld fodder and compare the site carrying capacity to that of benchmark figures. Data was collected from three surveys done in separate areas on the farm, to determine the grass species composition. Although data was recorded on individual animals, reporting is done on a total communal cattle basis. The sample size varied between observations periods from 125 to 45 animals.

Animals were observed bi-annually to record information regarding production and reproduction statuses. Any births were recorded together with the identity of the dam. Similarly, any deaths were recorded. Thereafter, all animals were weighed and the reproduction status of females were determined.
Phenotypic correlations ($P<0.05$) between the traits were determined using StatSoft, Inc. (2013).

Results and Discussion

The Gwaba community has fair internal organizational structures within the community. Beef cattle owners expressed willingness to participate and they understood the objectives of the study. There was access to cattle handling facilities in the form of a dipping race. There are however no camps and water access in drier months can be limited.

Data on veld condition was collected from three surveys done in separate areas on the farm. The average carrying capacity, for the specific veld types, according to three veld surveys completed, was 5.73 Ha/LSU under ideal conditions. However, the veld surveys in the grazing area show poorer carrying capacity figures with an average veld condition score of 43.89% over the three surveys done.

The results from the livelihood and agricultural productivity questionnaire are presented in Figures 1 to 6. Figures 1 to 3 depicts results from the questions related to demography and livelihood. Figure 1 shows the age distribution per gender of the livestock owners where Figure 2 indicates the literacy level per age group. Lastly, Figure 3 indicates the income source of the livestock owners.

The cattle owners are older and are in the 65 to 75 year age range (Figure 1). Female farmers represent only 17.6% of the livestock owners and are in the 55 and 65 age groups. This is in agreement with studies done by Ainslie (2002) and Marandure (2015). Most cattle owners indicated that they can read and write and 41.2% completed schooling at a tertiary level however, the level of education reduced as the age of the livestock owners increased (Figure 2). This is in agreement with the findings of Marandure (2015) and Molefi (2015) but much higher than the 10% reported by Ainslie (2002) for the Pedie district. The livelihood and agricultural productivity questionnaire responses indicate that the nature of farming for most of the communal cattle owners participating in the study is subsistence level in order to support their household. Farming is the main source of income (65.5%) in the community followed by pensions (31%) (Figure 3). This differs from the findings in Mpumalanga of Molefi (2015) who recorded that approximately 48% of the respondents relied on pension income, while 28.5% reported that the main source of income in their households came from a combination of beef cattle production and pension.

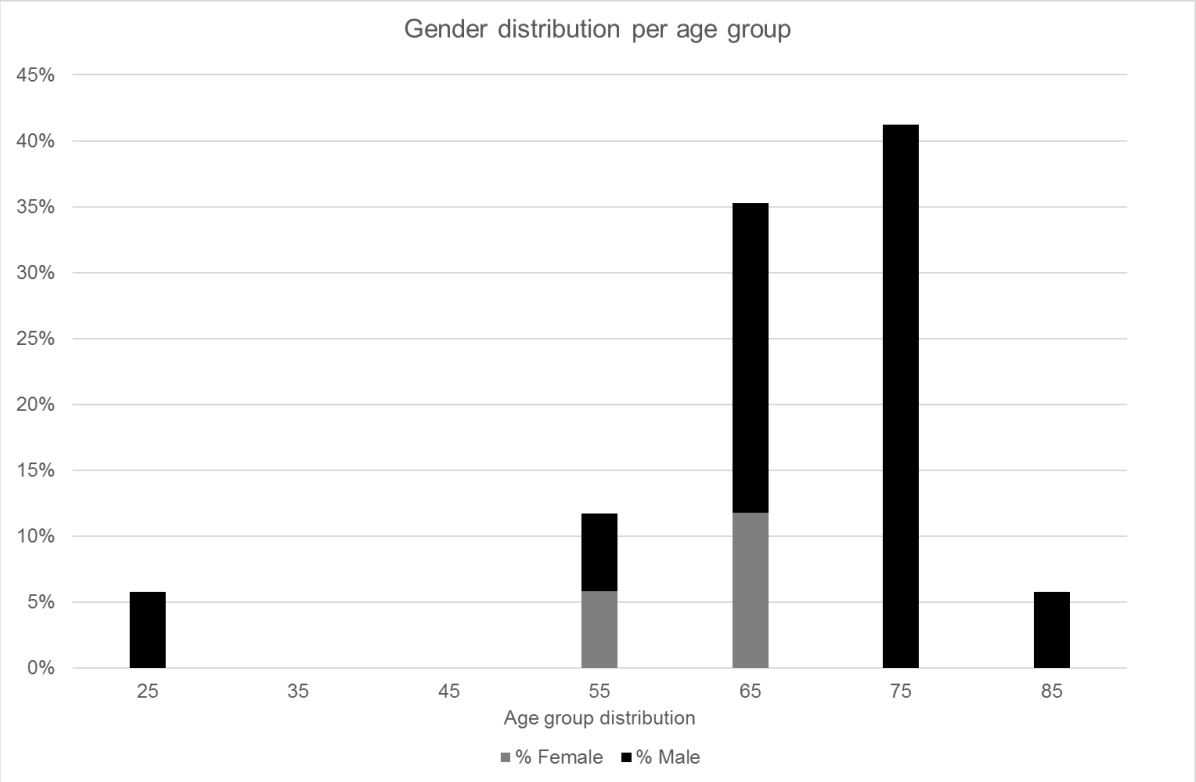

Figure 1 The gender distribution per age group of livestock owners from Gwaba village

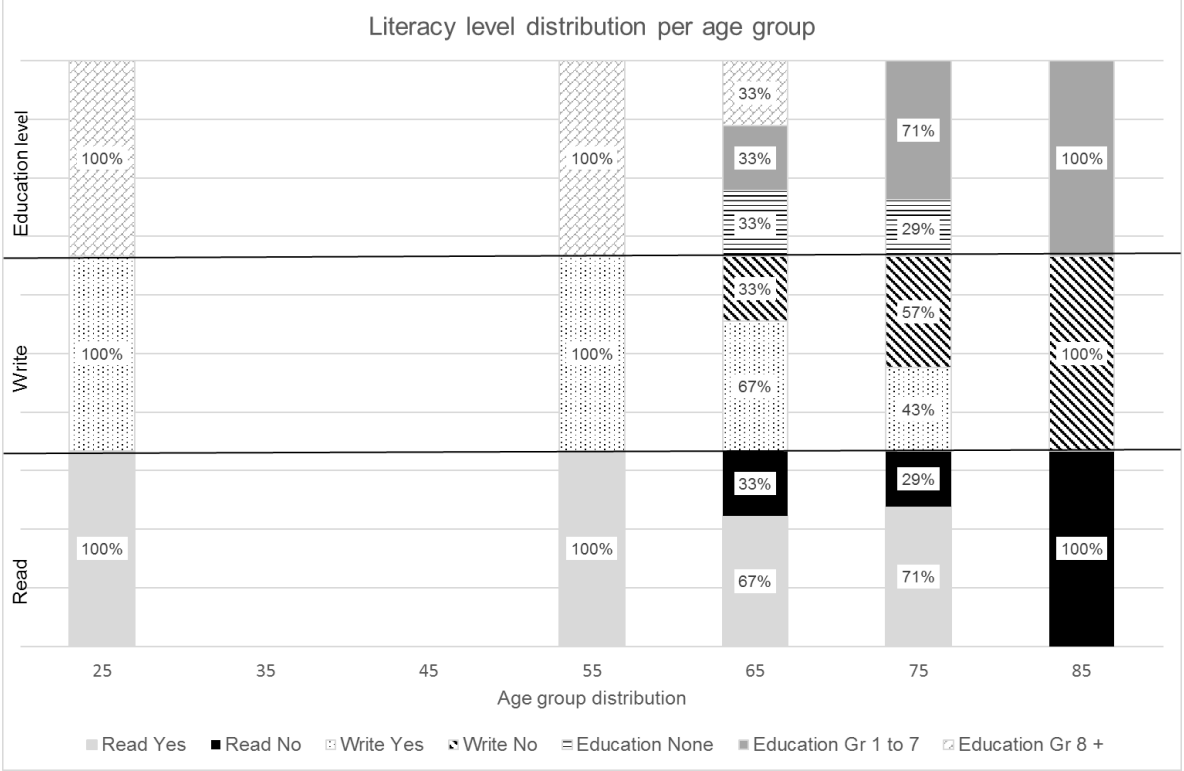

Figure 2 The literacy level distribution per age of livestock owners from Gwaba village

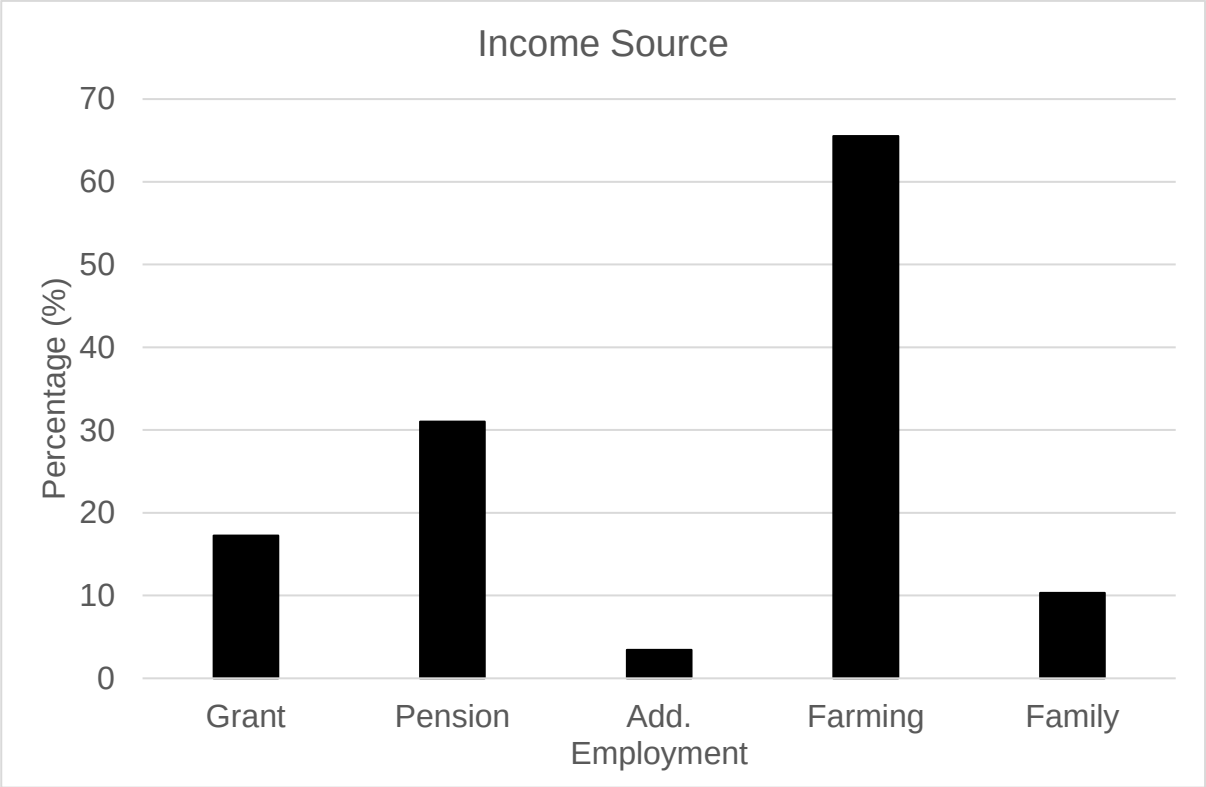

Figure 3 The distribution of the income sources of livestock owners from Gwaba village

Figures 4 and 5 highlight the farmer perceptions on livestock husbandry and productivity. A large percentage (41.2%) of the cattle owners rank cattle production as their priority followed by sheep and goat. Figure 4 depicts general husbandry practises regarding cattle farming with regards to where they obtain mating bulls, mating seasons, where they keep their bulls and the reasons why they kraal their animals at night. Lastly, Figure 5 depicts the perception of the most common livestock diseases cattle owners experience arranged in decreasing order of importance.

Bulls for mating are obtained from stud breeders or are borrowed from other cattle owners. Bulls are, for the most part, kept in the same herd with the females (75%), so even though the cattle owners observe mating in summer, an open mating season is mostly followed. Animals are kraaled at night to prevent stock theft or losses due to dogs or predators (Figure 4). Half of the cattle owners (51%) indicated in the questionnaire that they provide extra feed for their animals during the winter months. The diseases cattle owners mostly indicated to experience problems with are gal sickness (82%), external parasites (59%) and red water (59%). Mapiye *et al*. (2009) found tick-borne diseases to be one of the greatest limitations to cattle productivity in rural areas. Supplementary to the questionnaire, cattle owners were questioned on the use of preventative disease treatment, supplementary feeding and marketing of their livestock. If the animals get sick, the cattle owners treat them, but do not always take preventative steps. Cattle owners indicated that they market livestock mostly in the informal market and only 17% of livestock owners indicated that they market livestock through formal markets. Tapson (1982) estimates off-take of cattle in the former Transkei area as 5.4 % and Bembridge, (1987) estimated it slightly higher at around 6.8 %.

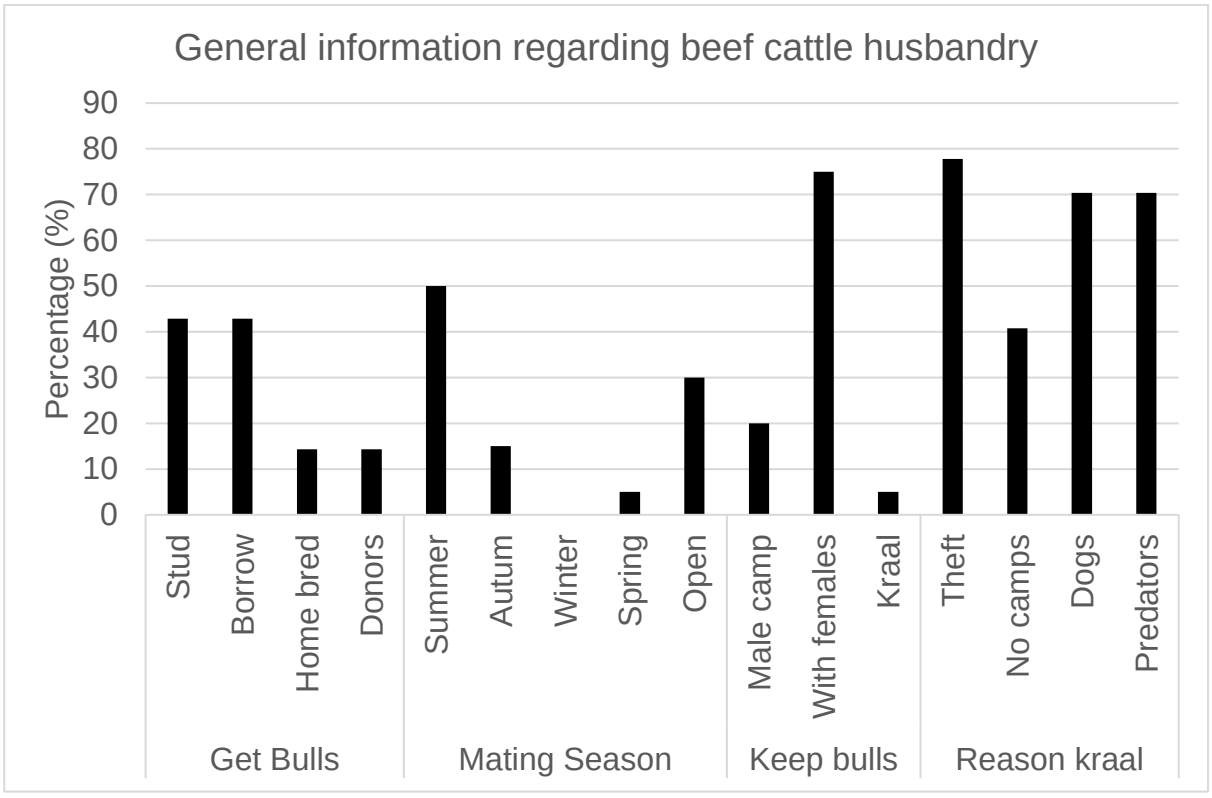

Figure 4 General husbandry practises of cattle owners from Gwaba village

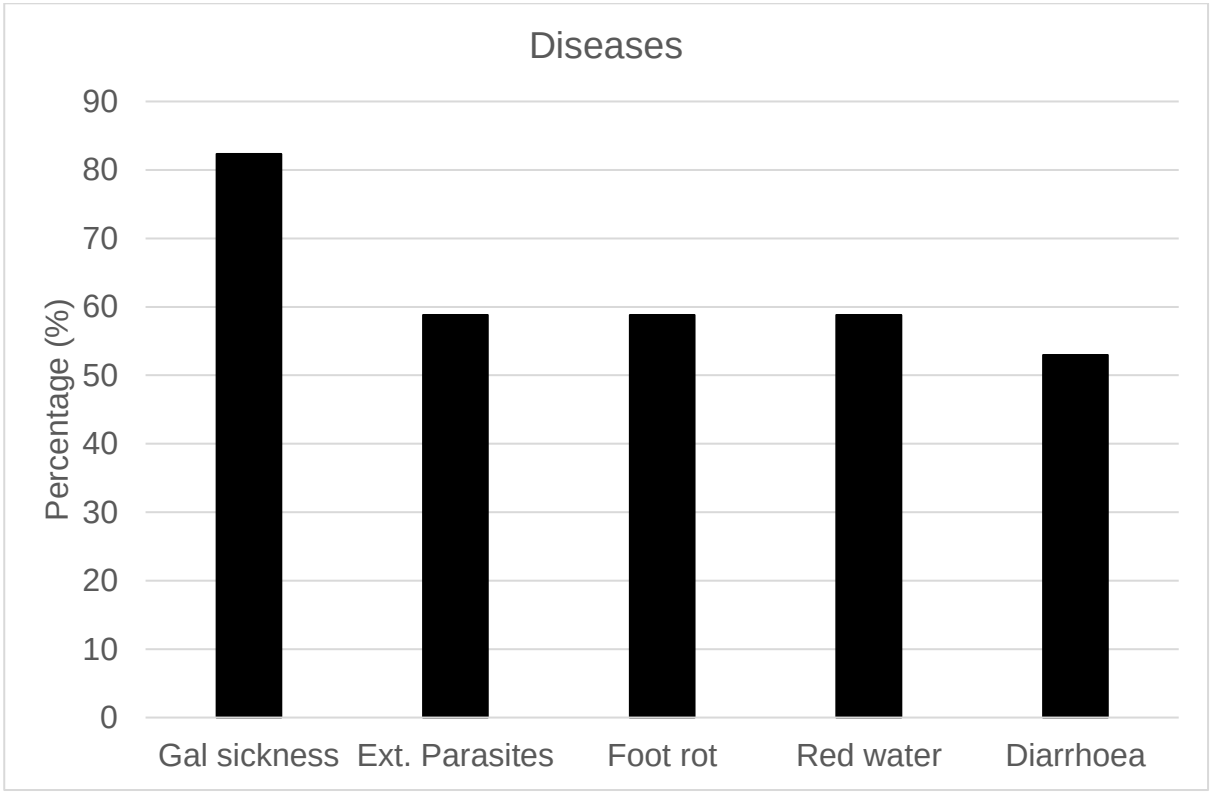

Figure 5 The distribution of most important diseases the livestock owners experience ranked in order of importance

Lastly, Figure 6 depicts the most important constraints, in decreasing order of importance, as indicated by the livestock owners. The biggest constrains cattle owners experience are veld management (77%), followed by production aspects (71%), poor infrastructure (59%) and financial issues (59%).

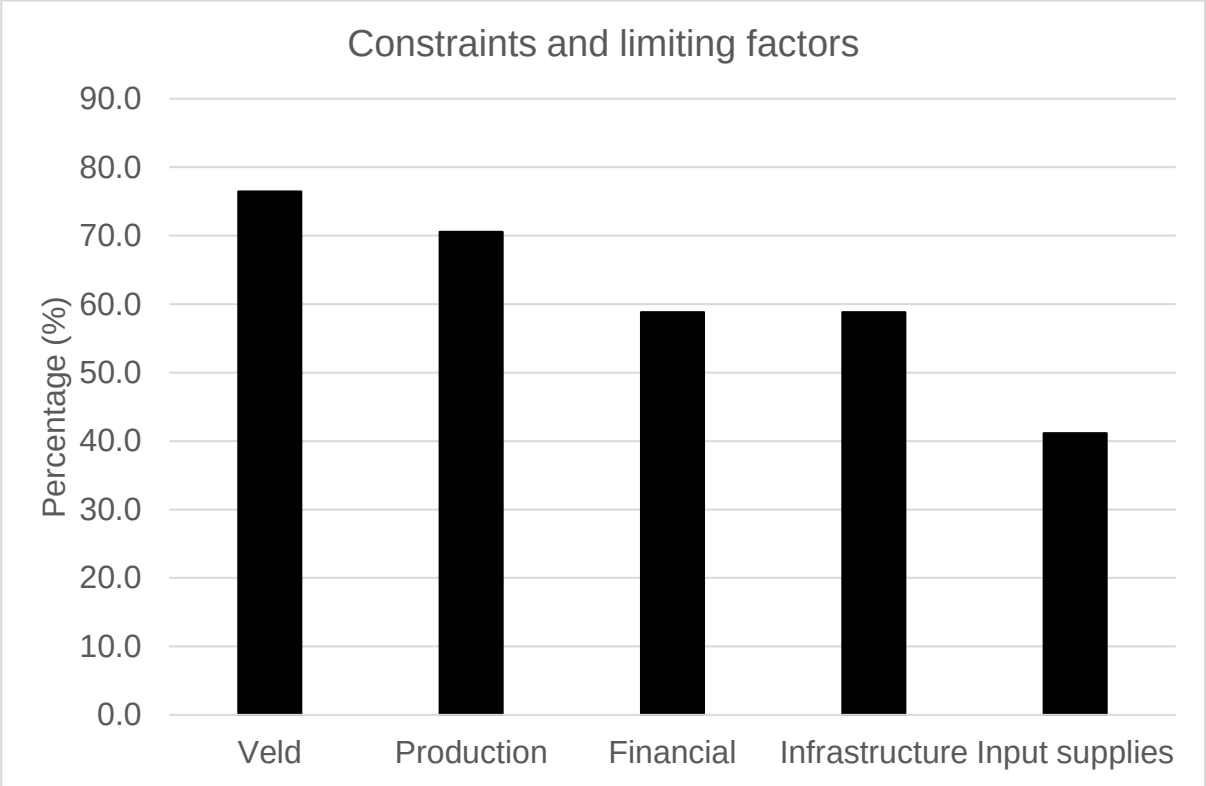

Figure 6 The distribution of most important constraints of the livestock owners ranked in order of importance

Recorded data is presented in Tables 1 to 4. Table 1 gives the number of female and male animals (including castrates) recorded per age group during the bi-annual observation periods. It also indicates the percentage herd representation per age group.

Table 1 Number of cattle per estimated age group

	Estimated age group (years)						
	1	**2**	**3**	**4**	**5 to ≤ 10**	**10 +**	**Total**
	Number of female animals (% of herd)						
Winter 1	18(14)	14(11)	4(3)	1(1)	32(26)	11(9)	80(64)
Summer 1	16(16)	13(13)	4(4)	1(1)	29(29)	0	63(62)
Winter 2	0	11(14)	8(10)	3(4)	25(32)	5(6)	52(67)
Summer 2	0	14(18)	10(13)	2(3)	21(28)	1(1)	48(63)
Winter 3	0	11(24)	7(16)	1(2)	16(36)	0	35(78)
	Number of male animals (percentage % of herd)						
Winter 1	13(12)	10(9)	6(6)	1(1)	15(14)	0	45(36)
Summer 1	11(11)	10(10)	6(6)	0	11(11)	0	38(38)
Winter 2	0	8(10)	8(10)	5(6)	5(6)	0	26(33)
Summer 2	0	8(11)	9(12)	5(7)	6(8)	0	28(37)
Winter 3	0	4(9)	2(4)	4(9)	0	0	10(22)

The average weight per age group and gender, as well as the average BCS per age group and gender over all three years (Year 1, Year 2 and Year 3) and seasons are presented in Table 2. Castrates are included in the male group.

Table 2 Average weight and BCS of male and female beef cattle for the respective age groups

	Female		Male	
Age (Year)	Avg. Weight (kg) ± SD	Avg. BCS	Avg. Weight (kg) ± SD	Avg. BCS
< 1	137.7 ± 62.3	2.21	117.2 ± 33.5	2.42
1	217.6 ± 55.2	2.23	199.9 ± 54.4	2.17
2	256.5 ± 67.0	2.47	270.6 ± 81.1	2.33
3	277.9 ± 59.4	2.57	290.3 ± 82.8	2.40
4	296.0 ± 96.0	2.29	365.6 ± 66.6	2.83
5 to ≤ 10	342.6 ± 58.4	2.15	407.4 ± 65.9	2.56
10 and older	376.7 ± 46.2	1.83	NA	NA

Shaded area indicates year females start to reproduce

The estimated ADG for the adult cattle were calculated by comparing the average winter and average summer weights respectively for female and male animals. The average kilograms gained or lost between recording dates were used to estimate the average ADG (Table 3).

Table 3 Estimated ADG (kg growth/days observed) for adult beef cattle

	Female	Male
Summer	0.21 ± 0.39	0.35 ± 0.06
Winter	-0.14 ± 0.33	-0.82 ± 0.34

The reproduction status of the female herd is presented in Table 4. Observations recorded were: Pregnant (P), Not Pregnant (NP) and Not Pregnant but Calved (NPC). The gestation length as estimated by rectal palpitation from the cows certified as pregnant.

Table 4 Reproduction status for female beef cows as recorded in year 1, 2 and 3

Season	Pregnant (P)	Average gestation, Months ± SD	Not Pregnant (NP)	Not Pregnant Calved (NPC)
Winter1	13	6.3 ± 2.1	16	21
Summer1	10	5.4 ± 3.2	21	8
Winter2	17	4.9 ± 1.8	12	8
Summer2	13	5.9 ± 2.4	11	4
Winter3	8	3.4 ± 1.9	5	8

The herd structure observed is not optimal for profitable beef farming with the females on average making up 64 % of the adult herd with on average only 29% females represented in the herd in the 5 to 10 year age range. This is very low and become more detrimental when taking into account that the females only start producing at or after the age of 4 years. Hangara *et al.* (2011) similarly identified the bull:cow ratio (1:38) as one of the main constraints in cattle production in the rural Omaheke region of Namibia.

The average weight of both female and male animals increased with age. The weight of young males are comparable to their female contemporaries up to the age of 4 years when the females begin to reproduce. The weight of a productive cow between 5 and 10 years of age is 342.6 ± 58.4 kg. The BCS of females is also highest just before they begin to reproduce at 2.57 from where it drops annually with old cows (older than 10 years) showing an average BCS of only 1.83. This trend is not as acute in their male counterparts. Traditionally, oxen are sold before they reach the age of 10 years when they weigh on average 407.4 ± 65.9 kg with an average BCS of 2.56.

The average BCS for the female cattle 10 years and younger vary between than 2.15 and 2.57, and they gain on average 0.21 kg per day during summer months and lose on average 0.14 kg per day during the winter months. For male animals (castrates included) the average BCS values were slightly better at 2.17 to 2.83 gaining 0.35 kg per day during the summer months and losing 0.83 kg per day during the winter. The females gained on average less weight during summer but also lost less weight during the winter months.

After data was recorded for three consecutive years, the traits Age, BCS and reproduction status (RS) were analysed to determine the phenotypic correlations between them. Only winter recordings were used to estimate the phenotypic correlations. The reason for this was firstly to compare data recorded at similar times of the year and generally the standard deviations of the summer recordings where larger. This was because some cows in summer were recorded as heavily pregnant while others were only a few month pregnant. Possible explanation can include that some cows only became pregnant late in the winter or aborted and reconceived towards the end of winter. The results are presented in Table 5. RS as depicted in Table 5 equates to a positive pregnancy or an animal that recently calved.

Table 5 Phenotypic correlations between age, BSC and Reproduction status (RS) in years 1, 2 and 3

	Age	**BCS 1**	**RS 1**	**BCS 2**	**RS 2**	**BCS 3**	**RS 3**
Age	1						
BCS 1	0.05	1					
RS 1	**0.74**	-0.33	1				
BCS 2	0.22	0.16	0.17	1			
RS 2	0.47	**0.55**	-0.11	-0.13	1		
BCS 3	-0.13	-0.03	0	0.31	**-0.56**	1	
RS 3	**0.58**	0.16	0.36	-0.18	**0.54**	-0.25	1

During the first year's calving season (Winter 1), 77% full mouthed cows (> 4 years and ≤ 10) either calved or were pregnant. However, in the following year (Winter 2) only 35% of them were recorded as pregnant. Similarly, of the full mouthed cows pregnant in Winter 2 only one managed to become pregnant again in Winter 3. This is in agreement with the finding of Bembridge (1987) that noted the calving rate in three areas of the former Transkei (Qamata, Emgcwe and Qumbu) as 38.8 %. Of the young animals (2 to 4 years) only one managed to become pregnant and calved in the first year (Winter 1) but failed to reconceive in the following year (Winter 2). Seventy-one percent of the young heifers that were two tooth (± 2years) in the first year (Winter 1), became pregnant for the first time in Winter 3.

Phenotypic correlations for age, BCS and RS were estimated based on annual reproduction data. In Winter 1, age had a significantly ($P< 0.05$) positive correlation of 0.74 with reproduction status meaning that the older cows were mostly pregnant or calved recently. In Winter 2, a similar correlation was not evident which probably meant that the older animals did not reproduce in that year. In Winter 3, the same positive correlation of 0.58 was evident which may indicate that females (> 4 years and ≤ 10) skipped year 2 and only calved again in year 3.

There was a significant positive correlation of 0.55 between BCS1 and reproduction status 2 in the second year meaning animals, which were in good condition during the first winter probably conceived and reproduced during the second year.

The reproduction status of females in the second year had a positive correlation of 0.54 with reproduction status in the third year, which means that animals which reproduced in the second year, probably reproduced again in the third year. They were in all probability younger females and the consecutive reproductions had a highly significant negative effect (-0.56) on their BCS.

Conclusions

It must be noted that the measurements and observations were recorded in a communal environment under semi-controlled conditions. The cattle owners had complete authority regarding the management of their own animals. Cattle owners were not prescribed to, and continued for the duration of the study, to follow their own preferred animal husbandry system. Exact measurements and observations in such circumstances are difficult to obtain. Many of the conclusions made are based on probabilities.

From the livelihood and agricultural productivity questionnaire, it is clear that the cattle owners are reasonably educated but are old. They list their main income source as farming enterprises and pension. Animals are kept as one herd and an open mating season is followed. Theft is a concern, forcing them to kraal their animals at night. Their biggest constraint is veld management followed by production aspects. It is clear that the cattle owners over utilize the grazing resource. Extensive restoration of old lands are necessary to improve the productivity of the communal farming area.

The average weight of both female and male animals increased with age, up to the age of 4 years old when the female animals start reproducing. The BCS of females are also the best just before they begin to reproduce. Animals experienced severe weight loss over the winter months. The females on average gained less weight during summer but also lost less weight during the winter months.

Estimated calving percentage appeared to be low. BCS was important for reproduction success and reproduction in turn had a negative effect on subsequent BCS. Due to the nature of the trial and the unpredictability of communal livestock husbandry practises, the results cannot explicitly represent the situation as far as cattle production is concerned. However, it is a good indicator of the trends to be expected regarding beef cattle production in a typical communal farming setup.

Author contributions

Conception: TR and JMR; Design: TR; Data collection and analysis: TR and JMR; Data collection: NSN, CHDR, NAF, SM and MM; Critical revision: JMR; Critical revision and final approval of version to be published: all authors.

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