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Cattle Production Management Practices Predisposing Animals to the Incidences of Reproductive Failures in Small Scale Farming

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Abstract: Preparing for an effective animal reproduction requires proper management practices before parturition. This study aimed to identify cattle production management practices that predispose cows to the incidences of reproductive conditions in small scale farming. One hundred and thirty-five (135) structured questionnaires were used to obtain information from the farmers following reported cases of dystocia, downer cow syndrome, retained placenta, vaginal prolapse and abortion in cows at the North West University animal hospital. The data included information such as cow age, parity, breed, number of incidence of the conditions, feeding system, feed type, whether or not the animals were supplemented, supplement type, condition experienced by the cow, vaccination status, cow's Brucellosis status and access to veterinary services were also assessed. The data were analyzed in Statistical Product and Service Solutions (SPSS) version 25 using descriptive statistics, Chi square and Stage-Two Cluster analysis. The results showed that the factors significantly related ($p < 0.05$) to the incidences of reproductive conditions were cow breed, parity, feeding system, whether the farmer has heard about Brucellosis and the frequency of getting animals checked by a veterinarian. The study found that in communal areas, herds with Afrikaner breeds, when farmers have not heard about Brucellosis, when cows are the first parity, while they are in free ranging method of feeding and with an annual veterinary check-up mostly experience abortions. Implementation of management strategies for the improvements of farming methods in communal farming is necessary to change the state of livestock agriculture through the reduction of reproductive failures in small scale farmer.

Key words: Management practices, reproductive condition, cows.

1. Introduction

In cow reproduction the transition period is an important contributor to both production efficiency and viability. Cows undergo several metabolic alterations as they transit from late pregnancy to early lactation [1]. The inability to account for physiological demands during pregnancy predisposes cows to reproductive disorders [2]. Research has greatly emphasized and produced with substantial evidence, knowledge about the impact of proper management on the reproduction of transitioning cows [3]. Particularly, poor farm management has been linked with low fertility and poor reproductive health in cows transitioning from late pregnancy to early lactation for example [4].

Even with many developments and innovation in strategies to increase production and reduce losses, the occurrence of reproductive disorders such as dystocia, retained placenta, vaginal prolapse, downer cow syndrome, abortion in cow reared in communal areas is seen almost every calving season [5-7]. Moreover, the status of cow reproductive efficiency in small-scale farms is not precisely known but only presumed to be low, mainly due to lack of data, absence of areas were proper testing can be done and also because of the animal health care inaccessibility for poorer farmers [8].

Most of communal farmers have lack of knowledge about management factors affecting reproduction and

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eventually face animal and financial loss due to treatment and replacement costs [9]. Hence, for efficient reproduction, it is important to ensure appropriate farm control and management strategies necessary for pregnancy to reduce the risks of calving problems and post-calving complications. Therefore, identifying factors leading to the incidences of reproductive condition is essential to help prevent reproductive failures and improve cattle production in small scale farming.

2. Materials and Methods

This study was conducted in Mafikeng area in the North West province in South Africa. The location coordinates are 25°51′ S and 25°38′ E. The area has temperature range of 22-35 °C which is typically experienced during summer encountered between August and March and the annual rainfall averages from 200 mm to 500 mm [10]. Sample size of 135 was determined using Roasoft calculator. Convenient sampling method was used to generate the sample. Questionnaires were distributed only to farmers who reported cases of dystocia, downer cow syndrome, retained placenta, vaginal prolapse and abortion at the North West University (Dale Beighle) animal hospital.

The questionnaire was tested (pilot-testing) prior to the commencement of the study. A total of 135 structured questionnaires were distributed to farmers who reported cases of reproductive failures in communal areas around Mafikeng. The data collected included farmer demographics, cow information and medical history, incidences of reproductive failures as well as management practices (veterinary check-ups, feeding systems, vaccination protocols, disease control programs, breeding practices) under which cows are reared and the Brucellosis status of the cows was also recorded. To assure the reliability of data the lead researcher self-administered the questionnaires. The data were analyzed using Statistical Product and Service Solutions (SPSS) version 25. SPSS was preferred for its higher analysis proficiencies also because of its ability to handle the multiple arrangements of data obtained from the survey. SPSS was therefore used to calculate all frequencies and descriptive statistics.

Pie charts were used to summarize the responses for each variable in the questionnaire. The Chi-square test of association was used to determine the association between the occurrence of the reproductive conditions and the attributes of the cows as well as the farm management practices. For the variables showing significant associations, the cross-tabulations were used to show the probability of the occurrence of the reproductive conditions given the cow attributes or farm management variables. The Two-Stage Cluster analysis was used to segment the animals based on the variables associated with the reproductive conditions as identified by the Chi-square test of association. A further Chi-square test of association was performed to confirm the association between the reproductive condition and the cluster to which the cow is allocated.

3. Results

The results for farmer's demographics and information about the cows experieperiencing reproductive disoders are represented below.

The age groups and gender of the farmers are presented in Figs. 1 and 2, respectively. Fig. 1 shows that the majority of the communal farmers were in ages between 40-55 years (61%), while 20% of the farmers were found in the age groups of 56-69 years, subsequently only 10% of farmers were in ages of 70 and above and the least proportion was farmers between 18-39 years (9%). The result of this study shows that most of the farmers involved in the small scale farming system were male (79%) while female farmers represented only 21% of the communal farmers (Fig. 2).

Fig. 3 reveals that only 25% of the farmers were married, while most of the farmers were single (68%). The study further indicated that the fewest of farmers

were widowed (7%). The data showed that 44% of the farmers have full time employment, whereas those with part-time jobs made up to 28% of the farmers and only about 24% were unemployed farmers (Fig. 4).

The present study indicated that most farmers had at least primary level (76%) education, followed by (10%) secondary level, while high school (7%) and those with no education (7%) indicated in Fig. 5. Those who had no income were about 3% of the farmers. A total of 56% of the farmers earned less than R1,000. Those with the income of between R1,000-R3,000 were 37% of the population. Only 2% of the farmers had income above R3,100 and R5,000 (Fig. 6).

Table 1 shows the tests of association for different attributes of cows affected by reproductive failures and *p*-values.

The Chi-square tests indicate that the reproductive

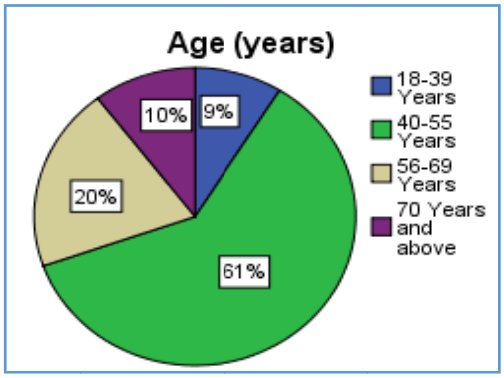

Fig. 1 Age group of farmers.

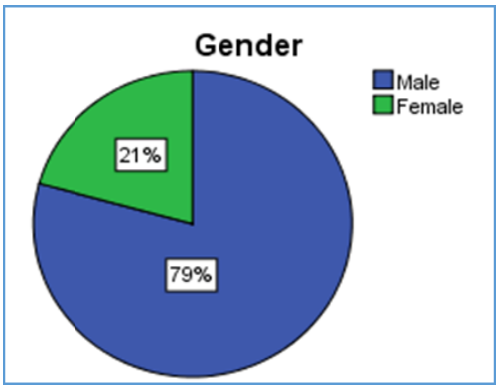

Fig. 2 Gender distribution of responding farmers.

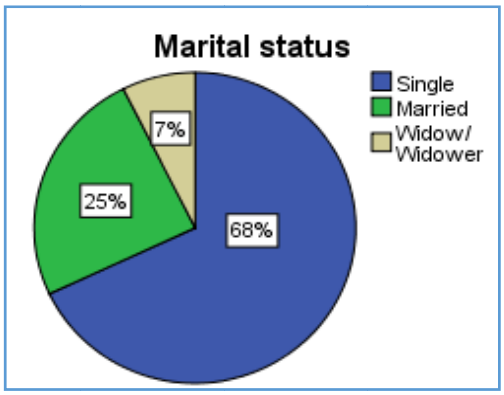

Fig. 3 Marital status of farmers.

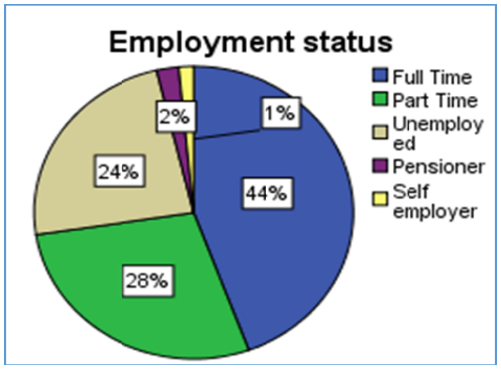

Fig. 4 Emploment status of responding farmers.

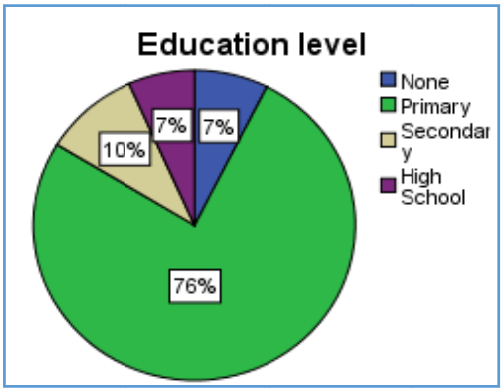

Fig. 5 Educational levels of farmers.

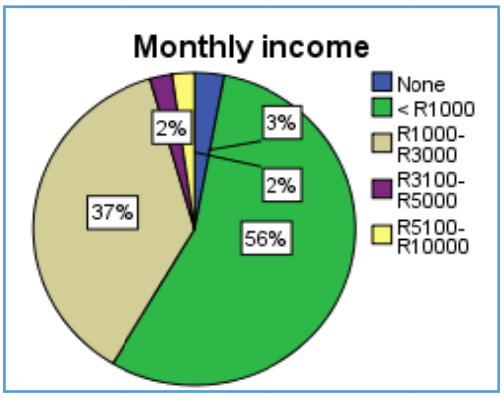

Fig. 6 Farmer's montlhy income.

Table 1 Test of association and *p*-values of different cow attributes in affected animals.

Cow attributes	Chi-square	*p*-value
Age of the cow	Likelihood ratio	0.349
Body condition score	Likelihood ratio	0.11
Breed	Likelihood ratio	0.002**
Parity	Likelihood ratio	0.003**
No. of incidence	Likelihood ratio	0.816
Feeding system	Likelihood ratio	0.026*
Feed type	Likelihood ratio	0.136
Whether the cows are supplemented	Likelihood ratio	0.817
Supplement given to the cows	Likelihood ratio	0.559
Type of supplements	Likelihood ratio	0.124
Whether treatment was for the current condition before	Pearson chi-square	0.114
Whether the cow was given anti-parasitic medication	Pearson chi-square	0.448
Whether the cow was vaccinated	Pearson chi-square	0.546
Vaccine administered to the cow	Likelihood ratio	0.453
Whether the farmer has heard about Brucellosis	Pearson chi-square	0.001**
Any other disease(s) encountered	Pearson chi-square	0.353
The frequency of getting animals checked by a veterinarian	Likelihood ratio	0.005**

*Significant at 5% ($p < 0.05$); **significant at 1% ($p < 0.01$).

condition encountered is significantly associated (p-value < 0.05) with the following variables: breed, parity, feeding system, whether the farmer has heard about Brucellosis and the frequency of getting animalschecked by a veterinarian.

The data show a decrease in proportion of cows among different breed type from Nguni (29%), Afrikaner (22%), Brahman (19%), Bonsmara (10%), mixed breed (9%), Drakensberger (3%) and Simental (1%) seen in Fig. 7.

The result of the present study revealed that all (100%) Simmental cows in the study were affected by downer cow syndrome. Moreover, Drankensberger cows had a relatively high chance of experiencing abortion (50%), while Angus cows stand a relatively high chance of experiencing retained placenta (62.5%), Drankensberger also stand a relatively high chance of experiencing virginal prolapse (50%) whereas other breeds (unidentifiable breeds) have a higher chance of experiencing Dystocia (Table 2).

About 49% of the cows were in the first parity and were the majoritywhile the second largest group of cows was in their second parity (37%). Only 7% of the cows were in the third parity and about 4% have calved five times. The least proportion was of the cows in their 8th parity (1%) (Fig. 8).

The cows with parity 1 have a high chance (23.1%) of having downer cow syndrome, the ones with parity 2 stand a high chance of experiencing abortion whereas 100% of the cows with parity 8 are highly likely to experience retained placenta. In addition, cows of parity 5 stand a high chance (50%) of experiencing vaginal prolapses whereas the cows with parity 4 stand the highest (100%) of having dystocia (Table 3).

Free range cattle rearing was the most practiced method of feeding (58%). On the other hand mixed feeding methods (39%) were the second most Common feeding method and only 3% used confined feeding method indicated in Fig. 9.

The cows grazing from a free range stand a relatively high chance (20.5%) of experiencing downer syndrome, a 100% of the cows in confined feeding experienced abortion, the cows grazing from a free range also stand a relatively high chance (29.5%) of experiencing retained placenta, vaginal prolapse was mostly seen in cows under free range and mixed feeding systems whereas cows fed through the mixed

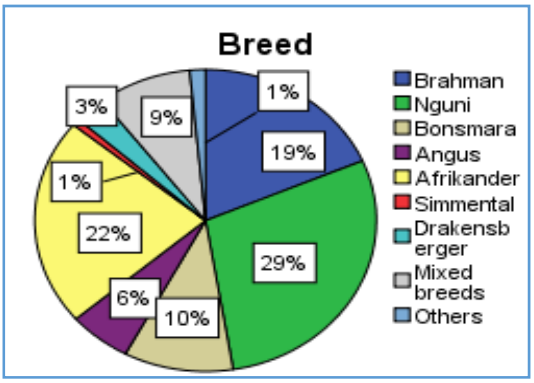

Fig. 7 Breeds of cows affected by reproductive failures.

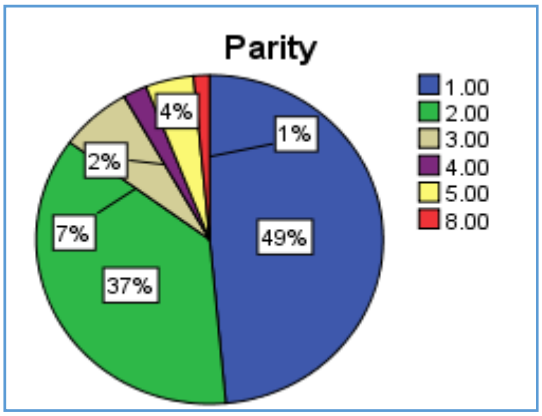

Fig. 8 Parity of cows affected by reproductive failures.

Table 2 Percentage of breeds having reproductive failures.

Breed	Reproductive condition encountered				
	Downer cow syndrome	Abortion	Retained placenta	Vaginal prolapse	Dystocia
Brahman	12.0%	20.0%	28.0%	24.0%	16.0%
Nguni	25.6%	38.5%	17.9%	12.8%	5.1%
Bonsmara	21.4%	42.9%	7.1%	14.3%	14.3%
Angus	-	37.5%	62.5%	-	-
Afrikander	20.0%	6.7%	23.3%	23.3%	26.7%
Simmental	100.0%	-	-	-	-
Drakensberger	-	50.0%	-	50.0%	-
Mixed breeds	16.7%	-	33.3%	8.3%	41.7%
Others	50.0%	-	-	-	50.0%

Table 3 Parity percentage of cows affected by reproductive failures.

Parity	Reproductive condition encountered				
	Downer cow syndrome	Abortion	Retained placenta	Vaginal prolapse	Dystocia
1	23.1%	21.5%	18.5%	23.1%	13.8%
2	14.3%	38.8%	26.5%	6.1%	14.3%
3	22.2%	-	22.2%	22.2%	33.3%
4	-	-	-	-	100.0%
5	16.7%	-	33.3%	50.0%	
8	-	-	100.0%	-	-

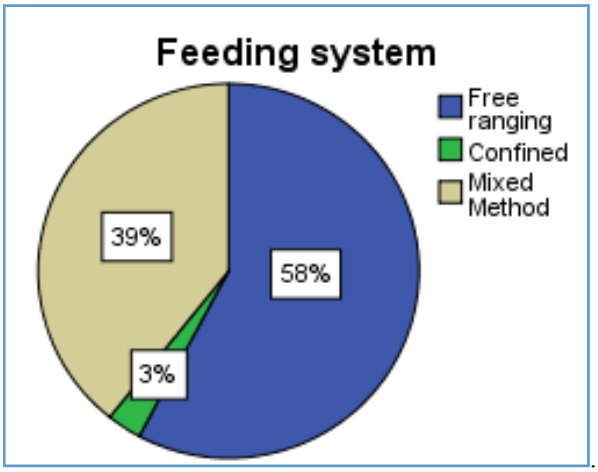

Fig. 9 Feeding system under which cows with reproductive failures were subjected.

method stand a relatively higher chance of experiencing dystocia (Table 4).

The cows from the farms whose farmers have heard about Brucellosis stand a relatively high (34%) chance of experiencing downer syndrome and a relatively high chance of experiencing retained placenta. However, the cows from farms whose farmers have never heard of Brucellosis stand a relatively high chance of experiencing abortion (34.1%) and dystocia (17%). On the other hand, the chance of experiencing vaginal prolapse is equal for both farmers (those who have heard and those who have not heard about Brucellosis) (Table 5).

The frequency of veterinary check-ups was largely done yearly (71%) in most farms, only three times a year (12%) and 9% of the farmers never get their cows checked by a veterinarian (Fig. 10).

The animals checked by a veterinarian yearly or three times per year stand a relatively higher chance (18.8%) of contracting downer syndrome, the ones checked weekly have a 100% chance of experiencing abortion. The ones checked three times per year also have a relatively high chance (50%) of experiencing a retained placenta, the cows checked by a veterinarian twice a year are more likely (40%) to experience vaginal prolapse whereas the ones checked yearly are highly likely (19.8%) to experience dystocia (Table 6).

For animals allocated to cluster 1 (33.3% of the animals) which comprise animals with the breed "other" (all non-descriptive breeds) or Bonsmara, the farmers keeping these animals have never heard about Brucellosis, their cows are of parity 2, the animals are subjected to the mixed method of feeding and are checked by a veterinarian only once a year, and have a higher chance of experiencing downer syndrome (23.3%) and abortion (39.5%) than the ones allocated to cluster 2 and cluster 3.

For animals allocated to cluster 2 (41% of the animals) which comprise animals with the breed Afrikaner, the farmers keeping these animals have never heard about Brucellosis, their cows are of parity 1, the animals are subjected to the free ranging method of feeding and are checked by a veterinarian only once a year and stand a higher chance of experiencing abortions (24.5%) than the ones allocated to cluster 3 (Table 7).

Table 8 shows the significantly different Chi-square test (p = 0.016) indicating that the clustered variables were significantly associated with cases of reproductive conditions. For animals allocated to cluster 3 (25.6% of the animals) which comprise animals with the breed Brahman, the farmers keeping these animals have heard about Brucellosis, their cows are of parity 1, the animals are subjected to the free ranging method of feeding and are checked by a veterinarian only once a year and stand a higher chance of experiencing downer syndrome (18.2%) than the ones belonging to cluster 2, and stand a high

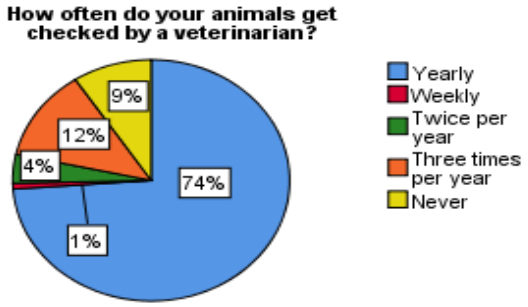

Fig. 10 Veterinary checkups in farms of cows having reproductive failures.

Table 4 Percentage of reproductive failures under different feeding systems.

Feeding systems	Reproductive condition encountered				
	Downer cow	Abortion	Retained placenta	Vaginal prolapse	Dystocia
Free ranging	20.5%	16.7%	29.5%	17.9%	15.4%
Confined	-	100.0%	-	-	-
Mixed method	18.9%	30.2%	15.1%	17.0%	18.9%

Table 5 Association between the incidences of reproductive conditions and farmer's knowledge about Brucellosis.

Have you ever heard about Brucellosis	Reproductive condition encountered				
	Downer cow syndrome	Abortion	Retained placenta	Vaginal prolapse	Dystocia
Yes	34.0%	6.4%	27.7%	17.0%	14.9%
No	11.4%	34.1%	20.5%	17.0%	17.0%

Table 6 Association between how often the cows get checked by a veterinarian and the occurrence of reproductive conditions.

Frequency of veterinary check	Reproductive condition encountered				
	Downer cow syndrome	Abortion	Retained placenta	Vaginal prolapse	Dystocia
Yearly	18.8%	20.8%	24.0%	16.7%	19.8%
Twice per year	-	60.0%	-	40.0%	-
Three times per year	18.8%	6.2%	50.0%	6.2%	18.8%
Never	16.7%	50.0%	-	33.3%	-

Table 7 Cluster allocation to the incidence of reproductive condition.

Two-step cluster numbers	Reproductive condition encountered				
	Downer cow syndrome	Abortion	Retained placenta	Vaginal prolapse	Dystocia
1	23.3%	39.5%	18.6%	9.3%	9.3%
2	11.3%	24.5%	24.5%	20.8%	18.9%
3	18.2%	3.0%	30.3%	24.2%	24.2%

Table 8 Cluster association significance value ($p < 0.05$).

Chi-square tests			
Pearson chi-square	Value	df	*p*-value
	18.838	8	0.016*

*The reproductive condition is significantly associated with the cluster to which the cow is allocated ($p < 0.05$).

chance of experiencing retained placenta (30.3%), vaginal prolapse (24.2%) and dystocia (24.2%) than the ones allocated to the other two clusters (Table 7).

4. Discussion

The aim of this study was to identify cattle production management practices that influence the occurrences of reproductive conditions in communal farming. This study has revealed that the majority of the farmers were in ages between 40-55 years (61%), followed by those of ages 56-69 years (20%), then 10% were of farmers aged 70 and above, while the smallest proportion was of farmers between 18-39 years (9%) noted in Fig. 1. Similar observations were reported which indicated that the majority of small-scale farmers were aged between 51-60 years [11]. The results of this study suggest that older people are the most participating group in livestock production. These outcomes are also in line with reports stating that age influences adaptation to farming methods and technologies [12, 13]. As a result, lack of participation by the youth negatively affects agricultural growth, since old farmers donot easily learn and practice new improved farming methods.

The results show that most of the farmers are male (79%) while female farmers only represent 21% of all farmers (Fig. 2). Similar reports demonstrated that the state of farming in communal areas still remains a male dominated sector [11]. Despite the emphasis on gender equality concepts and the attempts to redistribute resources, females are still at a disadvantage [14]. Considering that the power and control of female farmers in small scale farming still exhibits a gradual increase, female contribution has not made significant alterations in the controlling forces in agricultural developments. Further research shows that other contributing factors restricting women's participation in farming include culture, social and economic structures [15]. There is still a need for transformation in livestock agriculture to encourage and increase participation of female farmers in communal areas.

The results indicate that the fewest farmers were widowed (7%) as is depicted in Fig. 3. A previous study has also reported similar findings indicating that communal farmers were mostly widowed or unmarried (7%). The study further revealed that 25% of the farmers were married, while most of the farmers were single (68%) [12]. However, other previous reports have shown that most of the farmers in the communal areas were married [11, 12]. These differences could be due of the bias sampling of only focusing on farmers with cows affected by reproductive failures.

The data showed that 44% of the farmers have full time employment, those with part-time jobs made 28% of the farmers and 24% were unemployed (Fig. 4). However, previous studies have shown that most farmers rely mostly on pensions [13, 16]. The difference in the results could be due to the method of sampling which was a convenient sampling which relied on farmers reporting reproductive condition cases in their farms and their willingness to participate. The study showed that most farmers had primary level of education (76%), followed by secondary level (10%), high school (7%) and those with no education (7%) indicated in Fig. 5. Studies have similarly reported that most communal farmers of North West province have low level of education [17, 18]. Another conducted research has shown that farmers in rural areas have at-least primary to secondary education with the frequencies of about 57% [12].

A previous study have indicated that majority of communal farmers have low level of education [16]. These points to the fact that improved farming can be hindered by level of education among rural farmers. Adoption of new farming innovations and technologies could take longer due to the low level of farmer's education. Since highly educated people are most likely to be able to effectively implement technological and develop skills, designed to improve livestock production, and advance farmer's capacity to

contribute in the formal production market [16, 17].

Farmers with no income were found to make up to 3%, while most of the farmers (56%) earned less than R1,000 (Fig. 6). The results also showed that farmers with an income between R1,000-R3,000 were approximately 37% of the population, with only 2% of the farmers having an income between R3,100-R5,000 (Fig. 6). A previous study has as well indicated that most communal farms have a low income [19]. Another study has indicated that the reliance on livestock as a source of income was about 99% for communal farmers [20]. This could explain the low levels of income reported by the present study, since most of the rural farmers are still not significantly involved in the commercial market of livestock trading. The results of this study also highlight a great potential for development held by the communal farmers, provided agricultural resources and support are easily made accessible to the farmers.

The data showed significant variation in proportions of cows among different breed types from Nguni (29%), Afrikaner (22%), Brahman (19%), Bonsmara (10%), mixed breed (9%), Drakensberger (3%) and Simental (1%) as shown in Fig. 7. The results implied that Nguni, Afrikaner, Brahman breeds were most susceptible to reproductive conditions. Furthermore, Table 2 also showed that the incidences of downer cow syndrome were mostly reported in Simmental cows, while retained placentas were mostly seen in Angus breed, whereas abortions and vaginal prolapses were noted mainly in Drakensberger cows. Additionally, mixed breed cows and the other cows whosebreed farmers could not identify were mostly prone to dystocia. These outcomes are relatively in agreement with other research indicating high incidences of reproductive conditions in cross breed cows [21]. Lack of homogeneity in the number of cows among different breeds in this study could explain the differences in the finding.

In about 49% of the cows the reproductive condition occurred in their first parity while 37% of the cases were seen in the cow's second parity (Fig. 8). Additionally, the smallest fraction of cases reported was of cows in the 8th parity (1%) as indicated in Fig. 8. The result signifies that the reproductive conditions are more prominent in primiparous cows. In Table 3, it was demonstrated that the occurrences of downer cow syndrome and vaginal prolapse occurred mostly in the first parity cows. It was also indicated that the incidences of abortions were mostly in cows of the second parity. It was also noticed that cows in their 8th parity mostly suffered retained placenta. The significance of parity in reproduction has been emphasized in previous studies [22, 23]. Parity still remains a substantial predictor of cow reproductive conditions in most communal farms. Farmer's lack knowledge about the cow's calving history affect reproductive ability, as well as decision making with regards to keeping older animals in their herds, and consequently negatively impact on the reproductive profit.

This study also showed that a total of 58% reported cases were mostly in cows under free ranging method/system of feeding (Fig. 9). These results imply that in communal areas cows are in most instances reared on natural grassland alone. Table 4 shows that the most prevalent reproductive condition under free range feeding system was retained placenta. It is also indicated that in both confined and mixed feeding methods cows are most likely to abort. Similar observations were noted stating that natural pastures are the main feed resource in local farming [24]. The results imply that in communal farming the most prominent feeding system is free ranging as compared to other methods of feeding. Natural pastures lose nutritional value during the dry period [25]. This could explain the increase in incidences of reproductive conditions as the nutrient content of feed has a direct impact on reproductive health of the cows.

It was as well seen that the frequency of veterinary check-ups was largely done yearly (71%) in most communal farms. Additionally, the study also showed

that some cows were checked only three times a year (12%) and in about 9% of the farms cows never got checked by a veterinarian (Fig. 10). The findings also indicated that retained placentae typically occurring in cows checked by the veterinarian on a yearly basis, revealed that abortion cases were most probable to be seen in cows which never get checked by a veterinarian (Table 6). These results illustrate that the use of veterinary assistance is not a common practice amongst communal farmer as most indicated to only have veterinary visit atleast once a year. The outcomes of the current study are in agreement with other reports indicating that the use of veterinary services by communal farmers was low [26].

5. Conclusions

Livestock farming in communal areas is still a male dominated agricultural sector, with most of the farmers being older, having low level of education, generating less monthly income, among which there are full time employees and unemployed farmers. The incidences of reproductive conditions can be influenced by breed, parity, knowledge about animal diseases, feeding system and the use of veterinary services. Occurrences of downer cow syndrome, abortion, retained placenta, vaginal prolapses and dystocia cases in communal farms are directly related to farm management and practices. Brahman breeds in communal farming are at a predisposition to encounter increased incidences of reproduction condition. Lack of frequent interactions between communal farmers and veterinary practitioners does limit cattle production capacity. Development of properly designed disease control and feeding programmes, proper breed selection and constant monitoring of the cow production status in communal farms are necessary to ensure to improve production and reduce losses.

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