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RESEARCH

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Identification of the feed supplements commonly utilised by communal beef cattle farmers during the dry season at Ga-Matlala, Limpopo province

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Abstract

A survey was carried out to identify the feed supplements commonly utilised by communal beef cattle farmers and investigate knowledge and perception of farmers on the feed supplement during the dry season in Ga-Matlala, whether they assess the feed supplements before feeding to cattle and their perception on how they affect cattle. A structured questionnaire was used to collect data from a total of 59 cattle farmers from three rural villages (Phofu, Phetole and Madietane) in the Ga-Matlala area using a snowball sampling technique. In the studied area, males outnumbered females, with the majority aged 55 and older. The majority of respondents were cattle owners with 16 years or more of farming experience. Secondary school was the most frequently reported educational background, followed by primary school whereas 20.3% of respondents never attended school. The most common cattle breed owned was Nguni, while Afrikaner was the second most common breed. More than 50% of respondents reported releasing cattle in the morning and returning late to provide them with feed supplements and water. The majority of respondents were using feed supplements during the dry season, and the most feed supplements that were identified in the study areas are lucerne hay and maize stover. Lucerne hay and maize stover were the most commonly used and acceptable supplementary feeds during the dry season. The major reasons for feeding cattle with lucerne hay and maize stover were reported to be weight gain and average weight gain of cattle, respectively. The majority of farmers reported that they do not assess the quality of supplementary feeds especially those who supplement with lucerne hay. However, the remaining percentage of farmers assesses the quality of lucerne hay by checking the moisture content and moulds in the feed supplements. It is thus concluded that there is a need for more knowledge and information on the overall quality of the locally available dry season supplementary feeds for enhancing productivity in communal areas.

Keywords maize stover, weight gain, lucerne, South Africa rangelands

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Introduction

Global livestock production is predicted to more than double by 2050, from its current level (Berners-Lee et al. 2018; Froehlich et al. 2018). Livestock production plays a crucial part in the natural economy of South Africa and beyond as a component of agriculture, providing feed for both urban and rural inhabitants (Hurley et al. 2015). An estimated 80% of South Africa's agricultural land is

suited for extensive grazing (Hendriks et al. 2016). Extensive grazing is characterised by each animal grazing over a broad region with little labour and money required (Pulido et al., 2018). Cattle farmers in many rural communities often graze their cattle on natural rangeland for optimum productivity (Nyamushamba et al. 2017; Mapiye et al. 2020).

Rangeland is important for cattle production in terms of nutrition. During the rainy season, rangelands can support the production of cattle without any problems such as a lack of grasses, plants, forbs and shrubs suitable for browsing and grazing (Pykälä 2005). However, throughout the dry season, these rangelands can hardly maintain cattle as most of the feed resources have low nutritive quality (Kubkomawa et al. 2015). This tends to reduce the performance of the cattle unless the cattle are provided with appropriate supplements (Bheekhee et al. 2002).

Mostly in communal areas, the main factor that limits beef production and overall performance is limited forage during the dry season because of the erratic rainfall patterns (Katikati 2017a, b). Throughout this period, the overall performance of cattle substantially declines since the fibre content in grasses is high, which results in the reduction of consumption and digestibility (Lamidi and Ologbose 2014). The dry season feed and feeding have been acknowledged as a restricting factor to successful cattle production due to poor nourishment which results in poor cattle performance in terms of growth, work, maintenance, production and reproduction (Oladotun et al. 2003). Farmers have resorted to using available feed resources, particularly feed/crop wastes (market crop wastes, leftover feed, etc.) and forages obtained from open-access lands (roadsides, wetlands/swamps, etc.) as feed supplements (Katongole et al. 2012). Less information exists on the nutritional quality of these available feed resources (Lumu et al. 2013). The study was therefore conducted to identify the feed supplements commonly utilised by communal beef cattle farmers and investigate the knowledge and perception of farmers on the feed supplement during the dry season in Ga-Matlala, Limpopo province, South Africa.

Materials and methodology

Study site

The study was conducted in three communal areas (Phofu, Phetole and Madietane) in Ga-Matlala area (Fig. 1), in South Africa's Limpopo province's Capricorn District Municipality. The vegetation type in the three communal areas is Polokwane Platea Bushveld (Mucina and Rutherford 2006). The vegetation is distinguished by short open tree layers and a well-developed grass layer. The most common woody plant species are *Vachellia hebeclada*, *Vachellia karoo*, *Vachellia tortillis*, and *Dichrostachys cinerea*, while the most common grass

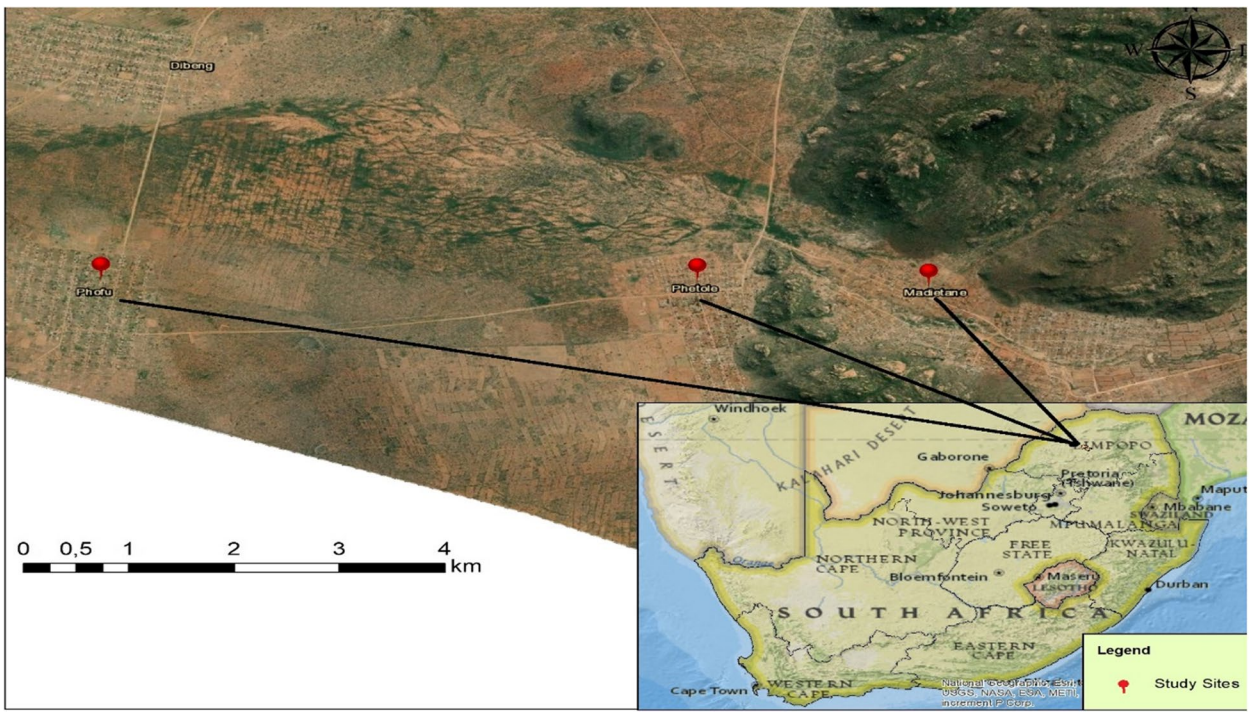

Fig. 1 Map of the study area

plant species are *Arista congesta*, *Brachiaria nigropedata*, *Cynodon dactylon*, *Digiteria eriantha* and *Eragrostis rigidior*. The climate is semi-arid, with an annual mean rainfall of 478 millimetres, the majority of which comes between October and March, with the greatest quantities falling between December and January. The highest temperature recorded was 36.8 °C, with the average temperature being 28.1 °C. The geology is characterised by shallow, skeletal soils, such as the Mispah and Glenrosa soil types, characterise the geology (Soil Classification Working Group 1991). The soils are frequently of poor quality, making crop production impossible but ideal for cattle grazing (Environmental Management Plan (EMP) 2009). In these communal areas, cattle grazed on common rangelands for a distance of 10 km from homesteads. Cattle are managed extensively and are kraaled at night, whereby communal livestock farmers share resources like grazing land and water for farming purposes. Cattle are grazed on communal rangelands all year at a carrying capacity of 9 ha per livestock unit (Department of Agriculture, Forestry and Fisheries 2018). The primary means of subsistence in these communal areas is cattle production.

Population and sampling size

The survey was conducted with 59 households with beef cattle from the three selected rural areas (Phofu, Phetole and Madietane) in the Ga-Matlala area. These communal areas were chosen based on their willingness to participate in the research. There were 15 respondents from Phetole, 15 from Phofu and 29 from Madietane. The respondents interviewed were either cattle owners (farmers), herders, family members or neighbours. These respondents were chosen based on their willingness to participate in the research. The small sample size and imbalance of farmers in the areas were caused by Madietane having more households with beef cattle (49.2) than Phetole (25.4%) and Phofu (25.4%) as well as the refusal to continue with interviews. Prior to the data collection day, each individual local Induna of the three villages (Phofu, Phetole and Madietane) was visited to request permission to collect data, and letters of request were provided.

Sampling procedure and data collection

The snowball sampling technique also known as referral sampling was used to select 59 households with beef cattle in each of the three villages for interviews. The study used a mixed research method which comprises both qualitative and quantitative data collection. Starting from the administrative centre of the department (extension officers), one farmer or cattle herder was interviewed, and the interviewed person suggested the next person to be included in the study. The questionnaire was pretested before use in the survey to check its suitability. This was done to identify ambiguous questions. The respondents were interviewed by trained enumerators at their homestead with a pre-tested structured questionnaire in the Sepedi vernacular.

The questionnaire was divided into two sections labelled A and B. Section A contained information on household demographics, herd size and management of cattle, while section B contained information on the nutritional quality of feed supplements used by communal beef cattle farmers during the dry season. Under the nutritional quality assessment category, information on the nutritional quality of feed supplements used by communal cattle farmers during the dry season was gathered.

Statistical analysis

Data were analysed using Statistical Package for the Social Sciences version 27 (SPSS, 2020).

Results

Demographic information of the farmers

All demographic characteristics of the respondents are shown in Table 1. Males made up more than 70%

Table 1 Demographic information of the farmers

Characteristics	Class	Percentage (%) of farmers
Number of farmers	Village	59
Gender	Male	72.9
	Female	27.1
Age distribution	< 25	1.7
	25–34	15.3
	35–44	10.2
	45–54	10.2
	≥ 55	62.7
Position	Cattle owner	72.9
	Herder	16.9
	Others	10.2
Farming experience (years)	< 2	6.8
	3–5	20.3
	6–10	15.3
	11–15	11.9
	≥ 16	45.8
Educational background	Never attended	20.3
	Primary school	23.7
	Secondary school	42.4
	College diploma	6.8
	University degree	5.1
	Postgraduate qualification	1.7

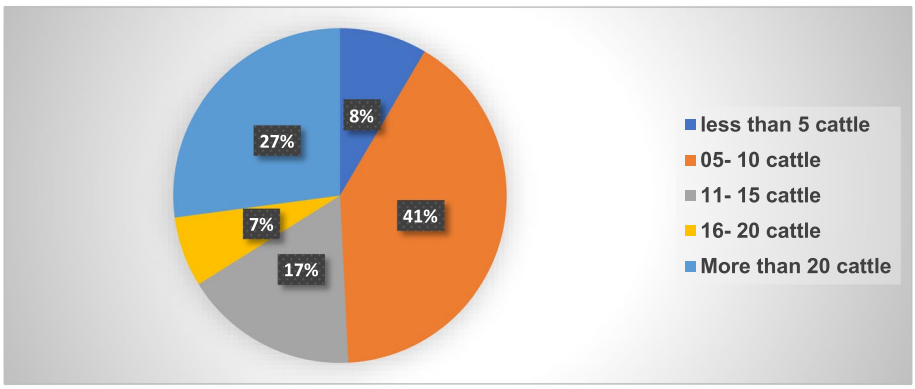

Fig. 2 Distribution of cattle in the three studied communal areas

Table 2 Summary of cattle breeds in the herds

Breeds	Percentage (%) of farmers
Nguni	27
Afrikaner	25
Nguni and Afrikaner	25
Brahman	9
Nguni and Brahman	4
Others	10

Others = (such as Nguni, Brahman and Afrikaner; cross (Brahman × Afrikaner); cross (Nguni × Afrikaner); cross (Nguni × Brahman × Afrikaner))

of respondents in the studied area, and most are older than 55 years old. The vast majority of respondents were cattle owners with more than 16 years of farming experience. The majority of respondents had secondary school education (42.4%), followed by primary school (23.7%), whereas 20.3% never attended school.

Cattle distribution, breeds in the herds and daily cattle management

Figure 2 depicts information on cattle distribution in the study areas. The majority of farmers (41%) had 5 to 10 cattle under their care, followed by farmers owning more than 20 cattle (27%). The least farmers (7%) owned 16–20 cattle. Nguni was the most commonly owned breed, followed by Afrikaner breed and both Nguni and Afrikaner (Table 2). Regarding daily cattle management, the majority of respondents (44.1%) in the studied area release cattle in the morning and returning late to provide them with feed, water and medication while other respondents (33.9%) reported that they release their cattle in the morning and return them late at night, with no provision for feed or water, and that they rely on the community for water supply.

Table 3 Feed supplements commonly utilised by communal cattle farmers during the dry season in the Limpopo communal area

Feed supplements	Frequency (%) of farmers
Lucerne hay	62.7
Maize stover	22.0
Salt licks	6.8
Molasses meal	5.1
Cattle feed pellets	3.4
Calf grower	3.4
Soya bean meal	1.7
Calf milk replacer	1.7
Beef cattle finisher	1.7
Mixture of Mabele, yellow meal and sunflower	1.7

Feed supplements commonly utilised by communal cattle farmers during the dry season in the Limpopo communal area

The majority of farmers in the study area are using dry season supplementary feeds for their cattle. About 10 feed supplements that were identified by the cattle farmers during the dry season are depicted in Table 3. Feed supplements that were identified in the studied communal areas included maize stover, molasses meal, calf milk replacer, beef cattle finisher, calf grower, cattle feed pellets, soybean meal, salt lick (block), lucerne hay and a mixture of sorghum, yellow meal and sunflower. Lucerne hay was the most common feed supplement used, followed by maize stover.

Farmers' perception of acceptable feed supplements for cattle in the dry season

Table 4 shows the acceptance of feed supplements for cattle as perceived by farmers. Lucerne hay was the most acceptable feed supplement for cattle, followed by maize stover. Farmers were further asked about the reasons for the acceptance of feed supplements for cattle (Table 5). The majority of the farmers (59.3%) reported weight gain of cattle as a result of feeding Lucerne hay to cattle, followed by average weight gain (15.3%) as a result of feeding maize stover.

Farmers' assessment of quality (moisture content and mould) of supplements in communal areas of Limpopo

The results on how farmers assess the quality of feed supplements utilised during the dry season are presented in Table 6. The majority of farmers (45.8%) reported that they do not assess the quality of supplementary feeds especially those who supplement with lucerne hay. However, about 13.6% of farmers assess the quality of lucerne hay by checking the moisture content and moulds (3.4%) in the feed.

Table 4 Farmers' perception of acceptable feed supplements for cattle in the dry season

Feed supplements	Yes, percentage (%)	No, percentage (%)	No response, percentage (%)
Lucerne hay	62.7	0	25.4
Maize stover	16.9	5.1	
Salt licks	6.8	0	
Molasses meal	5.1	0	
Cattle feed pellets	3.4	0	
Calf grower	3.4	0	
Soya bean meal	1.7	0	
Calf milk replacer	1.7	0	
Beef cattle finisher	1.7	0	
Mixture of Mabele, yellow meal and sunflower	1.7	0	

Table 6 Farmers' assessment of quality (moisture content and moulds) of supplements in communal areas of Limpopo

Feed supplements	Moisture content, percentage (%)	Moulds, percentage (%)	No response, percentage (%)
Lucerne hay	13.6	3.4	45.8
Maize stover	0	0	22.0
Salt licks	0	0	6.8
Molasses meal	0	0	5.1
Cattle feed pellets	0	0	3.4
Calf grower	0	0	3.4
Soya bean meal	0	0	1.7
Calf milk replacer	0	0	1.7
Beef cattle finisher	0	0	1.7
Mixture of Mabele, yellow meal and sunflower	0	0	1.7

Discussion

Demographic information of the farmers

In the current study, men made up the vast majority of respondents. This could be attributed to men's role in cattle management activities such as daily herding of cattle to grazing areas. Similar findings were reported by Oladele et al. (2013), who noted that cattle farming remains primarily a male-dominated industry. Furthermore, the findings of this study were corroborated by Ndhlovu and Masika (2013), Katiyatiya et al. (2014) and Mdungela et al. (2017), who found that men owned a

Table 5 The farmers' reasons for acceptability of feed supplements for cattle in communal areas of Limpopo province

Feed supplements	Average weight gain, percentage (%)	Weight gain, percentage (%)	Weight loss, percentage (%)	Sickness, percentage (%)	Fast growth, percentage (%)
Lucerne hay	3.4	59.3	0	0	0
Maize stover	15.3	1.7	1.7	3.4	0
Salt lick	6.8	0	0	0	0
Molasses meal	0	5.1	0	0	0
Cattle feed pellets	3.4	0	0	0	1.7
Calf grower	1.7	0	0	0	1.7
Soya bean meal	1.7	0	0	0	0
Calf milk replacer	1.7	0	0	0	0
Beef cattle finisher	1.7	0	0	0	0
Mixture of Mabele, yellow meal and sunflower	0	1.7	0	0	0

large number of cattle, which they attribute to management challenges such as handling for treatment. This, however, contradicts the findings of Lumu et al. (2013) in Kampala, Uganda, who reported females as the dominated interviewed farmers since males spend the majority of their time either conducting business or salaried jobs, allowing women to manage livestock on a daily basis.

The majority of farmers in this study were above the age of 54, indicating that elderly individuals are certainly involved in cattle farming in Ga-Matlala's areas with free communal grazing land. The findings of this study show elders have more time to care for cattle in rural areas than young people who reside in cities due to employment and school. Similar results within South Africa were reported in Eastern Cape by Mthi et al. (2020) who stated that youth do not participate in livestock farming because they are more focused on urban areas than living in rural communities. However, Mthi et al. (2020) found that the majority of respondents were between the ages of 31 and 50. According to Motiang and Webb (2016), a high proportion of involvement of middle-aged farmers in agriculture was observed in the North-West province which confirms the low participation rate of youth in agricultural development. The vast majority of those who responded were cattle owners. This suggests that farmers value their farming as a major source of income. They take care of their own cattle rather than entrusting the management of their herd to others. Similar findings were reported by Habiyaremye et al. (2017), who discovered that in most cases, family heads are in charge of running the day-to-day activities associated with livestock rearing.

The majority of farmers in the studied area had more experience in farming with cattle. This is consistent with the fact that older people are more involved in cattle farming than younger people. This result is in line with the findings of Mthi et al. (2020) who observed that the number of years of farming experience was above 15 years. Similar results were also reported by Yawa et al. (2020) who said that most of the farmers have 21 years of farming experience in keeping cattle. These results contrast with the findings by Goni et al. (2018) who reported 10 years of livestock farming experience.

In the present study, secondary school was reported to be the highest educational level obtained by the majority of the farmers. This result is a major advantage for the integration of communal area farmers into beef cattle value chain development projects. This finding was also unexpected in light of the number of older participants in the study area who depend on pensions for their income and who grew up in the apartheid era and had limited access to formal education (De Cock et al. 2013). These findings are similar to the reports of Ndhlovu and Masika (2013) and Sungirai et al. (2016) who observed that more than 90% of farmers participating in farming in Zimbabwe had a secondary education level. Chimonyo et al. (1999) reported that the majority of males had secondary education in Zimbabwe. The Food and Agriculture Organisation of the United Nations (FAO) emphasises that education, whether formal, non-formal or in the form of skills training, is very useful as it develops the capacity of people to ensure food security (FAO, 2009). However, Sakyi (2012) argues that a level of education contributes to food security and poverty reduction since it opens up opportunities to improve livelihood strategies.

Cattle distribution, cattle breeds in the herds and daily cattle management

In the present study, the majority of the farmers reported large herd sizes. According to Vetter et al. (2020), larger herds suffer lower mortality rates, suggesting that owners of larger herds have better means to support their herds and owners of larger herds are wealthier and have more access to inputs and herding labour. This is comparable with studies that reported large herd sizes (Mapiye et al. 2018; Santos et al. 2019; Smith et al. 2000). On the other hand, the average herd size that ranges from 5 to 10 cattle per household was reported by Bester et al. (2003) and Musemwa et al. (2008) with the purpose of primarily addressing the needs for subsistence with limited use of technology in South Africa.

All of the farmers surveyed raised cattle that were either Afrikaner, Nguni, Brahman, crossbred or a combination of the above breeds. However, most farmers indicated that they preferred to keep Nguni breed, Afrikaner breed and both Nguni and Afrikaner. This could be owing to these breeds' ability to produce and their increasing tolerance to rural conditions. Molefi (2015) found similar findings in Chief Albert Luthuli Local Municipality in Mpumalanga province, stating that roughly 31% of farmers considered farming with the Nguni breed because it is highly fertile with a long productive life and more resistant to diseases carried by ticks than other breeds. In contrast to the current findings, Katikati (2017a, b) discovered that in the communal areas of the Eastern Cape Province of South Africa, farmers unintentionally farm with crossbreeds due to unregulated mating as a result of insufficient fencing.

Cattle are normally freed in the morning and herded to the grazing areas, returned home later and kraaled at night in the Matlala's villages. However, most farmers reported that even though they let cattle graze during the day and kraaled at night, they still provide them with feed, water and medication when they return home later, whereas other farmers reported that cattle

rely on community water, so they do not provide them with feed or water when they return home. Nthakheni (2006) observed similar findings in the Vhembe District of Limpopo province, where cattle are generally herded since there are no camps and kraaled every night throughout the year for fear of theft, traffic accidents and crop damage prevention. Furthermore, Mutibvu et al. (2012) stated that communal farmers rely on a variety of water sources, which vary based on location, season and capacity.

Farmer response on the use of supplemental feeding and feed supplements commonly utilised by communal cattle farmers during the dry season in the Limpopo communal area

It has been revealed that the majority of the farmers are using feed resources as dry season supplements for their cattle. I think more farmers are knowledgeable about local feed resources available for dry season cattle supplementation. These results are comparable with those of Katikati and Fourie (2019) who reported that most of the respondents (77.0%) were supplementing their animals in winter, while 23% believed that supplements are expensive, and only 2.0% indicated that they did not know anything about supplements. Winter supplementation is for maintaining weight, while summer licks are to maximise growth (Van Pletzen 2009). This type of information needs to be emphasised to the farmers.

In the present study, lucerne hay was found to be the most commonly used feed supplement in all three selected communal areas, while maize stover was the second most commonly used. Farmers commonly use these feed supplements in the study area because they are cheaper and often available throughout the dry season. For instance, maize being the most important crop grown in communal areas, after harvesting, maize stovers are left to dry in their backyards and later stored for winter purposes, while others graze their cattle in situ during the dry season. This is comparable with studies of Beyene et al. (2014) who reported that the common feed supplements used by the farmers are lucerne, maize, maize stalk, pellets and salt. Gwelo (2013) reported lucerne and barley as the most feed supplements used in Dikidikana and Kwezana villages, while Gxasheka et al. (2017) reported maize as one of the major crop residues for feeding livestock in Tsengiwe, Manzimdaka and Upper Mnxe villages. In contrast to the current findings, Katikati and Fourie (2019) discovered that the majority of the farmers were using salt licks for their herds, and Mtengeti et al. (2008) reported that maize stover was not very popular among the farmers in Tanzania.

Farmers' perception of acceptable feed supplements for cattle and the reasons for acceptability of feed supplements for cattle in communal areas of Limpopo province

The majority of the farmers reported that lucerne hay is an acceptable feed supplement for their cattle followed by maize stover. This is consistent with the findings of Suttie (2000), who reported that lucerne is an excellent fodder supplement compared to hay from various grasses because of its high quality, high digestibility and roughage value. Erenstein et al. (2011) confirmed that maize is very good for digestion in cattle and can be used as fodder.

According to the findings of the study, the majority of the farmers reported weight gain and average weight gain of cattle as major reasons for feeding lucerne hay and maize stover to cattle, respectively. This is consistent with the findings of DelCurto et al. (2000) and Lattimore (2008), who found that cattle supplemented with lucerne hay gained more weight and tended to lose less body condition. However, Faftine and Zanetti (2010) reported that cattle fed with crop residue such as maize stover lose more than 20% of their body weight during the dry season because of the high fibre or lignin content contained in maize stover. Fibrous feeds are poorly digestible or ferment the rumen; hence, it led to high methane emission because rumen microbes take a longer time in fermenting the fibre. This weight loss has negative economic repercussions, since it reduces the rate of conception, and consequently, the number of births and physical condition of adult animals, causing mortality and stunted growth of young animals (Wathes et al. 2014).

Farmers' assessment of quality (moisture content and moulds) of supplements in communal areas of Limpopo

The study has shown that the majority of farmers do not assess the quality of supplementary feeds during the dry season, while the minority of farmers reported that they assess the quality of dry season supplementary feeds by checking the moisture content and moulds in the feed. These are the characteristics that farmers observe in the feed that indicate that a particular feed supplement is of good quality. According to Rocateli and Zhang (2015), a characteristic that shows a quality grass hay as a supplement is its bright green colour, thereby suggesting that the greenness indicates good preservation of grass hay.

Conclusions and recommendations

This study revealed that more farmers acknowledge the need for supplementing during the dry season and have knowledge of feed resources that are locally available for

dry season supplementary feeding. Farmers in the study area commonly use lucerne hay and maize stover because they are cheaper and often available throughout the dry season. Lucerne hay and maize stover supplements are generally used by communal farmers worldwide. Therefore, this indicates that more farmers in the present study are knowledgeable on the dry season supplementary feeds as they are able to use most of the common and used feed supplements than using any other available feed resources. Even though the majority of farmers do not assess the quality of feed supplements used, it is known that with the availability of these supplements, cattle are able to survive the dry seasons. Although most of the farmers are knowledgeable about feed supplements utilised during the dry season, they still have no knowledge on assessing the quality of feed supplements utilised; hence, research and more information dissemination on how to determine the quality of dry season supplementary feeds should be introduced. The results will have an improvement on farmers in the communal rural areas in terms of supplementation of livestock.

Recommendations

1. It is recommended that government be responsible for hosting planned workshops for communal farmers in order to equip them with knowledge regarding more of the best feed supplements and feeding for improved beef cattle production throughout the farming journey particularly during the dry seasons.

2. Farmers are also recommended to formulate (with help from an animal nutritionist) their own animal feed diets using locally available resources.

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Authors' contributions
BG and MG conceptualised and design the work. MTR collected the data. BG analysed the data. MTR and BG visualised the results. MTR and BG wrote the paper. BG and MG proofread the manuscript. The authors read and approved the final manuscript.

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Availability of data and materials
Kindly contact the author for data requests.

Declarations

Ethics approval and consent to participate
This study was approved by the Turfloop Research Ethics Committee from the University of Limpopo, South Africa, with ethical clearance number TREC/125/2021: PG. Interviewers were only conducted after consent forms had been signed indicating the willingness to participate freely.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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